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The *Western Undergraduate Economics Review* is an annual publication containing papers written by undergraduate students in Economics at Western. First published in 2002, the *Review* reflects the academic distinction and creativity of the Economics Department at Western. By showcasing some of the finest work of our students, it bestows on them a lasting honour and a sense of pride. Moreover, publication in the *Review* is highly beneficial to the students as they continue their studies or pursue other activities after graduation. For many, it is their first publication, and the experience of becoming a published author is a highlight of their undergraduate career. The *Review* is a collaborative effort of the students, faculty, and staff of the Economics Department. All papers submitted to the *Review* are essays written for courses taken in the Department. Some are by students in the early stages of their Economics studies, while others are papers written by senior students for the Department's unique thesis course, Economics 4400. Selections are made by the edition editors, in consultation with a faculty advisor, based on creativity, academic merit, and the written quality of the article.

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We hope that you enjoy reading the 2014 edition of the *Western Undergraduate Economics Review*. The *Review* is truly a testament to the capabilities and dedication of the students of the Undergraduate Economics Department.

Christian Sgro
Victoria Turner
London, Ontario
April 2014

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Political Protest Contagion Across Countries: Understanding the Effect of Geography, Language and the Media

Evelyn Baraké

Abstract

Despite the overwhelming qualitative evidence indicating that large-scale protest movements often transcend national borders, there has been little empirical work offering a quantitative analysis of this phenomenon. Using a linear probability model of protest data from 27 European countries for a period of 15 years, this paper aims to shed some light on the mechanisms governing protest contagion. The statistical results suggest that a protest contagion effect exists between countries sharing a common border, but that large-scale protest are less likely to occur in a country if one is taking place in a country with which it shares a common language. Furthermore, this paper finds that the media exacerbates the effect of near-by countries' protests on any given country's probability of protest incidence. This paper provides a framework for the future empirical investigation of cross-border protest movements.

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I would like to thank professors Igor Livshits, David Rivers and Youngki Shin for their continued support and patience throughout the process of researching and writing this paper. I would also like to thank Mr. Vince Gray for his advice regarding data collection, teaching assistant Andrew Naaum for his administrative support throughout the year, and the class of 4400E for their helpful comments and insight which helped make this project possible.

Introduction

The events of recent decades, and more significantly events in the past three years, strongly suggest the existence of a contagion effect that causes protest movement to transcend national borders. Large-scale protest movements such as the Arab Spring, Anti-Austerity protests and the Colour Revolutions have each spanned many countries within a geographical area, sharing common cultural traits. Even though protests are generally directed at each respective nation's government, the movements share a set of common grievances and demands.

Despite the overwhelming qualitative evidence suggesting that a country is more likely to experience large-scale protests if these are occurring in 'near-by'[1] countries, there are no existing quantitative analyses of this particular phenomenon. The conditions under which

[1] The vague term 'near-by' is purposefully used, as it can refer to geographical or cultural proximity.

this contagion effect takes hold remain highly uncertain. Large-scale political protests can have profound economic, social and political consequences, and thus a deeper understanding of the mechanisms affecting their proliferation would be useful to policy makers and academics alike.

This paper aims to use empirical methods to determine the characteristics that significantly influence which countries are most likely to take part in a protest wave and to quantify the magnitude of this contagion effect. My investigation of the cross-border spread of political protests will proceed in four sections. The first section will provide a general theoretical overview of protest contagion mechanisms. In the second section, I will outline the model used to test the existence and size of the contagion of political protests. The third section describes the data, its limitations, and the methods I have employed to mitigate the effects of said limitations. The final section will present the results of this statistical analysis and their implications for the study of the spread of political protests.

I. Large-scale Political Protest Movements and their Proliferation

Countries within large geographical blocks often share many political and socio-economic characteristics. This may be due in part to the shared regional history, population flows facilitated by geographical proximity, and the ever-increasing inter-connectedness of countries through trade and information flows. These features give rise to two main explanations for the observation of large-scale protests in different countries within a very short timespan.

The first is what I will call the organized contagion hypothesis, which stipulates that one country's protest movement is, in part, causally responsible for protest movements in another near-by country. Beissinger (2007) offers a compelling account of this phenomenon, attributing the diffusion of a political protest to the fact that once a large and successful protest movement occurs in one country, people in nearby countries that would like to protest against their respective regimes have an action 'blue-print' at their disposal. With every additional country that launches a successful protest movement, organizational processes and mobilization methods are perfected, and a protest movement becomes easier to set in motion in any given country (Beissinger 2007). This explanation is supported by Social Movement Theory, which states: "…people must be convinced that they could actually succeed if they started to protest" (Grünwald and Stefes 2012). "Success" in terms of political process is fairly ambiguous, as achieving success can refer to the mobilization of a large proportion of the population, the implementation of a change in policy or reforms demanded by protesters, or the overthrow of a regime in revolutionary contexts.

Regardless of the goal of the protest, the contagion theory suggests that protests will spread more readily to countries with common characteristics. These similarities minimize the degree to which mobilization tactics need to be adapted to fit the situation of a specific country. Under the contagion theory, protests will also spread more readily between countries that share important informational flows, such as shared media.

Often referred to as a social media or Facebook revolution, the Arab spring has highlighted the important role played by information technology and the media in the spread of political protests (Couts 2011). Grünwald and Stefes (2012) attribute a catalytic role to the media in their case study of the Egyptian revolution, stating: "with the aid of satellite-TV, new independent press, and the internet, the recurring episodes of protest […] eroded the image of Mubarak's invincibility and thus changed people's perceptions about the possibility of political change". This excerpt highlights the importance of the population believing that a level of success is possible through protest. Information about successful protests in near-by countries may change the expectation of success of a protest movement in one's own country, and incite more people to protest, precipitating large-scale protest action.

Cross-border protest waves may also have less to do with contagion than with common pre-existing characteristics. This idea gives rise to an alternate explanation for the observation of multiple large-scale protest movements in near-by countries within a short time frame, which I will call "the similarity hypothesis". These characteristics, which include type of regime, strength of economy and main industries, may largely determine the ways in which countries will respond to events that are international in scope. Such an event may negatively impact all countries that share these common characteristics. Resulting protest movements may appear in all affected countries almost simultaneously, not because they have been influenced by each other, but because of some undetected factor, which caused similar grievances in similar countries.

These two explanations are not necessarily mutually exclusive. However one effect may be much stronger than the other. The model outlined in the next section will attempt to analyze which of these explanations is dominant during the period of 1980 to 1995 in 27 European countries.

II. The Model

If there is a contagion effect of political protests, a relationship should be observed between protests occurring in a country's immediate geographical neighbourhood, or what I will call its "cultural neighbourhood", and the probability that protests are occurring in the country itself at any given time. However, if a contagion effect does exist, it is unlikely to be the main determining factor of a political protest occurring. Therefore, in order to test the existence of a contagion effect and to avoid omitted variable bias, my model attempts to take into account domestic factors that affect the onset of political protests. I have estimated the following models, one including a media and contagion interaction term, and one without.

1. $$\text{Prob(Protest)}_{i,t} = \beta_0 + \beta_1 \text{protest}_{i,\,t-1} + \beta_3 \text{polity}_{i,t} + \beta_4 \text{polity}^2_{i,t} + \beta_5 \text{election}_{i,t} + \beta_6 \text{regimeend}_{i,t} + \beta_7 \text{youthunemployment} + \beta_8 \text{contagion}_{i,t} + u_{i,t}$$

2. $$\text{Prob(Protest)}_{i,t} = \gamma_0 + \gamma_1 \text{protest}_{i,\,t-1} + \gamma_2 \text{polity}_{i,t} + \gamma_3 \text{polity}^2_{i,t} + \gamma_4 \text{election}_{i,t} + \beta_5 \text{regimeend}_{i,t} + \beta_6 \text{youthunemployment} + \gamma_7 \text{media} + \gamma_8 \text{contagion}_{i,t} + \gamma_9 \text{media*contagion} + \varepsilon_{i,t}$$

Explanatory Variables

A study by Ash (2011) is particularly useful for providing a framework including domestic factors to build my model for protest contagion. Ash constructs a model that estimates the effect of various factors influencing the likelihood of a protest occurring in any given month during the Colour Revolutions.

In this model, Ash (2011) finds that protests are most likely to erupt after a "triggering event," an event capable of galvanizing the opposition, has taken place. Triggering events are a common concept within protest literature. According to Social Movement theory, such events indicate that the conditions for a mass protest movement are ripe (Grünwald and Stefes 2012). Beissinger (2007) identifies "stolen election" as an important element in protest mobilization within the Colour Revolutions at the turn of the century. In order to capture the effect of domestic political trigger events, my model includes variables for both elections (election) and regime changes (regimeend).

Unemployment is largely considered a contributing factor to the incidence of political protests. Unemployment is indicative of a poorly performing economy, which is often blamed on the policies of a particular regime. A negative change in people's livelihood is thus expected to increase the incidence of political protests. Furthermore, low employment reduces the opportunity cost of time, and thus it becomes less costly for individuals to expend time manifesting in the streets. This further contributes to the intuition that increased unemployment is positively correlated to political protest incidence. Finally, there exists ample evidence that for any given protest, young people represent a large proportion of protestors. Combining these insights, there is a compelling case to expect a strong positive correlation between youth unemployment (youthunemployment) and political protest incidence.

I have included a polity index (polity), polity index squared (polity^2) and lagged protest variable (protest_{t-1}) because these were all shown to be significant domestic predictors of political protest occurrence by Ash (2011). The polity index accounts for the degree of authoritarianism or democracy of a regime, and thus the media freedom variable is excluded from the first model, as it is by nature highly correlated to the Polity index.

Three definitions of contagion variables are used in turn in order to capture different types of protest proliferation. The first is the sum of countries in which a large-scale protest movement occurred in a given month bordering a given country. The second is the sum of countries in which large-scale protest movements occurred in a given month in countries sharing an official language (spoken by 20 percent or more of the population) with a given country. The third is a variant of the second, but instead counts countries sharing a common language spoken by nine percent or more of the population.

Confirming the Existence of a Contagion Effect

Using this model, I attempt to discover the following information:

1. *Factors Influencing Probability of Simultaneous Protest Movements Within Countries*

Qualitative analyses and anecdotal evidence point to the existence of protest waves that encompass many countries. However there remains uncertainty regarding whether this phenomenon is dependent on physical proximity or common cultural features. To answer this question, I use the three definitions of contagion variables outlined above. Comparing the magnitude and significance of the coefficients on the different variations of the contagion variable in the model provides insight as to whether shared culture or geographical proximity results in a higher probability that protests will occur simultaneously in any two countries.

2. *Effect of Media Freedom on Probability of Protest Movements Spreading to a Near-by Country*

The combined effect of the media and near-by protests is captured by the media-contagion interaction term in the second model. Higher media scores indicate lower levels of media freedom. Thus, if the media increases the probability of protest movements spreading to a nearby country, the coefficient on this term is expected to be negative. The coefficient on the contagion term represents the increase in the probability of a protest occurring when the media freedom score is zero, which can be interpreted as in the case of perfect information flow.

3. *Relative Significance of Contagion Hypothesis and Similarity Hypothesis Regarding the Phenomenon of Large-Scale Protest Waves Transcending National Borders*

While one country's protest movement may influence the population of near-by countries to start their own protest movement, simultaneous protests may be more significantly attributed to existing external factors that have a similar influence on the probability of protest occurring in near-by countries. These unobserved events are not captured in the model. However, if the inclusion of fixed effects results in the magnitude and significance of the contagion variable significantly decreasing, this would suggest that the similarity hypothesis may provide a better explanation regarding the phenomenon of large-scale protest movements frequently occurring in different countries in short time-periods.

III. Data

Precise political protest data is particularly difficult to obtain. Few attempts have been made to compile countrywide protest data over a long period of time. I chose to use

political protest data from the European Protest and Coercion Dataset (EPCD), because it represents an incredibly detailed compilation of protest-related action. The data is broken down by country and day, for 27 countries during the time period from 1980-1995.[2]

The EPCD presents information about date of protest, type of protest, target, type of participant, and number of participants. Since this model deals with the spread of political protests targeting a country's regime or demanding extensive policy changes, observations that did not meet these criteria were discarded. Furthermore, I chose to focus on large-scale action, which I define as movements mobilizing 0.75 percent of the population or more. The "number of protestors" value was divided by country population for the given year, obtained through Lahmeyer's "Populstat" website. All observations that did not meet the 0.75 percent participation cut-off were discarded. The data was then restructured in terms of binary variables, indicating whether or not one or more protests took place for every month of the relevant time period for every given country.

Since the testing of this model requires very specific data, explanatory variables are obtained from a variety of sources. The Polity score is available on a yearly basis, and is obtained from the Polity IV Project site. The regime change variable, "regimeend" in the model, is also obtained from the Polity IV Project. National election dates are obtained from Hyde and Marinov's (2012) National Elections Across Democracy and Autocracy dataset and compiled to create a binary variable indicating the occurrence of a national election in a given month. Yearly youth unemployment statistics are obtained from the "Labour & Social Protection" category of the World Bank database. There are fewer missing data points for female youth unemployment, and thus to minimize missing data, the log of female unemployment alone is included in the mode. The media freedom scores are adapted from the Freedom House index for the relevant time-period.[3] Finally, the different monthly contagion variables are constructed using the data for protest mobilizing 0.75 percent of the population or more, and contiguity and shared language data found in the Mayer and Zingago Dyadic Geodist Dataset (2011).

Limitations

The dataset inherently limits the scope of the applicability of the results of this analysis, as it does not include protest data on all countries bordering or sharing a language with the countries included in the dataset. Furthermore, construction from various sources result in an unbalanced panel. This problem is exacerbated by the inclusion of Czechoslovakia, which broke up to form the Czech Republic and Slovakia, and the German Democratic Republic, which was reunited with the Federal Republic of Germany within the timeframe of this study.[4]

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[2] For a full list of countries, see Appendix.

[3] From 1980 to 1987, Freedom house used a Free, Partially Free and Not Free rating, divided by Print and Broadcast. From 1988 to 1995, it ceased reporting a separate rating for Print and Broadcast. For the purpose of this analysis, I gave ratings from one to three, with one corresponding to a free media. In the rare cases where print and broadcast received different ratings in the initial years, I took the mean of the two ratings, e.g., if print was free (1) and broadcast was partially free (2), the resulting rating was 1.5.

[4] My approach was to code Czechoslovakia, the Czech Republic and Slovakia as three distinct states for which missing values were inputted for the years they did not exist. For the German case, I equated the

Additionally, the youth unemployment data is rather sparse, and there exists the possibility of a missing value bias. There was no available unemployment data for all countries with the lowest polity scores. This resulted in dropping several former socialist European countries from the dataset. However, this mitigated the problem of the division of Czechoslovakia and the reunification of East and West Germany, as these countries were also dropped.

Finally, due to the limited data and the nature of the question, the contagion variables are constructed using the same protest data as the dependent variable. This raises important endogeneity issues. These were addressed by employing instrumental variables for the contagion variables. In order to account for the limitations discussed above, two types of independent variables are used.[5] The first are constructed using the log of the mean female unemployment rate in each country's 'contagion zone'.[6] The second instrumental variable was constructed using the mean polity score in each country's contagion zone. Both models are tested using each set of independent variables and each definition of contagion. However, female youth unemployment is absent from both models in the set of regressions using the polity score independent variable in order to maximize the number observations.

IV. Results

The necessity of running two-stage least squares regression resulted in the use of a linear probability model to estimate both models. In order to test whether protests spread to near-by countries, or whether they occur at the same time due to external factors, both models were also estimated using fixed effects two-stage least squared regression. Table 1 presents the estimates of the regressions using the log of average youth female unemployment as an independent variable, with and without fixed effects.

Though the coefficient on bordering countries' protests is not significant, the sign is consistently positive for both models. The effect of bordering countries' protests is magnified by the addition of a media freedom index, and a media freedom and bordering countries' protest interaction term. The media and border protest interaction term is negative, which corresponds to the expectation that a higher media score (more tightly controlled media) decreases the likelihood of contagion from bordering countries protests. Running a fixed effects regression to estimate the probability of protest yields the same signs in the variables of interest, further increasing their magnitude, but also increasing the noise of the coefficients by raising the standard errors.

FRG with modern-day Germany, and inputted missing values for the GDR for the years following reunification.

[5] Their construction was modeled after Pevehouse's (2002) IOScore variable which represents the "average democracy score of all members of a regional organization, except state i," for his study of the effect of International Organization membership on democratization.

[6] Since contagion was tested using border, and two definitions of common language, 'contagion zone' refers to bordering countries, countries sharing an official language and countries sharing a language spoken by nine percent or more of the total population. A separate independent variable was constructed for each definition of contagion.

Table 1

	(1)	(2)	(3)	(4)
Lagged DV (n-1)	.073 (.048)	.037 (.044)	.066 (.049)	.042 (.037)
Election month	.007 (.016)	.001 (.018)	.003 (.017)	.000 (.018)
Regime End	-.019** (.006)	.001 (.065)	-.021*** (.006)	-.005 (.059)
Polity	-.059 (.057)	.657* (.361)	-.056 (.055)	.318 (.425)
Polity^2	.004 (.003)	-.037* (.020)	.003 (.003)	-.018 (.023)
Log Female Youth Unemployment	.017*** (.004)	.004 (.013)	.018*** (.005)	.006 (.011)
Media			.018 (.020)	.029 (.042)
Border protests (IV: Log Average Female Unemployment)	.099 (.108)	0.435 (.552)	.735 (.454)	1.00 (1.33)
Border protests*Media (IV: Log Average Female Unemployment*media)			-.568* (.333)	-.630 (.911)
Constant	.177 (.231)	-2.91* (1.57)	.163 (.214)	-1.41 (1.93)
Fixed Effects	No	Yes	No	Yes
Observations	2664	2664	2664	2664
F-value, first stage regression	7.71	4.29	8.05	4.34

Note: values in parentheses are standard errors[7]

*** p ≦ .01

** p ≦ .05

* p ≦ .10

[7] Standard errors are robust for linear probability model, but are not robust for fixed effects panel regression due to statistical software limitations

Table 2 presents the results of the regressions using the definition of contagion associated with the spread of protests to countries that share a common language (spoken by over nine percent of the population) for the same set of countries, once again using the log of average youth female unemployment as an instrumental variable.

The results interestingly indicate that for the same set of countries, which excludes many former socialist countries and countries with very low polity scores, the effect of protests occurring in countries sharing a common language appears to decrease the probability of a protest taking place in a country during a given month. Once again, the addition of a media variable and a media interaction term significantly amplifies the magnitude of the contagion effect, this time in the negative direction. This essentially implies that if large protests are occurring in a country sharing a common language with other countries, the countries with freer media have a higher probability of not witnessing protests during that month. Once again, running a fixed effects regression does not appear to reverse the observed trend, and simply increases the noise of the coefficients.

These results suggest that the role played by the media should be reconsidered. This model does not include the angle of protest coverage by the media. Perhaps the media is capable of negatively influencing protest incidence by reporting on neighbouring protests from a negative angle. An explanation is still needed, however, for why the angle of protest coverage would differ depending on whether the protests are occurring in a neighbouring country or in one in which people speak a common language.

Table 3 presents the results of both models using the definition of contagion associated with the spread of protests to countries that share a common official language (spoken by over 20 percent of the population), this time using the average ‘linguistic neighbourhood’ polity score as an independent variable.

These statistical results are obtained using a larger number of observations, which include the highly authoritarian countries dropped in regressions, and includes a female youth unemployment variable. The coefficients on the variable for contagion from countries with a common official language are negative and significant at the five percent level. These results display further evidence of an amplifying media effect. However, in this case, running these models using a fixed effects regression increased the standard errors to the point of removing any significance from all variable coefficients.

This suggests another possible explanation for the negative sign of the contagion variable, and the positive sign of the interaction term. This set of regressions included observations from Czechoslovakia, the Czech Republic, the GDR, Poland and Hungary, all of which experienced increased media freedom around the same time as important regime changes occurred. Regime change, as denoted by regime end, is shown to be a significant indicator of protest incidence. If most of these protests occurred before the loosening of media restrictions, this could explain the significance of the inverse relationship between degree of media freedom and protest incidence.

Table 2

	(1)	(2)	(3)	(4)
Lagged DV (n-1)	.079 (.049)	.070*** (.021)	.080 (.049)	.077*** (.025)
Election month	.009 (.016)	.009 (.014)	.009 (.016)	.015 (.016)
Regime End	-.022*** (.005)	-.025 (.053)	-.020*** (.005)	-.017 (.059)
Polity	-.047 (.051)	.508* (.261)	-.045 (.048)	.302 (.347)
Polity^2	.003 (.003)	-.028* (.015)	.003 (.003)	-.017 (.019)
Log Female Youth Unemployment	.017*** (.005)	.008 (.010)	.017*** (.005)	.005 (.011)
Media			-.015 (.014)	-.046 (.053)
Common language protests (IV: Log Average Female Unemployment)	.042 (.120)	-.297 (.404)	-.181 (.437)	-2.29 (1.65)
Common language protests*Media (IV: Log Average Female Unemployment*media)			.213 (.360)	1.85 (1.31)
Constant	.137 (.216)	-2.26* (1.16)	.144 (.197)	-1.30 (1.58)
Fixed Effects Panel Regression	No	Yes	No	Yes
Observations	2664	2665	2666	2667
F-value, first stage regression	10.85	3.76	8.98	3.98

Note: values in parentheses are standard errors

*** p ≦ .01

** p ≦ .05

* p ≦ .10

Table 3

	(1)	(2)
Lagged DV (n-1)	.138*** (.039)	.138*** (.039)
Election month	.021 (.016)	.022 (.016)
Regime End	.157* (.086)	.157* (.086)
Polity	.002*** (.000)	.001 (.001)
Polity^2	-.001*** (.000)	-.001*** (.000)
Media		-.007 (.013)
Official common language protests (IV: Average Polity Score)	-.116** (.057)	-.274** (.115)
Official common language protests*Media (IV: Average Polity Score*media)		.186** (.093)
Constant	.061*** (.012)	.081** (.038)
Fixed Effects Panel Regression	No	No
Observations	4521	4521
F-value, first stage regression	26.15	25.48

Note: values in parentheses are standard errors

*** p ≦ .01

** p ≦ .05

* p ≦ .10

Result Interpretation

This statistical analysis presents weak evidence suggesting that between 1980 to 1995 in Europe, if contagion effects were present, they occurred between bordering countries and not between countries sharing cultural similarities such as a common language. Despite increasing the noise of the coefficients, controlling for fixed effects does not reduce the magnitude of contagion effects, whether they are positive or negative. This indicates that although country similarities may play a role in explaining cross-border protest waves, a country's population is partially induced to demonstrate or even to avoid demonstrating, based the occurrence of near-by large-scale protests.

When considering all the results obtained, the magnifying effect of the media on contagion is the most consistent. Adding a media variable and a media-contagion interaction term almost always increases the absolute magnitude of the contagion term, and is accompanied by a coefficient of the opposite sign on the media-contagion term. This result reflects the economic intuition, as a media score of zero can essentially be interpreted as a case where there is perfect information flow regarding protests between countries. Assuming that a population's decision to engage in large-scale protest action is influenced by the incidence of protests in near-by countries, the more information it has, the stronger the effect of near-by protest incidence, whether positive or negative.

This, however, does not explain why bordering countries' protests may positively influence the likelihood of protest incidence, while shared language countries' protests appear to have a negative influence. This particular point requires a reconsideration of why one country's protest may affect another population's decision to protest. If the driving force behind protests is the protesters' belief that they can succeed, perhaps the protest incidence of near-by countries is less important than the outcome of the protest. This could suggest that the actual contagion effect is moderately to severely lagged, or that its existence is entirely dependent on the protesters' demands being met by the government of protesting countries. Alternatively, the media's angle of coverage may play an important role in determining whether near-by countries' protests exert a positive or a negative influence contagion effect.

Interpretation Issues

Many of the coefficients motivating the previous interpretation are not significant because of high standard errors. This may be explained by endogeneity concerns facing the model, and the limitations posed by the available data. Although I have attempted to diminish the consequences of potential endogeneity using independent variables, these may be too weak to provide statistically reliable independent variables, or may fail to be uncorrelated with the error term. Female youth unemployment and polity scores both explain variance in the endogenous contagion variables; however, polity and female

youth unemployment are measured yearly while the contagion variables change monthly.[8]

One endogeneity concern not addressed is the presence of a lagged dependent variable in both models, which was assumed exogenous in computing the two-stage least squares estimation. This assumption was made in the interest of avoiding additional complications.

One way in which my analysis can be further fine-tuned is by modifying the large-scale protest threshold. The 0.75 percent of the population cut-off value for large-scale protests is somewhat arbitrary, and aims to capture only the largest protest movements in every country over the relevant time period. Small protest movements are generally less likely to involve grievances that affect a significant portion of the population, and therefore are likely to experience different spreading mechanisms than large protests. In the interest of avoiding possible confounding effects of smaller protest movements, the threshold was set relatively high. However, an interesting future task would be to experiment with different thresholds to observe any effects on the significance of the results.

Conclusion

The conclusions drawn from the results yielded by my model are likely limited by the scope and range of my data. The implications of contagion across borders and countries sharing a common language, and the effect of the media may not hold true in light of more recent protest data. The European case may not be applicable to protest behaviour in the rest of the world, as European countries have certain continent-specific characteristics that may affect the way that protest movements spread across countries. Furthermore, large advances in technology have been made since 1995, many of which have revolutionized the way the media operates and alternative forms of media have sprung up in countries where media freedom levels are particularly low. Changes in the mechanisms of information flow are also expected to have an effect on the role of the media plays in exacerbating the probability of protest contagion.

While the conclusions drawn from the statistical results obtained by my models may be limited in applicability, my analysis provides a framework for approaching the topic of protest movements transcending national borders. The models I have used provide a starting point for the analysis of the contagion effect, should new protest data become available. These models are also readily adaptable to different definitions of contagion. For example, a contagion variable can easily be created for countries sharing a common regime type, or countries having the same main export good, or a combination of many of these definitions. My two models can also be extended by adding a variable measuring the influence of successful protests, allowing for different definitions of success.

[8] I attempted to create instrumental variables using elections or end regime, which vary on a monthly basis, however these yielded much lower F-values in the first stage-least squares regression, proving to be worse instruments than those using female youth unemployment or polity.

Further areas of interest include whether geographical proximity is always a better predictor of protest contagion than common language, and if protests in countries sharing a common language always reduce the probability of protest occurring in a given country. Whether widely applicable or not, the results of this analysis provide interesting questions for further investigation in the field of political protest research.

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Appendix

Countries included in the dataset are coded as follows:

Country	Country ID
Albania	1
Austria	2
Belgium	3
Bulgaria	4
Cyprus	5
Czechoslovakia	6
Czech Republic	7
Denmark	8
Finland	9
France	10
Federal Republic of Germany/Germany	11
German Democratic Republic	12
Greece	13
Hungary	14
Ireland	15
Italy	16
Luxembourg	17
Netherlands	18
Norway	19
Poland	20
Portugal	21
Romania	22
Slovakia	23
Spain	24
Sweden	25
Switzerland	26
United Kingdom	27

Bitcoin: Financial Innovation Burgeoning into a New Form of Stable and Convenient Money

Tom Sykora

I. Introduction

The ancient Chinese curse, “May you live in interesting times,” certainly seems to have been cast on the monetary and financial systems of the world, especially in the last 100 years. In that period, economies have experienced historic downturns such as the Great Depression and the recent financial crisis of 2007-09. Moreover, many monetary, fiscal and financial innovations have become widespread such as fiat currencies, fractional reserve banking, Keynesian business cycle smoothing and the use of derivatives. On the tail end of the most recent financial crisis, a new financial innovation has been created that represents a truly novel approach to the definition of money; namely, Bitcoin.

In this paper, I argue that Bitcoin has the potential to become a dominant electronic currency to facilitate international trade and payment. The arguments put forth cover the benefits of Bitcoin as well as its properties. First, I show that Bitcoin, as an electronic payment system, has distinct advantages over current payment systems such as bank wires, debit/credit cards, cheques, and to some degree, even cash. Second, as a result of Bitcoin’s inherent algorithm to stabilize the money supply, it is not prone to inflation, especially when compared to some hyperinflationary episodes within the last century. Third, I demonstrate that Bitcoin has the ability to satisfy the three properties of money. Finally, I discuss some potential risks associated with broad adoption of Bitcoin as a currency in the long run.

II. The Rise of a New Currency

Bitcoin is a recent technological innovation designed as a decentralized, cyber-crypto-currency. There is no central authority required to issue and maintain the currency, since the Bitcoin network itself, with its distributed nodes, performs the task of creating new Bitcoins (called “mining”) and verifying all transactions that have occurred. The Bitcoin Protocol was designed to prevent double spending without the use of a trusted third-party such as a central bank. Essentially, transactions are encrypted with a public-private key authentication system and verification is performed via “forced work”, meaning that a certain amount of computer CPU cycles must be performed in order to generate the correct hash (a numeric value) that is then broadcast to the entire network. Once a transaction is verified, it becomes part of the transaction ledger, called the block chain. The larger the block chain, the more certain the nodes are that the transactions contained within the chain are valid, and consequently, the same owner is prevented from

spending the same Bitcoins twice (Nakamoto 2008).

Bitcoin was developed as an open-source project so that a community of software developers would have the ability to closely monitor the source code. This monitoring greatly reduces the probability of covert insertion of malicious code, "Indeed, as cybercrime goes, Bitcoin may be safer than traditional financial institutions, which are often on the receiving end of such attacks".[1] In addition to the availability of the project to all software developers, participation in the Bitcoin network is open to anybody with a computer, some software and an Internet connection. This represents a stark contrast to the system of debit and credit cards, which require authorization from a financial institution.

Since the first Bitcoins were mined in early 2009, the relative price of Bitcoins to U.S. dollars and the number of transactions have increased vastly (Figures 1 and 2 show the meteoric rise of both, respectively). Bitcoins are used as payment for online services such as Web development as well as real world commerce through venues such as restaurants.[2]

To use Bitcoins, a user requires a Bitcoin wallet, which is simply some software that runs on a user's computer or exists on some trusted service provider's servers. Each wallet can contain one or more unique addresses that are available to receive Bitcoins; superfluous addresses enhance a user's anonymity. After the wallet is funded,[3] a user is then able to trade his Bitcoins for goods and services by sending his Bitcoins to a recipient's address. Once confirmed by the Bitcoin network, the Bitcoins will then exist in the recipient's wallet.

Above, I have described most of the rudimentary technical details of Bitcoin and its usage. Next, the focus shifts to an economic examination.

III. Bitcoin as a Major Electronic Currency

III.1 Superior Electronic Payment System

Modern financial transactions are settled in many ways. Today, the most common method in the developed world is electronic funds transfers that can take many forms including bank wires, debit and credit card transactions. Paper notes such as cheques, bank drafts and, of course, cash are another popular form of settlement. There are advantages and disadvantages involved with each of the aforementioned forms of payment. While all of these methods are distinct, they share one common attribute: issuance of the underlying currency by a central authority (most commonly a central bank). Moreover, once cash is in circulation, every one of these payment forms (aside

[1] "Virtual Currencies." Last updated June 15, 2011.
http://www.economist.com/blogs/babbage/2011/06/virtual-currency

[2] For a listing of current locations accepting Bitcoin as payment see https://en.bitcoin.it/wiki/Trade.

[3] There are several ways to fund a wallet such as using an exchange provider that converts fiat currency into Bitcoins or by directly trading some labour in exchange for Bitcoins. (*Getting started with Bitcoin*. Accessed March 31, 2013. https: //www.weusecoins.com/getting-started.php).

from the cash itself) requires a financial intermediary to perform settlement of payments via their networks and/or fiduciary instruments. For example, most major banks participate in the Society for Worldwide Interbank Financial Telecommunication (SWIFT) network, which accommodates bank wire transfers. Ultimately, any individual dealing with these financial institutions relies on trust as the mechanism for keeping his financial assets safe and for ensuring that his transactions are carried out securely and correctly. Unfortunately, history is replete with instances of banks failing and governments defaulting (Allen and Gale 2007, 1-24; Reinhart and Rogoff 2009, 49-98, 139-171). In addition, whether justified or not, there have been restrictions imposed on the movement of money such as through capital controls or sanctions (Quinn 2003; Bale 2012). These examples and other mishaps tend to spoil or completely destroy the trust that once existed and may leave the individual with limited access to his assets or even the inability to recover a portion of said assets. With Bitcoin, trust is not placed with a central authority or a financial intermediary, but in technology: specifically, cryptography and mathematics. Proven and well-defined encryption algorithms and brute-force mathematical hashes are the key to making Bitcoin trustworthy as a payment system. As long as the Internet is functioning[4] and people continue to participate in the Bitcoin network, currency holders have the ability to access their Bitcoins and make unrestricted payments.

Another advantage of Bitcoin as a payment system is its cost, convenience and speed of processing payments. With many forms of electronic payment, such as credit card purchases, the fees charged to consumers and merchants can be substantial (Kelly 2013), and merchants can suffer from charge-backs and countermands that are sometimes associated with fraud. The usage of some instruments requires the physical presence of the user at a particular location to initiate the transaction or to obtain the instrument. In addition to the cost and convenience factors mentioned above, all of these forms, except for cash, require a fairly long settlement period by today's technological standards, lasting anywhere from one day to a week or more. Conversely, the Bitcoin network operates with voluntary fees and thus fees are low or zero.[5] Moreover, the settlement process lasts, on average, ten minutes (Nakamoto 2008, 4) meaning a transaction is finalized much faster than with many of the other present forms of payment. Another benefit of Bitcoin is that transactions can be facilitated in several ways. First, users can log into an online wallet service[6] and use the interface to make a transaction. Second, users can have a wallet running on their home computers, which allows them make payments without the need for a third-party service. Third, by running a Bitcoin application on their smart-phones, users can make payments anywhere that Internet access is available, often through mobile service providers' data access points. Bitcoin, therefore, allows for Web purchases as well as emulating in-person payments using a mobile device.

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[4] As is commonly known, the Internet was designed as a decentralized communication system to withstand large-scale wars, natural disasters and other catastrophes. If the Internet were to go off-line, Bitcoin would not be the only system affected. In such an event, the global economy would come to a grinding halt.

[5] However, a sender can pay a small fee as an incentive for miners to process his transaction quicker (*Getting started with Bitcoin.* Accessed March 30, 2013. https://www.weusecoins.com/getting-started.php).

[6] For example, Coinbase (http://coinbase.com).

Many people believe that their financial dealings should remain private. Presumably that is why cash transactions are still in favour today, albeit for small value transactions. Bitcoin can also provide a form of anonymity, however, unlike cash, Bitcoin addresses are not truly anonymous, but "pseudonymous". That is, by design, all transactions are public so given the will, through data mining and network analysis, Bitcoin addresses can possibly reveal somebody's identity. Having said that, there are ways to strongly increase the level of a user's privacy to a degree that a user can effectively enjoy full anonymity.[7] Furthermore, the ability to perform anonymous transactions removes many of the burdens associated with establishing and operating a bank account such as providing copious amounts of identification or being granted authorization for various transactions or their associated limits. Thus there is reasonable evidence to suggest that Bitcoin has the ability to make economic activity smoother and more accessible by removing potentially unnecessary encumbrances.

III.2 Built-in Inflation Control

Milton Friedman famously said, "Inflation is always and everywhere a monetary phenomenon" (Friedman and The Council for Economic Education 1963, 17). A recent and extreme example of this notion is the hyperinflation experienced in Zimbabwe where, "Inflation is estimated to have peaked in September 2008 at about 500 billion (10) percent" (Coomer and Gstraunthaler 2011, 21). Interestingly, as shown in Figure 3, during and after the financial crisis of 2007-2009, the U.S. money supply has seen explosive growth. Indeed, many developed countries have undertaken some form of quantitative easing in an attempt to jolt their economies into recovery or to provide liquidity. The world is still watching and waiting to see what, if any, inflation will result from these monetary expansions. Nonetheless, Fischer, Sahay and Vegh (2002) demonstrate that there is clear evidence, as shown in Figure 4, that a strong positive correlation exists between the growth of the money stock and price levels. In addition, today's monetary system is based on fiat money (most of which exists electronically) instead of commodity money. This allows for less effort to be exerted in the manipulation of the money supply by governments for various ends. In the name of repaying debts, boosting exports or funding military excursions, governments can dilute the value of their currency through money printing.

In light of this observation, Bitcoin was purposefully devised to mimic a steady and predictable growth in the stock of Bitcoins, somewhat akin to controlled mining of a commodity money, such as gold. This growth is to continue until the Bitcoin supply reaches its upper limit of 21 million around the year 2140 (Wallace 2011). Following this upper bound of available Bitcoins, a deflationary environment would undoubtedly prevail within the Bitcoin economy. That is, aggregate prices would begin to fall as each Bitcoin in existence gains in relative value. Bordo and Ellson (1985) argue if a gold money standard were to be adopted, eventually long-run deflation would take hold due to resource depletion and real economic growth. Thus, if their model were observed in practice, Bitcoin would experience the same outcome as the classical gold standard.

[7] For a more detailed description on anonymity in Bitcoin and how to increase it see https://en.bitcoin.it/wiki/Anonymity.

The inflation versus deflation debate with respect to economic policy remains unresolved. Some Austrian economists are not averse to deflation: "[Murray] Rothbard takes a more favorable position toward deflation than most Austrian economists and, of course, than the mainstream economists" (Bagus 2003, 19). Ben Bernake and others, however, caution against the risks of deflation: "Sustained deflation can be highly destructive to a modern economy and should be strongly resisted" (Bernanke 2002). In the face of this existing debate, this paper does not take a position on deflation, but considers that most, if not all, economists view high inflation as a condition that wreaks havoc on economies and people's lives. To the extent that high inflation can result from governments interfering with the money supply, Bitcoin can be viewed as a reliable deterrent. By its very nature, Bitcoin is anti-inflationary and therefore prevents or mitigates loss of purchasing power, uncertainty over expected prices, and monetary and fiscal dishonesty. Should the currencies of the world suffer from higher inflation in the years to come, Bitcoin's inherent deflationary property could entice the masses to adopt Bitcoin as a currency and participate in the Bitcoin economy.

III.3 Is it Money?

Before Bitcoin can become classified as a significant currency, it should pass, or have the potential to pass, the standard definition of money. The standard criteria that allow something to meet the definition of "money" are ability to act as: a medium of exchange, a store of value and a unit of account. Historically, the production of a particular form of money from gold coins to paper notes always remained within a nation-state, kingdom or region. For instance, even in the relatively free market era of coin minting, each mint was limited by a higher authority and by a specified location, "In England, for example, the mint system was directed by the crown, and all mints issued the same coin, whereas in France there existed a multitude of issuing authorities, coins and accounting systems, and Italy's largely autonomous cities all issued their own coins" (Eichengreen and Sussman 2000, 6). In this respect, Bitcoin deviates from the norm, since the production of Bitcoins exists across the entire Internet and the only authority is the mining protocol existing as code in software. The idea of an electronic, decentralized currency existing solely on the Internet represents a very unusual and novel interpretation of money and currency. In particular, when economists originally imagined the idea of money, they could never foresee the advent of the Internet and how it, in some ways, acts as its own nation, permeating physical geographies and national jurisdictions. What follows is a discussion of Bitcoin's ability to satisfy the three properties of money.

First, as previously mentioned, Bitcoin is already being used as a medium of exchange in many online purchases and being accepted by a growing number of merchants. Some appropriate indicators of a medium of exchange are recognition, homogeneity, divisibility, durability, portability and resistance to counterfeiting. Both commodity[8] and fiat[9] money are good candidates with respect to recognition and homogeneity. Fiat money

[8] Here I consider metallic coins such as gold and silver as commodity money since they both have a long history of serving as such.

[9] This includes paper notes as well as coins minted with little intrinsic value (non-gold and non-silver

is quite adept at being divisible, but commodity money has some problems. Specifically, as Velde (1998) highlights, commodity money suffers from “The Big Problem of Small Change" and a solution for finding a way to keep large and small coins in circulation requires token coinage and a central authority. Thus, in the absence of the solution, purchases of vastly varying amounts become very difficult when only one denomination of a coin exists in circulation. On the other hand, commodity money is much more durable than fiat paper money. As for portability, commodity money suffers from weight and transportation issues for large purchases. Also associated with transportation, commodity and fiat money are prone to the prospect of theft. Lastly, counterfeiting has been a plague on both commodity and fiat currencies since their inception. In contrast, Bitcoin is recognizable in a virtual sense due to its adherence to the protocol. Bitcoin also satisfies homogeneity, as each Bitcoin exists simply as a computationally identifiable digital sequence of bits. Bitcoin excels in terms of divisibility since it can scale up or down to eight decimal places. Since Bitcoin is non-physical, it relies on the existence of the Internet and continued use of the Bitcoin network to ensure its divisibility, thus Bitcoin could, at least theoretically, exist indefinitely. Furthermore, while Bitcoins themselves are not portable, the virtual nature of Bitcoin and the use of mobile devices means that payments can be. Finally, Bitcoin is nearly impossible to counterfeit due to its inherent cryptographic and decentralized design. Therefore, Bitcoin sufficiently meets the stated measures that constitute a “medium of exchange”.

The second property of money, the store of value, perhaps requires the most faith on the part of currency holders. Expressly, to hope to realize future purchasing power, people must believe in their choice of savings vehicle. In the same vein, commodity money has, even to this day, proven itself as a reliable store of value, at least in a long-run sense and in real terms (Harmston 1998). Fiat money, alternatively, does not enjoy this degree of persistence. Globally, a fully fiat monetary system has only been in existence since 1971 with the termination of Bretton-Woods. In the last four decades, using fiat money as a store of value has retained *nominal* purchasing power. Of course, that is subject to time and space; for example, the German Deutsche Mark, though once strong, is no longer a recognized currency and thus a poor store of value. Bitcoin is still too young a currency to rate its success as a store of value, but the potential exists for the same reasons mentioned above: if the Internet and Bitcoin network continue to operate, there is no reason why Bitcoins cannot act as a good store of value. Furthermore, since Bitcoin leans toward a deflationary design, its real purchasing power, assuming economic growth, should increase.

Lastly, the unit of account property of money is important for an economy to conduct business. Having a standard numerical measure of value to relate prices allows for opportunity cost and tax payment calculations, and market clearing, among other things. Presently, most national economies operate under a fiat system as a unit of account within each jurisdiction. For international trade settlement, the U.S. dollar is typically the reserve currency. Though commodity money has historically been used as a unit of account, demonstrating its ability to fulfill the unit of account property, that is not the case today. Similarly, Bitcoin has the potential to be a unit of account, but has not yet been widely

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coins), both of which are un-backed and derive their value by decree of a government.

adopted as such. There are, however, some merchants that are pricing in Bitcoin[10] by converting the U.S. dollar equivalent to Bitcoins through the current exchange rate. As previously discussed, the nation of Bitcoin can be understood as the Internet, and thus one can imagine that any transactions conducted over the Internet can use Bitcoins as the numéraire. Just as exchange rate conversions are performed when an individual wants to purchase goods or services from a foreign jurisdiction, Bitcoin and the Internet could act as another foreign currency and jurisdiction, respectively.

IV. Risks

For any currency to be practical and meaningful, it must afford the people using it the ability to spend it and to save it. With that in mind, there are two main risks to Bitcoin's widespread adoption as a currency in the long run: (i) extreme price volatility and (ii) political risk.

Firstly, wild price fluctuations of Bitcoin could dissuade individuals[11] from acquiring and holding Bitcoin. Regardless of the currency, economic actors save whatever they do not spend. Presumably those people want to feel confident that the currency units they have saved will retain purchasing power in the future in real or nominal terms, in the case of an inflationary environment. Needless to say, when a currency experiences massive or frequent price volatility, confidence in its ability to act as a store of value is diminished or lost; Bitcoin is not immune to this phenomenon. Alas, Bitcoin has encountered some major price swings in its short lifespan. For example, in the spring/summer of 2011, the Bitcoin price in terms of U.S. dollars lost about 90 percent of its value (see Figure 1). As the latest data from *Bitcoin charts*[12] indicate, Bitcoin has experienced some more price swings lately, but not to the same degree, in percentage terms, as in its early years. Moreover, rather than any fundamental economic causes, most of the price volatility stems from highly publicized media events such as failures of various Bitcoin exchanges as well as incidents of illicit trade activities settling in Bitcoin. Therefore, in order to induce more people to save a portion of their wealth as well as make payments in Bitcoins, the Bitcoin price should be widely perceived as stable to an extent.

Secondly, and more importantly, political risk may be a substantial hurdle to Bitcoin's success. Since the very nature of the crypto-currency is a threat to central banking and, possibly, governmental capital controls and taxation, there exists the foreseeable risk that some of these institutions could implement countermeasures in an attempt to subvert Bitcoin's use. In particular, governments can enact laws banning the use of Bitcoins, though this, like online file sharing software, would be difficult to enforce. Another potential avenue would be to outlaw Bitcoin exchanges where people can trade Bitcoins for fiat currencies and vice versa. This measure may be effective within a jurisdiction, but

[10] For example, see http://giftsforcoins.com/store/ and http://www.bitcoinin.com/.
[11] This applies equally to merchants as they will be hesitant to accept Bitcoin as a form of payment lest they suffer exchange rate or purchasing power losses.
[12] *Bitcoin charts*. Accessed March 30, 2013.
http://bitcoincharts.com/charts/mtgoxUSD#tgCzm1g10zm2g25

more difficult globally. Furthermore, there exists little possibility to prevent individuals from exchanging Bitcoins using other methods such as face to face or through online forums. As mentioned previously, Bitcoin's distributed design makes it nearly as robust as the Internet itself. Akin to the hitherto unsuccessful War on Drugs, illegalization of Bitcoin is not likely to result in its eradication if sufficient demand for the crypto-currency persists.

V. Conclusion

As far as financial innovations are concerned, the idea of a currency existing solely on the Internet with no central authority to manage its supply and having a foundation predicated on mathematics and cryptography is truly revolutionary and unorthodox. Bitcoin is such an innovation. This paper has demonstrated that Bitcoin has the potential to flourish into a major currency for conducting international trade. It was shown that through the ease of joining the network, retaining privacy, enjoying lower transaction fees and higher convenience, and having transactions settle in minutes instead of days, Bitcoin demonstrates its remarkable ability as a rival payment system to the traditional forms such as bank wires and credit cards. In addition, Bitcoin's design for a controlled growth rate of the supply of Bitcoins prevents it from being exorbitantly inflated by careless governments or exogenous supply shocks. This offers better price stability when compared to the many historic and recent inflationary episodes experienced by national currencies. Finally, though Bitcoin is still aborning, it satisfies the three properties of money or at the very least, demonstrates its capacity to be money.

There exist risks in the form of extreme price volatility and political obstruction, which may undermine Bitcoin's widespread adoption and long run viability as a currency. Thus, it may be premature to make a definitive statement on Bitcoin's lifespan. However, the concept of a decentralized cyber-crypto-currency will be difficult to stuff back into Pandora's box.

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Appendix

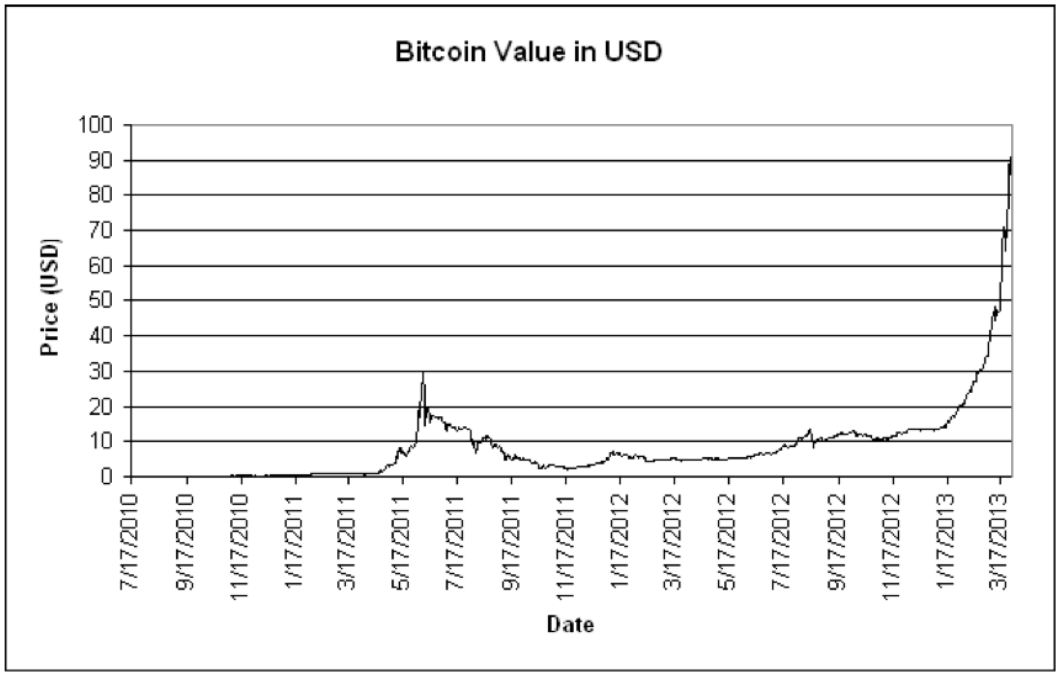

Figure 1: Bitcoin value in U.S. dollars (Source: *Bitcoin charts* 2013).

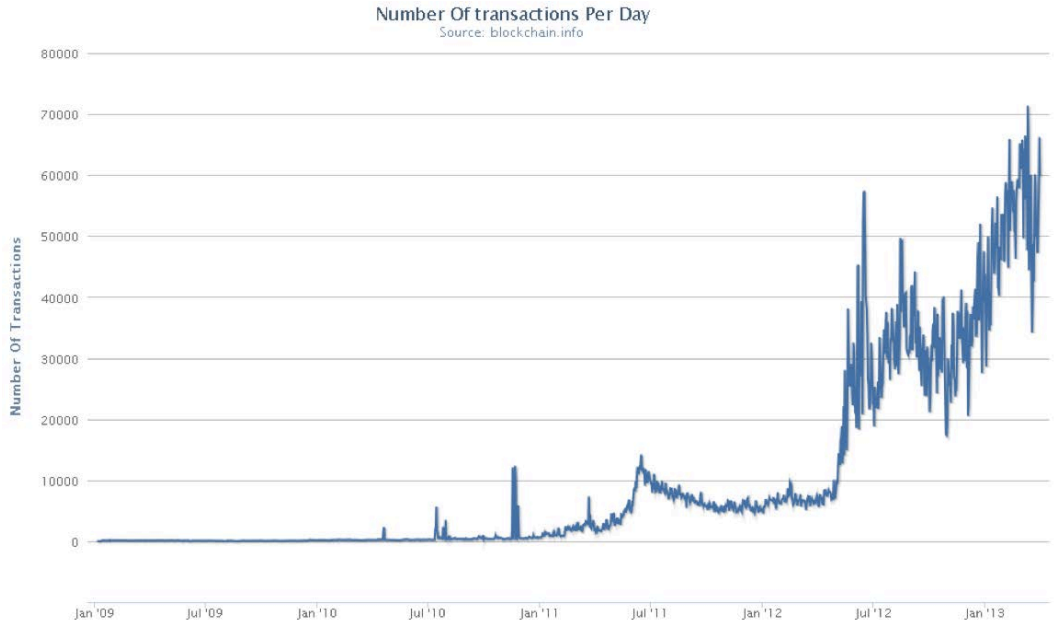

Figure 2: Estimated Bitcoin transactions per day.[13]

[13] Blockchain. "Number of Bitcoins." Accessed March 30, 2013. http://www.chicagomanualofstyle.org/tools_citationguide.html

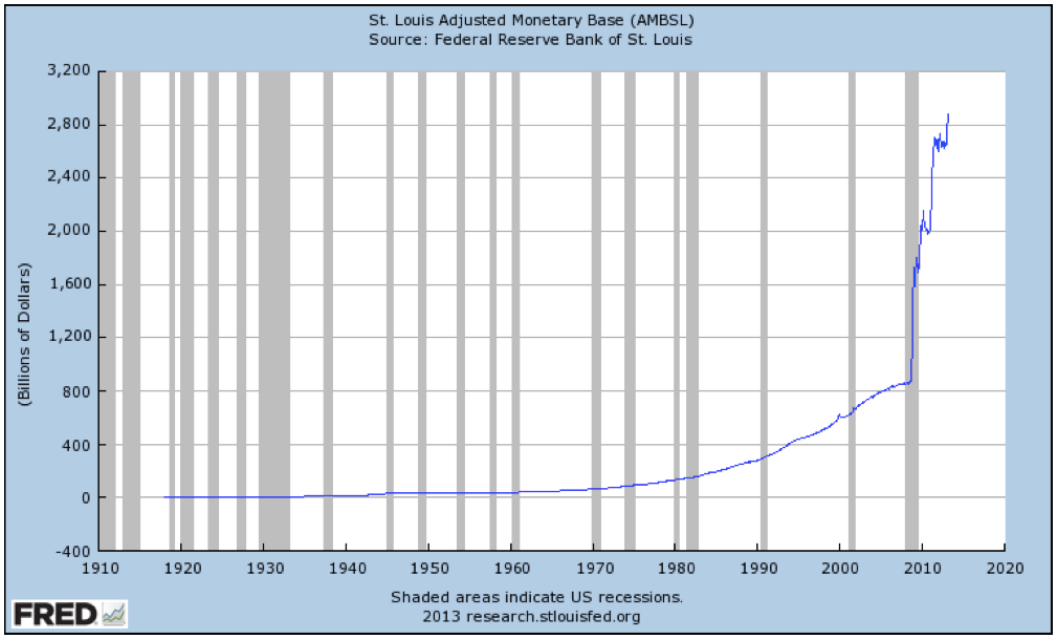

Figure 3: U.S. adjusted monetary base.[14]

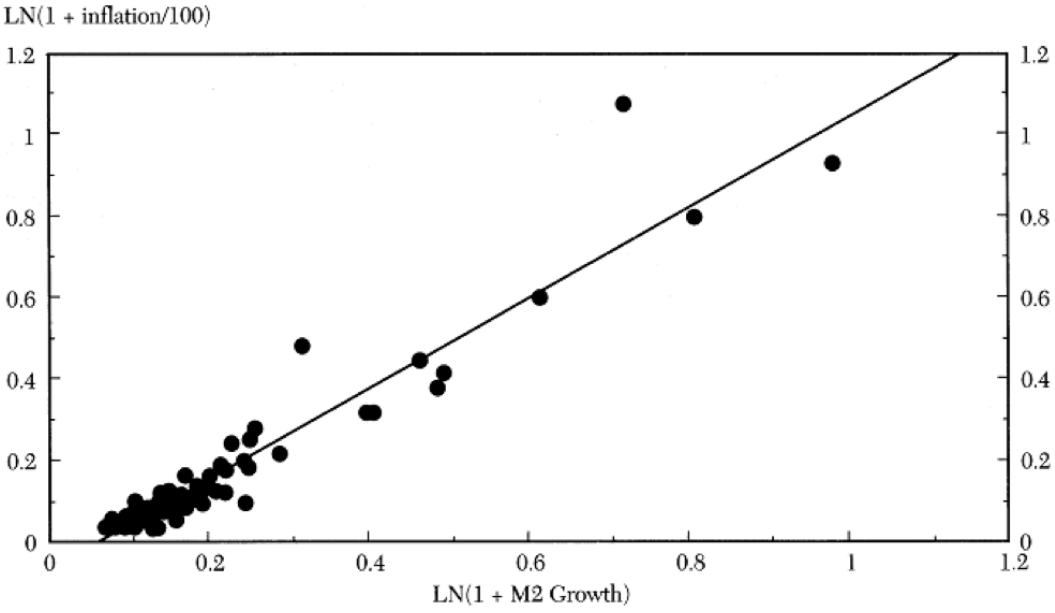

Figure 2. Inflation and Money (M2) Growth[1]
1960–95 averages

[1] Slope of regression line is 1.115 with a t-statistic of 12.13; 94 countries in total, each with 10 or more observations.

Figure 4: Correlation between inflation and money supply growth (Source: Fischer, Sahay, and Vegh 2002, p. 848).

[14] Federal Reserve Bank of St. Louis. "St. Louis Adjusted Monetary Base." Accessed April 4, 2013; page now discontinued. http://research.stlouisfed.org/fred2/ series/AMBSL

The Effect of a Recession on the Volunteer Workforce and Donation Activity in the United States

Courtney White and Vybhavi Balasundharam

Abstract

The non-profit sector is an important and integral part of the American Economy. During a recession, the demand for both the volunteer workforce and monetary donations increases. In our paper, we analyze the effect of a recession on the supply of volunteer hours and donations in the United States. We hypothesize that supply of both volunteer hours and donations will increase during a recession, because the intrinsic motivations will continue to outweigh the extrinsic motivations as prior to the recession. We develop a model to replicate the individual's decision making and determine that the effect of a recession on volunteering and donations depends on the level of altruistic motivation present during these times. The empirical analysis rejects our hypothesis. The extrinsic motivations dominate the intrinsic motivations in times of economic distress. During a recession, donations decrease. However, there is no significant change in volunteer hours.

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Introduction

Many goods and services are non-rival and non-exclusive, and as a result would not be provided by the free market alone. In addition, the government is unable to provide all of these aforementioned services. Therefore, the sustainability of the non-profit sector is crucial to the economy, and government policies pertaining to the sector's inputs must be analyzed effectively.

The non-profit sector is funded largely through donations, and many of the operations in this sector involve the use of volunteers. Volunteer activity is work performed without monetary compensation, which creates social output that would otherwise require paid resources (Freeman 1997). Approximately 64.3 million people volunteered in the United States from September 2010 to September 2011 (Bureau of Labor Statistics, 2012). In 2010, volunteers served 8.1 billion hours, which was valued at approximately $173 billion, according to the Corporation for National & Community Service (2011). According to the Internal Revenue Agency (2012) a charitable contribution represents a donation of money or gifts to a qualified and recognized organization without the

expectation of anything in return. For the purposes of our research, we are interested in determining the effect on solely monetary contributions rather than physical gifts. In 2011, individuals, foundations and corporations increased aggregate donations from the prior year by 4 percent to $298 billion (The Center on Philanthropy at Indiana University 2012).

Since the non–profit sector requires both donations and volunteers to function, it becomes critical to assess the interdependence of monetary donations and time spent volunteering, both of which are philanthropic endeavours. Much of the literature on volunteerism and donations of money discuss whether or not donations of time and money are related. Andreoni, Gale and Sholtz (1996), Brown and Lankford (1992) found that gifts of time and money were complements of each other, as did Menchik and Weisbrod (1987) and Callen (1994). Understanding the nature of the relationship between these two activities is essential when explaining behaviours and developing appropriate government policies. For example, the effect of deductibility of charitable donations on the amount of time spent volunteering is dependent on whether these two activities are complements, substitutes, or neither. We expect the nature of this relationship to contribute to patterns witnessed during a recession on these two philanthropic activities, and thus the relationship is considered in our model and empirical analysis.

During a recession, volunteers and donations become even more critical for the functioning of an economy, as there is an increase in unmet needs during this period (Starr 2010). The rise in demand is a result of greater need for human services, as homelessness, hunger, mental health problems, crime and other social problems rise while less funding is available to meet these needs. Despite the importance of volunteer activity during a recession, the economic literature involving the voluntary labour force has been relatively quiet compared to other topics, due to the lack of compensation received by participants (Menchik and Weisbrod 1987). Volunteering raises questions about behaviours and social pressures that are not part of standard analyses of work for compensation (Freeman 1997). The economic community must consider the patterns in volunteering and donating, as government policy has the ability to affect these patterns. In our paper, we would like to determine the relationship during a recession, when there is a surge in demand for volunteers and donations. The results of this paper will have important policy implications especially if the supply of philanthropic activity does not increase to meet this higher demand. If there is a shortage of donations and volunteer activity, then the government should devise and implement policies that encourage individuals to donate their time and money during a recession.

Literature Review

Volunteering is an interesting subject largely because there are few, if any, monetary incentives for participation. Generally, an individual’s decision to work is seen as a means of accumulating money, with which he or she can gain some utility through the consumption of goods and services as well as spending time on leisure and other activities. The decision to volunteer, on the other hand, cannot be understood in terms of

direct monetary reward. Donations actually reduce the money available for the individual to spend on consumption. Thus, much of the literature on this subject argues as to what motivates an individual to donate time and money. We want to use the previous conclusions on philanthropic activities in order to determine the patterns that explain volunteering and donation during a recession, and whether certain motivational effects are more or less prevalent during a recessionary period. The major types of motivations discussed in the literature are "intrinsic" and "extrinsic".

Intrinsic Motivations to Volunteer

An individual is "intrinsically motivated to perform an activity when he receives no apparent rewards except the activity itself" (Deci 1971, 105). Intrinsic motivation would indicate that relative prices and opportunity costs have only limited effects on an individual's decision to donate time and money. If the intrinsic motivations have a dominant effect on decision-making, we expect to find that during a recession, when the opportunity cost of philanthropic activities increases, volunteer activity and donations still increase. Since non-profit organizations experience a greater strain, and must stretch their services in times of troubles, altruistically motivated individuals would experience increased utility by helping others through increasing donations of time and money during a recession. In particular, there are three basic rewards that are associated with intrinsic motivations (Meier and Stutzer 2008): the utility of the recipient, feelings of competence by the donor, and the act of helping another. We consider these intrinsic motivations in our regression analysis, as they will determine which type of individual will volunteer in a recession, and may contribute to the changes in patterns witnessed throughout the recession.

The voluntary sector and non-profit organizations are considered a type of public good (Andreoni 1988). As such, altruism plays an important role in explaining volunteer behaviours, but will not solely predict the patterns witnessed in the voluntary sector. According to Andreoni (1988), pure altruistic behaviours fail to explain the empirical data as in large economies, the prevalence of free riders results in only a very small portion of the population donating. Consequently, the average "giving converges to zero" (Andreoni 1988), and volunteer behaviour, therefore, must be additionally influenced by extrinsic motivation. In addition, the presence of monetary incentives may actually negatively effect on volunteer behaviour when intrinsic motivations are present (Frey and Goette 1999), which has implications for the type of government policies that can encourage volunteer behaviour during a recession.

Extrinsic Motivations to Volunteer

There are numerous extrinsic motivations discussed in the literature that will impact the variables incorporated into our econometric regression equation. Extrinsic motivations refer to the outside incentives placed upon an individual, such as financial rewards or recognition. This type of motivation would indicate that relative prices and opportunity costs significantly affect an individual's decision to donate time and money.

The promise of financial rewards, such as tax deductions, provides an incentive to offer volunteer services (Frey and Goette 1999). To measure the extrinsic motivations, the opportunity cost of volunteering can be interpreted as an individual's after-tax wage rate (Menchik and Weisbrod 1987). Accordingly, changes in the wage rate and tax rates can affect an individual's decision to volunteer. Thus, during a recession, when wages increase the opportunity cost also increases, and we will expect the supply for voluntary hours and donations to decrease.

According to Freeman (1997), significant factors affecting the supply of volunteering include the likelihood of being asked to volunteer, the value individuals place on charitable activity, the effect of social pressure and the perceived moral obligation associated with volunteering. Individuals with higher levels of education, employment and generally higher incomes are more likely to be asked to volunteer. This provides an explanation for why people with higher wages and thus higher opportunity costs contribute more to philanthropic activities and suggests that the intrinsic motivations dominate the extrinsic motivations of relative prices and opportunity costs.

Hypothesis

There are two different ways to view the volunteer sector and donation environment:

a) Volunteer work and donation activity can be interpreted under the same framework as any other sector in the economy – individuals make decisions based on the relative prices (opportunity cost). The opportunity cost of volunteering is higher when the wages in the economy increase, hence less voluntary work is offered. Similarly, the opportunity cost of donating is lower when wages rise hence more money is donated. Under this interpretation, the decisions to donate time and money can be understood through their extrinsic motivations.

b) Many volunteers find the goals and purpose of the volunteer sector attractive and achieve some utility from giving and providing services and resources that benefit others. "Ideological founders will seek to hire managers and employees who share their vision. Committed employees may be easier to attract ... (and) may accept lower levels of pay in return for greater certainty that their efforts are actually helping to achieve their altruistic goals" (Rose-Ackerman 1996, 719-720). This view of the non-profit sector extends to the intrinsic motivations discussed earlier.

Given that a significant portion of volunteer activity is provided by employed individuals with high productivity and income, which translates to high opportunity costs (Freeman 1997), this provides reason to hypothesize that intrinsic motivations dominate extrinsic motivations. Those individuals who donate volunteer time are also providing monetary donations. While people who donate usually have lower opportunity costs because of higher wages, the fact that these are the same individuals providing high levels of

volunteer time still supports the idea that the latter effect (b) dominates (a). Thus, during difficult times when there is greater demand for volunteers and donations, the intrinsic motivations will increase further. However, considering that wages decrease during a recession, the extrinsic motivations will decrease as the opportunity cost of volunteering and donations will be lower. Considering that people with higher productivity and income are the ones who pursue philanthropic endeavors in the first place, and that higher wealth individuals are less financially affected proportionally by a recession (Smeeding 2012) than the intrinsic motivations will continue to exceed the extrinsic motivations. Thus, we will expect the supply of volunteer hours and donations to increase during a recession.

Model

The literature on economic modelling of donating time and money is focused largely on two different models: the public goods model and the private consumption model. The public goods model states that individuals will donate time and money if the output or quality of output increases. Therefore, an individual will donate because he values the provision of the public good. The latter model specifies that individuals will always contribute time and money as long as they obtain some enjoyment or utility from giving (Duncan 1999). We will be using the private consumption model in our paper because we are assuming that the individuals are rational and will maximize their utility subject to their constraints.

In our research, we will assume that all supply of volunteers will be consumed, hence there is no surplus in the market, and the demand for volunteers is perfectly elastic at a price of zero (Menchik and Weisbrod 1987).

Let U = Utility of an individual

An individual's utility curve is assumed to be concave and increasing in all goods. Our model will be an extension of the private consumption model that was derived by Menchik and Weisbrod (1987). U is a function of the time spent on leisure (L), the time spent volunteering (v), the amount of consumption expenditures (C), and the amount of monetary donations contributed (D) (Menchik and Weisbrod 1987):

$$U = U(L,v,C,D)$$

The individual faces a time endowment (T), which can be spent pursuing leisure (L), working (H) or volunteering (v):

$$T= v + L + H$$

We will normalise the time endowment to 1 (i.e. T = 1 year)

We want to maximize this utility function, subject to the individual's budget constraint. Let w represents the individual's real wage and let Y represent all non-wage income earned by the individual. Therefore, the budget constraint will be:

$$C = w\,(1- L - v) – D + Y$$

We assume that individuals want to maximize their utility function U subject to the budget constraint, C. Thus, the Lagrangian function is Ł:

$$Ł = U(L,v,C,D) – \lambda\,[w\,(1 – v – L) – D + Y – C]$$

In our model, the utility function will be assumed to be a Constant Elasticity of Substitution function. Thus:

$$U(L,v,C,D) = [a_1L^p + a_2v^p + a_3C^p + (1 - a_1 - a_2 - a_3)D^p]^{1/p}$$

Extending from Menchik and Weisbrod's model, we want to introduce a parameter that models the effect of a recession on the volunteer labour supply. We will include the Recession parameter (R) into the model as a dummy variable where:

$$R = \begin{cases} 1 \text{ when there is a recession} \\ 0 \text{ otherwise} \end{cases}$$

Hence, the utility function is now:

$$U(L,v,C,D) = [a_1L^p + (a_2 + b_2R)v^p + (a_3 + b_3R)D^p + (1 - a_1 - a_2 - a_3)C^p]^{1/p}$$

With this new utility function, we can determine the numerical effect of recession on volunteering (b_2) and donations (b_3) where b_2, b_3 are real numbers. According to this utility function, a recession might affect the utility from volunteering and donating. For example, if $b_2 > 0$, then during a recession, the utility from volunteering will increase indicating that intrinsic motivations is dominating, and volunteering will increase. However, if $b_2 = 0$, then the recession has no effect on volunteering.

Our Lagrangian equation with the recession parameter is:

$$Ł = [\,a_1L^p + (a_2 + b_2R)v^p + (a_3 + b_3R)D^p + (1 - a_1 - a_2 - a_3)C^p]^{1/p} – \lambda\,[w\,(1- L - v) – D + Y – C]]$$

The first-order conditions yield:

1. v: $(a_2 + b_2R)v^{p-1}\,[a_1L^p + (a_2 + b_2R)v^p + (a_3 + b_3R)D^p + (1 - a_1 - a_2 - a_3)C^p]^{(1-p)/p} + \lambda w = 0$

2. L: $a_1 L^{p-1}\,[a_1 L^p + (a_2 + b_2 R)v^p + (a_3 + b_3 R)D^p + (1 - a_1 - a_2 - a_3)C^p]^{(1-p)/p} + \lambda w = 0$
3. D: $(a_3 + b_3 R)D^{p-1}\,[a_1 L^p + (a_2 + b_2 R)v^p + (a_3 + b_3 R)D^p + (1 - a_1 - a_2 - a_3)C^p]^{(1-p)/p} + \lambda = 0$
4. C: $(1 - a_1 - a_2 - a_3)C^{p-1}\,[a_1 L^p + (a_2 + b_2 R)v^p + (a_3 + b_3 R)D^p + (1 - a_1 - a_2 - a_3)C^p]^{(1-p)/p} + \lambda = 0$
5. λ : w(1- L - v) – D + Y – C = 0

Solving for the first order conditions:

a) Using equations 3 & 4:

$$D = C\left(\frac{1 - a_1 - a_2 - a_3}{a_3 + b_3 R}\right)^{1/(p-1)}$$

b) Using equations 1 & 2:

$$L = v\left(\frac{a_2 + b_2 R}{a_1}\right)^{1/(p-1)}$$

c) Using equations 1 & 4:

$$v = C\left[\frac{(1 - a_1 - a_2 - a_3)}{a_2 + b_2 R}\right]^{\frac{1}{p-1}}$$

Now, using equation a) to simply c)

$$v = D\left[\frac{a_3 + b_3 R}{a_2 + b_2 R}\right]^{\frac{1}{p-1}}$$

Substituting a), b) and d) into equation 5 and simplifying:

$$v^* = (w + Y)\left[\left(\frac{1}{w}\left(\frac{a_1}{a_2 + b_2 R}\right)^{\frac{1}{p-1}}\right) + \left(\frac{(1 - a_1 - a_2 - a_3)(a_3 + b_3 R)}{(a_2 + b_2 R)[(1 - a_1 - a_2 - a_3) - (a_3 + b_3 R)]}\right)^{\frac{1}{p-1}} + \frac{1}{w}\right]$$

Where v^* is the optimal hours of volunteer for an individual.

Substituting this into b

$$L^* = (w+Y)[\frac{1}{w} + \left(\frac{1}{w}\left(\frac{a_2 + b_2R}{a_1}\right)^{\frac{1}{p-1}}\right) + \left(\frac{(1-a_1-\square_2-a_3)(a_3+b_3R)}{[a_1[(1-a_1-a_2-a_3)-(a_3+b_3R)]]}\right)^{\frac{1}{p-1}}]$$

Where L^* is the optimal hours of leisure for an individual.

Similarly, solving for the remaining variables

$$C^* = (w+Y)[\left(\frac{1}{w}\left(\frac{a_1-(a_2+\square_2R)}{(1-a_1-a_2-a_3)}\right)^{\frac{1}{p-1}}\right) + \left(\frac{(a_3+b_3R)}{[(1-a_1-a_2-a_3)-(a_3+b_3R)]}\right)^{\frac{1}{p-1}}]$$

Where C* is the optimal value of consumption for an individual.

$$D^* = (w+Y)[\left(\frac{1}{w}\left(\frac{a_1-(a_2+b_2R)}{(a_3+b_3R)}\right)^{\frac{1}{p-1}}\right) + \left(\frac{(1-a_1-a_2-a_3)}{[(1-a_1-a_2-a_3)-(a_3+b_3R)]}\right)^{\frac{1}{p-1}}]$$

Where D* is the optimal hours of donations for an individual.

We perform comparative statics on the results of the model, for the purpose of testing the accuracy of the model through our empirical analysis. We will only concentrate on donations and volunteer hours because analysis of consumption and leisure hours has been extensive over the years.

Fall in wages (w)

Given that solutions to the model for optimal volunteer hours and donations supplied are complicated, we cannot make predictions about the direction of donations and volunteer hours without making assumptions surrounding p, b_2 and b_3, since the variable w will be present in more than one term of the derivative.

Fall in non-wage income (Y)

The derivative of v* and D* with respect to household income (Y) is positive. Therefore, a fall in income will decrease volunteer hours and donation activity. This confirms Freeman's (1997) conclusion that people with higher income volunteer and donate more and can be interpreted as extrinsic motivations dominating intrinsic motivations of an individual.

Presence of a recession (R = 1)

Since we are unaware of the direction of the coefficients b_2 and b_3, and are interested in determining those directions through empirical analysis, we cannot determine the correlation between a recession and donation activity or volunteer behaviour until the values of b_2 and b_3 are confirmed.

In order to conduct a concrete comparative static investigation, we will consider a specific case of the constant elasticity of substitution model – the Cobb-Douglas multivariate utility model with constant returns to scale.

Let us define the Cobb-Douglas Utility function as:

$$\text{U(L,v,C,D)} = L^{a_1} v^{a_2+b_2R} D^{a_3+b_3R} C^{(1-a_1-a_2-b_2R-a_3-b_3R)}$$

Our Lagrangian equation with this utility function is:

$$Ł = \left[L^{a_1} v^{a_2+b_2R} D^{a_3+b_3R} C^{(1-a_1-a_2-b_2R-a_3-b_3R)}\right] - \lambda\,[\text{w}\,(1-\text{L}-\text{v}) - \text{D} + \text{Y} - \text{C}]$$

The first-order conditions yield:

1. v: $(a_2 + b_2R)\left[L^{a_1} v^{a_2+b_2R-1} D^{a_3+b_3R} C^{(1-a_1-a_2-b_2R-a_3-b_3R)}\right] + \lambda w = 0$
2. L: $a_1\left[L^{a_1-1} v^{a_2+b_2R} D^{a_3+b_3R} C^{(1-a_1-a_2-b_2R-a_3-b_3R)}\right] + \lambda w = 0$
3. D: $(a_3 + b_3R)\left[L^{a_1} v^{a_2+b_2R} D^{a_3+b_3R-1} C^{(1-a_1-a_2-b_2R-a_3-b_3R)}\right] + \lambda = 0$
4. C:$(1 - a_1 - a_2 - b_2R - a_3 - b_3R)\left[L^{a_1} v^{a_2+b_2R} D^{a_3+b_3R} C^{(-a_1-a_2-b_2R-a_3-b_3R)}\right] + \lambda = 0$
5. λ: w(1- L - v) – D + Y – C = 0

Solving for the first order conditions:

$$L = \left(\frac{a_1}{a_2 + b_2R}\right) v$$

$$D = \frac{a_3 + b_3R}{1 - a_1 - a_2 - b_2R - a_3 - b_3R} C$$

$$v = \frac{(a_2 + b_2 R)}{w(1 - a_1 - a_2 - b_2 R - a_3 - b_3 R)} C$$

Simplifying further:

$$v = \frac{(a_2 + b_2 R)}{w(a_3 + b_3 R)} D$$

Substituting these results into equation 5)

$$v^* = \frac{w + Y}{w}[a_2 + \square_2 R]$$

$$L^* = \frac{w + Y}{w}[a_1]$$

$$C^* = (w + Y)[1 - a_1 - a_2 - b_2 R - a_3 - b_3 R]$$

$$D^* = (w + Y)[a_3 + b_3 R]$$

The following section will highlight the results of the comparative static analysis of the Cobb-Douglas model.

Fall in wages (w)

A fall in wages will cause consumption and donation activity to fall. This is consistent with our economic intuition as lower wages means the individual has less available wealth to spend on these activities and confirms Freeman's (1997) conclusion that individuals with higher wages will donate more. Furthermore, leisure will increase with a fall in wages as the opportunity cost of not working an extra hour has reduced. Finally, volunteer hours will increase with a fall in wages because the opportunity cost of volunteering directly corresponds to the wage rate. This indicates that at a higher wage, the opportunity cost of volunteering is higher, thus individuals earning higher wages will volunteer less. This result implies that extrinsic motivations compelling an individual will outweigh intrinsic motivations.

Fall in non-wage income (Y)

The derivative of v*, D*, L*, and C* with respect to household income (Y) is positive. Therefore, a fall in income will decrease volunteering, donation activity, consumption and time spent pursuing leisure. This confirms that fact that people with higher income tend to be more involved in philanthropic activity, and can be interpreted as extrinsic motivations dominating intrinsic motivations of an individual, which is consistent with the findings of our previous model.

Presence of a recession (R = 1)

The individual's optimal choice of leisure will remain independent during a recession or period of growth. Furthermore, by making the assumption that the value of b_2, b_3 is positive, the optimal consumption level will decrease, volunteer hours will increase, and donation activity will increase. By making this assumption, we are hypothesizing that intrinsic motivations outweigh external pressures.
Contrarily, if $b_2 < 0$ and $b_3 < 0$, consumption increases, while volunteer hours and donations decrease. In other words, during a recession, individuals will substitute consumption for donations and leisure for volunteer hours and because the utility from volunteering and donations decreases during a recessionary period, extrinsic motivations dominate.

We hope that through our empirical analysis we can determine the value of b_2 and b_3 – if they are positive, negative or negligible. We know from our model that in general, extrinsic motivations dominate because people with higher wages will volunteer less. Through empirical analysis, we will determine the value of b_2, b_3 and observe if there are any motivational changes during a recession. If the results show that b_2, $b_3 > 0$, the model implies that intrinsic motivations are dominant during a recessionary period.

Empirical Analysis

Data

The purpose of the empirical portion of our analysis is to determine the accuracy of the model developed above and determine whether the comparative statics highlighted earlier are of any significance in the data. In order to determine this relationship, we have compiled State-level data for the variables included in our model and have run a random effects GLS regression. In order to ensure we have significant observations to perform an accurate empirical analysis, we developed a panel dataset for each of the 50 United States for the years from 2007 to 2009, which falls before and during the recession referred to as the "Financial Crisis". Therefore, our data set includes 150 observations over three years.

Our recession variable focuses on whether a particular state in each period was experiencing a recession rather than the entire nation due to issues regarding data availability. Since the United States had not experienced a recession between 2001 and 2007, including further data points in our regression becomes cumbersome as our regression variable for the majority of the data points for the period would obtain a value of 0 and there would not be adequate variation to run a fixed effect regression. By focusing on the state level and three years of statistics, we are able to obtain sufficient observations and variation in order to ensure accurate analysis.

Our data was collected through numerous U.S. governmental sources. Wage and labour hour data was collected through the Bureau of Labour Statistics' Current Employment Statistics Program. This program surveys approximately 141,000 businesses and

government agencies each month to provide data relating to nonfarm payroll workers. Household income data was taken from the American Community Survey developed by the U.S. Census Bureau. This survey is collected from a sample of the population in the United States and represents survey estimates. Donation information was collected by the National Center for Charitable Statistics with data released by the Internal Revenue Service called the "Statistics of Income Bulletin". The data published represents data selected from taxpayer's tax returns. One issue with this data is that some donations are excluded, as only returns with itemized donations appear. According to the National Center for Charitable Statistics, 33 percent of U.S. taxpayers chose to itemize their deductions on their tax returns meaning that the majority of American's use the standard deduction. However, according to The Center on Philanthropy at Indiana University 2012, it was estimated that in 2009, total U.S. giving was $227.41 billion compared to $157.2 billion in itemized contributions. This represents nearly 70 percent of all giving, and therefore it can be concluded that this dataset will provide adequate information on state-level donation activity. Volunteer hour data was collected through the publication, "Volunteering and Civic Life in America", which gathered information through a supplement to the Current Population Survey: the Volunteer Supplement and the Civic Supplement.

The Current Population survey is distributed monthly and surveys 60,000 households. The dataset defines volunteers as "individuals who performed unpaid volunteer activities through or for an organization at any point during the 12-month period." There is currently no available state-level consumption data and therefore a proxy must be used for the consumption variable. In research surrounding wealth and consumption data at the state level conducted by Xia Zhou (2010), he concluded that retail sales per state represent a statistically significant proxy for consumption data. Therefore, our data set uses retail sales per capita as a proxy for consumption level data.

To determine whether each state was suffering from a recessionary period, the percentage change in GDP for the year was determined. If the percentage change was negative, then a recession exists and if the change was zero or positive, the state was not suffering from a recession. Given that our determination of a recessionary period involves the percentage change for the entire year, we understand that this does not necessary align with the formal definition of a recession. We were unable to obtain percentage change information at a state-level for the last two quarters of each year, in order to accurately determine whether at year end there existed a recession.

Regression Equation

The variables used in this dataset along with summary statistics are found in appendix A. Stateid includes a range from 1 to 50 and represents each United State. It should be noted that the District of Columbia is not included in the analysis as data pertaining to numerous variables were not available. Included in our regression are three dummy variables: recession, y08, and y09. If the state in one of the three years was determined to be suffering from a recessionary period, then the observation would

include a 1 under the recession variable, and 0 otherwise. If the observation was taken during 2008, then the data entry would consist of a 1 for that observation and if it were during 2007 or 2009, it would be 0. The same logic is employed for the dummy variable y09. For example, if Michigan were in a recession in 2007, then in the regression, the recession dummy variable, R, would equal 1. If Texas were not experiencing a recession for the same year, then R would equal 0 for that particular data point.

Variable labourhrs, leisure and volunteerhrs represent the number of hours an individual spent working, pursuing leisure activities and volunteering, respectively. We implemented a time endowment for the purposes of the empirical analysis of 168 hours, which represents the number of hours during a week. Therefore, each variable represents the number of hours spent pursuing that variable per week.

In order to obtain more statistically significant results, we also ran a regression featuring the natural logarithm of each variable. This is represented in the dataset bya "ln" before each variable name. The natural logarithm of variables are used because this allows the data to achieve a normal distribution as the volunteer hours, wages, income, leisure and consumption take on negative values. Without natural logarithm, the data is truncated at 0. Additionally, the natural logarithm demonstrates percentage changes, whereas the unadjusted value only shows absolute changes. Since absolute changes in volunteering and donations may be very small, and thus not statistically significant, using the natural logarithm allows even small changes to be accounted for in our analysis. Finally, the function we are interested in, the Cobb-Douglas/Constant Elasticity function, is non-linear which is problematic for our empirical analysis. The natural logarithm corrects this issue as it linearizes the function and allows us to run the random effects regression.

The regression equations that we are interested in include:

$$\text{ln\_volunteerhrs} = \beta_1 + \beta_2 \text{ln\_donations} + \beta_3 \text{recession} + \beta_4 \text{ln\_wage} + \beta_5 \text{ln\_income} + \beta_6 \text{ln\_leisure} + \beta_7 \text{y08} + \beta_8 \text{y09} + \beta_9 \text{ln\_consumption} + u$$

$$\text{ln\_donations} = \beta_1 + \beta_2 \text{ln\_volunteerhrs} + \beta_3 \text{recession} + \beta_4 \text{ln\_wage} + \beta_5 \text{ln\_income} + \beta_6 \text{ln\_leisure} + \beta_7 \text{y08} + \beta_8 \text{y09} + \beta_9 \text{ln\_consumption} + u$$

Discussion of Findings

The regression output for each of the above equations can be found in Appendix B. A summary is presented below:

Independent Variable	Coefficient (Standard Error) Dependent Variable	
	ln_donations	*ln_volunteerhrs*
ln_donations	-	.0664 (.1142)
ln_volunteerhrs	.0324 (.0530)	-
ln_income	-0.2561 (.1981)	.5169 (.2987)**
ln_wage	-0.0451 (.2509)	-0.4316 (.3732)
recession	-0.0292 (.0141)*	-0.0125 (.0253)
ln_consumption	.0346 (.1765)	.0242 (.2499)
ln_leisure	.1536 (1.659)	-7.5108 (2.5345)*
y08	-0.0344 (.1454)*	-0.0406 (.0252)
y09	-0.0693 (.0216)	.0304 (.0363)
constant	10.027 (8.2152)	31.3191 (12.615)*

** statistically significant at the 5% level*

***statistically significant at the 10% level*

We cannot reject the null hypothesis that a recession does not have an effect on volunteer hours due to the p-value of 0.819 and t-statistic of -0.23. As such, the coefficient on volunteer hours that was developed in our theoretical model (b_2) is nil. This finding is interesting as in our Cobb-Douglas model leisure is independent of a recession. If volunteer hours and leisure hours remain constant with the onset of a recession, then labour hours must also remain constant also for our time endowment to be satisfied. However, much of the literature surrounding the link between a recession and employment disputes this finding. According to Aliprantis (2012), for example, the average number of hours worked dramatically decreased in the United States during the most recent recession. Therefore, in our constant elasticity model, if hours worked decreases during a recession, and volunteer hours remain constant, then leisure must increase. If leisure is increasing then this would cause our model's coefficients to be $b_2 = 0$, $b_3 < 0$ and $p < 1$. We have confirmed that indeed $b_2 = 0$, $b_3 < 0$ from our empirical analysis, which is discussed below. Hence, leisure must increase during the recession to ensure volunteer hours remain constant when assuming $p < 1$. In fact, in a study conducted by Aguigar, Hurst and Karabarbounis (2012) it was determined that the decrease in work hours is largely offset by an increase in leisure hours during a recessionary period. Thus, this is evidence that our model is an accurate depiction of the observed phenomenon in the volunteer sector.

The statistically significant results for the relationship between leisure and volunteer hours are consistent with intuition. Since time endowment is fixed, and we assume hours worked to be constant, an increase in leisure should result in a fall in volunteer hours. An interesting observation, however, is that an increase in leisure by 1 percent leads to a fall in volunteer hours by nearly 7.5 percent, suggesting that individuals value leisure more than volunteer hour. This provides further evidence that extrinsic motivations dominate intrinsic motivations.

Our regression also indicates that the relationships between wage and volunteer hours and wage and donations are insignificant. This is important to our analysis as our hypothesis was heavily influenced by behaviours that are a function of changes in wage levels. Since our model only considers the opportunity costs placed upon an individual, then this insignificant result in the regression output may be due to the fact that people with higher wages are more likely to be asked to volunteer and are under greater social pressure to volunteer, causing the effect of wages to be nil.

From our regression equation using ln_volunteerhrs as our dependent variable, we also find ln_income to positively affect the number of volunteer hours supplied by an individual. The coefficient on ln_income is 0.517 with a standard error of 0.299. The p-value pertaining to the coefficient is 0.084, thus allowing us to determine that the natural logarithm of income is statistically significant at the 90 percent accuracy level. Therefore, ceteris paribus, individuals with greater household income will supply more volunteer hours. This is consistent with our model's findings.

Moreover, with donation activity representing the dependent variable, the recession parameter is statistically significant with a coefficient of -.029, which demonstrates that a recession results in a 2.9 percent decrease in the level of donations per individual. This finding brings us to the conclusion that extrinsic motivations outweigh intrinsic motivations: greater need for non profit goods and services in society as a result of a recessionary period does not motivate individuals to increase donation activity. The coefficient b_3 developed in our theoretical model must be negative: the presence of a recession causes donation activity to decrease, which requires a negative value of b_3, the coefficient of R relating to Donations in our model, in order to decrease utility.

We are also interested in determining the relationship between volunteer behaviour and donation activity. Using a standard random effects regression equation, shown below, we find that an increase in donations only results in a negligible increase in volunteer activity. This is demonstrated by a coefficient of 0.00038 on the donation variable and a p-value of 0.076. Therefore, the effect is only statistically significant at the 90 percent level. This allows us to conclude that donation activity and volunteer behaviour do not have a significant relationship.

Regression Equation:

$$\text{volunteerhrs} = \beta_1 + \beta_2 \text{donations} + \beta_3 \text{recession} + \beta_4 \text{wage} + \beta_5 \text{income} + \beta_6 \text{leisure} + \beta_7 \text{y08} + \beta_8 \text{y09} + \beta_9 \text{consumption} + u$$

If we use donations as the dependent variable when testing the relationship between donation activity and volunteer time, we find that the coefficient on volunteer hours is 551.7. Therefore, an increase in volunteer hours per week by one hour will increase monetary donations by $551 per individual. The standard error of the coefficient is 315.9 and the p-value is 0.081, allowing us to conclude that at a 90 percent significance level, volunteer hours will have a positive effect on donation activity. This regression was run using the following equation:

$$\text{donations} = \beta_1 + \beta_2 \text{volunteerhrs} + \beta_3 \text{recession} + \beta_4 \text{wage} + \beta_5 \text{income} + \beta_6 \text{leisure} + \beta_7 \text{y08} + \beta_8 \text{y09} + \beta_9 \text{consumption} + u$$

In order to relate these relationships between donations and volunteer hours to business cycles, we are interested in how the elasticity between the two variables changes from 2007 to 2009 – before and during the most recent recession. By running two separate regressions for 2007 and 2009, we find that in 2007, a $100 dollar increase in charitable giving increases volunteer hours per week by 0.004 or 0.2 hours per year. This has a p-value of 0.1 and a t-statistic of 1.68. This confirms the existing literature on the complementary relationship between donations and volunteering hours. In 2009, a $100 dollar increase in charitable giving's increases volunteer hours per week by 0.006 or 0.3 hours per year. However, this result is statistically insignificant with a p-value of 0.121 and a t-statistic of 1.58. This implies that during a recession, there is no relationship between donations and volunteer hours – they are neither complimentary nor substitutable. Therefore, this confirms the observed phenomena in our empirical work. Even though donations decrease during hard times, volunteer behaviour remain constant despite the expectation that volunteering might decrease due to the complementarity relationship during a boom period.

The regression outputs for the above equations can be found in appendix B.

Robustness

Since there exists a possibility for the explanatory variables such as donation activity, income and wage to be correlated with an omitted variable that is hard to quantify, such as recognition achieved from philanthropic activity, it is beneficial to perform the previous regression equations using a fixed effects model. This model allows us to control for some of the omitted variable bias that may occur in the random effects as a result of correlated variables. To reduce the amount of bias, the omitted variable must have time-invariant values. Recognition tends to change in response to changes in socio-economics status, so this variable may not be truly time-invariant. However, since our study is based solely on a three-year period, we can safely conclude that the recognition

achieved through volunteering and donation activity would not fluctuate substantially throughout this period, as recognition in society takes time to develop in individuals.

The fixed effects model was used with ln_volunteerhrs and ln_donations as the dependent variables for the two regressions equations mentioned earlier, and the regression output can be found in Appendix C. Here is a summary for comparison purposes:

Independent Variable	**Coefficient (Standard Error) Dependent Variable**			
	ln_donations		*ln_volunteerhrs*	
	Random Effects	Fixed Effects	Random Effects	Fixed Effects
ln_donations	-	-	.0664 (.1142)	.2046 (.2017)
ln_volunteerhrs	.0324 (.0530)	.0540 (.0533)	-	-
ln_income	-0.2561 (.1981)	.1094 (.2388)	.5169 (.2987)**	-.2071 (.4647)
ln_wage	-0.0451 (.2509)	.2534 (.3086)	-0.4316 (.3732)	-.8031 (.5969)
recession	-0.0292 (.0141)*	-.0222 (.0130)**	-0.0125 (.0253)	-.0120 (.0257)
ln_consumption	.0346 (.1765)	.1298 (.1977)	.0242 (.2499)	-.1691 (.3852)
ln_leisure	.1536 (1.659)	3.2373 (1.6944)**	-7.5108 (2.5345)*	-11.074 (3.157)*
y08	-0.0344 (.1454)*	-.0495 (.0142)*	-0.0406 (.0252)	-.0158 (.0294)
y09	-0.0693 (.0216)	-.0854 (.0215)*	.0304 (.0363)	.0436 (.0450)
constant	10.027 (8.2152)	-10.817 (9.112)	31.3191 (12.615)*	58.433 (16.795)*

** statistically significant at the 5% level*

***statistically significant at the 10% level*

Focusing on the regression using ln_volunteerhrs as the dependent variable first, we find that the coefficient on the recession variable does not change significantly from the random effects model. We are interested in the significant change in the coefficient on ln_income between the two models. Under the random effects model, we found that volunteer hours and household income were positively correlated with a coefficient of 0.517 and a p-value of 0.084. Under the fixed effects model, we found that an increase in household income would decrease the amount of volunteer hours contributed by 21 percent, however this is statistically insignificant with a p-value of 0.657. The significant difference in the effect of ln_income between the fixed effects model and the random-

effects model, suggests the potential for correlation between omitted variables and the level of household income. The fixed effects model, therefore, may be more representative for the purposes of our analysis, as the random effects model used previously includes a bias in the positive direction. However, since the focus of our analysis is to discover the relationship between the dependent variables (volunteer hours and donations), the model chosen is not particularly concerning, as the change in the coefficient and significance on the recession variable is negligible.

When using ln_donations as the dependent variable and running the two models, we find that the change in the coefficient on the recession variable is minimal, changing from -0.029 under the random effects model to -0.022 under the fixed effects model. The fixed effects model causing the significance level to decrease to 10 from 5 percent in the random effects model. The coefficient on ln_income changes from being negatively correlated with donation activity in the random effects model to being positively correlated with donation activity under the fixed effects model. This may also indicate bias in the random effects model however, both values still remain statistically insignificant. The difference observed between the significance levels and values of the coefficient on leisure is important. Under the RE model, we determined that this variable was statistically insignificant with a p-value of 0.926. Under the FE model, the p-value becomes significant at the 10 percent level (p-value of .059) and the coefficient increases by a multiple of 21, to 3.24. This implies that leisure and donations are positively correlated. This result may be explained by the fact that individuals who value leisure more will volunteer less and compensate this lack of volunteering with donations.

Conclusion

Our analysis shows that during a recession, individuals become less altruistic, demonstrated by a shift in motivations towards extrinsic motivations dominating intrinsic motivations. This allows us to interpret the fall in donations during a recession as a result of individuals' attempts to maintain their level of consumption in the face of lower wages and higher unemployment. During a recession, people substitute consumption for donation.

This effect is not observed with volunteer hours. During a recession, the average hours worked tends to decrease because of lower demand for labour. Under the extrinsic motivation framework, which is dominant in a recession, leisure increases because individuals gain more utility from leisure than volunteering, but volunteer hours remain constant. During a recession, volunteer hours and donations are not complementary as they are during a pre-recessionary period. As a result, a fall in donations does not result in a fall in volunteer hours.

These results have significant policy implications. Since demand for volunteering and the level of donations increases during a recession, and the supply of volunteer hours and donations do not increase to compensate for the higher demand, a shortage will exist in the non-profit sector. In order to achieve equilibrium, the government should implement

policies that will alter the influence of extrinsic motivations on individuals. The government will have to reduce the opportunity cost of volunteering and donations, such as through tax cuts or subsidies, and increase the recognition received from volunteering and donating by presenting these activities as moral obligation and promoting awareness of the subject.

A future direction of study in this topic will be observation of the effect of tax rates on volunteering during a recession and determining the optimal tax rate that allows the donation and volunteer sector to clear during a recessionary period.

In this paper, we studied the opportunity cost of wages as the only extrinsic motivation. Discussing the existence of additional extrinsic motivations, such as the probability of being asked to volunteer, or the social pressures of volunteering, would provide a better understanding of the observed situation.

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Appendix A

Summary Statistics of the Dataset

Variable	Obs	Mean	Std. Dev.	Min	Max
stateid	150	25.5	14.47921	1	50
labourhrs	150	34.43333	1.106216	31.2	37.3
recession	150	.48	.5012735	0	1
wage	150	20.99113	2.609591	16.27	27.81
volunteerhrs	150	.7288	.206085	.39	1.93
donations	150	3544.533	973.649	2000	7600
income	150	51372.62	8554.96	36646	70759
leisure	150	132.8385	1.123602	130.23	135.83
year	150	2008	.8192319	2007	2009
y08	150	.3333333	.4729838	0	1
y09	150	.3333333	.4729838	0	1
consumption	150	15317.73	1979.713	12354	23369
ln_labourhrs	150	3.538511	.0321817	3.440418	3.618993
ln_wage	150	3.036618	.1220952	2.789323	3.325396
ln_volunte~s	150	-.3491665	.2454752	-.9505239	.6549259
ln_donations	150	8.139979	.2528655	7.600903	8.935904
ln_income	150	10.83348	.1631812	10.50906	11.16704
ln_leisure	150	4.889097	.0084571	4.869308	4.91141
ln_consump~n	150	9.629023	.1229184	9.421741	10.05917

Appendix B – Random Effects Model

```
. xtreg ln_donations ln_volunteerhrs recession ln_wage ln_income ln_leisure y08 y09 ln_consumption

Random-effects GLS regression                   Number of obs      =       150
Group variable: stateid                         Number of groups   =        50

R-sq:  within  = 0.4015                         Obs per group: min =         3
       between = 0.1221                                        avg =       3.0
       overall = 0.1240                                        max =         3

                                                Wald chi2(8)       =     61.36
corr(u_i, X)   = 0 (assumed)                    Prob > chi2        =    0.0000
```

ln_donations	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
ln_volunteerhrs	.0323801	.0530453	0.61	0.542	-.0715867	.1363469
recession	-.0291992	.0141032	-2.07	0.038	-.0568411	-.0015574
ln_wage	-.0451352	.2508571	-0.18	0.857	-.536806	.4465357
ln_income	-.2560638	.1980742	-1.29	0.196	-.6442822	.1321546
ln_leisure	.1535512	1.658884	0.09	0.926	-3.097802	3.404905
y08	-.0344238	.0145402	-2.37	0.018	-.062922	-.0059255
y09	-.0692994	.0216086	-3.21	0.001	-.1116514	-.0269473
ln_consumption	.0346057	.17654	0.20	0.845	-.3114064	.3806177
_cons	10.02705	8.215247	1.22	0.222	-6.074537	26.12864
sigma_u	.19584436					
sigma_e	.05434981					
rho	.92849239	(fraction of variance due to u_i)				

```
. xtreg ln_volunteerhrs ln_donations recession ln_wage ln_income ln_leisure y08 y09 ln_consumption

Random-effects GLS regression                   Number of obs      =       150
Group variable: stateid                         Number of groups   =        50

R-sq:  within  = 0.1960                         Obs per group: min =         3
       between = 0.0771                                        avg =       3.0
       overall = 0.0946                                        max =         3

                                                Wald chi2(8)       =     27.08
corr(u_i, X)   = 0 (assumed)                    Prob > chi2        =    0.0007
```

ln_volunteer~s	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
ln_donations	.0664394	.1142388	0.58	0.561	-.1574645	.2903432
recession	-.0124698	.0253277	-0.49	0.622	-.0621111	.0371716
ln_wage	-.431629	.3732436	-1.16	0.248	-1.163173	.299915
ln_income	.5168527	.2987206	1.73	0.084	-.068629	1.102334
ln_leisure	-7.510794	2.534495	-2.96	0.003	-12.47831	-2.543275
y08	-.0406417	.0252488	-1.61	0.107	-.0901284	.0088451
y09	.0303805	.0363498	0.84	0.403	-.0408637	.1016248
ln_consumption	.0241685	.2499258	0.10	0.923	-.4656771	.514014
_cons	31.31908	12.61537	2.48	0.013	6.593411	56.04476
sigma_u	.21906483					
sigma_e	.10575259					
rho	.81100149	(fraction of variance due to u_i)				

```
. xtreg volunteerhrs donations income wage leisure consumption y08 y09 recession

Random-effects GLS regression                   Number of obs      =       150
Group variable: stateid                         Number of groups   =        50

R-sq:  within  = 0.2380                         Obs per group: min =         3
       between = 0.1041                                        avg =       3.0
       overall = 0.1176                                        max =         3

                                                Wald chi2(8)       =     34.76
corr(u_i, X)   = 0 (assumed)                    Prob > chi2        =    0.0000
```

volunteerhrs	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
donations	.000038	.0000214	1.77	0.076	-4.00e-06	.0000801
income	7.20e-06	4.56e-06	1.58	0.114	-1.74e-06	.0000161
wage	-.0125881	.0141691	-0.89	0.374	-.040359	.0151829
leisure	-.0550665	.0140224	-3.93	0.000	-.0825498	-.0275832
consumption	1.51e-06	.0000117	0.13	0.898	-.0000215	.0000245
y08	-.0241326	.0177128	-1.36	0.173	-.0588491	.0105839
y09	.0347157	.0264539	1.31	0.189	-.0171331	.0865644
recession	.0018806	.0176948	0.11	0.915	-.0328005	.0365617
_cons	7.775592	1.847302	4.21	0.000	4.154946	11.39624
sigma_u	.18798508					
sigma_e	.07390691					
rho	.86612384	(fraction of variance due to u_i)				

```
. xtreg donations volunteerhrs income wage leisure consumption y08 y09 recession

Random-effects GLS regression                   Number of obs      =       150
Group variable: stateid                         Number of groups   =        50

R-sq:  within  = 0.3062                         Obs per group: min =         3
       between = 0.1430                                        avg =       3.0
       overall = 0.1470                                        max =         3

                                                Wald chi2(8)       =     44.83
corr(u_i, X)   = 0 (assumed)                    Prob > chi2        =    0.0000
```

donations	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
volunteerhrs	551.7097	315.913	1.75	0.081	-67.46847	1170.888
income	-.0137696	.0176054	-0.78	0.434	-.0482756	.0207364
wage	-36.72608	54.53253	-0.67	0.501	-143.6079	70.1557
leisure	8.505324	55.64511	0.15	0.879	-100.5571	117.5677
consumption	-.0183537	.0453568	-0.40	0.686	-.1072514	.0705439
y08	-103.8556	64.61585	-1.61	0.108	-230.5003	22.78913
y09	-254.2313	96.90552	-2.62	0.009	-444.1627	-64.3
recession	-82.75956	63.86504	-1.30	0.195	-207.9327	42.41362
_cons	3931.14	7383.397	0.53	0.594	-10540.05	18402.33
sigma_u	748.54279					
sigma_e	249.27585					
rho	.90017194	(fraction of variance due to u_i)				

Regression Output Using Strictly 2007 Data:

```
. reg volhours donations
```

Source	SS	df	MS	Number of obs =	50
				F(1, 48) =	2.82
Model	.098579393	1	.098579393	Prob > F =	0.0997
Residual	1.67933266	48	.034986097	R-squared =	0.0554
				Adj R-squared =	0.0358
Total	1.77791205	49	.036283919	Root MSE =	.18705

volhours	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
donations	.0000422	.0000251	1.68	0.100	-8.35e-06	.0000928
_cons	.6008691	.0970451	6.19	0.000	.4057467	.7959914

Regression Output using strictly 2009 data:

```
. reg volhours donations
```

Source	SS	df	MS	Number of obs =	50
				F(1, 48) =	2.49
Model	.124461548	1	.124461548	Prob > F =	0.1212
Residual	2.40034028	48	.050007089	R-squared =	0.0493
				Adj R-squared =	0.0295
Total	2.52480183	49	.051526568	Root MSE =	.22362

volhours	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
donations	.0000579	.0000367	1.58	0.121	-.0000159	.0001317
_cons	.5221918	.1284506	4.07	0.000	.2639245	.7804591

Appendix C: Fixed Effects Model

```
. xtreg ln_volunteerhrs y08 y09 recession ln_wage ln_income ln_leisure ln_consumption ln_donations, fe

Fixed-effects (within) regression               Number of obs      =       150
Group variable: stateid                         Number of groups   =        50

R-sq:  within  = 0.2339                         Obs per group: min =         3
       between = 0.0003                                        avg =       3.0
       overall = 0.0007                                        max =         3

                                                F(8,92)           =      3.51
corr(u_i, Xb)  = -0.6525                        Prob > F          =    0.0014
```

ln_volunteer~s	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
y08	-.0158362	.029416	-0.54	0.592	-.0742589	.0425866
y09	.0435883	.0449689	0.97	0.335	-.0457239	.1329005
recession	-.0119467	.0257028	-0.46	0.643	-.0629947	.0391012
ln_wage	-.8030737	.5968707	-1.35	0.182	-1.98851	.382363
ln_income	-.2070615	.4646656	-0.45	0.657	-1.129927	.7158046
ln_leisure	-11.0739	3.15724	-3.51	0.001	-17.34446	-4.803354
ln_consumption	-.1690625	.3851666	-0.44	0.662	-.9340365	.5959116
ln_donations	.2046077	.2017366	1.01	0.313	-.1960585	.6052739
_cons	58.43295	16.79478	3.48	0.001	25.07707	91.78882
sigma_u	.30674558					
sigma_e	.10575259					
rho	.89376912	(fraction of variance due to u_i)				

```
F test that all u_i=0:     F(49, 92) =    12.49                 Prob > F = 0.0000
```

```
. xtreg ln_donations y08 y09 recession ln_wage ln_income ln_leisure ln_consumption ln_volunteerhrs, fe

Fixed-effects (within) regression               Number of obs      =       150
Group variable: stateid                         Number of groups   =        50

R-sq:  within  = 0.4414                         Obs per group: min =         3
       between = 0.1240                                        avg =       3.0
       overall = 0.0498                                        max =         3

                                                F(8,92)            =      9.09
corr(u_i, Xb)  = -0.4801                        Prob > F           =    0.0000
```

ln_donations	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
y08	-.0495399	.0142336	-3.48	0.001	-.0778089	-.0212708
y09	-.0854326	.0214532	-3.98	0.000	-.1280406	-.0428247
recession	-.022168	.0130215	-1.70	0.092	-.0480299	.0036938
ln_wage	.253353	.3086269	0.82	0.414	-.3596067	.8663127
ln_income	.1093796	.2387927	0.46	0.648	-.3648833	.5836425
ln_leisure	3.237373	1.694408	1.91	0.059	-.1278675	6.602613
ln_consumption	.1297834	.1976947	0.66	0.513	-.2628553	.5224221
ln_volunteerhrs	.0540426	.0532842	1.01	0.313	-.0517845	.1598696
_cons	-10.81734	9.112177	-1.19	0.238	-28.91491	7.280236
sigma_u	.27861312					
sigma_e	.05434981					
rho	.96334162	(fraction of variance due to u_i)				

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F test that all u_i=0:     F(49, 92) =    44.49                 Prob > F = 0.0000
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Chinese Venture Capital: A Discussion of the Efficacy of Recent Policies

James Balsillie

I. Venture Capital

I.1 Introduction

Since 1978, exports and low value-added manufacturing have driven China's remarkable economic growth (Ding and Zhang 2009). Recently, greater emphasis has been placed on indigenous innovation to maintain competitiveness and sustain growth rates. This goal has been reflected in economic policy, as the Chinese Government has stated its commitment to shifting towards an innovation-driven economy by 2020 (OECD 2008). In light of this objective, Venture Capital (VC) is an effective solution to encourage innovation and growth through the funding of private enterprises.

VC is defined as "independently managed, dedicated pools of capital that focus on equity or equity-linked investments in privately held, high growth companies" (Ács and Audretsch 2003). Essentially, VC is a long-term active investment in which a Small to Medium sized Enterprise (SME), often in a high-tech industry, receives cash as well as intangible value from the VC firm, in the form of managerial expertise and network connections (Grundling, Steynberg, and Wang 2009). The venture capitalist receives a return in the form of an "exit": a return on investment from an equity sale such as acquisition, liquidation, or initial public offering (Hu 2010).

Small to medium sized enterprises (SME) are often underfinanced due to their lack of tangible assets, unpredictable value of innovation, and informational asymmetries. Additionally, while private VC returns are substantial, positive externalities of innovation associated with investment in SMEs suggest that returns on investment remain below social returns (Lerner 2002). Therefore, the VC supply is likely suboptimal.

The economic benefits of an active venture capital sector and the possibility of market failure, provide a justification for implementing policies that encourage VC transactions. A venture capital industry did not exist in China until 1985, when intrusive policies were implemented (Wong 2011). Numerous tax incentives, subsidies, and direct investments have since been used to increase funding to SMEs (Hu 2010). These policies have been largely successful, as risk capital investments in China have increased from US $56 million in 1993 to US $15,163 million in 2010 (Wong 2011). There exists extensive theoretical and empirical literature that discuss two possible explanations for this investment increase: the leveraging effect, which suggests that policies have increased supply of VC, or the crowding-out effect, which suggests that the policies have increased competition and thus dissuaded entry of private VC firms (Guo and Zhao 2013).

This paper will examine theoretical constructs of VC, foreign examples, and China's VC history to conclude whether China's recent economic policies for VC are effective in encouraging innovation and economic growth.

I.2 The Economic Benefits of Venture Capital

In order to increase production output, either capital or labour inputs must be increased (extrinsic growth), or total factor productivity must be increased (intrinsic growth). Early research in productivity observed that in the U.S. between 1870 and 1950, inputs only accounted for 15% of economic growth, with the rest of growth attributed to improved productivity through more efficient allocation and technological progress (Abramowitz 1956). New technological innovation is the main driver of productivity growth (Globerman 2012). Furthermore, society benefits from innovation in a variety of ways, such as progress in health care, transportation, and communication.

Capital is a constraint for research and development firms that commercialize technology, particularly small firms (Lerner 2009). SMEs, especially high-technology firms, have a number of risky characteristics that greatly increase the difficulty of obtaining financing from traditional financial institutions, such as banks. Examples of these risky characteristics associated with SMEs are: few tangible assets that can serve as collateral, difficulty in valuating the potential of their innovation, and high incidence of failure (bankruptcy) (Grundling, Steynberg, and Wang 2009).

VC encourages innovation through relief of the capital constraint by financing firms that would otherwise be deemed too high risk for traditional investment institutions (Avnimelech, Bar-El, and Schwartz 2007). Firms that are funded by VC often develop completely new technologies or products, which contribute to technological progress. In the United States of America, VC represented 3 percent of research and development funds in 1998, though VC backed firms generated 15 percent of national industrial innovation (Kortum and Lerner 1998). This evidence shows that risk capital is an extremely efficient source for financing innovation and increasing productivity.

VC delivers far greater value to investees than just the capital provided, resulting in more successful businesses. Bankruptcies in new businesses are primarily caused by: capital constraints, poor management, and lack of market knowledge (Avnimelech, Bar-El, and Schwartz 2007). In addition to providing capital, VC firms provide strategic advice, industry connections, and legitimacy to overcome these faults (Auerswald and Branscombe 2001). Extensive research shows that VC backed firms outperform comparable SMEs in terms of failure rates and profitability (Bertoni, Luukkonena, and Deschryverea 2012). This is due to the mentioned value added and financing, as well as a selection bias; VCs selectively fund firms with higher expected return on investment. This bias is beneficial for economic growth as it allocates resources with greater efficiency.

I.3 Venture Capital Market Failures

A supply gap for VC funding of SMEs exists as a result of a number of market features. For example, technological innovation often leads to profits earned by competitors, not exclusively by the researching firm (Lerner 2009). An example of this is Toyota’s development of the Prius in 1997 as the world’s first commercial hybrid vehicle

(Lake 2001). Though Toyota developed new technologies, many competing firms quickly invested in similar technologies and profited as a result. Externalities could also be realized by consumers who benefit from less expensive or more enjoyable products, or by the general population due to progress in social sectors such as health care or environmental sustainability. Since return on investment for the venture capitalist is unlikely to capture total social return, investment will fall below the social optimum regardless of which particular positive externality occurs (Lerner 2002). The gap between social and private rates of return on innovation is estimated to be between 50% and 100% of private returns (Griliches 1992).

Another reason for the undersupply of risk capital is asymmetric information (Lerner and Watson 2007). The entrepreneur is more knowledgeable about their future profits since they have a more complete understanding of their technology and the market in which their SME operates. Since entrepreneurs cannot communicate this information with perfect honesty and clarity, venture capitalists have difficulty differentiating strong firms from weaker ones. Thus, the venture capitalist assesses all projects with assumed higher risk, which leads to a lower valuation and an overall undersupply of VC.

Empirical evidence shows a long-run trend of venture capitalists decreasing the frequency of their investment in early stage ventures (Pierrakis 2010). Another observable trend is that VC is heavily focused on specific sectors in many prominent markets. In 2000, 92 percent of U.S. VC funding was invested in information technology and health care sectors (Lerner 2002). These dramatic trends have largely been caused by a "herding" effect: the phenomenon of market agents reacting to other market agents rather than the actual market conditions (Devenow and Welch 1996). Low investment rates in young SMEs and particular neglected sectors represent failures in the VC market.

II. Government Intervention

II.1 The Role of Government Intervention

Successful economic VC policy should address the discussed market failures, and accentuate the benefits of VC. Policy can be used to increase supply of VC and thus move the market into social equilibrium. Common policy tools that encourage VC activity include subsidies, tax benefits, changes in regulations, grants, and public participation in the market (Lerner 2009). Policies aimed at expanding the pool of risk capital usually take the form of investment subsidies or direct investment in the VC industry (OECD 2006). Subsidizing VC investment directly increases rate of return for the venture capitalists, thus incentivizing greater participation by lowering the entry threshold. Direct investment is either structured as public funded and operated VC organizations, or through government investment as a limited partner in VC funds (Guo and Zhao 2013). This achieves a leverage effect by increasing the supply of VC by expanding the number of investors, resulting in greater VC investment.

In the development stages of a VC industry, an important role of government is initiating the investment cycle. Prior to the first successful VC funding and profitable exit by a VC

backed firm, there exists a dilemma: no risk capital exists so SMEs are capital constrained, but there are no returns on VC investment to entice investor participation (Lerner and Watson 2007). Once initiated, the development of a risk capital industry is a long-term process that requires the evolution of market and legal structures, of supporting professional intermediaries such as lawyers and accountants, and of expectations between SMEs and venture capitalists. Government intervention can initiate and accelerate the development of a VC industry by supporting early investments and by establishing these institutions.

A third purpose of government intervention is to increase financing for firms in industries neglected by VC (Wong 2011). Subsidizing or focusing government-funded VC on these sectors would increase investment in underfinanced markets (leverage effect). Obtaining government funded VC funding additionally provides legitimacy, which can ease concerns over asymmetric information and increase the likelihood of receiving financing from banks or follow-up funding from private VCs (Jeon and Kim 2013). Government officials may also be better suited to assess firms in some neglected sectors, such as those where customers are government services, such as national defence or health care (Lerner 2002). Thus, government investment can develop risk capital markets in neglected sectors.

II.2 Drawbacks of Government Policy

The greatest concern regarding government participation in the VC market is the possible manifestation of a crowding-out effect. Increased supply of VC could initially result in lower expected returns due to a shift to long-run equilibrium that clears at greater quantity of investment and lower profit level (Gilson 2002). If government funded VC competes with private VCs, these lower expected returns could slow the development of private VC, possibly causing some investors to leave the market (Cumming and MacIntosh 2006). The theoretical result of a crowding out effect is that projects that would have been financed by private VCs instead receive state funding (Guo and Zhao 2013). Thus, unless government funded VC does not compete with private VC, the risk capital market may become dependent on state funding in the long run. This implies that government funded VC should only be used temporarily to accelerate the development risk capital markets, or as a permanent agent in an undersupplied market.

A drawback of government operated VC firms is the lack of experience in selecting the most promising firms. Predicting success of SMEs is extremely difficult, though private venture capitalists have demonstrated significant effectiveness in financing firms with higher returns (Lerner 2002). There is much doubt regarding the ability of government officials to forecast the profitability of SMEs (Avinimelech and Teubal 2006). Thus, on a firm-by-firm basis, resources would be allocated most efficiently by the private sector. Further, largely due to the intangible value provided by private venture capitalists, high levels of government funded VC funding result in lower financial returns from SMEs compared to private VC (Picker 2011).

A final concern with government intervention is the ability for government officials to implement policies for their own benefit (Ding and Zhang 2009). Though this potential issue arises with many forms of government intervention, decisions of government funded VCs often seem arbitrary, which creates the potential for investment to be directed to unfeasible enterprises if funding regulations are not strict and explicit.

II.3 Types of Government Policies

The most common policy used to address VC market failure is equity enhancement, often referred to as "hybrid schemes" (Cowling, et al. 2012). These hybrid VC firms are structured with the state investing as a passive limited partner in the VC fund, giving full operation responsibility to the general partner. Thus, public investment increases supply of VC, though the market still behaves with the effectiveness of private VC. Governments can select VCs that fund targeted sectors such as early stage SMEs and neglected industries, but firm by firm selection is done by experienced and proven private venture capitalists. This structure complements existing VC institutions, rather than crowding-out the private sector with state controlled investments. British evidence demonstrated that many hybrid VC firms achieved the same standard as private VC firms regarding returns on investment (Cowling, et al. 2012). Also, data from 1984-2008 in European countries indicates that government-funded VC improves growth rates of early stage SMEs, thus enhancing investment returns and innovation (Grilli and Murtinu 2011).

A disadvantage to hybrid schemes is that funding a neglected sector does not change investment conditions in that sector; the unattractive characteristics that initially caused the supply-side market failure are not remedied. Expected return from these sectors has not increased so there is no greater incentive for VC investment (Avinimelech and Teubal 2006). To overcome this persistent failure, governments often act as a limited partner and agree to cap their returns in order to provide greater profits to private limited partners (Gilson and Schizer 2003). This provides greater returns from previously neglected sectors, encouraging greater market participation by private VC firms, thus moving investment quantity towards the social equilibrium. Government funded VC, however, must not represent too large of a proportion of the VC industry. Information from 25 countries showed that low levels of government funded VC lead to better exit performance, while high government involvement began to crowd-out private VC (Jeon and Kim 2013).

II.4 Successful Government Intervention: Israel's Government Policy

In the early 1990's, Israel was experiencing widespread failure to commercialize technology despite massive research and development investment. Issues went beyond capital constraints, including lack of business experience and managerial expertise (Gilson and Schizer 2003). In 1993, the Yozma Programme was created to generate a competitive Israeli VC industry to invest in young SMEs, hoping to successfully develop high-technology businesses (Grundling, Steynberg, and Wang 2009). Ten hybrid VC funds were created though Yozma, each with the involvement of a foreign and a domestic financial institution, and at least US$ 8 million of government investment (Avnimelech,

Bar-El, and Schwartz 2007). From 1993-1998, approximately US$ 250 million was invested in early-stage SMEs, generating a leverage effect. Hybrid VC firms experienced higher success rates than average (16.5 percent compared to 9 percent) and lower failure rates (28.3 percent compared to 35.6 percent) (Avnimelech, Bar-El, and Schwartz 2007). Use of successful government policy sparked and expanded the pool of risk capital, allowing Israel to become the world's most active VC market, with VC investments exceeding those of any other country, at 1.2 percent of GDP (Haour 2005). Israel's success in generating a thriving VC industry serves as justification for similar policies to be implemented in other developing countries.

III. Venture Capital in China

III.1 Chinese Venture Capital History

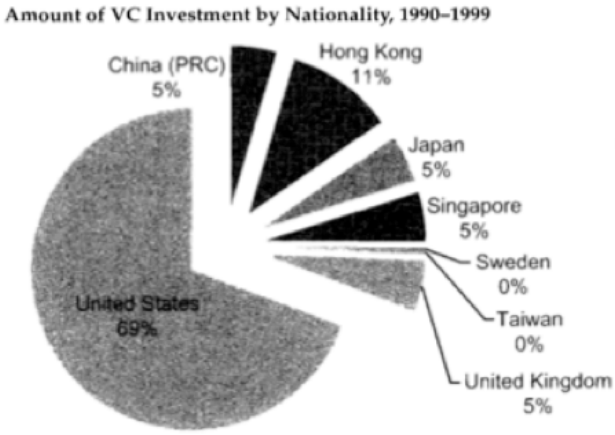
Prior to 1985, there was no VC activity in China, but in subsequent years a number of government funded initiatives eventually succeeded in fostering a VC industry. With ambitions of cultivating a more innovative economy, China's State Science and Technology Commission created the China New Technology Venture Capital Investment Corporation (CNTVI) in 1985, the first VC firm to operate in China (Feng 2004). Other government funded VC firms joined the market in the 1980's as well, though there was little investment activity until the early 1990's (Wong 2011).

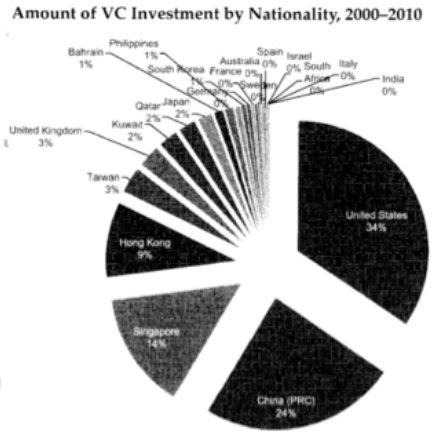
In the early 1990s, tax benefits were implemented to incentivize VC investment in high technology sectors and young SMEs (Hu 2010). Also, many provinces began to participate in VC markets by creating state funded and operated VC firms (Wong 2011). By the early 1990's some exits were occurring, but the VC market was still dominated by government funded VC firms. Prior to 1996, total VC deals in China remained below 10 each year (Wong 2011).

China's VC industry began to accelerate in the mid-1990s, as technology development became a pressing policy concern. The Chinese government created an ad hoc committee to monitor and study the domestic VC industry (Hu 2010). Simultaneously, government funded VC firms began to step back from direct market participation due to their limited success as investors resulting from a lack of experience (Wong 2011). Prior to the late 1990's, private fundraising required the government's permission and was seldom given to domestic firms. The relaxation of this regulation combined with a wave of foreign direct investment across industries in China, caused a shift in VC investment towards foreign firms, who contributed 95 percent of total VC funding in the 1990s (Feng 2004). This investment was heavily skewed towards state owned enterprises (accounting for 90 percent of VC investment) and businesses in the information technology sector (Feng 2004). VC investment in 1999 was more than eight-fold the total in 1993 (Wong 2011).

A major shift in VC policy occurred in 1998 when CNTVI was closed due to its inability to commercialize research and development projects (Grundling, Steynberg, and Wang 2009). CNTVI was replaced by the Innovation Fund for Small and Medium Technology-based Enterprises (Innofund), the first of many hybrid VC funds. Though Innofund did

not have a significant impact, it served as a policy experiment that inspired many additional hybrid VC firms in the future.





Source: (Hu 2010)

Beginning in the mid-2000's many implemented policies including increased VC market participation, diversifying VC sources, and encouraging foreign investment experienced considerable success (Hu 2010). Beneficial tax policy that was initially only available to specific sectors was applied to all VC firms, further encouraging participation. Chinese VC firms became significantly more active, and were responsible for nearly one quarter of all VC deals from 2000 to 2010. Also, risk capital investment was distributed more evenly among industries compared to the 1990's, providing funds to previously neglected sectors (Wong 2011). Total VC investment in 2010 was thirty-times greater than investment in 1999 (Wong 2011).

Foreign and Domestic VC Investment by Year

Year	Number of VC Investments	Total (US$ Million)
1993	4	55.6892
1994	8	80.3
1995	8	184.13
1996	16	102.6821
1997	19	180.8657
1998	15	137.364
1999	47	477.5146
2000	103	856.7725
2001	94	2,170.5632
2002	95	513.2531
2003	103	1,786.0116
2004	184	3,661.0366
2005	246	9,621.5954
2006	479	10,831.3774
2007	712	15,026.1007
2008	567	14,985.9974
2009	336	13,474.2851
2010	302	15,163.1126
Grand Total	**3,338**	**89,308.6512**

Source: (Hu, 2010)

III.2 Recent Chinese Economic Policy

Since 2007, there have been three major national expenditure programs to develop the VC industry. The creation and progression of these programs will be examined and critiqued in relation to theoretical arguments and foreign experiences.

Industrial Technology Research and Development Budgets Funded Venture Capital Fund

The Industrial Technology Research and Development Budgets Funded VC Funds (ITRDF) was founded in 2007 and funded by the Industrial Technology Research and Development Budget, a portion of fiscal spending earmarked for commercializing technologies. ITRDF hired venture capitalists based on their experience and past record to operate the fund according to its targets. The fund financed early stage SMEs to create technical progress in high-technology industries (Jian 2007). Targeted firms were to have innovation potential that could create a positive public impact and a high level of expected financial returns (Hu 2010). The venture capitalist did not set the strategic agenda, but had responsibilities akin to those of any fund manager, such as proposing firm-by-firm investment decisions, guiding their investees, and seeking exit options.

ITRDF behaved like a state owned and operated VC firm. While managers were hired from the private sector to remedy the lack of experience of government officials, the ITRDF still could not reach the same level of efficiency of a private firm. A private VC firm would target companies solely based on the maximization of expected financial return on investment. The fund manager of ITRDF also had considered the targets of generating positive externalities when making investment decisions. Investment was directed to young SMEs that could generate innovation of public benefit. The goal of government intervention was to move the market to social equilibrium, by addressing the positive externalities present in specific sectors. Additionally, prior to 2007 there was a market movement away from funding young SMEs, so this intervention was complementary to the market, achieving a leverage effect (Wong 2011). However, since these firms only received government backed VC, they were expected to experience lower financial and innovative returns, as discussed above.

ITRDF was structured to provide capital to underfinanced VC sectors, expanding the pool of risk capital. However, this policy selects firms according to specific targets rather than market incentives, distorting the market and failing to finance firms that would maximize financial and innovative returns. Thus, ITRDF did partially fill the equity gap, but did not do so in an efficient way.

Government Directory Venture Capital Fund

The Government Directory Venture Capital Fund (GDVCF) was also initiated in 2007 by Ministry of Science and Technology, and surpassed ITRDF as the most significant government funded program to encourage VC (Guo 2008). Like ITRDF, this

program aimed to encourage innovation and economic development by increasing investment in early stage and high-technology SMEs. The most significant difference between GDVCF and ITRDF is that GDVCF invested in private VC firms rather than individual SMEs. GDVCF was not involved with managing VCs or selecting SMEs, but instead collected private VC and set targets for this fund. GDVCF invested as a limited partner in private VC firms that focused on financing young or technology oriented SMEs. GDVCF value of remaining market oriented resulted in the condition that they could not be the largest shareholder or general partner of a fund. Other investors could purchase shares of GDVCF investment with ease and on favourable terms. Also, a subsidy of up to 5 per cent for VCs that invest in early stage SMEs was created in this program (Hu 2010).

By providing funds to private VC firms rather than competing with them, GDVCF increased the total pool of privately invested VC. This program is a true hybrid VC firm that allowed markets to allocate the increased supply of capital. One can expect the empirical evidence to show that this program generated leverage effects, as many similar foreign programs have (Cowling, et. al. 2012). The ease with which private investors were able to purchase GDVCF equity minimized the crowding out effect. Any crowding-out that may have initially occurred could be quickly be corrected by private share purchases. This hybrid VC firm structure also made use of evidence that suggested SMEs perform better under a combination of private and public investment. Private VC strongly desired GDVCF investment due to the generous terms and the legitimacy derived from the backing of the Chinese government, allowing the program to remain active and effective. Incentive to invest in target sectors was further increased by the subsidy, which efficiently addressed the positive externalities that cause VC market failure. The downside of this program was that it was likely to generate negative financial returns for the government because of investment in lower return industries, giving preferential terms to co-investors, and the cost of the subsidy. Overall, GDVCF created very favourable investment conditions for VC firms, causing increased market supply of risk capital to targeted SMEs.

Industrial Technology Research and Development Budget Participated Venture Capital Fund

The Industrial Technology Research and Development Budget Participated Venture Capital Funds (ITRDPF) was created in late 2009 in response to the financial crisis (Fa 2009). Capital is gathered from national expenditure, local investment, and private investors, and then invested in individual SMEs. Each fund must be at least 250 million RMB, private investment must account for a minimum of 60 percent of total capital, and local government expenditure must be at least as much as national government investment (Hu 2010). Similar to GDVCF, government investment is entirely passive: the government cannot act as a controlling shareholder or general partner of a fund. Investment of each fund is focused on new and high-technology firms as well as strong local industries. A minimum threshold for investment in young SMEs must be met by all funds, encouraging funds to provide seed funding. Investment objectives and targets are specific to each fund, stated in shareholder agreements and

acted upon by fund managers. Like ITRDF, fund managers are chosen from private institutions based on their previous experience with VC. A bonus system for the fund manager incentivizes greater investment in young SMEs.

ITRDPF continues the evolution towards complementary policy rather than competitive. Reducing the percent of investment in each fund decreases intervention, and improves the efficiency of the market. By fundraising investment from local governments and private sources, the pool of risk capital is directly increased. Like ITRDF, operational investment decisions are delegated to experienced fund managers, overcoming likely poor allocation by government officials. Like the programs that preceded ITRDPF, resources remain focused towards sectors that produce the greatest externalities and have the largest equity gap, namely young and high-tech SMEs. Since funds are sometimes devoted to areas with significant market failures, increasing supply moves the market towards the socially optimal equilibrium. Thus, the ITRDPF represents the natural evolution that combines the best policies from each of ITRDF and GDVCF, marking a trend away from distortionary intervention to a more efficient leverage effect.

IV. Conclusion

VC plays a vital role in generating innovation and productivity growth in an economy. Many innovative firms are capital constrained due to characteristics that make debt financing unattainable. VC relieves this constraint and adds intangible value, generating innovation and economic growth. Funding cash constrained firms creates positive externalities, causing VC markets to supply suboptimal quantity of investment. Government policy can address this market failure using policy tools including subsidy, market participation, and deregulation. The success of these policies rests on generating a leverage effect as opposed to a crowding-out effect.

China’s recent VC market interventions have been comprehensive, using multiple policies to address the undersupply of VC in many sectors. The Chinese government targeted young SMEs and high-tech firms as ideal candidates for investment because local market failures are greatest in these sectors. These policies quickly evolved, showing inclination towards market-oriented policies to achieve a leverage effect.

Chinese policy-makers should continue this trend of decreasing government intervention in the VC market. Public investment should be passive and target specific sectors where market failure is greatest. This focus should be on industries with high public return such as health care, environmental sustainability, and new technology.

China developed an active and rapidly growing VC sector over the course of less than 30 years due to active government intervention. This impressive period will continue under market-oriented policy that effectively targets and addresses market failures.

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Political Protest Contagion Across Countries: Understanding the Effect of Geography, Language and the Media

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Abstract

Despite the overwhelming qualitative evidence indicating that large-scale protest movements often transcend national borders, there has been little empirical work offering a quantitative analysis of this phenomenon. Using a linear probability model of protest data from 27 European countries for a period of 15 years, this paper aims to shed some light on the mechanisms governing protest contagion. The statistical results suggest that a protest contagion effect exists between countries sharing a common border, but that large-scale protest are less likely to occur in a country if one is taking place in a country with which it shares a common language. Furthermore, this paper finds that the media exacerbates the effect of near-by countries' protests on any given country's probability of protest incidence. This paper provides a framework for the future empirical investigation of cross-border protest movements.

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Introduction

The events of recent decades, and more significantly events in the past three years, strongly suggest the existence of a contagion effect that causes protest movement to transcend national borders. Large-scale protest movements such as the Arab Spring, Anti-Austerity protests and the Colour Revolutions have each spanned many countries within a geographical area, sharing common cultural traits. Even though protests are generally directed at each respective nation's government, the movements share a set of common grievances and demands.

Despite the overwhelming qualitative evidence suggesting that a country is more likely to experience large-scale protests if these are occurring in 'near-by'[1] countries, there are no existing quantitative analyses of this particular phenomenon. The conditions under which

[1] The vague term 'near-by' is purposefully used, as it can refer to geographical or cultural proximity.

this contagion effect takes hold remain highly uncertain. Large-scale political protests can have profound economic, social and political consequences, and thus a deeper understanding of the mechanisms affecting their proliferation would be useful to policy makers and academics alike.

This paper aims to use empirical methods to determine the characteristics that significantly influence which countries are most likely to take part in a protest wave and to quantify the magnitude of this contagion effect. My investigation of the cross-border spread of political protests will proceed in four sections. The first section will provide a general theoretical overview of protest contagion mechanisms. In the second section, I will outline the model used to test the existence and size of the contagion of political protests. The third section describes the data, its limitations, and the methods I have employed to mitigate the effects of said limitations. The final section will present the results of this statistical analysis and their implications for the study of the spread of political protests.

I. Large-scale Political Protest Movements and their Proliferation

Countries within large geographical blocks often share many political and socio-economic characteristics. This may be due in part to the shared regional history, population flows facilitated by geographical proximity, and the ever-increasing inter-connectedness of countries through trade and information flows. These features give rise to two main explanations for the observation of large-scale protests in different countries within a very short timespan.

The first is what I will call the organized contagion hypothesis, which stipulates that one country's protest movement is, in part, causally responsible for protest movements in another near-by country. Beissinger (2007) offers a compelling account of this phenomenon, attributing the diffusion of a political protest to the fact that once a large and successful protest movement occurs in one country, people in nearby countries that would like to protest against their respective regimes have an action 'blue-print' at their disposal. With every additional country that launches a successful protest movement, organizational processes and mobilization methods are perfected, and a protest movement becomes easier to set in motion in any given country (Beissinger 2007). This explanation is supported by Social Movement Theory, which states: "…people must be convinced that they could actually succeed if they started to protest" (Grünwald and Stefes 2012). "Success" in terms of political process is fairly ambiguous, as achieving success can refer to the mobilization of a large proportion of the population, the implementation of a change in policy or reforms demanded by protesters, or the overthrow of a regime in revolutionary contexts.

Regardless of the goal of the protest, the contagion theory suggests that protests will spread more readily to countries with common characteristics. These similarities minimize the degree to which mobilization tactics need to be adapted to fit the situation of a specific country. Under the contagion theory, protests will also spread more readily between countries that share important informational flows, such as shared media.

Often referred to as a social media or Facebook revolution, the Arab spring has highlighted the important role played by information technology and the media in the spread of political protests (Couts 2011). Grünwald and Stefes (2012) attribute a catalytic role to the media in their case study of the Egyptian revolution, stating: "with the aid of satellite-TV, new independent press, and the internet, the recurring episodes of protest […] eroded the image of Mubarak's invincibility and thus changed people's perceptions about the possibility of political change". This excerpt highlights the importance of the population believing that a level of success is possible through protest. Information about successful protests in near-by countries may change the expectation of success of a protest movement in one's own country, and incite more people to protest, precipitating large-scale protest action.

Cross-border protest waves may also have less to do with contagion than with common pre-existing characteristics. This idea gives rise to an alternate explanation for the observation of multiple large-scale protest movements in near-by countries within a short time frame, which I will call "the similarity hypothesis". These characteristics, which include type of regime, strength of economy and main industries, may largely determine the ways in which countries will respond to events that are international in scope. Such an event may negatively impact all countries that share these common characteristics. Resulting protest movements may appear in all affected countries almost simultaneously, not because they have been influenced by each other, but because of some undetected factor, which caused similar grievances in similar countries.

These two explanations are not necessarily mutually exclusive. However one effect may be much stronger than the other. The model outlined in the next section will attempt to analyze which of these explanations is dominant during the period of 1980 to 1995 in 27 European countries.

II. The Model

If there is a contagion effect of political protests, a relationship should be observed between protests occurring in a country's immediate geographical neighbourhood, or what I will call its "cultural neighbourhood", and the probability that protests are occurring in the country itself at any given time. However, if a contagion effect does exist, it is unlikely to be the main determining factor of a political protest occurring. Therefore, in order to test the existence of a contagion effect and to avoid omitted variable bias, my model attempts to take into account domestic factors that affect the onset of political protests. I have estimated the following models, one including a media and contagion interaction term, and one without.

1. $$\text{Prob(Protest)}_{i,t} = \beta_0 + \beta_1 \text{protest}_{i,\,t-1} + \beta_3 \text{polity}_{i,t} + \beta_4 \text{polity}^2_{i,t} + \beta_5 \text{election}_{i,t} + \beta_6 \text{regimeend}_{i,t} + \beta_7 \text{youthunemployment} + \beta_8 \text{contagion}_{i,t} + u_{i,t}$$

2. $$\text{Prob(Protest)}_{i,t} = \gamma_0 + \gamma_1 \text{protest}_{i,\,t-1} + \gamma_2 \text{polity}_{i,t} + \gamma_3 \text{polity}^2_{i,t} + \gamma_4 \text{election}_{i,t} + \beta_5 \text{regimeend}_{i,t} + \beta_6 \text{youthunemployment} + \gamma_7 \text{media} + \gamma_8 \text{contagion}_{i,t} + \gamma_9 \text{media*contagion} + \varepsilon_{i,t}$$

Explanatory Variables

A study by Ash (2011) is particularly useful for providing a framework including domestic factors to build my model for protest contagion. Ash constructs a model that estimates the effect of various factors influencing the likelihood of a protest occurring in any given month during the Colour Revolutions.

In this model, Ash (2011) finds that protests are most likely to erupt after a "triggering event," an event capable of galvanizing the opposition, has taken place. Triggering events are a common concept within protest literature. According to Social Movement theory, such events indicate that the conditions for a mass protest movement are ripe (Grünwald and Stefes 2012). Beissinger (2007) identifies "stolen election" as an important element in protest mobilization within the Colour Revolutions at the turn of the century. In order to capture the effect of domestic political trigger events, my model includes variables for both elections (election) and regime changes (regimeend).

Unemployment is largely considered a contributing factor to the incidence of political protests. Unemployment is indicative of a poorly performing economy, which is often blamed on the policies of a particular regime. A negative change in people's livelihood is thus expected to increase the incidence of political protests. Furthermore, low employment reduces the opportunity cost of time, and thus it becomes less costly for individuals to expend time manifesting in the streets. This further contributes to the intuition that increased unemployment is positively correlated to political protest incidence. Finally, there exists ample evidence that for any given protest, young people represent a large proportion of protestors. Combining these insights, there is a compelling case to expect a strong positive correlation between youth unemployment (youthunemployment) and political protest incidence.

I have included a polity index (polity), polity index squared (polity^2) and lagged protest variable (protest_{t-1}) because these were all shown to be significant domestic predictors of political protest occurrence by Ash (2011). The polity index accounts for the degree of authoritarianism or democracy of a regime, and thus the media freedom variable is excluded from the first model, as it is by nature highly correlated to the Polity index.

Three definitions of contagion variables are used in turn in order to capture different types of protest proliferation. The first is the sum of countries in which a large-scale protest movement occurred in a given month bordering a given country. The second is the sum of countries in which large-scale protest movements occurred in a given month in countries sharing an official language (spoken by 20 percent or more of the population) with a given country. The third is a variant of the second, but instead counts countries sharing a common language spoken by nine percent or more of the population.

Confirming the Existence of a Contagion Effect

Using this model, I attempt to discover the following information:

1. *Factors Influencing Probability of Simultaneous Protest Movements Within Countries*

Qualitative analyses and anecdotal evidence point to the existence of protest waves that encompass many countries. However there remains uncertainty regarding whether this phenomenon is dependent on physical proximity or common cultural features. To answer this question, I use the three definitions of contagion variables outlined above. Comparing the magnitude and significance of the coefficients on the different variations of the contagion variable in the model provides insight as to whether shared culture or geographical proximity results in a higher probability that protests will occur simultaneously in any two countries.

2. *Effect of Media Freedom on Probability of Protest Movements Spreading to a Near-by Country*

The combined effect of the media and near-by protests is captured by the media-contagion interaction term in the second model. Higher media scores indicate lower levels of media freedom. Thus, if the media increases the probability of protest movements spreading to a nearby country, the coefficient on this term is expected to be negative. The coefficient on the contagion term represents the increase in the probability of a protest occurring when the media freedom score is zero, which can be interpreted as in the case of perfect information flow.

3. *Relative Significance of Contagion Hypothesis and Similarity Hypothesis Regarding the Phenomenon of Large-Scale Protest Waves Transcending National Borders*

While one country's protest movement may influence the population of near-by countries to start their own protest movement, simultaneous protests may be more significantly attributed to existing external factors that have a similar influence on the probability of protest occurring in near-by countries. These unobserved events are not captured in the model. However, if the inclusion of fixed effects results in the magnitude and significance of the contagion variable significantly decreasing, this would suggest that the similarity hypothesis may provide a better explanation regarding the phenomenon of large-scale protest movements frequently occurring in different countries in short time-periods.

III. Data

Precise political protest data is particularly difficult to obtain. Few attempts have been made to compile countrywide protest data over a long period of time. I chose to use

political protest data from the European Protest and Coercion Dataset (EPCD), because it represents an incredibly detailed compilation of protest-related action. The data is broken down by country and day, for 27 countries during the time period from 1980-1995.[2]

The EPCD presents information about date of protest, type of protest, target, type of participant, and number of participants. Since this model deals with the spread of political protests targeting a country's regime or demanding extensive policy changes, observations that did not meet these criteria were discarded. Furthermore, I chose to focus on large-scale action, which I define as movements mobilizing 0.75 percent of the population or more. The "number of protestors" value was divided by country population for the given year, obtained through Lahmeyer's "Populstat" website. All observations that did not meet the 0.75 percent participation cut-off were discarded. The data was then restructured in terms of binary variables, indicating whether or not one or more protests took place for every month of the relevant time period for every given country.

Since the testing of this model requires very specific data, explanatory variables are obtained from a variety of sources. The Polity score is available on a yearly basis, and is obtained from the Polity IV Project site. The regime change variable, "regimeend" in the model, is also obtained from the Polity IV Project. National election dates are obtained from Hyde and Marinov's (2012) National Elections Across Democracy and Autocracy dataset and compiled to create a binary variable indicating the occurrence of a national election in a given month. Yearly youth unemployment statistics are obtained from the "Labour & Social Protection" category of the World Bank database. There are fewer missing data points for female youth unemployment, and thus to minimize missing data, the log of female unemployment alone is included in the mode. The media freedom scores are adapted from the Freedom House index for the relevant time-period.[3] Finally, the different monthly contagion variables are constructed using the data for protest mobilizing 0.75 percent of the population or more, and contiguity and shared language data found in the Mayer and Zingago Dyadic Geodist Dataset (2011).

Limitations

The dataset inherently limits the scope of the applicability of the results of this analysis, as it does not include protest data on all countries bordering or sharing a language with the countries included in the dataset. Furthermore, construction from various sources result in an unbalanced panel. This problem is exacerbated by the inclusion of Czechoslovakia, which broke up to form the Czech Republic and Slovakia, and the German Democratic Republic, which was reunited with the Federal Republic of Germany within the timeframe of this study.[4]

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[2] For a full list of countries, see Appendix.

[3] From 1980 to 1987, Freedom house used a Free, Partially Free and Not Free rating, divided by Print and Broadcast. From 1988 to 1995, it ceased reporting a separate rating for Print and Broadcast. For the purpose of this analysis, I gave ratings from one to three, with one corresponding to a free media. In the rare cases where print and broadcast received different ratings in the initial years, I took the mean of the two ratings, e.g., if print was free (1) and broadcast was partially free (2), the resulting rating was 1.5.

[4] My approach was to code Czechoslovakia, the Czech Republic and Slovakia as three distinct states for which missing values were inputted for the years they did not exist. For the German case, I equated the

Additionally, the youth unemployment data is rather sparse, and there exists the possibility of a missing value bias. There was no available unemployment data for all countries with the lowest polity scores. This resulted in dropping several former socialist European countries from the dataset. However, this mitigated the problem of the division of Czechoslovakia and the reunification of East and West Germany, as these countries were also dropped.

Finally, due to the limited data and the nature of the question, the contagion variables are constructed using the same protest data as the dependent variable. This raises important endogeneity issues. These were addressed by employing instrumental variables for the contagion variables. In order to account for the limitations discussed above, two types of independent variables are used.[5] The first are constructed using the log of the mean female unemployment rate in each country's 'contagion zone'.[6] The second instrumental variable was constructed using the mean polity score in each country's contagion zone. Both models are tested using each set of independent variables and each definition of contagion. However, female youth unemployment is absent from both models in the set of regressions using the polity score independent variable in order to maximize the number observations.

IV. Results

The necessity of running two-stage least squares regression resulted in the use of a linear probability model to estimate both models. In order to test whether protests spread to near-by countries, or whether they occur at the same time due to external factors, both models were also estimated using fixed effects two-stage least squared regression. Table 1 presents the estimates of the regressions using the log of average youth female unemployment as an independent variable, with and without fixed effects.

Though the coefficient on bordering countries' protests is not significant, the sign is consistently positive for both models. The effect of bordering countries' protests is magnified by the addition of a media freedom index, and a media freedom and bordering countries' protest interaction term. The media and border protest interaction term is negative, which corresponds to the expectation that a higher media score (more tightly controlled media) decreases the likelihood of contagion from bordering countries protests. Running a fixed effects regression to estimate the probability of protest yields the same signs in the variables of interest, further increasing their magnitude, but also increasing the noise of the coefficients by raising the standard errors.

FRG with modern-day Germany, and inputted missing values for the GDR for the years following reunification.

[5] Their construction was modeled after Pevehouse's (2002) IOScore variable which represents the "average democracy score of all members of a regional organization, except state i," for his study of the effect of International Organization membership on democratization.

[6] Since contagion was tested using border, and two definitions of common language, 'contagion zone' refers to bordering countries, countries sharing an official language and countries sharing a language spoken by nine percent or more of the total population. A separate independent variable was constructed for each definition of contagion.

Table 1

	(1)	(2)	(3)	(4)
Lagged DV (n-1)	.073 (.048)	.037 (.044)	.066 (.049)	.042 (.037)
Election month	.007 (.016)	.001 (.018)	.003 (.017)	.000 (.018)
Regime End	-.019** (.006)	.001 (.065)	-.021*** (.006)	-.005 (.059)
Polity	-.059 (.057)	.657* (.361)	-.056 (.055)	.318 (.425)
Polity^2	.004 (.003)	-.037* (.020)	.003 (.003)	-.018 (.023)
Log Female Youth Unemployment	.017*** (.004)	.004 (.013)	.018*** (.005)	.006 (.011)
Media			.018 (.020)	.029 (.042)
Border protests (IV: Log Average Female Unemployment)	.099 (.108)	0.435 (.552)	.735 (.454)	1.00 (1.33)
Border protests*Media (IV: Log Average Female Unemployment*media)			-.568* (.333)	-.630 (.911)
Constant	.177 (.231)	-2.91* (1.57)	.163 (.214)	-1.41 (1.93)
Fixed Effects	No	Yes	No	Yes
Observations	2664	2664	2664	2664
F-value, first stage regression	7.71	4.29	8.05	4.34

Note: values in parentheses are standard errors[7]

*** p ≦ .01

** p ≦ .05

* p ≦ .10

[7] Standard errors are robust for linear probability model, but are not robust for fixed effects panel regression due to statistical software limitations

Table 2 presents the results of the regressions using the definition of contagion associated with the spread of protests to countries that share a common language (spoken by over nine percent of the population) for the same set of countries, once again using the log of average youth female unemployment as an instrumental variable.

The results interestingly indicate that for the same set of countries, which excludes many former socialist countries and countries with very low polity scores, the effect of protests occurring in countries sharing a common language appears to decrease the probability of a protest taking place in a country during a given month. Once again, the addition of a media variable and a media interaction term significantly amplifies the magnitude of the contagion effect, this time in the negative direction. This essentially implies that if large protests are occurring in a country sharing a common language with other countries, the countries with freer media have a higher probability of not witnessing protests during that month. Once again, running a fixed effects regression does not appear to reverse the observed trend, and simply increases the noise of the coefficients.

These results suggest that the role played by the media should be reconsidered. This model does not include the angle of protest coverage by the media. Perhaps the media is capable of negatively influencing protest incidence by reporting on neighbouring protests from a negative angle. An explanation is still needed, however, for why the angle of protest coverage would differ depending on whether the protests are occurring in a neighbouring country or in one in which people speak a common language.

Table 3 presents the results of both models using the definition of contagion associated with the spread of protests to countries that share a common official language (spoken by over 20 percent of the population), this time using the average ‘linguistic neighbourhood’ polity score as an independent variable.

These statistical results are obtained using a larger number of observations, which include the highly authoritarian countries dropped in regressions, and includes a female youth unemployment variable. The coefficients on the variable for contagion from countries with a common official language are negative and significant at the five percent level. These results display further evidence of an amplifying media effect. However, in this case, running these models using a fixed effects regression increased the standard errors to the point of removing any significance from all variable coefficients.

This suggests another possible explanation for the negative sign of the contagion variable, and the positive sign of the interaction term. This set of regressions included observations from Czechoslovakia, the Czech Republic, the GDR, Poland and Hungary, all of which experienced increased media freedom around the same time as important regime changes occurred. Regime change, as denoted by regime end, is shown to be a significant indicator of protest incidence. If most of these protests occurred before the loosening of media restrictions, this could explain the significance of the inverse relationship between degree of media freedom and protest incidence.

Table 2

	(1)	(2)	(3)	(4)
Lagged DV (n-1)	.079 (.049)	.070*** (.021)	.080 (.049)	.077*** (.025)
Election month	.009 (.016)	.009 (.014)	.009 (.016)	.015 (.016)
Regime End	-.022*** (.005)	-.025 (.053)	-.020*** (.005)	-.017 (.059)
Polity	-.047 (.051)	.508* (.261)	-.045 (.048)	.302 (.347)
Polity^2	.003 (.003)	-.028* (.015)	.003 (.003)	-.017 (.019)
Log Female Youth Unemployment	.017*** (.005)	.008 (.010)	.017*** (.005)	.005 (.011)
Media			-.015 (.014)	-.046 (.053)
Common language protests (IV: Log Average Female Unemployment)	.042 (.120)	-.297 (.404)	-.181 (.437)	-2.29 (1.65)
Common language protests*Media (IV: Log Average Female Unemployment*media)			.213 (.360)	1.85 (1.31)
Constant	.137 (.216)	-2.26* (1.16)	.144 (.197)	-1.30 (1.58)
Fixed Effects Panel Regression	No	Yes	No	Yes
Observations	2664	2665	2666	2667
F-value, first stage regression	10.85	3.76	8.98	3.98

Note: values in parentheses are standard errors

*** p ≦ .01

** p ≦ .05

* p ≦ .10

Table 3

	(1)	(2)
Lagged DV (n-1)	.138*** (.039)	.138*** (.039)
Election month	.021 (.016)	.022 (.016)
Regime End	.157* (.086)	.157* (.086)
Polity	.002*** (.000)	.001 (.001)
Polity^2	-.001*** (.000)	-.001*** (.000)
Media		-.007 (.013)
Official common language protests (IV: Average Polity Score)	-.116** (.057)	-.274** (.115)
Official common language protests*Media (IV: Average Polity Score*media)		.186** (.093)
Constant	.061*** (.012)	.081** (.038)
Fixed Effects Panel Regression	No	No
Observations	4521	4521
F-value, first stage regression	26.15	25.48

Note: values in parentheses are standard errors

*** p ≦ .01

** p ≦ .05

* p ≦ .10

Result Interpretation

This statistical analysis presents weak evidence suggesting that between 1980 to 1995 in Europe, if contagion effects were present, they occurred between bordering countries and not between countries sharing cultural similarities such as a common language. Despite increasing the noise of the coefficients, controlling for fixed effects does not reduce the magnitude of contagion effects, whether they are positive or negative. This indicates that although country similarities may play a role in explaining cross-border protest waves, a country's population is partially induced to demonstrate or even to avoid demonstrating, based the occurrence of near-by large-scale protests.

When considering all the results obtained, the magnifying effect of the media on contagion is the most consistent. Adding a media variable and a media-contagion interaction term almost always increases the absolute magnitude of the contagion term, and is accompanied by a coefficient of the opposite sign on the media-contagion term. This result reflects the economic intuition, as a media score of zero can essentially be interpreted as a case where there is perfect information flow regarding protests between countries. Assuming that a population's decision to engage in large-scale protest action is influenced by the incidence of protests in near-by countries, the more information it has, the stronger the effect of near-by protest incidence, whether positive or negative.

This, however, does not explain why bordering countries' protests may positively influence the likelihood of protest incidence, while shared language countries' protests appear to have a negative influence. This particular point requires a reconsideration of why one country's protest may affect another population's decision to protest. If the driving force behind protests is the protesters' belief that they can succeed, perhaps the protest incidence of near-by countries is less important than the outcome of the protest. This could suggest that the actual contagion effect is moderately to severely lagged, or that its existence is entirely dependent on the protesters' demands being met by the government of protesting countries. Alternatively, the media's angle of coverage may play an important role in determining whether near-by countries' protests exert a positive or a negative influence contagion effect.

Interpretation Issues

Many of the coefficients motivating the previous interpretation are not significant because of high standard errors. This may be explained by endogeneity concerns facing the model, and the limitations posed by the available data. Although I have attempted to diminish the consequences of potential endogeneity using independent variables, these may be too weak to provide statistically reliable independent variables, or may fail to be uncorrelated with the error term. Female youth unemployment and polity scores both explain variance in the endogenous contagion variables; however, polity and female

youth unemployment are measured yearly while the contagion variables change monthly.[8]

One endogeneity concern not addressed is the presence of a lagged dependent variable in both models, which was assumed exogenous in computing the two-stage least squares estimation. This assumption was made in the interest of avoiding additional complications.

One way in which my analysis can be further fine-tuned is by modifying the large-scale protest threshold. The 0.75 percent of the population cut-off value for large-scale protests is somewhat arbitrary, and aims to capture only the largest protest movements in every country over the relevant time period. Small protest movements are generally less likely to involve grievances that affect a significant portion of the population, and therefore are likely to experience different spreading mechanisms than large protests. In the interest of avoiding possible confounding effects of smaller protest movements, the threshold was set relatively high. However, an interesting future task would be to experiment with different thresholds to observe any effects on the significance of the results.

Conclusion

The conclusions drawn from the results yielded by my model are likely limited by the scope and range of my data. The implications of contagion across borders and countries sharing a common language, and the effect of the media may not hold true in light of more recent protest data. The European case may not be applicable to protest behaviour in the rest of the world, as European countries have certain continent-specific characteristics that may affect the way that protest movements spread across countries. Furthermore, large advances in technology have been made since 1995, many of which have revolutionized the way the media operates and alternative forms of media have sprung up in countries where media freedom levels are particularly low. Changes in the mechanisms of information flow are also expected to have an effect on the role of the media plays in exacerbating the probability of protest contagion.

While the conclusions drawn from the statistical results obtained by my models may be limited in applicability, my analysis provides a framework for approaching the topic of protest movements transcending national borders. The models I have used provide a starting point for the analysis of the contagion effect, should new protest data become available. These models are also readily adaptable to different definitions of contagion. For example, a contagion variable can easily be created for countries sharing a common regime type, or countries having the same main export good, or a combination of many of these definitions. My two models can also be extended by adding a variable measuring the influence of successful protests, allowing for different definitions of success.

[8] I attempted to create instrumental variables using elections or end regime, which vary on a monthly basis, however these yielded much lower F-values in the first stage-least squares regression, proving to be worse instruments than those using female youth unemployment or polity.

Further areas of interest include whether geographical proximity is always a better predictor of protest contagion than common language, and if protests in countries sharing a common language always reduce the probability of protest occurring in a given country. Whether widely applicable or not, the results of this analysis provide interesting questions for further investigation in the field of political protest research.

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Appendix

Countries included in the dataset are coded as follows:

Country	Country ID
Albania	1
Austria	2
Belgium	3
Bulgaria	4
Cyprus	5
Czechoslovakia	6
Czech Republic	7
Denmark	8
Finland	9
France	10
Federal Republic of Germany/Germany	11
German Democratic Republic	12
Greece	13
Hungary	14
Ireland	15
Italy	16
Luxembourg	17
Netherlands	18
Norway	19
Poland	20
Portugal	21
Romania	22
Slovakia	23
Spain	24
Sweden	25
Switzerland	26
United Kingdom	27

Bitcoin: Financial Innovation Burgeoning into a New Form of Stable and Convenient Money

Tom Sykora

I. Introduction

The ancient Chinese curse, “May you live in interesting times,” certainly seems to have been cast on the monetary and financial systems of the world, especially in the last 100 years. In that period, economies have experienced historic downturns such as the Great Depression and the recent financial crisis of 2007-09. Moreover, many monetary, fiscal and financial innovations have become widespread such as fiat currencies, fractional reserve banking, Keynesian business cycle smoothing and the use of derivatives. On the tail end of the most recent financial crisis, a new financial innovation has been created that represents a truly novel approach to the definition of money; namely, Bitcoin.

In this paper, I argue that Bitcoin has the potential to become a dominant electronic currency to facilitate international trade and payment. The arguments put forth cover the benefits of Bitcoin as well as its properties. First, I show that Bitcoin, as an electronic payment system, has distinct advantages over current payment systems such as bank wires, debit/credit cards, cheques, and to some degree, even cash. Second, as a result of Bitcoin’s inherent algorithm to stabilize the money supply, it is not prone to inflation, especially when compared to some hyperinflationary episodes within the last century. Third, I demonstrate that Bitcoin has the ability to satisfy the three properties of money. Finally, I discuss some potential risks associated with broad adoption of Bitcoin as a currency in the long run.

II. The Rise of a New Currency

Bitcoin is a recent technological innovation designed as a decentralized, cyber-crypto-currency. There is no central authority required to issue and maintain the currency, since the Bitcoin network itself, with its distributed nodes, performs the task of creating new Bitcoins (called “mining”) and verifying all transactions that have occurred. The Bitcoin Protocol was designed to prevent double spending without the use of a trusted third-party such as a central bank. Essentially, transactions are encrypted with a public-private key authentication system and verification is performed via “forced work”, meaning that a certain amount of computer CPU cycles must be performed in order to generate the correct hash (a numeric value) that is then broadcast to the entire network. Once a transaction is verified, it becomes part of the transaction ledger, called the block chain. The larger the block chain, the more certain the nodes are that the transactions contained within the chain are valid, and consequently, the same owner is prevented from

spending the same Bitcoins twice (Nakamoto 2008).

Bitcoin was developed as an open-source project so that a community of software developers would have the ability to closely monitor the source code. This monitoring greatly reduces the probability of covert insertion of malicious code, "Indeed, as cybercrime goes, Bitcoin may be safer than traditional financial institutions, which are often on the receiving end of such attacks".[1] In addition to the availability of the project to all software developers, participation in the Bitcoin network is open to anybody with a computer, some software and an Internet connection. This represents a stark contrast to the system of debit and credit cards, which require authorization from a financial institution.

Since the first Bitcoins were mined in early 2009, the relative price of Bitcoins to U.S. dollars and the number of transactions have increased vastly (Figures 1 and 2 show the meteoric rise of both, respectively). Bitcoins are used as payment for online services such as Web development as well as real world commerce through venues such as restaurants.[2]

To use Bitcoins, a user requires a Bitcoin wallet, which is simply some software that runs on a user's computer or exists on some trusted service provider's servers. Each wallet can contain one or more unique addresses that are available to receive Bitcoins; superfluous addresses enhance a user's anonymity. After the wallet is funded,[3] a user is then able to trade his Bitcoins for goods and services by sending his Bitcoins to a recipient's address. Once confirmed by the Bitcoin network, the Bitcoins will then exist in the recipient's wallet.

Above, I have described most of the rudimentary technical details of Bitcoin and its usage. Next, the focus shifts to an economic examination.

III. Bitcoin as a Major Electronic Currency

III.1 Superior Electronic Payment System

Modern financial transactions are settled in many ways. Today, the most common method in the developed world is electronic funds transfers that can take many forms including bank wires, debit and credit card transactions. Paper notes such as cheques, bank drafts and, of course, cash are another popular form of settlement. There are advantages and disadvantages involved with each of the aforementioned forms of payment. While all of these methods are distinct, they share one common attribute: issuance of the underlying currency by a central authority (most commonly a central bank). Moreover, once cash is in circulation, every one of these payment forms (aside

[1] "Virtual Currencies." Last updated June 15, 2011.
http://www.economist.com/blogs/babbage/2011/06/virtual-currency

[2] For a listing of current locations accepting Bitcoin as payment see https://en.bitcoin.it/wiki/Trade.

[3] There are several ways to fund a wallet such as using an exchange provider that converts fiat currency into Bitcoins or by directly trading some labour in exchange for Bitcoins. (*Getting started with Bitcoin*. Accessed March 31, 2013. https: //www.weusecoins.com/getting-started.php).

from the cash itself) requires a financial intermediary to perform settlement of payments via their networks and/or fiduciary instruments. For example, most major banks participate in the Society for Worldwide Interbank Financial Telecommunication (SWIFT) network, which accommodates bank wire transfers. Ultimately, any individual dealing with these financial institutions relies on trust as the mechanism for keeping his financial assets safe and for ensuring that his transactions are carried out securely and correctly. Unfortunately, history is replete with instances of banks failing and governments defaulting (Allen and Gale 2007, 1-24; Reinhart and Rogoff 2009, 49-98, 139-171). In addition, whether justified or not, there have been restrictions imposed on the movement of money such as through capital controls or sanctions (Quinn 2003; Bale 2012). These examples and other mishaps tend to spoil or completely destroy the trust that once existed and may leave the individual with limited access to his assets or even the inability to recover a portion of said assets. With Bitcoin, trust is not placed with a central authority or a financial intermediary, but in technology: specifically, cryptography and mathematics. Proven and well-defined encryption algorithms and brute-force mathematical hashes are the key to making Bitcoin trustworthy as a payment system. As long as the Internet is functioning[4] and people continue to participate in the Bitcoin network, currency holders have the ability to access their Bitcoins and make unrestricted payments.

Another advantage of Bitcoin as a payment system is its cost, convenience and speed of processing payments. With many forms of electronic payment, such as credit card purchases, the fees charged to consumers and merchants can be substantial (Kelly 2013), and merchants can suffer from charge-backs and countermands that are sometimes associated with fraud. The usage of some instruments requires the physical presence of the user at a particular location to initiate the transaction or to obtain the instrument. In addition to the cost and convenience factors mentioned above, all of these forms, except for cash, require a fairly long settlement period by today's technological standards, lasting anywhere from one day to a week or more. Conversely, the Bitcoin network operates with voluntary fees and thus fees are low or zero.[5] Moreover, the settlement process lasts, on average, ten minutes (Nakamoto 2008, 4) meaning a transaction is finalized much faster than with many of the other present forms of payment. Another benefit of Bitcoin is that transactions can be facilitated in several ways. First, users can log into an online wallet service[6] and use the interface to make a transaction. Second, users can have a wallet running on their home computers, which allows them make payments without the need for a third-party service. Third, by running a Bitcoin application on their smart-phones, users can make payments anywhere that Internet access is available, often through mobile service providers' data access points. Bitcoin, therefore, allows for Web purchases as well as emulating in-person payments using a mobile device.

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[4] As is commonly known, the Internet was designed as a decentralized communication system to withstand large-scale wars, natural disasters and other catastrophes. If the Internet were to go off-line, Bitcoin would not be the only system affected. In such an event, the global economy would come to a grinding halt.

[5] However, a sender can pay a small fee as an incentive for miners to process his transaction quicker (*Getting started with Bitcoin.* Accessed March 30, 2013. https://www.weusecoins.com/getting-started.php).

[6] For example, Coinbase (http://coinbase.com).

Many people believe that their financial dealings should remain private. Presumably that is why cash transactions are still in favour today, albeit for small value transactions. Bitcoin can also provide a form of anonymity, however, unlike cash, Bitcoin addresses are not truly anonymous, but "pseudonymous". That is, by design, all transactions are public so given the will, through data mining and network analysis, Bitcoin addresses can possibly reveal somebody's identity. Having said that, there are ways to strongly increase the level of a user's privacy to a degree that a user can effectively enjoy full anonymity.[7] Furthermore, the ability to perform anonymous transactions removes many of the burdens associated with establishing and operating a bank account such as providing copious amounts of identification or being granted authorization for various transactions or their associated limits. Thus there is reasonable evidence to suggest that Bitcoin has the ability to make economic activity smoother and more accessible by removing potentially unnecessary encumbrances.

III.2 Built-in Inflation Control

Milton Friedman famously said, "Inflation is always and everywhere a monetary phenomenon" (Friedman and The Council for Economic Education 1963, 17). A recent and extreme example of this notion is the hyperinflation experienced in Zimbabwe where, "Inflation is estimated to have peaked in September 2008 at about 500 billion (10) percent" (Coomer and Gstraunthaler 2011, 21). Interestingly, as shown in Figure 3, during and after the financial crisis of 2007-2009, the U.S. money supply has seen explosive growth. Indeed, many developed countries have undertaken some form of quantitative easing in an attempt to jolt their economies into recovery or to provide liquidity. The world is still watching and waiting to see what, if any, inflation will result from these monetary expansions. Nonetheless, Fischer, Sahay and Vegh (2002) demonstrate that there is clear evidence, as shown in Figure 4, that a strong positive correlation exists between the growth of the money stock and price levels. In addition, today's monetary system is based on fiat money (most of which exists electronically) instead of commodity money. This allows for less effort to be exerted in the manipulation of the money supply by governments for various ends. In the name of repaying debts, boosting exports or funding military excursions, governments can dilute the value of their currency through money printing.

In light of this observation, Bitcoin was purposefully devised to mimic a steady and predictable growth in the stock of Bitcoins, somewhat akin to controlled mining of a commodity money, such as gold. This growth is to continue until the Bitcoin supply reaches its upper limit of 21 million around the year 2140 (Wallace 2011). Following this upper bound of available Bitcoins, a deflationary environment would undoubtedly prevail within the Bitcoin economy. That is, aggregate prices would begin to fall as each Bitcoin in existence gains in relative value. Bordo and Ellson (1985) argue if a gold money standard were to be adopted, eventually long-run deflation would take hold due to resource depletion and real economic growth. Thus, if their model were observed in practice, Bitcoin would experience the same outcome as the classical gold standard.

[7] For a more detailed description on anonymity in Bitcoin and how to increase it see https://en.bitcoin.it/wiki/Anonymity.

The inflation versus deflation debate with respect to economic policy remains unresolved. Some Austrian economists are not averse to deflation: "[Murray] Rothbard takes a more favorable position toward deflation than most Austrian economists and, of course, than the mainstream economists" (Bagus 2003, 19). Ben Bernake and others, however, caution against the risks of deflation: "Sustained deflation can be highly destructive to a modern economy and should be strongly resisted" (Bernanke 2002). In the face of this existing debate, this paper does not take a position on deflation, but considers that most, if not all, economists view high inflation as a condition that wreaks havoc on economies and people's lives. To the extent that high inflation can result from governments interfering with the money supply, Bitcoin can be viewed as a reliable deterrent. By its very nature, Bitcoin is anti-inflationary and therefore prevents or mitigates loss of purchasing power, uncertainty over expected prices, and monetary and fiscal dishonesty. Should the currencies of the world suffer from higher inflation in the years to come, Bitcoin's inherent deflationary property could entice the masses to adopt Bitcoin as a currency and participate in the Bitcoin economy.

III.3 Is it Money?

Before Bitcoin can become classified as a significant currency, it should pass, or have the potential to pass, the standard definition of money. The standard criteria that allow something to meet the definition of "money" are ability to act as: a medium of exchange, a store of value and a unit of account. Historically, the production of a particular form of money from gold coins to paper notes always remained within a nation-state, kingdom or region. For instance, even in the relatively free market era of coin minting, each mint was limited by a higher authority and by a specified location, "In England, for example, the mint system was directed by the crown, and all mints issued the same coin, whereas in France there existed a multitude of issuing authorities, coins and accounting systems, and Italy's largely autonomous cities all issued their own coins" (Eichengreen and Sussman 2000, 6). In this respect, Bitcoin deviates from the norm, since the production of Bitcoins exists across the entire Internet and the only authority is the mining protocol existing as code in software. The idea of an electronic, decentralized currency existing solely on the Internet represents a very unusual and novel interpretation of money and currency. In particular, when economists originally imagined the idea of money, they could never foresee the advent of the Internet and how it, in some ways, acts as its own nation, permeating physical geographies and national jurisdictions. What follows is a discussion of Bitcoin's ability to satisfy the three properties of money.

First, as previously mentioned, Bitcoin is already being used as a medium of exchange in many online purchases and being accepted by a growing number of merchants. Some appropriate indicators of a medium of exchange are recognition, homogeneity, divisibility, durability, portability and resistance to counterfeiting. Both commodity[8] and fiat[9] money are good candidates with respect to recognition and homogeneity. Fiat money

[8] Here I consider metallic coins such as gold and silver as commodity money since they both have a long history of serving as such.

[9] This includes paper notes as well as coins minted with little intrinsic value (non-gold and non-silver

is quite adept at being divisible, but commodity money has some problems. Specifically, as Velde (1998) highlights, commodity money suffers from “The Big Problem of Small Change" and a solution for finding a way to keep large and small coins in circulation requires token coinage and a central authority. Thus, in the absence of the solution, purchases of vastly varying amounts become very difficult when only one denomination of a coin exists in circulation. On the other hand, commodity money is much more durable than fiat paper money. As for portability, commodity money suffers from weight and transportation issues for large purchases. Also associated with transportation, commodity and fiat money are prone to the prospect of theft. Lastly, counterfeiting has been a plague on both commodity and fiat currencies since their inception. In contrast, Bitcoin is recognizable in a virtual sense due to its adherence to the protocol. Bitcoin also satisfies homogeneity, as each Bitcoin exists simply as a computationally identifiable digital sequence of bits. Bitcoin excels in terms of divisibility since it can scale up or down to eight decimal places. Since Bitcoin is non-physical, it relies on the existence of the Internet and continued use of the Bitcoin network to ensure its divisibility, thus Bitcoin could, at least theoretically, exist indefinitely. Furthermore, while Bitcoins themselves are not portable, the virtual nature of Bitcoin and the use of mobile devices means that payments can be. Finally, Bitcoin is nearly impossible to counterfeit due to its inherent cryptographic and decentralized design. Therefore, Bitcoin sufficiently meets the stated measures that constitute a “medium of exchange”.

The second property of money, the store of value, perhaps requires the most faith on the part of currency holders. Expressly, to hope to realize future purchasing power, people must believe in their choice of savings vehicle. In the same vein, commodity money has, even to this day, proven itself as a reliable store of value, at least in a long-run sense and in real terms (Harmston 1998). Fiat money, alternatively, does not enjoy this degree of persistence. Globally, a fully fiat monetary system has only been in existence since 1971 with the termination of Bretton-Woods. In the last four decades, using fiat money as a store of value has retained *nominal* purchasing power. Of course, that is subject to time and space; for example, the German Deutsche Mark, though once strong, is no longer a recognized currency and thus a poor store of value. Bitcoin is still too young a currency to rate its success as a store of value, but the potential exists for the same reasons mentioned above: if the Internet and Bitcoin network continue to operate, there is no reason why Bitcoins cannot act as a good store of value. Furthermore, since Bitcoin leans toward a deflationary design, its real purchasing power, assuming economic growth, should increase.

Lastly, the unit of account property of money is important for an economy to conduct business. Having a standard numerical measure of value to relate prices allows for opportunity cost and tax payment calculations, and market clearing, among other things. Presently, most national economies operate under a fiat system as a unit of account within each jurisdiction. For international trade settlement, the U.S. dollar is typically the reserve currency. Though commodity money has historically been used as a unit of account, demonstrating its ability to fulfill the unit of account property, that is not the case today. Similarly, Bitcoin has the potential to be a unit of account, but has not yet been widely

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coins), both of which are un-backed and derive their value by decree of a government.

adopted as such. There are, however, some merchants that are pricing in Bitcoin[10] by converting the U.S. dollar equivalent to Bitcoins through the current exchange rate. As previously discussed, the nation of Bitcoin can be understood as the Internet, and thus one can imagine that any transactions conducted over the Internet can use Bitcoins as the numéraire. Just as exchange rate conversions are performed when an individual wants to purchase goods or services from a foreign jurisdiction, Bitcoin and the Internet could act as another foreign currency and jurisdiction, respectively.

IV. Risks

For any currency to be practical and meaningful, it must afford the people using it the ability to spend it and to save it. With that in mind, there are two main risks to Bitcoin's widespread adoption as a currency in the long run: (i) extreme price volatility and (ii) political risk.

Firstly, wild price fluctuations of Bitcoin could dissuade individuals[11] from acquiring and holding Bitcoin. Regardless of the currency, economic actors save whatever they do not spend. Presumably those people want to feel confident that the currency units they have saved will retain purchasing power in the future in real or nominal terms, in the case of an inflationary environment. Needless to say, when a currency experiences massive or frequent price volatility, confidence in its ability to act as a store of value is diminished or lost; Bitcoin is not immune to this phenomenon. Alas, Bitcoin has encountered some major price swings in its short lifespan. For example, in the spring/summer of 2011, the Bitcoin price in terms of U.S. dollars lost about 90 percent of its value (see Figure 1). As the latest data from *Bitcoin charts*[12] indicate, Bitcoin has experienced some more price swings lately, but not to the same degree, in percentage terms, as in its early years. Moreover, rather than any fundamental economic causes, most of the price volatility stems from highly publicized media events such as failures of various Bitcoin exchanges as well as incidents of illicit trade activities settling in Bitcoin. Therefore, in order to induce more people to save a portion of their wealth as well as make payments in Bitcoins, the Bitcoin price should be widely perceived as stable to an extent.

Secondly, and more importantly, political risk may be a substantial hurdle to Bitcoin's success. Since the very nature of the crypto-currency is a threat to central banking and, possibly, governmental capital controls and taxation, there exists the foreseeable risk that some of these institutions could implement countermeasures in an attempt to subvert Bitcoin's use. In particular, governments can enact laws banning the use of Bitcoins, though this, like online file sharing software, would be difficult to enforce. Another potential avenue would be to outlaw Bitcoin exchanges where people can trade Bitcoins for fiat currencies and vice versa. This measure may be effective within a jurisdiction, but

[10] For example, see http://giftsforcoins.com/store/ and http://www.bitcoinin.com/.
[11] This applies equally to merchants as they will be hesitant to accept Bitcoin as a form of payment lest they suffer exchange rate or purchasing power losses.
[12] *Bitcoin charts*. Accessed March 30, 2013.
http://bitcoincharts.com/charts/mtgoxUSD#tgCzm1g10zm2g25

more difficult globally. Furthermore, there exists little possibility to prevent individuals from exchanging Bitcoins using other methods such as face to face or through online forums. As mentioned previously, Bitcoin's distributed design makes it nearly as robust as the Internet itself. Akin to the hitherto unsuccessful War on Drugs, illegalization of Bitcoin is not likely to result in its eradication if sufficient demand for the crypto-currency persists.

V. Conclusion

As far as financial innovations are concerned, the idea of a currency existing solely on the Internet with no central authority to manage its supply and having a foundation predicated on mathematics and cryptography is truly revolutionary and unorthodox. Bitcoin is such an innovation. This paper has demonstrated that Bitcoin has the potential to flourish into a major currency for conducting international trade. It was shown that through the ease of joining the network, retaining privacy, enjoying lower transaction fees and higher convenience, and having transactions settle in minutes instead of days, Bitcoin demonstrates its remarkable ability as a rival payment system to the traditional forms such as bank wires and credit cards. In addition, Bitcoin's design for a controlled growth rate of the supply of Bitcoins prevents it from being exorbitantly inflated by careless governments or exogenous supply shocks. This offers better price stability when compared to the many historic and recent inflationary episodes experienced by national currencies. Finally, though Bitcoin is still aborning, it satisfies the three properties of money or at the very least, demonstrates its capacity to be money.

There exist risks in the form of extreme price volatility and political obstruction, which may undermine Bitcoin's widespread adoption and long run viability as a currency. Thus, it may be premature to make a definitive statement on Bitcoin's lifespan. However, the concept of a decentralized cyber-crypto-currency will be difficult to stuff back into Pandora's box.

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Appendix

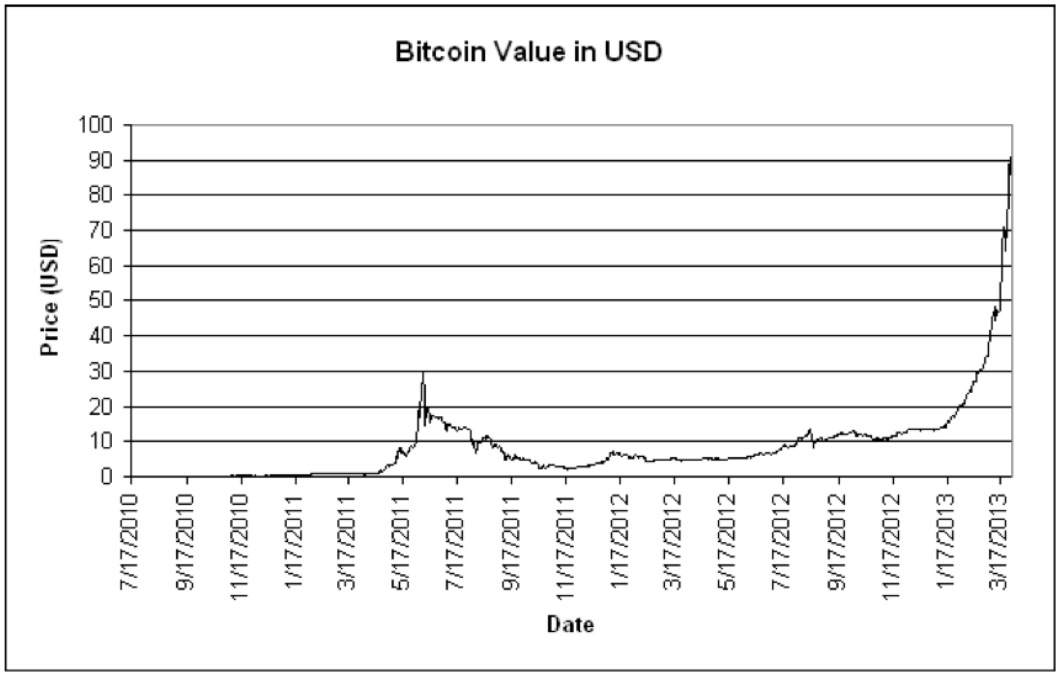

Figure 1: Bitcoin value in U.S. dollars (Source: *Bitcoin charts* 2013).

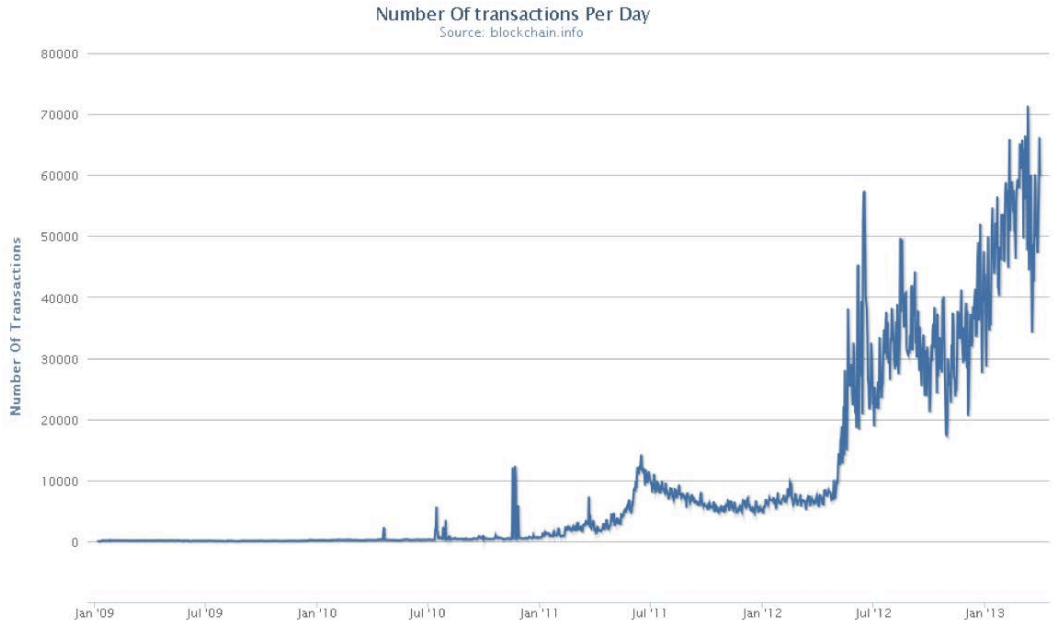

Figure 2: Estimated Bitcoin transactions per day.[13]

[13] Blockchain. "Number of Bitcoins." Accessed March 30, 2013. http://www.chicagomanualofstyle.org/tools_citationguide.html

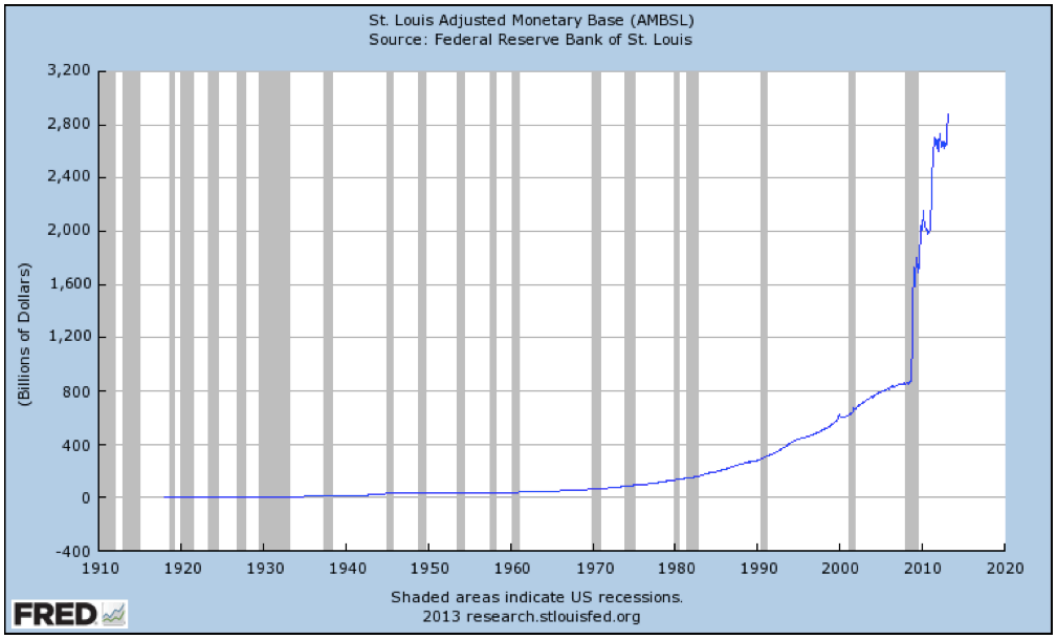

Figure 3: U.S. adjusted monetary base.[14]

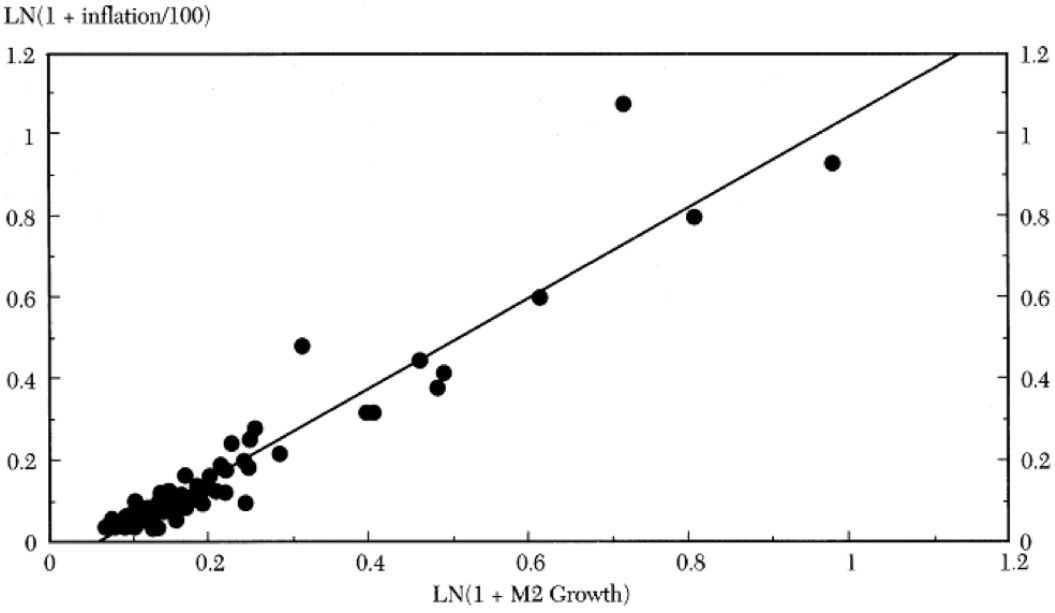

Figure 2. Inflation and Money (M2) Growth[1]
1960–95 averages

[1] Slope of regression line is 1.115 with a t-statistic of 12.13; 94 countries in total, each with 10 or more observations.

Figure 4: Correlation between inflation and money supply growth (Source: Fischer, Sahay, and Vegh 2002, p. 848).

[14] Federal Reserve Bank of St. Louis. "St. Louis Adjusted Monetary Base." Accessed April 4, 2013; page now discontinued. http://research.stlouisfed.org/fred2/ series/AMBSL

The Effect of a Recession on the Volunteer Workforce and Donation Activity in the United States

Courtney White and Vybhavi Balasundharam

Abstract

The non-profit sector is an important and integral part of the American Economy. During a recession, the demand for both the volunteer workforce and monetary donations increases. In our paper, we analyze the effect of a recession on the supply of volunteer hours and donations in the United States. We hypothesize that supply of both volunteer hours and donations will increase during a recession, because the intrinsic motivations will continue to outweigh the extrinsic motivations as prior to the recession. We develop a model to replicate the individual's decision making and determine that the effect of a recession on volunteering and donations depends on the level of altruistic motivation present during these times. The empirical analysis rejects our hypothesis. The extrinsic motivations dominate the intrinsic motivations in times of economic distress. During a recession, donations decrease. However, there is no significant change in volunteer hours.

Acknowledgments

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Introduction

Many goods and services are non-rival and non-exclusive, and as a result would not be provided by the free market alone. In addition, the government is unable to provide all of these aforementioned services. Therefore, the sustainability of the non-profit sector is crucial to the economy, and government policies pertaining to the sector's inputs must be analyzed effectively.

The non-profit sector is funded largely through donations, and many of the operations in this sector involve the use of volunteers. Volunteer activity is work performed without monetary compensation, which creates social output that would otherwise require paid resources (Freeman 1997). Approximately 64.3 million people volunteered in the United States from September 2010 to September 2011 (Bureau of Labor Statistics, 2012). In 2010, volunteers served 8.1 billion hours, which was valued at approximately $173 billion, according to the Corporation for National & Community Service (2011). According to the Internal Revenue Agency (2012) a charitable contribution represents a donation of money or gifts to a qualified and recognized organization without the

expectation of anything in return. For the purposes of our research, we are interested in determining the effect on solely monetary contributions rather than physical gifts. In 2011, individuals, foundations and corporations increased aggregate donations from the prior year by 4 percent to $298 billion (The Center on Philanthropy at Indiana University 2012).

Since the non–profit sector requires both donations and volunteers to function, it becomes critical to assess the interdependence of monetary donations and time spent volunteering, both of which are philanthropic endeavours. Much of the literature on volunteerism and donations of money discuss whether or not donations of time and money are related. Andreoni, Gale and Sholtz (1996), Brown and Lankford (1992) found that gifts of time and money were complements of each other, as did Menchik and Weisbrod (1987) and Callen (1994). Understanding the nature of the relationship between these two activities is essential when explaining behaviours and developing appropriate government policies. For example, the effect of deductibility of charitable donations on the amount of time spent volunteering is dependent on whether these two activities are complements, substitutes, or neither. We expect the nature of this relationship to contribute to patterns witnessed during a recession on these two philanthropic activities, and thus the relationship is considered in our model and empirical analysis.

During a recession, volunteers and donations become even more critical for the functioning of an economy, as there is an increase in unmet needs during this period (Starr 2010). The rise in demand is a result of greater need for human services, as homelessness, hunger, mental health problems, crime and other social problems rise while less funding is available to meet these needs. Despite the importance of volunteer activity during a recession, the economic literature involving the voluntary labour force has been relatively quiet compared to other topics, due to the lack of compensation received by participants (Menchik and Weisbrod 1987). Volunteering raises questions about behaviours and social pressures that are not part of standard analyses of work for compensation (Freeman 1997). The economic community must consider the patterns in volunteering and donating, as government policy has the ability to affect these patterns. In our paper, we would like to determine the relationship during a recession, when there is a surge in demand for volunteers and donations. The results of this paper will have important policy implications especially if the supply of philanthropic activity does not increase to meet this higher demand. If there is a shortage of donations and volunteer activity, then the government should devise and implement policies that encourage individuals to donate their time and money during a recession.

Literature Review

Volunteering is an interesting subject largely because there are few, if any, monetary incentives for participation. Generally, an individual’s decision to work is seen as a means of accumulating money, with which he or she can gain some utility through the consumption of goods and services as well as spending time on leisure and other activities. The decision to volunteer, on the other hand, cannot be understood in terms of

direct monetary reward. Donations actually reduce the money available for the individual to spend on consumption. Thus, much of the literature on this subject argues as to what motivates an individual to donate time and money. We want to use the previous conclusions on philanthropic activities in order to determine the patterns that explain volunteering and donation during a recession, and whether certain motivational effects are more or less prevalent during a recessionary period. The major types of motivations discussed in the literature are "intrinsic" and "extrinsic".

Intrinsic Motivations to Volunteer

An individual is "intrinsically motivated to perform an activity when he receives no apparent rewards except the activity itself" (Deci 1971, 105). Intrinsic motivation would indicate that relative prices and opportunity costs have only limited effects on an individual's decision to donate time and money. If the intrinsic motivations have a dominant effect on decision-making, we expect to find that during a recession, when the opportunity cost of philanthropic activities increases, volunteer activity and donations still increase. Since non-profit organizations experience a greater strain, and must stretch their services in times of troubles, altruistically motivated individuals would experience increased utility by helping others through increasing donations of time and money during a recession. In particular, there are three basic rewards that are associated with intrinsic motivations (Meier and Stutzer 2008): the utility of the recipient, feelings of competence by the donor, and the act of helping another. We consider these intrinsic motivations in our regression analysis, as they will determine which type of individual will volunteer in a recession, and may contribute to the changes in patterns witnessed throughout the recession.

The voluntary sector and non-profit organizations are considered a type of public good (Andreoni 1988). As such, altruism plays an important role in explaining volunteer behaviours, but will not solely predict the patterns witnessed in the voluntary sector. According to Andreoni (1988), pure altruistic behaviours fail to explain the empirical data as in large economies, the prevalence of free riders results in only a very small portion of the population donating. Consequently, the average "giving converges to zero" (Andreoni 1988), and volunteer behaviour, therefore, must be additionally influenced by extrinsic motivation. In addition, the presence of monetary incentives may actually negatively effect on volunteer behaviour when intrinsic motivations are present (Frey and Goette 1999), which has implications for the type of government policies that can encourage volunteer behaviour during a recession.

Extrinsic Motivations to Volunteer

There are numerous extrinsic motivations discussed in the literature that will impact the variables incorporated into our econometric regression equation. Extrinsic motivations refer to the outside incentives placed upon an individual, such as financial rewards or recognition. This type of motivation would indicate that relative prices and opportunity costs significantly affect an individual's decision to donate time and money.

The promise of financial rewards, such as tax deductions, provides an incentive to offer volunteer services (Frey and Goette 1999). To measure the extrinsic motivations, the opportunity cost of volunteering can be interpreted as an individual's after-tax wage rate (Menchik and Weisbrod 1987). Accordingly, changes in the wage rate and tax rates can affect an individual's decision to volunteer. Thus, during a recession, when wages increase the opportunity cost also increases, and we will expect the supply for voluntary hours and donations to decrease.

According to Freeman (1997), significant factors affecting the supply of volunteering include the likelihood of being asked to volunteer, the value individuals place on charitable activity, the effect of social pressure and the perceived moral obligation associated with volunteering. Individuals with higher levels of education, employment and generally higher incomes are more likely to be asked to volunteer. This provides an explanation for why people with higher wages and thus higher opportunity costs contribute more to philanthropic activities and suggests that the intrinsic motivations dominate the extrinsic motivations of relative prices and opportunity costs.

Hypothesis

There are two different ways to view the volunteer sector and donation environment:

a) Volunteer work and donation activity can be interpreted under the same framework as any other sector in the economy – individuals make decisions based on the relative prices (opportunity cost). The opportunity cost of volunteering is higher when the wages in the economy increase, hence less voluntary work is offered. Similarly, the opportunity cost of donating is lower when wages rise hence more money is donated. Under this interpretation, the decisions to donate time and money can be understood through their extrinsic motivations.

b) Many volunteers find the goals and purpose of the volunteer sector attractive and achieve some utility from giving and providing services and resources that benefit others. "Ideological founders will seek to hire managers and employees who share their vision. Committed employees may be easier to attract ... (and) may accept lower levels of pay in return for greater certainty that their efforts are actually helping to achieve their altruistic goals" (Rose-Ackerman 1996, 719-720). This view of the non-profit sector extends to the intrinsic motivations discussed earlier.

Given that a significant portion of volunteer activity is provided by employed individuals with high productivity and income, which translates to high opportunity costs (Freeman 1997), this provides reason to hypothesize that intrinsic motivations dominate extrinsic motivations. Those individuals who donate volunteer time are also providing monetary donations. While people who donate usually have lower opportunity costs because of higher wages, the fact that these are the same individuals providing high levels of

volunteer time still supports the idea that the latter effect (b) dominates (a). Thus, during difficult times when there is greater demand for volunteers and donations, the intrinsic motivations will increase further. However, considering that wages decrease during a recession, the extrinsic motivations will decrease as the opportunity cost of volunteering and donations will be lower. Considering that people with higher productivity and income are the ones who pursue philanthropic endeavors in the first place, and that higher wealth individuals are less financially affected proportionally by a recession (Smeeding 2012) than the intrinsic motivations will continue to exceed the extrinsic motivations. Thus, we will expect the supply of volunteer hours and donations to increase during a recession.

Model

The literature on economic modelling of donating time and money is focused largely on two different models: the public goods model and the private consumption model. The public goods model states that individuals will donate time and money if the output or quality of output increases. Therefore, an individual will donate because he values the provision of the public good. The latter model specifies that individuals will always contribute time and money as long as they obtain some enjoyment or utility from giving (Duncan 1999). We will be using the private consumption model in our paper because we are assuming that the individuals are rational and will maximize their utility subject to their constraints.

In our research, we will assume that all supply of volunteers will be consumed, hence there is no surplus in the market, and the demand for volunteers is perfectly elastic at a price of zero (Menchik and Weisbrod 1987).

Let U = Utility of an individual

An individual's utility curve is assumed to be concave and increasing in all goods. Our model will be an extension of the private consumption model that was derived by Menchik and Weisbrod (1987). U is a function of the time spent on leisure (L), the time spent volunteering (v), the amount of consumption expenditures (C), and the amount of monetary donations contributed (D) (Menchik and Weisbrod 1987):

$$U = U(L,v,C,D)$$

The individual faces a time endowment (T), which can be spent pursuing leisure (L), working (H) or volunteering (v):

$$T= v + L + H$$

We will normalise the time endowment to 1 (i.e. T = 1 year)

We want to maximize this utility function, subject to the individual's budget constraint. Let w represents the individual's real wage and let Y represent all non-wage income earned by the individual. Therefore, the budget constraint will be:

$$C = w\,(1- L - v) – D + Y$$

We assume that individuals want to maximize their utility function U subject to the budget constraint, C. Thus, the Lagrangian function is Ł:

$$Ł = U(L,v,C,D) – \lambda\,[w\,(1 – v – L) – D + Y – C]$$

In our model, the utility function will be assumed to be a Constant Elasticity of Substitution function. Thus:

$$U(L,v,C,D) = [a_1L^p + a_2v^p + a_3C^p + (1 - a_1 - a_2 - a_3)D^p]^{1/p}$$

Extending from Menchik and Weisbrod's model, we want to introduce a parameter that models the effect of a recession on the volunteer labour supply. We will include the Recession parameter (R) into the model as a dummy variable where:

$$R = \begin{cases} 1 \text{ when there is a recession} \\ 0 \text{ otherwise} \end{cases}$$

Hence, the utility function is now:

$$U(L,v,C,D) = [a_1L^p + (a_2 + b_2R)v^p + (a_3 + b_3R)D^p + (1 - a_1 - a_2 - a_3)C^p]^{1/p}$$

With this new utility function, we can determine the numerical effect of recession on volunteering (b_2) and donations (b_3) where b_2, b_3 are real numbers. According to this utility function, a recession might affect the utility from volunteering and donating. For example, if $b_2 > 0$, then during a recession, the utility from volunteering will increase indicating that intrinsic motivations is dominating, and volunteering will increase. However, if $b_2 = 0$, then the recession has no effect on volunteering.

Our Lagrangian equation with the recession parameter is:

$$Ł = [\,a_1L^p + (a_2 + b_2R)v^p + (a_3 + b_3R)D^p + (1 - a_1 - a_2 - a_3)C^p]^{1/p} – \lambda\,[w\,(1- L - v) – D + Y – C]]$$

The first-order conditions yield:

1. v: $(a_2 + b_2R)v^{p-1}\,[a_1L^p + (a_2 + b_2R)v^p + (a_3 + b_3R)D^p + (1 - a_1 - a_2 - a_3)C^p]^{(1-p)/p} + \lambda w = 0$

2. L: $a_1 L^{p-1}\,[a_1 L^p + (a_2 + b_2 R)v^p + (a_3 + b_3 R)D^p + (1 - a_1 - a_2 - a_3)C^p]^{(1-p)/p} + \lambda w = 0$
3. D: $(a_3 + b_3 R)D^{p-1}\,[a_1 L^p + (a_2 + b_2 R)v^p + (a_3 + b_3 R)D^p + (1 - a_1 - a_2 - a_3)C^p]^{(1-p)/p} + \lambda = 0$
4. C: $(1 - a_1 - a_2 - a_3)C^{p-1}\,[a_1 L^p + (a_2 + b_2 R)v^p + (a_3 + b_3 R)D^p + (1 - a_1 - a_2 - a_3)C^p]^{(1-p)/p} + \lambda = 0$
5. λ : w(1- L - v) – D + Y – C = 0

Solving for the first order conditions:

a) Using equations 3 & 4:

$$D = C\left(\frac{1 - a_1 - a_2 - a_3}{a_3 + b_3 R}\right)^{1/(p-1)}$$

b) Using equations 1 & 2:

$$L = v\left(\frac{a_2 + b_2 R}{a_1}\right)^{1/(p-1)}$$

c) Using equations 1 & 4:

$$v = C\left[\frac{(1 - a_1 - a_2 - a_3)}{a_2 + b_2 R}\right]^{\frac{1}{p-1}}$$

Now, using equation a) to simply c)

$$v = D\left[\frac{a_3 + b_3 R}{a_2 + b_2 R}\right]^{\frac{1}{p-1}}$$

Substituting a), b) and d) into equation 5 and simplifying:

$$v^* = (w + Y)\left[\left(\frac{1}{w}\left(\frac{a_1}{a_2 + b_2 R}\right)^{\frac{1}{p-1}}\right) + \left(\frac{(1 - a_1 - a_2 - a_3)(a_3 + b_3 R)}{(a_2 + b_2 R)[(1 - a_1 - a_2 - a_3) - (a_3 + b_3 R)]}\right)^{\frac{1}{p-1}} + \frac{1}{w}\right]$$

Where v^* is the optimal hours of volunteer for an individual.

Substituting this into b

$$L^* = (w+Y)[\frac{1}{w} + \left(\frac{1}{w}\left(\frac{a_2 + b_2R}{a_1}\right)^{\frac{1}{p-1}}\right) + \left(\frac{(1-a_1-\square_2-a_3)(a_3+b_3R)}{[a_1[(1-a_1-a_2-a_3)-(a_3+b_3R)]]}\right)^{\frac{1}{p-1}}]$$

Where L^* is the optimal hours of leisure for an individual.

Similarly, solving for the remaining variables

$$C^* = (w+Y)[\left(\frac{1}{w}\left(\frac{a_1-(a_2+\square_2R)}{(1-a_1-a_2-a_3)}\right)^{\frac{1}{p-1}}\right) + \left(\frac{(a_3+b_3R)}{[(1-a_1-a_2-a_3)-(a_3+b_3R)]}\right)^{\frac{1}{p-1}}]$$

Where C* is the optimal value of consumption for an individual.

$$D^* = (w+Y)[\left(\frac{1}{w}\left(\frac{a_1-(a_2+b_2R)}{(a_3+b_3R)}\right)^{\frac{1}{p-1}}\right) + \left(\frac{(1-a_1-a_2-a_3)}{[(1-a_1-a_2-a_3)-(a_3+b_3R)]}\right)^{\frac{1}{p-1}}]$$

Where D* is the optimal hours of donations for an individual.

We perform comparative statics on the results of the model, for the purpose of testing the accuracy of the model through our empirical analysis. We will only concentrate on donations and volunteer hours because analysis of consumption and leisure hours has been extensive over the years.

Fall in wages (w)

Given that solutions to the model for optimal volunteer hours and donations supplied are complicated, we cannot make predictions about the direction of donations and volunteer hours without making assumptions surrounding p, b_2 and b_3, since the variable w will be present in more than one term of the derivative.

Fall in non-wage income (Y)

The derivative of v* and D* with respect to household income (Y) is positive. Therefore, a fall in income will decrease volunteer hours and donation activity. This confirms Freeman's (1997) conclusion that people with higher income volunteer and donate more and can be interpreted as extrinsic motivations dominating intrinsic motivations of an individual.

Presence of a recession (R = 1)

Since we are unaware of the direction of the coefficients b_2 and b_3, and are interested in determining those directions through empirical analysis, we cannot determine the correlation between a recession and donation activity or volunteer behaviour until the values of b_2 and b_3 are confirmed.

In order to conduct a concrete comparative static investigation, we will consider a specific case of the constant elasticity of substitution model – the Cobb-Douglas multivariate utility model with constant returns to scale.

Let us define the Cobb-Douglas Utility function as:

$$\text{U(L,v,C,D)} = L^{a_1} v^{a_2+b_2R} D^{a_3+b_3R} C^{(1-a_1-a_2-b_2R-a_3-b_3R)}$$

Our Lagrangian equation with this utility function is:

$$Ł = \left[L^{a_1} v^{a_2+b_2R} D^{a_3+b_3R} C^{(1-a_1-a_2-b_2R-a_3-b_3R)}\right] - \lambda\,[\text{w}\,(1-\text{L}-\text{v}) - \text{D} + \text{Y} - \text{C}]$$

The first-order conditions yield:

1. v: $(a_2 + b_2R)\left[L^{a_1} v^{a_2+b_2R-1} D^{a_3+b_3R} C^{(1-a_1-a_2-b_2R-a_3-b_3R)}\right] + \lambda w = 0$
2. L: $a_1\left[L^{a_1-1} v^{a_2+b_2R} D^{a_3+b_3R} C^{(1-a_1-a_2-b_2R-a_3-b_3R)}\right] + \lambda w = 0$
3. D: $(a_3 + b_3R)\left[L^{a_1} v^{a_2+b_2R} D^{a_3+b_3R-1} C^{(1-a_1-a_2-b_2R-a_3-b_3R)}\right] + \lambda = 0$
4. C:$(1 - a_1 - a_2 - b_2R - a_3 - b_3R)\left[L^{a_1} v^{a_2+b_2R} D^{a_3+b_3R} C^{(-a_1-a_2-b_2R-a_3-b_3R)}\right] + \lambda = 0$
5. λ: w(1- L - v) – D + Y – C = 0

Solving for the first order conditions:

$$L = \left(\frac{a_1}{a_2 + b_2R}\right) v$$

$$D = \frac{a_3 + b_3R}{1 - a_1 - a_2 - b_2R - a_3 - b_3R} C$$

$$v = \frac{(a_2 + b_2 R)}{w(1 - a_1 - a_2 - b_2 R - a_3 - b_3 R)} C$$

Simplifying further:

$$v = \frac{(a_2 + b_2 R)}{w(a_3 + b_3 R)} D$$

Substituting these results into equation 5)

$$v^* = \frac{w + Y}{w}[a_2 + \square_2 R]$$

$$L^* = \frac{w + Y}{w}[a_1]$$

$$C^* = (w + Y)[1 - a_1 - a_2 - b_2 R - a_3 - b_3 R]$$

$$D^* = (w + Y)[a_3 + b_3 R]$$

The following section will highlight the results of the comparative static analysis of the Cobb-Douglas model.

Fall in wages (w)

A fall in wages will cause consumption and donation activity to fall. This is consistent with our economic intuition as lower wages means the individual has less available wealth to spend on these activities and confirms Freeman's (1997) conclusion that individuals with higher wages will donate more. Furthermore, leisure will increase with a fall in wages as the opportunity cost of not working an extra hour has reduced. Finally, volunteer hours will increase with a fall in wages because the opportunity cost of volunteering directly corresponds to the wage rate. This indicates that at a higher wage, the opportunity cost of volunteering is higher, thus individuals earning higher wages will volunteer less. This result implies that extrinsic motivations compelling an individual will outweigh intrinsic motivations.

Fall in non-wage income (Y)

The derivative of v*, D*, L*, and C* with respect to household income (Y) is positive. Therefore, a fall in income will decrease volunteering, donation activity, consumption and time spent pursuing leisure. This confirms that fact that people with higher income tend to be more involved in philanthropic activity, and can be interpreted as extrinsic motivations dominating intrinsic motivations of an individual, which is consistent with the findings of our previous model.

Presence of a recession (R = 1)

The individual's optimal choice of leisure will remain independent during a recession or period of growth. Furthermore, by making the assumption that the value of b_2, b_3 is positive, the optimal consumption level will decrease, volunteer hours will increase, and donation activity will increase. By making this assumption, we are hypothesizing that intrinsic motivations outweigh external pressures.
Contrarily, if $b_2 < 0$ and $b_3 < 0$, consumption increases, while volunteer hours and donations decrease. In other words, during a recession, individuals will substitute consumption for donations and leisure for volunteer hours and because the utility from volunteering and donations decreases during a recessionary period, extrinsic motivations dominate.

We hope that through our empirical analysis we can determine the value of b_2 and b_3 – if they are positive, negative or negligible. We know from our model that in general, extrinsic motivations dominate because people with higher wages will volunteer less. Through empirical analysis, we will determine the value of b_2, b_3 and observe if there are any motivational changes during a recession. If the results show that b_2, $b_3 > 0$, the model implies that intrinsic motivations are dominant during a recessionary period.

Empirical Analysis

Data

The purpose of the empirical portion of our analysis is to determine the accuracy of the model developed above and determine whether the comparative statics highlighted earlier are of any significance in the data. In order to determine this relationship, we have compiled State-level data for the variables included in our model and have run a random effects GLS regression. In order to ensure we have significant observations to perform an accurate empirical analysis, we developed a panel dataset for each of the 50 United States for the years from 2007 to 2009, which falls before and during the recession referred to as the "Financial Crisis". Therefore, our data set includes 150 observations over three years.

Our recession variable focuses on whether a particular state in each period was experiencing a recession rather than the entire nation due to issues regarding data availability. Since the United States had not experienced a recession between 2001 and 2007, including further data points in our regression becomes cumbersome as our regression variable for the majority of the data points for the period would obtain a value of 0 and there would not be adequate variation to run a fixed effect regression. By focusing on the state level and three years of statistics, we are able to obtain sufficient observations and variation in order to ensure accurate analysis.

Our data was collected through numerous U.S. governmental sources. Wage and labour hour data was collected through the Bureau of Labour Statistics' Current Employment Statistics Program. This program surveys approximately 141,000 businesses and

government agencies each month to provide data relating to nonfarm payroll workers. Household income data was taken from the American Community Survey developed by the U.S. Census Bureau. This survey is collected from a sample of the population in the United States and represents survey estimates. Donation information was collected by the National Center for Charitable Statistics with data released by the Internal Revenue Service called the "Statistics of Income Bulletin". The data published represents data selected from taxpayer's tax returns. One issue with this data is that some donations are excluded, as only returns with itemized donations appear. According to the National Center for Charitable Statistics, 33 percent of U.S. taxpayers chose to itemize their deductions on their tax returns meaning that the majority of American's use the standard deduction. However, according to The Center on Philanthropy at Indiana University 2012, it was estimated that in 2009, total U.S. giving was $227.41 billion compared to $157.2 billion in itemized contributions. This represents nearly 70 percent of all giving, and therefore it can be concluded that this dataset will provide adequate information on state-level donation activity. Volunteer hour data was collected through the publication, "Volunteering and Civic Life in America", which gathered information through a supplement to the Current Population Survey: the Volunteer Supplement and the Civic Supplement.

The Current Population survey is distributed monthly and surveys 60,000 households. The dataset defines volunteers as "individuals who performed unpaid volunteer activities through or for an organization at any point during the 12-month period." There is currently no available state-level consumption data and therefore a proxy must be used for the consumption variable. In research surrounding wealth and consumption data at the state level conducted by Xia Zhou (2010), he concluded that retail sales per state represent a statistically significant proxy for consumption data. Therefore, our data set uses retail sales per capita as a proxy for consumption level data.

To determine whether each state was suffering from a recessionary period, the percentage change in GDP for the year was determined. If the percentage change was negative, then a recession exists and if the change was zero or positive, the state was not suffering from a recession. Given that our determination of a recessionary period involves the percentage change for the entire year, we understand that this does not necessary align with the formal definition of a recession. We were unable to obtain percentage change information at a state-level for the last two quarters of each year, in order to accurately determine whether at year end there existed a recession.

Regression Equation

The variables used in this dataset along with summary statistics are found in appendix A. Stateid includes a range from 1 to 50 and represents each United State. It should be noted that the District of Columbia is not included in the analysis as data pertaining to numerous variables were not available. Included in our regression are three dummy variables: recession, y08, and y09. If the state in one of the three years was determined to be suffering from a recessionary period, then the observation would

include a 1 under the recession variable, and 0 otherwise. If the observation was taken during 2008, then the data entry would consist of a 1 for that observation and if it were during 2007 or 2009, it would be 0. The same logic is employed for the dummy variable y09. For example, if Michigan were in a recession in 2007, then in the regression, the recession dummy variable, R, would equal 1. If Texas were not experiencing a recession for the same year, then R would equal 0 for that particular data point.

Variable labourhrs, leisure and volunteerhrs represent the number of hours an individual spent working, pursuing leisure activities and volunteering, respectively. We implemented a time endowment for the purposes of the empirical analysis of 168 hours, which represents the number of hours during a week. Therefore, each variable represents the number of hours spent pursuing that variable per week.

In order to obtain more statistically significant results, we also ran a regression featuring the natural logarithm of each variable. This is represented in the dataset bya "ln" before each variable name. The natural logarithm of variables are used because this allows the data to achieve a normal distribution as the volunteer hours, wages, income, leisure and consumption take on negative values. Without natural logarithm, the data is truncated at 0. Additionally, the natural logarithm demonstrates percentage changes, whereas the unadjusted value only shows absolute changes. Since absolute changes in volunteering and donations may be very small, and thus not statistically significant, using the natural logarithm allows even small changes to be accounted for in our analysis. Finally, the function we are interested in, the Cobb-Douglas/Constant Elasticity function, is non-linear which is problematic for our empirical analysis. The natural logarithm corrects this issue as it linearizes the function and allows us to run the random effects regression.

The regression equations that we are interested in include:

$$\text{ln\_volunteerhrs} = \beta_1 + \beta_2 \text{ln\_donations} + \beta_3 \text{recession} + \beta_4 \text{ln\_wage} + \beta_5 \text{ln\_income} + \beta_6 \text{ln\_leisure} + \beta_7 \text{y08} + \beta_8 \text{y09} + \beta_9 \text{ln\_consumption} + u$$

$$\text{ln\_donations} = \beta_1 + \beta_2 \text{ln\_volunteerhrs} + \beta_3 \text{recession} + \beta_4 \text{ln\_wage} + \beta_5 \text{ln\_income} + \beta_6 \text{ln\_leisure} + \beta_7 \text{y08} + \beta_8 \text{y09} + \beta_9 \text{ln\_consumption} + u$$

Discussion of Findings

The regression output for each of the above equations can be found in Appendix B. A summary is presented below:

Independent Variable	Coefficient (Standard Error) Dependent Variable	
	ln_donations	*ln_volunteerhrs*
ln_donations	-	.0664 (.1142)
ln_volunteerhrs	.0324 (.0530)	-
ln_income	-0.2561 (.1981)	.5169 (.2987)**
ln_wage	-0.0451 (.2509)	-0.4316 (.3732)
recession	-0.0292 (.0141)*	-0.0125 (.0253)
ln_consumption	.0346 (.1765)	.0242 (.2499)
ln_leisure	.1536 (1.659)	-7.5108 (2.5345)*
y08	-0.0344 (.1454)*	-0.0406 (.0252)
y09	-0.0693 (.0216)	.0304 (.0363)
constant	10.027 (8.2152)	31.3191 (12.615)*

** statistically significant at the 5% level*

***statistically significant at the 10% level*

We cannot reject the null hypothesis that a recession does not have an effect on volunteer hours due to the p-value of 0.819 and t-statistic of -0.23. As such, the coefficient on volunteer hours that was developed in our theoretical model (b_2) is nil. This finding is interesting as in our Cobb-Douglas model leisure is independent of a recession. If volunteer hours and leisure hours remain constant with the onset of a recession, then labour hours must also remain constant also for our time endowment to be satisfied. However, much of the literature surrounding the link between a recession and employment disputes this finding. According to Aliprantis (2012), for example, the average number of hours worked dramatically decreased in the United States during the most recent recession. Therefore, in our constant elasticity model, if hours worked decreases during a recession, and volunteer hours remain constant, then leisure must increase. If leisure is increasing then this would cause our model's coefficients to be $b_2 = 0$, $b_3 < 0$ and $p < 1$. We have confirmed that indeed $b_2 = 0$, $b_3 < 0$ from our empirical analysis, which is discussed below. Hence, leisure must increase during the recession to ensure volunteer hours remain constant when assuming $p < 1$. In fact, in a study conducted by Aguigar, Hurst and Karabarbounis (2012) it was determined that the decrease in work hours is largely offset by an increase in leisure hours during a recessionary period. Thus, this is evidence that our model is an accurate depiction of the observed phenomenon in the volunteer sector.

The statistically significant results for the relationship between leisure and volunteer hours are consistent with intuition. Since time endowment is fixed, and we assume hours worked to be constant, an increase in leisure should result in a fall in volunteer hours. An interesting observation, however, is that an increase in leisure by 1 percent leads to a fall in volunteer hours by nearly 7.5 percent, suggesting that individuals value leisure more than volunteer hour. This provides further evidence that extrinsic motivations dominate intrinsic motivations.

Our regression also indicates that the relationships between wage and volunteer hours and wage and donations are insignificant. This is important to our analysis as our hypothesis was heavily influenced by behaviours that are a function of changes in wage levels. Since our model only considers the opportunity costs placed upon an individual, then this insignificant result in the regression output may be due to the fact that people with higher wages are more likely to be asked to volunteer and are under greater social pressure to volunteer, causing the effect of wages to be nil.

From our regression equation using ln_volunteerhrs as our dependent variable, we also find ln_income to positively affect the number of volunteer hours supplied by an individual. The coefficient on ln_income is 0.517 with a standard error of 0.299. The p-value pertaining to the coefficient is 0.084, thus allowing us to determine that the natural logarithm of income is statistically significant at the 90 percent accuracy level. Therefore, ceteris paribus, individuals with greater household income will supply more volunteer hours. This is consistent with our model's findings.

Moreover, with donation activity representing the dependent variable, the recession parameter is statistically significant with a coefficient of -.029, which demonstrates that a recession results in a 2.9 percent decrease in the level of donations per individual. This finding brings us to the conclusion that extrinsic motivations outweigh intrinsic motivations: greater need for non profit goods and services in society as a result of a recessionary period does not motivate individuals to increase donation activity. The coefficient b_3 developed in our theoretical model must be negative: the presence of a recession causes donation activity to decrease, which requires a negative value of b_3, the coefficient of R relating to Donations in our model, in order to decrease utility.

We are also interested in determining the relationship between volunteer behaviour and donation activity. Using a standard random effects regression equation, shown below, we find that an increase in donations only results in a negligible increase in volunteer activity. This is demonstrated by a coefficient of 0.00038 on the donation variable and a p-value of 0.076. Therefore, the effect is only statistically significant at the 90 percent level. This allows us to conclude that donation activity and volunteer behaviour do not have a significant relationship.

Regression Equation:

$$\text{volunteerhrs} = \beta_1 + \beta_2 \text{donations} + \beta_3 \text{recession} + \beta_4 \text{wage} + \beta_5 \text{income} + \beta_6 \text{leisure} + \beta_7 \text{y08} + \beta_8 \text{y09} + \beta_9 \text{consumption} + u$$

If we use donations as the dependent variable when testing the relationship between donation activity and volunteer time, we find that the coefficient on volunteer hours is 551.7. Therefore, an increase in volunteer hours per week by one hour will increase monetary donations by $551 per individual. The standard error of the coefficient is 315.9 and the p-value is 0.081, allowing us to conclude that at a 90 percent significance level, volunteer hours will have a positive effect on donation activity. This regression was run using the following equation:

$$\text{donations} = \beta_1 + \beta_2 \text{volunteerhrs} + \beta_3 \text{recession} + \beta_4 \text{wage} + \beta_5 \text{income} + \beta_6 \text{leisure} + \beta_7 \text{y08} + \beta_8 \text{y09} + \beta_9 \text{consumption} + u$$

In order to relate these relationships between donations and volunteer hours to business cycles, we are interested in how the elasticity between the two variables changes from 2007 to 2009 – before and during the most recent recession. By running two separate regressions for 2007 and 2009, we find that in 2007, a $100 dollar increase in charitable giving increases volunteer hours per week by 0.004 or 0.2 hours per year. This has a p-value of 0.1 and a t-statistic of 1.68. This confirms the existing literature on the complementary relationship between donations and volunteering hours. In 2009, a $100 dollar increase in charitable giving's increases volunteer hours per week by 0.006 or 0.3 hours per year. However, this result is statistically insignificant with a p-value of 0.121 and a t-statistic of 1.58. This implies that during a recession, there is no relationship between donations and volunteer hours – they are neither complimentary nor substitutable. Therefore, this confirms the observed phenomena in our empirical work. Even though donations decrease during hard times, volunteer behaviour remain constant despite the expectation that volunteering might decrease due to the complementarity relationship during a boom period.

The regression outputs for the above equations can be found in appendix B.

Robustness

Since there exists a possibility for the explanatory variables such as donation activity, income and wage to be correlated with an omitted variable that is hard to quantify, such as recognition achieved from philanthropic activity, it is beneficial to perform the previous regression equations using a fixed effects model. This model allows us to control for some of the omitted variable bias that may occur in the random effects as a result of correlated variables. To reduce the amount of bias, the omitted variable must have time-invariant values. Recognition tends to change in response to changes in socio-economics status, so this variable may not be truly time-invariant. However, since our study is based solely on a three-year period, we can safely conclude that the recognition

achieved through volunteering and donation activity would not fluctuate substantially throughout this period, as recognition in society takes time to develop in individuals.

The fixed effects model was used with ln_volunteerhrs and ln_donations as the dependent variables for the two regressions equations mentioned earlier, and the regression output can be found in Appendix C. Here is a summary for comparison purposes:

Independent Variable	**Coefficient (Standard Error) Dependent Variable**			
	ln_donations		*ln_volunteerhrs*	
	Random Effects	Fixed Effects	Random Effects	Fixed Effects
ln_donations	-	-	.0664 (.1142)	.2046 (.2017)
ln_volunteerhrs	.0324 (.0530)	.0540 (.0533)	-	-
ln_income	-0.2561 (.1981)	.1094 (.2388)	.5169 (.2987)**	-.2071 (.4647)
ln_wage	-0.0451 (.2509)	.2534 (.3086)	-0.4316 (.3732)	-.8031 (.5969)
recession	-0.0292 (.0141)*	-.0222 (.0130)**	-0.0125 (.0253)	-.0120 (.0257)
ln_consumption	.0346 (.1765)	.1298 (.1977)	.0242 (.2499)	-.1691 (.3852)
ln_leisure	.1536 (1.659)	3.2373 (1.6944)**	-7.5108 (2.5345)*	-11.074 (3.157)*
y08	-0.0344 (.1454)*	-.0495 (.0142)*	-0.0406 (.0252)	-.0158 (.0294)
y09	-0.0693 (.0216)	-.0854 (.0215)*	.0304 (.0363)	.0436 (.0450)
constant	10.027 (8.2152)	-10.817 (9.112)	31.3191 (12.615)*	58.433 (16.795)*

** statistically significant at the 5% level*

***statistically significant at the 10% level*

Focusing on the regression using ln_volunteerhrs as the dependent variable first, we find that the coefficient on the recession variable does not change significantly from the random effects model. We are interested in the significant change in the coefficient on ln_income between the two models. Under the random effects model, we found that volunteer hours and household income were positively correlated with a coefficient of 0.517 and a p-value of 0.084. Under the fixed effects model, we found that an increase in household income would decrease the amount of volunteer hours contributed by 21 percent, however this is statistically insignificant with a p-value of 0.657. The significant difference in the effect of ln_income between the fixed effects model and the random-

effects model, suggests the potential for correlation between omitted variables and the level of household income. The fixed effects model, therefore, may be more representative for the purposes of our analysis, as the random effects model used previously includes a bias in the positive direction. However, since the focus of our analysis is to discover the relationship between the dependent variables (volunteer hours and donations), the model chosen is not particularly concerning, as the change in the coefficient and significance on the recession variable is negligible.

When using ln_donations as the dependent variable and running the two models, we find that the change in the coefficient on the recession variable is minimal, changing from -0.029 under the random effects model to -0.022 under the fixed effects model. The fixed effects model causing the significance level to decrease to 10 from 5 percent in the random effects model. The coefficient on ln_income changes from being negatively correlated with donation activity in the random effects model to being positively correlated with donation activity under the fixed effects model. This may also indicate bias in the random effects model however, both values still remain statistically insignificant. The difference observed between the significance levels and values of the coefficient on leisure is important. Under the RE model, we determined that this variable was statistically insignificant with a p-value of 0.926. Under the FE model, the p-value becomes significant at the 10 percent level (p-value of .059) and the coefficient increases by a multiple of 21, to 3.24. This implies that leisure and donations are positively correlated. This result may be explained by the fact that individuals who value leisure more will volunteer less and compensate this lack of volunteering with donations.

Conclusion

Our analysis shows that during a recession, individuals become less altruistic, demonstrated by a shift in motivations towards extrinsic motivations dominating intrinsic motivations. This allows us to interpret the fall in donations during a recession as a result of individuals' attempts to maintain their level of consumption in the face of lower wages and higher unemployment. During a recession, people substitute consumption for donation.

This effect is not observed with volunteer hours. During a recession, the average hours worked tends to decrease because of lower demand for labour. Under the extrinsic motivation framework, which is dominant in a recession, leisure increases because individuals gain more utility from leisure than volunteering, but volunteer hours remain constant. During a recession, volunteer hours and donations are not complementary as they are during a pre-recessionary period. As a result, a fall in donations does not result in a fall in volunteer hours.

These results have significant policy implications. Since demand for volunteering and the level of donations increases during a recession, and the supply of volunteer hours and donations do not increase to compensate for the higher demand, a shortage will exist in the non-profit sector. In order to achieve equilibrium, the government should implement

policies that will alter the influence of extrinsic motivations on individuals. The government will have to reduce the opportunity cost of volunteering and donations, such as through tax cuts or subsidies, and increase the recognition received from volunteering and donating by presenting these activities as moral obligation and promoting awareness of the subject.

A future direction of study in this topic will be observation of the effect of tax rates on volunteering during a recession and determining the optimal tax rate that allows the donation and volunteer sector to clear during a recessionary period.

In this paper, we studied the opportunity cost of wages as the only extrinsic motivation. Discussing the existence of additional extrinsic motivations, such as the probability of being asked to volunteer, or the social pressures of volunteering, would provide a better understanding of the observed situation.

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Appendix A

Summary Statistics of the Dataset

Variable	Obs	Mean	Std. Dev.	Min	Max
stateid	150	25.5	14.47921	1	50
labourhrs	150	34.43333	1.106216	31.2	37.3
recession	150	.48	.5012735	0	1
wage	150	20.99113	2.609591	16.27	27.81
volunteerhrs	150	.7288	.206085	.39	1.93
donations	150	3544.533	973.649	2000	7600
income	150	51372.62	8554.96	36646	70759
leisure	150	132.8385	1.123602	130.23	135.83
year	150	2008	.8192319	2007	2009
y08	150	.3333333	.4729838	0	1
y09	150	.3333333	.4729838	0	1
consumption	150	15317.73	1979.713	12354	23369
ln_labourhrs	150	3.538511	.0321817	3.440418	3.618993
ln_wage	150	3.036618	.1220952	2.789323	3.325396
ln_volunte~s	150	-.3491665	.2454752	-.9505239	.6549259
ln_donations	150	8.139979	.2528655	7.600903	8.935904
ln_income	150	10.83348	.1631812	10.50906	11.16704
ln_leisure	150	4.889097	.0084571	4.869308	4.91141
ln_consump~n	150	9.629023	.1229184	9.421741	10.05917

Appendix B – Random Effects Model

```
. xtreg ln_donations ln_volunteerhrs recession ln_wage ln_income ln_leisure y08 y09 ln_consumption

Random-effects GLS regression                   Number of obs      =       150
Group variable: stateid                         Number of groups   =        50

R-sq:  within  = 0.4015                         Obs per group: min =         3
       between = 0.1221                                        avg =       3.0
       overall = 0.1240                                        max =         3

                                                Wald chi2(8)       =     61.36
corr(u_i, X)   = 0 (assumed)                    Prob > chi2        =    0.0000
```

ln_donations	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
ln_volunteerhrs	.0323801	.0530453	0.61	0.542	-.0715867	.1363469
recession	-.0291992	.0141032	-2.07	0.038	-.0568411	-.0015574
ln_wage	-.0451352	.2508571	-0.18	0.857	-.536806	.4465357
ln_income	-.2560638	.1980742	-1.29	0.196	-.6442822	.1321546
ln_leisure	.1535512	1.658884	0.09	0.926	-3.097802	3.404905
y08	-.0344238	.0145402	-2.37	0.018	-.062922	-.0059255
y09	-.0692994	.0216086	-3.21	0.001	-.1116514	-.0269473
ln_consumption	.0346057	.17654	0.20	0.845	-.3114064	.3806177
_cons	10.02705	8.215247	1.22	0.222	-6.074537	26.12864
sigma_u	.19584436					
sigma_e	.05434981					
rho	.92849239	(fraction of variance due to u_i)				

```
. xtreg ln_volunteerhrs ln_donations recession ln_wage ln_income ln_leisure y08 y09 ln_consumption

Random-effects GLS regression                   Number of obs      =       150
Group variable: stateid                         Number of groups   =        50

R-sq:  within  = 0.1960                         Obs per group: min =         3
       between = 0.0771                                        avg =       3.0
       overall = 0.0946                                        max =         3

                                                Wald chi2(8)       =     27.08
corr(u_i, X)   = 0 (assumed)                    Prob > chi2        =    0.0007
```

ln_volunteer~s	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
ln_donations	.0664394	.1142388	0.58	0.561	-.1574645	.2903432
recession	-.0124698	.0253277	-0.49	0.622	-.0621111	.0371716
ln_wage	-.431629	.3732436	-1.16	0.248	-1.163173	.299915
ln_income	.5168527	.2987206	1.73	0.084	-.068629	1.102334
ln_leisure	-7.510794	2.534495	-2.96	0.003	-12.47831	-2.543275
y08	-.0406417	.0252488	-1.61	0.107	-.0901284	.0088451
y09	.0303805	.0363498	0.84	0.403	-.0408637	.1016248
ln_consumption	.0241685	.2499258	0.10	0.923	-.4656771	.514014
_cons	31.31908	12.61537	2.48	0.013	6.593411	56.04476
sigma_u	.21906483					
sigma_e	.10575259					
rho	.81100149	(fraction of variance due to u_i)				

```
. xtreg volunteerhrs donations income wage leisure consumption y08 y09 recession

Random-effects GLS regression                   Number of obs      =       150
Group variable: stateid                         Number of groups   =        50

R-sq:  within  = 0.2380                         Obs per group: min =         3
       between = 0.1041                                        avg =       3.0
       overall = 0.1176                                        max =         3

                                                Wald chi2(8)       =     34.76
corr(u_i, X)   = 0 (assumed)                    Prob > chi2        =    0.0000
```

volunteerhrs	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
donations	.000038	.0000214	1.77	0.076	-4.00e-06	.0000801
income	7.20e-06	4.56e-06	1.58	0.114	-1.74e-06	.0000161
wage	-.0125881	.0141691	-0.89	0.374	-.040359	.0151829
leisure	-.0550665	.0140224	-3.93	0.000	-.0825498	-.0275832
consumption	1.51e-06	.0000117	0.13	0.898	-.0000215	.0000245
y08	-.0241326	.0177128	-1.36	0.173	-.0588491	.0105839
y09	.0347157	.0264539	1.31	0.189	-.0171331	.0865644
recession	.0018806	.0176948	0.11	0.915	-.0328005	.0365617
_cons	7.775592	1.847302	4.21	0.000	4.154946	11.39624
sigma_u	.18798508					
sigma_e	.07390691					
rho	.86612384	(fraction of variance due to u_i)				

```
. xtreg donations volunteerhrs income wage leisure consumption y08 y09 recession

Random-effects GLS regression                   Number of obs      =       150
Group variable: stateid                         Number of groups   =        50

R-sq:  within  = 0.3062                         Obs per group: min =         3
       between = 0.1430                                        avg =       3.0
       overall = 0.1470                                        max =         3

                                                Wald chi2(8)       =     44.83
corr(u_i, X)   = 0 (assumed)                    Prob > chi2        =    0.0000
```

donations	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
volunteerhrs	551.7097	315.913	1.75	0.081	-67.46847	1170.888
income	-.0137696	.0176054	-0.78	0.434	-.0482756	.0207364
wage	-36.72608	54.53253	-0.67	0.501	-143.6079	70.1557
leisure	8.505324	55.64511	0.15	0.879	-100.5571	117.5677
consumption	-.0183537	.0453568	-0.40	0.686	-.1072514	.0705439
y08	-103.8556	64.61585	-1.61	0.108	-230.5003	22.78913
y09	-254.2313	96.90552	-2.62	0.009	-444.1627	-64.3
recession	-82.75956	63.86504	-1.30	0.195	-207.9327	42.41362
_cons	3931.14	7383.397	0.53	0.594	-10540.05	18402.33
sigma_u	748.54279					
sigma_e	249.27585					
rho	.90017194	(fraction of variance due to u_i)				

Regression Output Using Strictly 2007 Data:

```
. reg volhours donations
```

Source	SS	df	MS	Number of obs =	50
				F(1, 48) =	2.82
Model	.098579393	1	.098579393	Prob > F =	0.0997
Residual	1.67933266	48	.034986097	R-squared =	0.0554
				Adj R-squared =	0.0358
Total	1.77791205	49	.036283919	Root MSE =	.18705

volhours	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
donations	.0000422	.0000251	1.68	0.100	-8.35e-06	.0000928
_cons	.6008691	.0970451	6.19	0.000	.4057467	.7959914

Regression Output using strictly 2009 data:

```
. reg volhours donations
```

Source	SS	df	MS	Number of obs =	50
				F(1, 48) =	2.49
Model	.124461548	1	.124461548	Prob > F =	0.1212
Residual	2.40034028	48	.050007089	R-squared =	0.0493
				Adj R-squared =	0.0295
Total	2.52480183	49	.051526568	Root MSE =	.22362

volhours	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
donations	.0000579	.0000367	1.58	0.121	-.0000159	.0001317
_cons	.5221918	.1284506	4.07	0.000	.2639245	.7804591

Appendix C: Fixed Effects Model

```
. xtreg ln_volunteerhrs y08 y09 recession ln_wage ln_income ln_leisure ln_consumption ln_donations, fe

Fixed-effects (within) regression               Number of obs      =       150
Group variable: stateid                         Number of groups   =        50

R-sq:  within  = 0.2339                         Obs per group: min =         3
       between = 0.0003                                        avg =       3.0
       overall = 0.0007                                        max =         3

                                                F(8,92)           =      3.51
corr(u_i, Xb)  = -0.6525                        Prob > F          =    0.0014
```

ln_volunteer~s	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
y08	-.0158362	.029416	-0.54	0.592	-.0742589	.0425866
y09	.0435883	.0449689	0.97	0.335	-.0457239	.1329005
recession	-.0119467	.0257028	-0.46	0.643	-.0629947	.0391012
ln_wage	-.8030737	.5968707	-1.35	0.182	-1.98851	.382363
ln_income	-.2070615	.4646656	-0.45	0.657	-1.129927	.7158046
ln_leisure	-11.0739	3.15724	-3.51	0.001	-17.34446	-4.803354
ln_consumption	-.1690625	.3851666	-0.44	0.662	-.9340365	.5959116
ln_donations	.2046077	.2017366	1.01	0.313	-.1960585	.6052739
_cons	58.43295	16.79478	3.48	0.001	25.07707	91.78882
sigma_u	.30674558					
sigma_e	.10575259					
rho	.89376912	(fraction of variance due to u_i)				

```
F test that all u_i=0:     F(49, 92) =    12.49                 Prob > F = 0.0000
```

```
. xtreg ln_donations y08 y09 recession ln_wage ln_income ln_leisure ln_consumption ln_volunteerhrs, fe

Fixed-effects (within) regression               Number of obs      =       150
Group variable: stateid                         Number of groups   =        50

R-sq:  within  = 0.4414                         Obs per group: min =         3
       between = 0.1240                                        avg =       3.0
       overall = 0.0498                                        max =         3

                                                F(8,92)            =      9.09
corr(u_i, Xb)  = -0.4801                        Prob > F           =    0.0000
```

ln_donations	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
y08	-.0495399	.0142336	-3.48	0.001	-.0778089	-.0212708
y09	-.0854326	.0214532	-3.98	0.000	-.1280406	-.0428247
recession	-.022168	.0130215	-1.70	0.092	-.0480299	.0036938
ln_wage	.253353	.3086269	0.82	0.414	-.3596067	.8663127
ln_income	.1093796	.2387927	0.46	0.648	-.3648833	.5836425
ln_leisure	3.237373	1.694408	1.91	0.059	-.1278675	6.602613
ln_consumption	.1297834	.1976947	0.66	0.513	-.2628553	.5224221
ln_volunteerhrs	.0540426	.0532842	1.01	0.313	-.0517845	.1598696
_cons	-10.81734	9.112177	-1.19	0.238	-28.91491	7.280236
sigma_u	.27861312					
sigma_e	.05434981					
rho	.96334162	(fraction of variance due to u_i)				

```
F test that all u_i=0:     F(49, 92) =    44.49                 Prob > F = 0.0000
```

Chinese Venture Capital: A Discussion of the Efficacy of Recent Policies

James Balsillie

I. Venture Capital

I.1 Introduction

Since 1978, exports and low value-added manufacturing have driven China's remarkable economic growth (Ding and Zhang 2009). Recently, greater emphasis has been placed on indigenous innovation to maintain competitiveness and sustain growth rates. This goal has been reflected in economic policy, as the Chinese Government has stated its commitment to shifting towards an innovation-driven economy by 2020 (OECD 2008). In light of this objective, Venture Capital (VC) is an effective solution to encourage innovation and growth through the funding of private enterprises.

VC is defined as "independently managed, dedicated pools of capital that focus on equity or equity-linked investments in privately held, high growth companies" (Ács and Audretsch 2003). Essentially, VC is a long-term active investment in which a Small to Medium sized Enterprise (SME), often in a high-tech industry, receives cash as well as intangible value from the VC firm, in the form of managerial expertise and network connections (Grundling, Steynberg, and Wang 2009). The venture capitalist receives a return in the form of an "exit": a return on investment from an equity sale such as acquisition, liquidation, or initial public offering (Hu 2010).

Small to medium sized enterprises (SME) are often underfinanced due to their lack of tangible assets, unpredictable value of innovation, and informational asymmetries. Additionally, while private VC returns are substantial, positive externalities of innovation associated with investment in SMEs suggest that returns on investment remain below social returns (Lerner 2002). Therefore, the VC supply is likely suboptimal.

Given the economic benefits of an active VC sector, policies should be implemented that encourage VC transactions. A VC industry did not exist in China until 1985, when intrusive policies were implemented (Wong, 2011). Numerous tax incentives, subsidies, and direct investments have been used to increase funding to SMEs (Hu, 2010). These policies have been largely successful, as risk capital investments in China have increased from US $56 million in 1993 to US $15,163 million in 2010 (Wong, 2011). There is extensive theoretical and empirical literature discussing whether these types of policies have increased supply of VC (leveraging effect), or increased competition and thus dissuaded entry of private VC firms (crowding-out effect) (Guo & Zhao, 2013).

This paper will examine theoretical constructs of VC, foreign examples, and China's VC history to conclude whether China's recent economic policies for VC are effective in encouraging innovation and economic growth.

I.2 The Economic Benefits of Venture Capital

In order to increase production output, either capital or labour inputs must be increased (extrinsic growth), or total factor productivity must be increased (intrinsic growth). Early research in productivity observed that in the U.S. between 1870 and 1950, inputs only accounted for 15% of economic growth, with the rest of growth attributed to improved productivity through more efficient allocation and technological progress (Abramowitz 1956). New technological innovation is the main driver of productivity growth (Globerman 2012). Furthermore, society benefits from innovation in a variety of ways, such as progress in health care, transportation, and communication.

Capital is a constraint for research and development firms that commercialize technology, particularly small firms (Lerner 2009). SMEs, especially high-technology firms, have a number of risky characteristics that greatly increase the difficulty of obtaining financing from traditional financial institutions, such as banks. Examples of these risky characteristics associated with SMEs are: few tangible assets that can serve as collateral, difficulty in valuating the potential of their innovation, and high incidence of failure (bankruptcy) (Grundling, Steynberg, and Wang 2009).

VC encourages innovation through relief of the capital constraint by financing firms that would otherwise be deemed too high risk for traditional investment institutions (Avnimelech, Bar-El, and Schwartz 2007). Firms that are funded by VC often develop completely new technologies or products, which contribute to technological progress. In the United States of America, VC represented 3 percent of research and development funds in 1998, though VC backed firms generated 15 percent of national industrial innovation (Kortum and Lerner 1998). This evidence shows that risk capital is an extremely efficient source for financing innovation and increasing productivity.

VC delivers far greater value to investees than just the capital provided, resulting in more successful businesses. Bankruptcies in new businesses are primarily caused by: capital constraints, poor management, and lack of market knowledge (Avnimelech, Bar-El, and Schwartz 2007). In addition to providing capital, VC firms provide strategic advice, industry connections, and legitimacy to overcome these faults (Auerswald and Branscombe 2001). Extensive research shows that VC backed firms outperform comparable SMEs in terms of failure rates and profitability (Bertoni, Luukkonena, and Deschryverea 2012). This is due to the mentioned value added and financing, as well as a selection bias; VCs selectively fund firms with higher expected return on investment. This bias is beneficial for economic growth as it allocates resources with greater efficiency.

I.3 Venture Capital Market Failures

A supply gap for VC funding of SMEs exists as a result of a number of market features. For example, technological innovation often leads to profits earned by competitors, not exclusively by the researching firm (Lerner 2009). An example of this is Toyota’s development of the Prius in 1997 as the world’s first commercial hybrid vehicle

(Lake 2001). Though Toyota developed new technologies, many competing firms quickly invested in similar technologies and profited as a result. Externalities could also be realized by consumers who benefit from less expensive or more enjoyable products, or by the general population due to progress in social sectors such as health care or environmental sustainability. Since return on investment for the venture capitalist is unlikely to capture total social return, investment will fall below the social optimum regardless of which particular positive externality occurs (Lerner 2002). The gap between social and private rates of return on innovation is estimated to be between 50% and 100% of private returns (Griliches 1992).

Another reason for the undersupply of risk capital is asymmetric information (Lerner and Watson 2007). The entrepreneur is more knowledgeable about their future profits since they have a more complete understanding of their technology and the market in which their SME operates. Since entrepreneurs cannot communicate this information with perfect honesty and clarity, venture capitalists have difficulty differentiating strong firms from weaker ones. Thus, the venture capitalist assesses all projects with assumed higher risk, which leads to a lower valuation and an overall undersupply of VC.

Empirical evidence shows a long-run trend of venture capitalists decreasing the frequency of their investment in early stage ventures (Pierrakis 2010). Another observable trend is that VC is heavily focused on specific sectors in many prominent markets. In 2000, 92 percent of U.S. VC funding was invested in information technology and health care sectors (Lerner 2002). These dramatic trends have largely been caused by a "herding" effect: the phenomenon of market agents reacting to other market agents rather than the actual market conditions (Devenow and Welch 1996). Low investment rates in young SMEs and particular neglected sectors represent failures in the VC market.

II. Government Intervention

II.1 The Role of Government Intervention

Successful economic VC policy should address the discussed market failures, and accentuate the benefits of VC. Policy can be used to increase supply of VC and thus move the market into social equilibrium. Common policy tools that encourage VC activity include subsidies, tax benefits, changes in regulations, grants, and public participation in the market (Lerner 2009). Policies aimed at expanding the pool of risk capital usually take the form of investment subsidies or direct investment in the VC industry (OECD 2006). Subsidizing VC investment directly increases rate of return for the venture capitalists, thus incentivizing greater participation by lowering the entry threshold. Direct investment is either structured as public funded and operated VC organizations, or through government investment as a limited partner in VC funds (Guo and Zhao 2013). This achieves a leverage effect by increasing the supply of VC by expanding the number of investors, resulting in greater VC investment.

In the development stages of a VC industry, an important role of government is initiating the investment cycle. Prior to the first successful VC funding and profitable exit by a VC

backed firm, there exists a dilemma: no risk capital exists so SMEs are capital constrained, but there are no returns on VC investment to entice investor participation (Lerner and Watson 2007). Once initiated, the development of a risk capital industry is a long-term process that requires the evolution of market and legal structures, of supporting professional intermediaries such as lawyers and accountants, and of expectations between SMEs and venture capitalists. Government intervention can initiate and accelerate the development of a VC industry by supporting early investments and by establishing these institutions.

A third purpose of government intervention is to increase financing for firms in industries neglected by VC (Wong 2011). Subsidizing or focusing government-funded VC on these sectors would increase investment in underfinanced markets (leverage effect). Obtaining government funded VC funding additionally provides legitimacy, which can ease concerns over asymmetric information and increase the likelihood of receiving financing from banks or follow-up funding from private VCs (Jeon and Kim 2013). Government officials may also be better suited to assess firms in some neglected sectors, such as those where customers are government services, such as national defence or health care (Lerner 2002). Thus, government investment can develop risk capital markets in neglected sectors.

II.2 Drawbacks of Government Policy

The greatest concern regarding government participation in the VC market is the possible manifestation of a crowding-out effect. Increased supply of VC could initially result in lower expected returns due to a shift to long-run equilibrium that clears at greater quantity of investment and lower profit level (Gilson 2002). If government funded VC competes with private VCs, these lower expected returns could slow the development of private VC, possibly causing some investors to leave the market (Cumming and MacIntosh 2006). The theoretical result of a crowding out effect is that projects that would have been financed by private VCs instead receive state funding (Guo and Zhao 2013). Thus, unless government funded VC does not compete with private VC, the risk capital market may become dependent on state funding in the long run. This implies that government funded VC should only be used temporarily to accelerate the development risk capital markets, or as a permanent agent in an undersupplied market.

A drawback of government operated VC firms is the lack of experience in selecting the most promising firms. Predicting success of SMEs is extremely difficult, though private venture capitalists have demonstrated significant effectiveness in financing firms with higher returns (Lerner 2002). There is much doubt regarding the ability of government officials to forecast the profitability of SMEs (Avinimelech and Teubal 2006). Thus, on a firm-by-firm basis, resources would be allocated most efficiently by the private sector. Further, largely due to the intangible value provided by private venture capitalists, high levels of government funded VC funding result in lower financial returns from SMEs compared to private VC (Picker 2011).

A final concern with government intervention is the ability for government officials to implement policies for their own benefit (Ding and Zhang 2009). Though this potential issue arises with many forms of government intervention, decisions of government funded VCs often seem arbitrary, which creates the potential for investment to be directed to unfeasible enterprises if funding regulations are not strict and explicit.

II.3 Types of Government Policies

The most common policy used to address VC market failure is equity enhancement, often referred to as "hybrid schemes" (Cowling, et al. 2012). These hybrid VC firms are structured with the state investing as a passive limited partner in the VC fund, giving full operation responsibility to the general partner. Thus, public investment increases supply of VC, though the market still behaves with the effectiveness of private VC. Governments can select VCs that fund targeted sectors such as early stage SMEs and neglected industries, but firm by firm selection is done by experienced and proven private venture capitalists. This structure complements existing VC institutions, rather than crowding-out the private sector with state controlled investments. British evidence demonstrated that many hybrid VC firms achieved the same standard as private VC firms regarding returns on investment (Cowling, et al. 2012). Also, data from 1984-2008 in European countries indicates that government-funded VC improves growth rates of early stage SMEs, thus enhancing investment returns and innovation (Grilli and Murtinu 2011).

A disadvantage to hybrid schemes is that funding a neglected sector does not change investment conditions in that sector; the unattractive characteristics that initially caused the supply-side market failure are not remedied. Expected return from these sectors has not increased so there is no greater incentive for VC investment (Avinimelech and Teubal 2006). To overcome this persistent failure, governments often act as a limited partner and agree to cap their returns in order to provide greater profits to private limited partners (Gilson and Schizer 2003). This provides greater returns from previously neglected sectors, encouraging greater market participation by private VC firms, thus moving investment quantity towards the social equilibrium. Government funded VC, however, must not represent too large of a proportion of the VC industry. Information from 25 countries showed that low levels of government funded VC lead to better exit performance, while high government involvement began to crowd-out private VC (Jeon and Kim 2013).

II.4 Successful Government Intervention: Israel's Government Policy

In the early 1990's, Israel was experiencing widespread failure to commercialize technology despite massive research and development investment. Issues went beyond capital constraints, including lack of business experience and managerial expertise (Gilson and Schizer 2003). In 1993, the Yozma Programme was created to generate a competitive Israeli VC industry to invest in young SMEs, hoping to successfully develop high-technology businesses (Grundling, Steynberg, and Wang 2009). Ten hybrid VC funds were created though Yozma, each with the involvement of a foreign and a domestic financial institution, and at least US$ 8 million of government investment (Avnimelech,

Bar-El, and Schwartz 2007). From 1993-1998, approximately US$ 250 million was invested in early-stage SMEs, generating a leverage effect. Hybrid VC firms experienced higher success rates than average (16.5 percent compared to 9 percent) and lower failure rates (28.3 percent compared to 35.6 percent) (Avnimelech, Bar-El, and Schwartz 2007). Use of successful government policy sparked and expanded the pool of risk capital, allowing Israel to become the world's most active VC market, with VC investments exceeding those of any other country, at 1.2 percent of GDP (Haour 2005). Israel's success in generating a thriving VC industry serves as justification for similar policies to be implemented in other developing countries.

III. Venture Capital in China

III.1 Chinese Venture Capital History

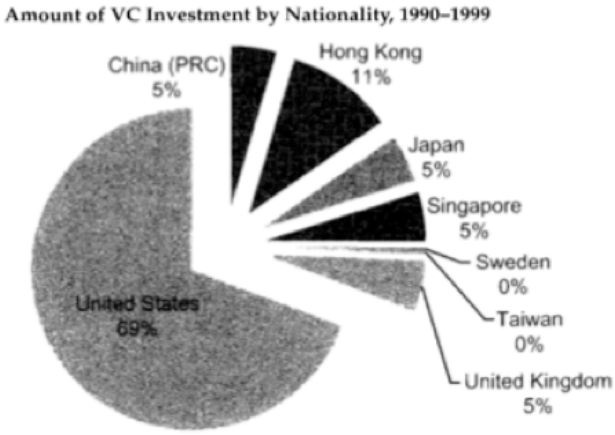
Prior to 1985, there was no VC activity in China, but in subsequent years a number of government funded initiatives eventually succeeded in fostering a VC industry. With ambitions of cultivating a more innovative economy, China's State Science and Technology Commission created the China New Technology Venture Capital Investment Corporation (CNTVI) in 1985, the first VC firm to operate in China (Feng 2004). Other government funded VC firms joined the market in the 1980's as well, though there was little investment activity until the early 1990's (Wong 2011).

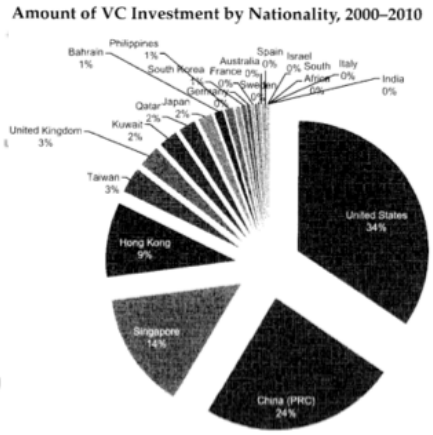
In the early 1990s, tax benefits were implemented to incentivize VC investment in high technology sectors and young SMEs (Hu 2010). Also, many provinces began to participate in VC markets by creating state funded and operated VC firms (Wong 2011). By the early 1990's some exits were occurring, but the VC market was still dominated by government funded VC firms. Prior to 1996, total VC deals in China remained below 10 each year (Wong 2011).

China's VC industry began to accelerate in the mid-1990s, as technology development became a pressing policy concern. The Chinese government created an ad hoc committee to monitor and study the domestic VC industry (Hu 2010). Simultaneously, government funded VC firms began to step back from direct market participation due to their limited success as investors resulting from a lack of experience (Wong 2011). Prior to the late 1990's, private fundraising required the government's permission and was seldom given to domestic firms. The relaxation of this regulation combined with a wave of foreign direct investment across industries in China, caused a shift in VC investment towards foreign firms, who contributed 95 percent of total VC funding in the 1990s (Feng 2004). This investment was heavily skewed towards state owned enterprises (accounting for 90 percent of VC investment) and businesses in the information technology sector (Feng 2004). VC investment in 1999 was more than eight-fold the total in 1993 (Wong 2011).

A major shift in VC policy occurred in 1998 when CNTVI was closed due to its inability to commercialize research and development projects (Grundling, Steynberg, and Wang 2009). CNTVI was replaced by the Innovation Fund for Small and Medium Technology-based Enterprises (Innofund), the first of many hybrid VC funds. Though Innofund did

not have a significant impact, it served as a policy experiment that inspired many additional hybrid VC firms in the future.





Source: (Hu 2010)

Beginning in the mid-2000's many implemented policies including increased VC market participation, diversifying VC sources, and encouraging foreign investment experienced considerable success (Hu 2010). Beneficial tax policy that was initially only available to specific sectors was applied to all VC firms, further encouraging participation. Chinese VC firms became significantly more active, and were responsible for nearly one quarter of all VC deals from 2000 to 2010. Also, risk capital investment was distributed more evenly among industries compared to the 1990's, providing funds to previously neglected sectors (Wong 2011). Total VC investment in 2010 was thirty-times greater than investment in 1999 (Wong 2011).

Foreign and Domestic VC Investment by Year

Year	Number of VC Investments	Total (US$ Million)
1993	4	55.6892
1994	8	80.3
1995	8	184.13
1996	16	102.6821
1997	19	180.8657
1998	15	137.364
1999	47	477.5146
2000	103	856.7725
2001	94	2,170.5632
2002	95	513.2531
2003	103	1,786.0116
2004	184	3,661.0366
2005	246	9,621.5954
2006	479	10,831.3774
2007	712	15,026.1007
2008	567	14,985.9974
2009	336	13,474.2851
2010	302	15,163.1126
Grand Total	**3,338**	**89,308.6512**

Source: (Hu, 2010)

III.2 Recent Chinese Economic Policy

Since 2007, there have been three major national expenditure programs to develop the VC industry. The creation and progression of these programs will be examined and critiqued in relation to theoretical arguments and foreign experiences.

Industrial Technology Research and Development Budgets Funded Venture Capital Fund

The Industrial Technology Research and Development Budgets Funded VC Funds (ITRDF) was founded in 2007 and funded by the Industrial Technology Research and Development Budget, a portion of fiscal spending earmarked for commercializing technologies. ITRDF hired venture capitalists based on their experience and past record to operate the fund according to its targets. The fund financed early stage SMEs to create technical progress in high-technology industries (Jian 2007). Targeted firms were to have innovation potential that could create a positive public impact and a high level of expected financial returns (Hu 2010). The venture capitalist did not set the strategic agenda, but had responsibilities akin to those of any fund manager, such as proposing firm-by-firm investment decisions, guiding their investees, and seeking exit options.

ITRDF behaved like a state owned and operated VC firm. While managers were hired from the private sector to remedy the lack of experience of government officials, the ITRDF still could not reach the same level of efficiency of a private firm. A private VC firm would target companies solely based on the maximization of expected financial return on investment. The fund manager of ITRDF also had considered the targets of generating positive externalities when making investment decisions. Investment was directed to young SMEs that could generate innovation of public benefit. The goal of government intervention was to move the market to social equilibrium, by addressing the positive externalities present in specific sectors. Additionally, prior to 2007 there was a market movement away from funding young SMEs, so this intervention was complementary to the market, achieving a leverage effect (Wong 2011). However, since these firms only received government backed VC, they were expected to experience lower financial and innovative returns, as discussed above.

ITRDF was structured to provide capital to underfinanced VC sectors, expanding the pool of risk capital. However, this policy selects firms according to specific targets rather than market incentives, distorting the market and failing to finance firms that would maximize financial and innovative returns. Thus, ITRDF did partially fill the equity gap, but did not do so in an efficient way.

Government Directory Venture Capital Fund

The Government Directory Venture Capital Fund (GDVCF) was also initiated in 2007 by Ministry of Science and Technology, and surpassed ITRDF as the most significant government funded program to encourage VC (Guo 2008). Like ITRDF, this

program aimed to encourage innovation and economic development by increasing investment in early stage and high-technology SMEs. The most significant difference between GDVCF and ITRDF is that GDVCF invested in private VC firms rather than individual SMEs. GDVCF was not involved with managing VCs or selecting SMEs, but instead collected private VC and set targets for this fund. GDVCF invested as a limited partner in private VC firms that focused on financing young or technology oriented SMEs. GDVCF value of remaining market oriented resulted in the condition that they could not be the largest shareholder or general partner of a fund. Other investors could purchase shares of GDVCF investment with ease and on favourable terms. Also, a subsidy of up to 5 per cent for VCs that invest in early stage SMEs was created in this program (Hu 2010).

By providing funds to private VC firms rather than competing with them, GDVCF increased the total pool of privately invested VC. This program is a true hybrid VC firm that allowed markets to allocate the increased supply of capital. One can expect the empirical evidence to show that this program generated leverage effects, as many similar foreign programs have (Cowling, et. al. 2012). The ease with which private investors were able to purchase GDVCF equity minimized the crowding out effect. Any crowding-out that may have initially occurred could be quickly be corrected by private share purchases. This hybrid VC firm structure also made use of evidence that suggested SMEs perform better under a combination of private and public investment. Private VC strongly desired GDVCF investment due to the generous terms and the legitimacy derived from the backing of the Chinese government, allowing the program to remain active and effective. Incentive to invest in target sectors was further increased by the subsidy, which efficiently addressed the positive externalities that cause VC market failure. The downside of this program was that it was likely to generate negative financial returns for the government because of investment in lower return industries, giving preferential terms to co-investors, and the cost of the subsidy. Overall, GDVCF created very favourable investment conditions for VC firms, causing increased market supply of risk capital to targeted SMEs.

Industrial Technology Research and Development Budget Participated Venture Capital Fund

The Industrial Technology Research and Development Budget Participated Venture Capital Funds (ITRDPF) was created in late 2009 in response to the financial crisis (Fa 2009). Capital is gathered from national expenditure, local investment, and private investors, and then invested in individual SMEs. Each fund must be at least 250 million RMB, private investment must account for a minimum of 60 percent of total capital, and local government expenditure must be at least as much as national government investment (Hu 2010). Similar to GDVCF, government investment is entirely passive: the government cannot act as a controlling shareholder or general partner of a fund. Investment of each fund is focused on new and high-technology firms as well as strong local industries. A minimum threshold for investment in young SMEs must be met by all funds, encouraging funds to provide seed funding. Investment objectives and targets are specific to each fund, stated in shareholder agreements and

acted upon by fund managers. Like ITRDF, fund managers are chosen from private institutions based on their previous experience with VC. A bonus system for the fund manager incentivizes greater investment in young SMEs.

ITRDPF continues the evolution towards complementary policy rather than competitive. Reducing the percent of investment in each fund decreases intervention, and improves the efficiency of the market. By fundraising investment from local governments and private sources, the pool of risk capital is directly increased. Like ITRDF, operational investment decisions are delegated to experienced fund managers, overcoming likely poor allocation by government officials. Like the programs that preceded ITRDPF, resources remain focused towards sectors that produce the greatest externalities and have the largest equity gap, namely young and high-tech SMEs. Since funds are sometimes devoted to areas with significant market failures, increasing supply moves the market towards the socially optimal equilibrium. Thus, the ITRDPF represents the natural evolution that combines the best policies from each of ITRDF and GDVCF, marking a trend away from distortionary intervention to a more efficient leverage effect.

IV. Conclusion

VC plays a vital role in generating innovation and productivity growth in an economy. Many innovative firms are capital constrained due to characteristics that make debt financing unattainable. VC relieves this constraint and adds intangible value, generating innovation and economic growth. Funding cash constrained firms creates positive externalities, causing VC markets to supply suboptimal quantity of investment. Government policy can address this market failure using policy tools including subsidy, market participation, and deregulation. The success of these policies rests on generating a leverage effect as opposed to a crowding-out effect.

China’s recent VC market interventions have been comprehensive, using multiple policies to address the undersupply of VC in many sectors. The Chinese government targeted young SMEs and high-tech firms as ideal candidates for investment because local market failures are greatest in these sectors. These policies quickly evolved, showing inclination towards market-oriented policies to achieve a leverage effect.

Chinese policy-makers should continue this trend of decreasing government intervention in the VC market. Public investment should be passive and target specific sectors where market failure is greatest. This focus should be on industries with high public return such as health care, environmental sustainability, and new technology.

China developed an active and rapidly growing VC sector over the course of less than 30 years due to active government intervention. This impressive period will continue under market-oriented policy that effectively targets and addresses market failures.

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