

ABSTRACT

Title of Document: ENABLING ENVIRONMENTS
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A strong and growing private sector is a critical factor for the promotion of growth and the increase of opportunities for all. A vibrant business sector would mean economic investment, job creation, improvement in overall productivity, and an increase in the economic pie for all those involved in a society. To foster the growth of a legal business sector, governments and policy makers around the world have been interested in learning about effective policies and implementing wide-ranging reforms. This general policy climate which supports and enhances the growth of the formal private business sector has been called a business-enabling environment.

The fundamental premise is that growth of the official business sector of economic activity requires good regulations, strong economic fundamentals, and a nourishing sociopolitical structure. The question to which this dissertation responds is which of these factors are quantitatively significant in describing the number of registered businesses worldwide and how these factors compare to each other when they are tested econometrically beside each other.

Would the ease of doing business variables still be significant in describing the number of registered businesses when it is compared to fundamental macro policy factors such as corporate tax rate? How far does business bribery affect business growth?

This dissertation presents an effort to quantitatively analyze these factors and their effects on the business growth worldwide. It also offers an estimate on the amount of annual business to government bribery around the world disaggregated to a national level. It offers an estimation of national annual bribes paid by the business sector to governments, in each country worldwide, in the currency of that country at the time, and the equivalent amount in US dollars.

ENABLING ENVIRONMENTS

By

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Professor Christopher Foreman
Professor Thomas Schelling
Professor Rob Sprinkle

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*Now my charms are all o'erthrown, And what strength I have's mine own,
But release me from my bands, With the help of your good hands.
Gentle breath of yours my sails. Must fill, or else my project fails,
As you from crimes would pardon'd be, Let your indulgence set me free.*

--The Tempest, Shakespeare

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With a handshake, ever yours,

Amir Farmanesh

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Chapter 1: Enabling Environments

A 30% tax rate for a \$456 income

In Tanzania, the 30% tax rate becomes applicable at US\$456 (shs 720,000 Tanzanian shilling) of individual income and same rate of 30% is also applicable for marginal corporate tax rate (Tanzania Revenue Authority, 2012), these tax burden gets an additional 18-20% value added tax (VAT) on top which is applicable to a wide variety of goods and services (Tanzania Revenue Authority, 2006). When on an income of US\$456, there is a tax rate of 30% plus an additional 18-20% VAT, it becomes very hard to build capital and to become an entrepreneur who would willingly register his or her business to pay taxes.

In result, fewer infrastructures get built, less goods and services will be available, and those businesses which are working would do their best to evade taxes through not registering their business. This also affects the Foreign Direct Investment (FDI) to these countries. While less developed countries have a comparatively low average wage, but international companies would not invest there in result of harsh environments for business activities.

This example presents the importance of business-enabling policy environments for growth of a country. A strong and growing private sector is a critical factor for the promotion of growth and the increase of opportunities for all. A vibrant business sector would mean economic investment, job creation, improvement in overall productivity, and an increase in the economic pie for all those involved in a

society. To this end, the importance of business sector growth and entrepreneurship for long term sustainable development of countries has been well studied in literature (Acs, Desai, & Klapper, 2008; Acs & Szerb, 2007; Djankov, La Porta, Lopez-De-Silanes, & Shleifer, 2002; Klapper, Laeven, & Rajan, 2006; van Stel, Storey, & Thurik, 2007).

To foster the growth of a legal business sector, governments and policy makers around the world have been interested in learning about effective policies and implementing wide-ranging reforms. This general policy climate which supports and enhances the growth of the formal private business sector has been called a business-enabling environment.

The decision of an entrepreneur to invest in trying out a business idea and to establish it as a registered business could be influenced by a number of variables. They could include perceptions of ease of doing business factors such as the difficulty of dealing with related rules and regulations, the classical macro policy factors such as corporate tax rate, and general environmental factors such as governance and the corruption situation of that country.

The fundamental premise is that growth of the official business sector of economic activity requires good regulations, strong economic fundamentals, and a nourishing sociopolitical structure. The question to which this dissertation responds is which of these factors are quantitatively significant in describing the number of registered businesses worldwide and how these factors compare to each other when they are tested econometrically beside each other.

Would the ease of doing business variables still be significant in describing the number of registered businesses when it is compared to fundamental macro policy factors such as corporate tax rate? How far does business bribery affect business growth?

This dissertation presents an effort to quantitatively analyze these factors and their effects on the business growth worldwide. It also offers an estimate on the amount of annual business to government bribery around the world disaggregated to a national level. The final chapter offers a case study of the issue utilizing agglomeration-dispersion models in one country.

The first paper titled “Business-enabling policy environments” utilizes the size of formal business sector to empirically analyze the policy factors relevant to business-enabling environments. As the paper shows, the size of formal business sector across the globe can have diverse implications. It can help us understand relationship between formal sector and government taxation, study the factors affecting the size of legal and shadow economy, and provide insights into the policies for supporting entrepreneurship.

The World Bank Entrepreneurship Survey (WBES) has collected business registration data from 112 countries for the past six years. Utilizing this data source this paper attempts to explore the relationship of a number of macroeconomics and sociopolitical factors with the growth of the formal business sector by using the multiple variable random effect Generalized Least Squares (GLS) regression method.

The second paper titled “Developing a Business Bribery Index (BBI), A new methodology for the measurement of corruption and bribery” presents an effort to

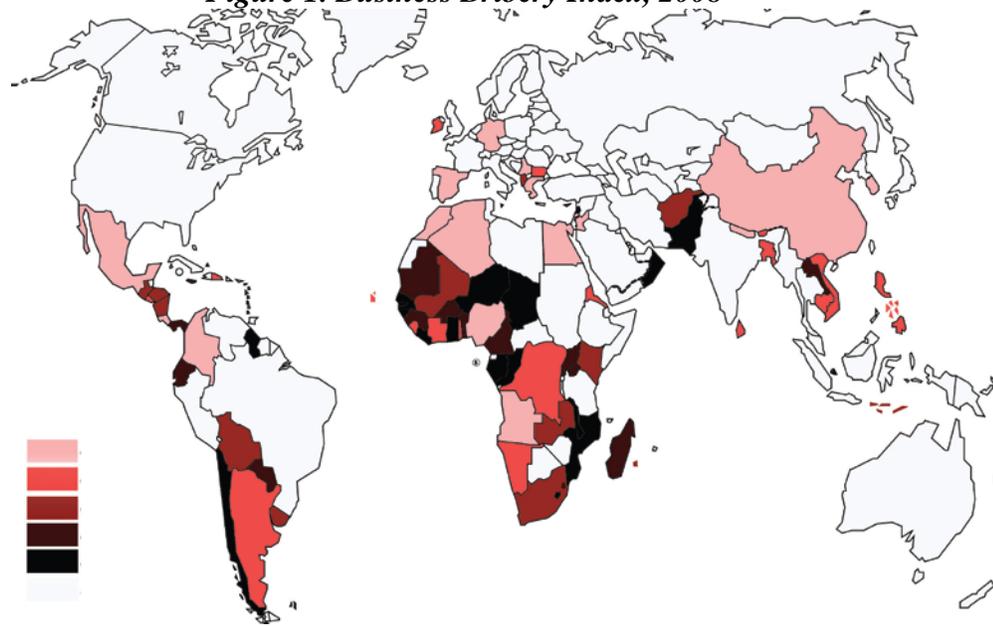
estimate the amount of annual business-to-government bribery around the world disaggregated to a national level. It offers an estimation of national annual bribes paid by the business sector to governments, in each country worldwide, in the currency of that country at the time, and the equivalent amount in US dollars.

The paper presents a cross-country time-series index and methodology for measuring bribe paid by businesses to the government officials, by utilizing more than 130,000 face-to-face interviews with business managers in 130 countries over 10 years. This paper also provides a comparison with current corruption measurement indices, testing their explanatory power to describe real world variables related to the business environment. The Business Bribery Index (BBI) introduced in this paper is an example of the “experience-based” method in corruption quantification.

The depth of data used in creating BBI enables it to be both an aggregate panel data on bribery and corruption of countries over time and across countries, and a disaggregated source of bribery data for a particular country, in a specific year, in a certain sector of business (i.e., manufacturing, agriculture, or service), and for a specific business size (i.e., small, medium, and large businesses).

For example, BBI can answer what the “going rate” for business bribes were in Argentina in 2006 in \$US, and it can answer what the “going rate” for business bribes were in the middle size service sector of Argentina in 2006 in \$US. Below is an early illustration of BBI for 2008.

Figure 1. Business Bribery Index, 2008



*Darker color indicates more bribery reported.
Colors range from dark red to lighter red each indicates 20 percentiles.*

Across the limited literature on bribery, there is no consensus or even prediction as to who initiates a bribe, the distinction between the supply and demand sides of bribery, or how a value-enabling policy environment could be created. While bribery is as old as human trade, the empirical estimation of this inherently human phenomenon has not been explored.

Utilizing BBI, the paper analyzes the effects of business bribery on the value-generation dynamics in the business-government relationships and the factors affecting corruption mechanisms between the private sector and the public sector across the globe. This paper attempts to explore the relationship of a number of macroeconomics and sociopolitical factors with the growth of the business-to-

government bribery by using the multiple variable random effect GLS method and the Bayesian statistics.

The final paper titled “Regional dimensions of economic development in Iran, a New Economic Geography approach” presents a spatial analysis on regional dimensions of economic development across provinces of Iran. It offers the first ever estimation made in the Middle East using this strand of “New Economic Geography” (NEG) models and provides a comparison of the results between previously studied developed countries and Iran as a developing country.

The goal of this study is to offer an analysis of the effects of agglomeration and dispersion economies on the patterns of regional economic development in Iran. It analyzes the linkages among adjacent provinces as well as effects of agglomeration and dispersion economies on the patterns of Iran’s regional economic development through empirical estimation of two of the NEG models.

First, it presents an estimation of a “Market Potential Function” (MPF), in which wages are associated with proximity to consumer markets. Second, the paper estimates an augmented MPF derived from the Krugman model of economic geography. The parameters in this model estimate the importance of transportation cost and economies of scale.

The estimation results suggest that Iran showed generally good fit to both models and satisfied both MPF and Krugman model specifications. Compared to other similar studies in developed countries, Iran shows smaller returns to scale and consistently higher size of the effect of market potential on wages.

The results of this dissertation indicate that the decision of an entrepreneur to invest on trying out a business idea and to establish a registered business could be influenced by a number of variables. The fundamental premise is that the growth of official business sectors of economic activity requires good regulations, strong economic fundamentals, and a nourishing sociopolitical structure.

This work analyzed three general groups of factors: rules and regulations related to the ease of doing business, classic macro policies, and general business climates. In short, this work concludes that classic macroeconomics policies are the main effective variables and other variables are only significant if tested without the presence of these macroeconomics policies.

This result is in fact intuitive. An entrepreneur would make the decision about formally registering a business more on the cost-benefit basis of the corporate tax rate and the amount of the financial incentives and loans that could be obtained through transition to the legal sector. While barriers of doing business, such as the number of days necessary to register a business, are important, however, compared to the main macroeconomics issues they lose their importance and would have an insignificant effect in the level of a nuisance for conducting business rather than a true impediment.

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Chapter 2: Business-enabling Policy Environments

Business-enabling Environments

Introduction and definitions

A strong and growing private sector is a critical factor for the promotion of growth and the increase of opportunities for all. A vibrant business sector would mean economic investment, job creation, improvement in overall productivity, and an increase in the economic pie for all those involved in a society. To this end, the importance of business sector growth and entrepreneurship for long term sustainable development of countries has been well studied in literature (Acs, Desai, & Klapper, 2008; Acs & Szerb, 2007; Djankov, La Porta, Lopez-De-Silanes, & Shleifer, 2002; Klapper, Laeven, & Rajan, 2006; van Stel, Storey, & Thurik, 2007).

To foster the growth of a legal business sector, governments and policy makers around the world have been interested in learning about effective policies and implementing wide-ranging reforms. This general policy climate which supports and enhances the growth of the formal private business sector has been called a business-enabling environment. In 1998, the Trade and Development Board of the United Nations Conference on Trade and Development (UNCTAD) offered a definition for such business friendly policy climates:

“Enabling environment is the expression that encompasses government policies that focus on creating and maintaining an overall macroeconomic

environment that brings together suppliers and consumers in an inter-firm co-operation manner” (UNCTAD, 1998).

This definition was further described in the Marrakech Accords and the Marrakech Declaration by the 7th Conference of the Parties (COP7) of the United Nations (UNFCCC) in 2001 (UNFCCC 7th Conference of the Parties (COP7), 2001). It described the enabling environments as focusing on “government actions, such as fair trade policies, removal of technical, legal and administrative barriers to technology transfer, sound economic policy, regulatory frameworks and transparency, all of which create an environment conducive to private and public sector technology transfer” (Ranganathan & Reynaers, 2003; UNFCCC 7th Conference of the Parties (COP7), 2001).

While the general definitions have been provided, it is not yet completely clear as to which factors are the most relevant and where the highest productivity could be gained in an expansion of the formal business sector. Would the highest gain be in the improvement of macroeconomic conditions, where governments are committed to the economic health of their country, or in what shapes the daily economic activity for businesses such as the regulations and institutional arrangements?

Business-enabling factors

The decision of an entrepreneur to invest in trying out a business idea and to establish it as a registered business could be influenced by a number of variables. They could include perceptions of ease of doing business factors such as the difficulty

of dealing with related rules and regulations, the classical macro policy factors such as corporate tax rate, and general environmental factors such as governance and the corruption situation of that country.

The fundamental premise is that growth of the official business sector of economic activity requires good regulations, strong economic fundamentals, and a nourishing sociopolitical structure. The question to which this paper responds is which of these factors are quantitatively significant in describing the number of registered businesses worldwide and how these factors compare to each other when they are tested econometrically beside each other. Would the ease of doing business variables still be significant in describing the number of registered businesses when it is compared to fundamental macro policy factors such as corporate tax rate?

This paper analyzes these factors in three general groups: rules and regulations related to the ease of doing business, classic macro policies, and general business climates.

Classic macroeconomics policies

Whether the entrepreneur would decide to implement the business idea, to abandon it, or to consider implementing it in another country might depend on how the general macroeconomics policies of each country are set up. For example, the amount of corporate tax, availability of credit to finance in the private sector, the overall health and growth of the economy measured by different measurements such as Gross Domestic Product (GDP) could be examples of such classic macroeconomics factors affecting business registration in countries.

A number of these factors are included in the empirical analysis of business registration in this paper and are described further in the data source section.

Rules and regulations related to the ease of doing business

This set of factors include “rules that establish and clarify property rights and reduce the cost of resolving disputes, rules that increase the predictability of economic interactions and rules that provide contractual partners with core protections against abuse” (Doing Business Group, 2012). The objective of this set of factors is to study the effect of regulations on business registration growth.

For example, whether the entrepreneur would decide to register the business might depend on how simple it is to comply with the requirements for opening a new business or getting a construction permit and how efficient the mechanisms are for resolving commercial disputes or dealing with insolvency.

While there are some aggregate rankings available for the ease of doing business across countries, including from both sources of data used in this paper, the more disaggregate forms of such variables have also been tested in this paper. This is due to the high diversity of an economy’s business regulatory environment. As the following graph shows there is a high in-country variation in rankings across business variables. Focusing solely on the aggregate forms of business variables will disregard the in-country variability and could potentially undermine the accuracy of the research.

This paper utilizes two data sources for such variables: The World Bank Doing Business Survey, and the Heritage Index of Freedom from the Heritage

Foundation. Both of these data sources will be described in detail in the data source section of this paper.

General nation-wide factors like governance and corruption

Factors such as rules and regulations (e.g., business registry regulations) and macroeconomics policies (e.g., corporate tax rate) are under more direct control of policy makers. Similar to intentions to reform businesses sector development, these factors could be changed by short-term decisions of policy makers. This stands in contrast with general nation-wide factors such as governance and the corruption situation in a country.

The quality of governance, the prevalence of corruption, or the freedom of media are more general factors which could arguably affect business registration in a country but are not as readily changeable by policy makers' decisions. A limited number of quantified indices for these factors are available and they have been tested in this paper further described in the data source section.

Formal vs. Informal business sector

The size of formal business sector across the globe can have diverse implications. It can help us find the global size of shadow economy, understand relationships between the formal sector and government taxation, and provide multiple research opportunities.

The World Bank Entrepreneurship Survey (WBES) collected business registration data from 112 countries for the past six years. In its data collection, the

survey defines its unit of measurement as “any economic unit of the formal sector incorporated as a legal entity and registered in a public registry, which is capable, in its own right, of incurring liabilities and of engaging in economic activities and transactions with other entities” (Coolidge, Hornberger, & Luttikhuizen, 2008).

While The World Bank Entrepreneurship Survey focused on quantifying the number of formally registered businesses and hence cannot directly inform us about this important section of economies, it can provide some ideas about the informal business sector of countries. The basic definitional distinction between formal and informal sectors is not very clear. In general, the literature focusing on “formal” firms is separate from the literature focusing on the “informal” sector and there is a wide diversity of definitions within the literature and across countries.

In the broadest definition of “formal” businesses are those with at least some legal recognition by a governmental agency (e.g., a municipal administration). While the informal enterprises refers to “production units (mostly in the nonagricultural sector) that are not registered with the relevant authorities, for a wide range of reasons” (Coolidge, et al., 2008). The Non-Observed Economy has been defined by Organization for Economic Co-operation and Development (OECD) as “those economic activities which should be included in the GDP but which are not covered in the statistical surveys or administrative records from which the national accounts are constructed” (OECD, 2002).

The firms registered in the formal sector have a number of advantages over informal enterprises. For example, they have legal access to borrow money, invite investment and financing of their operation both domestically and internationally.

They enjoy legal protection from police and the judicial system reducing the potential exposure to corruption and bribery and they have access to the use of legal contracts. This is in contrast to the enterprises in the informal sector which have none of the mentioned benefits, however, they would not need to pay corporate taxes and abide by burdensome regulations.

Underground economies have been known to have a clear association with corruption as “higher tax rates are associated with less unofficial activity as a percent of GDP but corruption is associated with more unofficial activity” (Friedman, Johnson, Kaufmann, & Zoido-Lobaton, 2000). In such situations, entrepreneurs would have an incentive to work underground and informally to both avoid taxes and to reduce the burden of regulations, bureaucracy, and its subsequent corruption. This in turn would reduce both the size of the formal business sector and the tax revenue collected for public services. As a result, it could be claimed that the “corrupt governments become small governments and only relatively uncorrupt governments can sustain high tax rates” (Friedman, et al., 2000).

Enterprise-level quantification efforts

While the general questions in this field are not new, the quantification of many related variables is very recent and as a result the empirical study of these factors has just recently begun. Until less than a decade ago, there were no globally available sets of variables for analyzing enterprises in a cross-country panel format or monitoring such microeconomic factors.

The first efforts aiming to fill this gap “mostly drew on perceptions data from expert or business surveys that capture often one-time experiences of businesses” (Doing Business Group, 2012). As discussed in details in the “Business Bribery Index” paper, while perception surveys can be useful in gauging economic and policy conditions, they suffer from numerous methodological and conceptual shortcomings. In addition, very few of the available perception surveys provide annual updates of the mentioned variables with global coverage.

Since 2000, few global data collection efforts by major organizations that have started are continuing on an annual basis. Four major efforts have been undertaken by The World Bank including The WBES, The World Bank Enterprise Survey, The World Bank Business Environment and Enterprise Performance Survey (BEEPS), and The World Bank Doing Business Survey.

1. The World Bank Doing Business Survey

The World Bank Doing Business Survey (Doing Business Survey) focuses on “domestic, primarily small and medium-size companies and measures the regulations applying to them through their life cycle” (Doing Business Group, 2012). The Doing Business Survey includes quantitative indicators on business regulation compared across 183 economies and over time. The Doing Business Survey complements other surveys by focusing on the major constraints for businesses, both the experiences of businesses and the regulations which apply to them.

2. The World Bank Entrepreneurship Survey

The WBES is collected globally to enhance the knowledge of private enterprise dynamics through the “collection of data on business creation at the international level that can be comparable across heterogeneous legal, economic, and political systems” (WBES, 2010). This survey is discussed in details in the data sources section of this paper.

3. World Bank Business Environment and Enterprise Performance Survey (BEEPS)

World Bank Business Environment and Enterprise Performance Survey (BEEPS) is a joint initiative of the European Bank for Reconstruction and Development and The World Bank. The BEEPS has been conducted in 1999, 2002, and 2005 and covers virtually all of the countries of Central and Eastern Europe and the former Soviet Union, as well as Turkey. It includes detailed information such as bribes paid by a firm as a share of its annual sales and percent of annual sales used for protection payments (World Bank, 1999-2009).

The quality of data collection in BEEPS has been tested and cited by multiple academic papers and has generally received very positive reviews. For example, Hellman et al. (2000) tested the quality of BEEPS data and concluded that “cross-country surveys may suffer from bias if firms tend to systematically over- or underestimate the extent of problems within their country. The authors provide a new test of this potential bias, finding little evidence of country perception bias in BEEPS” (Hellman, Jones, Kaufmann, & Schankerman, 2000).

4. The World Bank Enterprise Survey

The World Bank Enterprise Survey (The Enterprise Survey) is one of The World Bank's largest and longest surveys covering a broad spectrum of business climate topics including access to finance, corruption, infrastructure, competition, and performance measures. The World Bank has collected this data from face-to-face interviews with top managers and business owners at over 130,000 companies in 125 economies (World Bank, 2009). The sample size in both BEEPS and The Enterprise Survey varies between 150 and 1,320 business managers in each country depending on the size of the country.

Data Sources

Number of registered businesses

Definitions and data structure

The WBES has collected business registration data from about 125 countries over the past six years. The businesses are defined as private companies with limited liability, which is the most prevalent business form in most economies around the world. Notably, this is the same definition used by The World Bank's Doing Business index (Doing Business Group, 2012) the data of which is also used in this paper. By this definition, partnerships and sole proprietorships are not included to keep the focus of research on limited liability registered businesses.

In addition, the data focuses on the formal (officially registered) sector of the economy. Data on the informal sector has not been included as there is no reliable measurement for this sector of the economy. One suggested way to estimate the size of the informal business sector is through economic censuses. Economic censuses are, however, considerably costly and are not performed on a consistent nor global manner. Even if the high cost for such a measure is covered, offering a reliable estimate for an informal economy out of economic censuses would be of questionable quality.

However, even at its current stage, WBES data provides a venue for further analysis of the growth ratio between the informal private sector and the formal private sector. This enables us to study the policy environments and factors encouraging firms to make the transition to the formal sector.

Business Entry Density

Utilizing the WBES data as a measure for new entries into the private sector could also be defined. This Entry Density measure is calculated using the number of newly registered businesses as a percentage of each country's working age population (ages 15-65), normalized by 1,000.

The World Bank Entrepreneurship Survey data

Survey Structure

The WBES is collected globally to enhance the knowledge of private enterprise dynamics through the "collection of data on business creation at the

international level that can be comparable across heterogeneous legal, economic, and political systems” (WBES, 2010). According to The World Bank’s data collection quality standards and to ensure the cross country comparability of data, the collected data is based on a defined unit of measurement and concept of the private sector which is applicable and available among the multiple countries surveyed.

WBES’s main source of information is national business registries. Most countries surveyed have a governmental entity in charge of business registration or collecting data on all businesses, companies, trademarks and brands. In a limited number of countries where this is not possible the WBES has substituted alternatives sources “such as statistical agencies, tax and labor agencies, chambers of commerce, and private vendors (such as D&B)” (WBES, 2010).

The WBES collected the data through email, fax, and phone interviews. In 2010, 150 national business registries were contacted and from them 125 countries responded to the survey. After processing the collected data, the business registration data for 112 countries were released.

Survey Shortcomings

WBES data has a number of limitations which need to be addressed. However, if these shortcomings are properly noted they are not impediments in the usefulness of the data.

1. The main challenge, as mentioned before, is that the WBES data only covers a certain type of formally registered private sector in countries. This limits the scope of analysis and its power for generalization in macro policy studies.

2. The second challenge is that the data is only provided in a national aggregate fashion. WBES does not disaggregate its data based on different types of formal sector activities and the size of the businesses.

3. The recent release of the WBES does not include the number of total registered firms. This has been justified “since most countries do not accurately collect data on total active or inactive firms. Therefore, we are concerned that the stock number of total firms includes many closed firms that did not formally de-register. Furthermore, the process to remove inactive firms from the Registrar varies widely across countries” (WBES, 2010).

This could be a major challenge for the quality of data in WBES. The World Bank hasn’t provided further details about this; it would be preferable if WBES would disclose the details and extent of this problem in each country.

4. Another potentially major challenge is introduced by the data processing WBES staff is performing on the data it collects. The WBES team sometimes changes the data collected from the official data which is published by the individual countries.

They justify this as a measure to unify the methodologies, “the reason is that local statistical agencies might use a different methodology than the one used by the WBES. For instance, the European Statistical Agency (Eurostat) uses a methodology based on the minimum number of employees to measure entrepreneurship. As a result, in some cases the data published by Eurostat and the WBES, while accurate in all cases, differs” (WBES, 2010).

This becomes a potential problem due to the lack of transparency by the WBES in the publication of its results. The published data is a final product and there is no way for researchers to know what the original collected data was and whether the cleaning process was accurate or is adhering to the researchers' data needs.

5. A number of challenges has made the creation of WBES data impossible in some countries. These include the decentralization of the business registries, lack of the professional and technical resources, and inefficient legal support of the data collection process.

In addition, several countries do not collect the necessary data for WBES or do not possess the capacity to process the data once collected. As a result, WBES is only covering 112 countries in its current dataset, mostly from the developed economies.

6. WBES also excludes the data collected from countries categorized by the International Monetary Fund (IMF) and the Financial Stability Forum (FSF) as offshore financial centers. WBES believes that "the information provided by these countries likely reflects a nontrivial amount of shell companies, defined as companies that are registered for tax purposes, but are not active businesses. Such corporations may be set up for illegal purposes, such as tax evasion, or formed in anticipation of attracting funding" (WBES, 2010).

The World Bank Doing Business data

The World Bank Doing Business group has been collecting data and publishing an annual report for the past nine years called Doing Business Report. The

data investigates the regulations and conditions enhancing and constraining business activities. Doing Business includes quantitative indicators on business regulation for 183 economies over nine years.

World Bank Doing Business Survey covers eleven areas of the business regulations: starting a business, dealing with construction permits, getting electricity, registering property, getting credit, protecting investors, paying taxes, trading across borders, enforcing contracts, resolving insolvency, and employing workers.

Heritage Index of Economic Freedom

The Index of Economic Freedom is a series of economic measurements created by The Heritage Foundation and The Wall Street Journal. The objective for this index is to measure the degree of economic freedom across countries utilizing an approach similar to Adam Smith's *The Wealth of Nations* that “basic institutions that protect the liberty of individuals to pursue their own economic interests result in greater prosperity for the larger society” (Kane, 2007).

The index includes ten variables: Business Freedom, Trade Freedom, Fiscal Freedom, Government Spending, Monetary Freedom, Investment Freedom, Financial Freedom, Property Rights, Freedom from Corruption, and Labor Freedom

Methodology

Overall methodology

Utilizing The WBES this paper attempts to explore the relation of a number of macroeconomics and sociopolitical factors with the growth of the formal business sector by using the multiple variable random effect Generalized Least Squares (GLS) regression method.

This paper utilizes the mentioned data on the total number of registered businesses per country for each year and normalizes this factor by the urban population of each country for each year. By doing this, the paper utilizes a measure of business registry density for its empirical analysis of the issue.

The overall methodology can be broadly divided into three steps:

- 1) Variables that can influence the business registration are collected,
- 2) The relationship between the influencing variable and business registration is formulated using a regression equation,
- 3) The prediction accuracy of the model has been studied using a number of new data exploration techniques such as Naïve Bayes, Classification And Regression Tree (CART), Cluster Analysis (hierarchical modeling), and Principal Component Analysis (PCA).

Each of the steps is further described in the following section.

Identification of variables & their relationship with business registration

Based on these studies and theoretical understanding of the relationship, the following variables were identified as potentially influencing variables:

i) Formal business sector size: The business registered directly proportional to the size of the urban population where most of the formal businesses are registered.

ii) Financial environment: Formal businesses are also directly proportional to the availability of private and public credit in the market. The financial environment relationship with business formulation could flow in both directions, on one hand financial credit may require the establishment of a formal business entity causing an increase in the business market size. On the other hand, as businesses grow, existing businesses can require more credit for expansion and growth of the businesses.

iii) Business Environment: Tax rates and cumbersome regulations can negatively alter the business flow. High tax rates discourage new businesses to enter as well as existing businesses to switch to new businesses. Similarly the cumbersome business regulations can decrease business growth.

iv) Infrastructure: Stronger infrastructure can influence foreign direct investments (FDI) and improves the business growth by reducing the transaction cost. While they are important variables, the construction of new infrastructure generally takes multiple years and hence lacks the variability for a robust regression. Infrastructure variables were dropped out.

v) Governance and political factors: Stronger and less corrupt governance provides the political environment and other environments necessary for business growth. Factors like political stability, civil war incidence, and corruption cases were

evaluated using available World Governance Indicators and civil war indices from the Polity IV democracy and civil violence datasets.

Clustering of countries

Data presented in WBES exhibits a wide variation across regions and income groups. For example, for every four new firms registered every year per 1,000 people in high income countries, there is only less than one new firm registered in lower income countries. The following chart clearly presents the amount of diversity among income groups of countries.

An attempt to develop a single regression that best fits all the countries was challenging because of countries with a wide range of business growth according to GDP. Advanced countries grew at a slower pace while businesses in emerging economies were more prominent.

In result, clusters were formulated based on GDP per capita. The K-mean clustering method was used to formulate five different kinds of clusters. The information of cluster distribution is provided as follows:

Table 1. World Bank Country Classification

World Bank Country Classification	Cluster ID						Total
	1	2	3	4	5	6	
Low Income	0	0	39	0	0	0	39
Lower-middle income	7	0	44	0	0	0	51
Non-OECD	0	11	0	5	3	0	19
OECD	0	7	0	3	17	0	27
Upper-middle income	33	1	2	0	0	6	42
Total	40	19	85	8	20	6	178

Regression analysis

Regression framework

Different models of regression analysis (i.e., linear, time and entity fixed and random effect) were tested with the combinations of the above-mentioned independent variables. The goal of the regression analysis was to find an equation that best predicts the dependent variable i.e., business registered per capita.

In result, two criteria were used to find the ideal regression:

- 1) The independent variables used were statistically significant.
- 2) The percentage difference between the real value and the predicted dependent variable is least. The following formula was used to calculate the percentage difference:

$$= [(Y_{\text{Estimated}} - Y_{\text{Real}}) / Y_{\text{Real}}] \times 100$$

Dependent and Independent variables

Dependent Variable: Business per urban capita was chosen as the dependent variable. Per urban capita normalizes the size of the country.

Independent Variables: Following are the key independent variable that had a significant result on regression.

1. Gross Domestic Product (GDP) per capita

GDP per capita (constant 2000 US\$): GDP value has a strong direct relationship with a number of registered businesses. As the following graph depicts,

the economies ranked by GDP per capita quintiles are strongly related to the business density.

2. Domestic credit to private sector

Domestic credit to private sector (% of GDP): Domestic credit availability calculated as a percentage of a country's GDP has an equally significant relationship with business per capita. Similar to GDP the following graph depicts that the economies ranked by their domestic credit quintiles are strongly related to the business density.

3. Highest marginal tax rate

Highest marginal tax rate (corporate rate): It is the highest rate shown on the schedule of tax rates applied to the taxable income of corporations. Corporate tax rates also have significant relationships with the business capita.

The comparison of WBES data with measures of country-level governance provides us further knowledge about the effect of the overall economic, political and financial conditions of the countries over time. The strong relationship between the number of registered businesses and corporate tax rate are robust when controlling for the income-level dummies in a multivariate panel data econometric analysis.

4. Ease of Doing Business indices

WBES data shows a level of significant relationship between various components of a country's business environment and the number of firm

registrations. One of these measures is the Doing Business ranking which is a summary measure of the various business environment indicators containing a country's overall rank. There is a positive correlation between a country's overall Doing Business ranking and the firm registrations.

In addition, there are strong negative correlations between a country's firm registrations and three of the Doing Business indicators: procedures to start a business, cost to start a business (% Gross National Income (GNI)), and days to start a business. As shown in the regression results these Doing Business factors tend to also be significant to describe that the initial business environment is important for firm registrations.

To ensure that the results are driven by the business enabling policy environment rather than the overall level of development in a country or other macro policies, the analysis controls for GDP per capita, marginal corporate tax rate, credit availability to the private sector, and the business bribery level. As shown in the full regression results, the significance of the Doing Business variables are not anymore present in comparison to the mentioned factors.

5. Governance indices

As shown in the graph, there is also a positive correlation between business density and the governance composite indices. This result has been confirmed when regressing governance alone on business density; however, when included with other variables it does not hold significance.

Panel data OLS regression utilizing the random effect model

Using the mentioned variables, the following quantitative analysis has been performed. The method used is panel data Ordinary Least Squares (OLS) regression utilizing the random effect model.

$$y_{it} = \alpha + \beta'X_{it} + u_{it}$$

Utilizing the panel data the quality of the econometrics analysis would be significantly enhanced as with “the combination of time series with cross-sections can enhance the quality and quantity of data in ways that would be impossible using only one of these two dimensions” (Gujarati, 2003).

In addition, panel data enables us to control for unobserved variables or factors which are known but are impossible to quantify “like cultural factors or difference in business practices across companies; or variables that change over time but not across entities (i.e. national policies, federal regulations, international agreements, etc.). This is, it accounts for individual heterogeneity” (Baltagi, 2005).

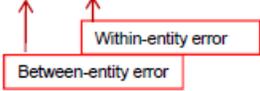
Hausman specification test

There is an important question of whether the panel regression analysis should utilize the fixed effect or random effect modeling. Generally, random effects offer efficient results compared to the fixed effects model if the underlying assumptions are satisfied.

The main difference is that unlike the fixed effects model, in the random effects model the variation across entities is assumed to be unsystematic and uncorrelated with the independent variables. As Greene describes “the crucial

distinction between fixed and random effects is whether the unobserved individual effect embodies elements that are correlated with the regressors in the model, not whether these effects are stochastic or not” (Greene, 2011).

The main advantage of the random effects model is that the time invariant variables are being utilized while in the fixed effects model these variables are absorbed by the intercept. This is because the random effects model assumes no correlated error term with the predictors which in turn allows for time-invariant variables to influence the regression as explanatory variables. The random effects model is:

$$Y_{it} = \beta X_{it} + \alpha + u_{it} + \varepsilon_{it}$$


Considering the definition, if differences across entities would influence the dependent variable then the random effects model should be utilized in the regression. This can also be tested by running the random effects model, then running the fixed effects model, and finally performing a Hausman specification test. If the Hausman specification test rejects the hypothesis, then the random effects model is biased and the fixed effects model is the correct estimation procedure. The Hausman specification test for this paper indicated that the random effects model is the proper model.

Data Exploration Techniques

Initial set-up

As the nature of the task is more exploratory than predictive, the initial techniques were assumed to be Categorical Response and Data Reduction models. One of the questions for the Categorical Response was, can the variable of interest, bus_reg_urban, be transformed into a categorical output? Based on the statistical summary, the mean, median and mode were the same value whereby one could not simply take an average and classify any value above the average as 0 and any value below to be 1, especially when all three measures of the average value itself were the same (0.0332) and consisted of approximately 80% of the data points. A decision was then made to bin this variable data using two bins based on the median value of each bin. Prior to the binning process, a time series chart was created showing the average bus_reg_urban per year of the 11 year period including a trend line just to get a sense of the variable over time.

Additional variables that had a large set of non-distinctive values were also binned otherwise XLMiner would not allow the model to run. Once the binning was complete, the data was partitioned using a Training Data of 60% and Validation of 40%. Since the number of records for this data set was relatively small, there was no need to increase the Training Data percentage. Before running the models the assumptions were assessed as to whether the process had been reasonable. Although a few predictors exhibited outliers, it was concluded that leaving those data as part of the model was better than removing the record completely.

Naïve Bayes

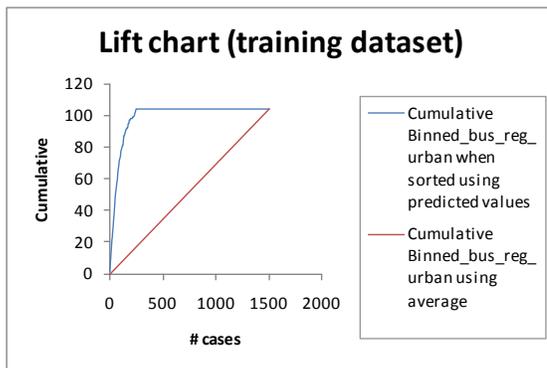
The first technique that was run was Naïve Bayes. The best model resulted initially in an Overall % Error of 4.32 with a Cut off of 0.5. This was improved upon by using a 0.8 Cut off as shown below:

Table 2. Naïve Bayes results

Cut off Prob.Val. for Success (Updatable) **0.8**

Classification Confusion Matrix		
	Predicted Class	
Actual Class	0.06	0.04
0.06	70	34
0.04	18	1383

Error Report			
Class	# Cases	# Errors	% Error
0.06	104	34	32.69
0.04	1401	18	1.28
Overall	1505	52	3.46



During the exploration of this data set, multiple Classification and Data Reduction tools were used to see if useful information or meaningful patterns within the data would emerge. Although a few tools provided low error rates, one of the fundamental takeaways is that the accuracy and quality of the data set is absolutely critical to being able to stand behind one's analysis, no matter how fancy the tool

used. Data mining is also dependent on an individual's domain knowledge and is an iterative process. However, using a variety of the appropriate tools can help lead to new and unintended discoveries.

Conclusion of data exploration techniques

In order to simplify and better understand the factors influencing the number of registered businesses for a country in a given year, the output for each of the observations were separated into two groups: 0.06 and 0.04. 0.06 was the "success" class and represented the observations that had a higher number of registered businesses, while 0.04 represented the observations with the relatively lower number of registered businesses. Various models were then run to see if any valuable information could be gleaned from the data.

In summarizing the various modeling techniques, the Naïve Bayes results show that it was effective in identifying records of the 0.6 class which were binned as the group with the higher number of average registered businesses. The variables that played more of a factor were Martax, where the tax rate increased the probability of occurrence depicted in the conditional probabilities which showed a significant drop off in number of registered businesses. Cr_priv was another influential factor while bribe_0_dollar_sale was not really a factor. The lift chart shows the model provided a strong lift in predicting the 0.6 class. Likewise, the decile chart shows the model significantly outperformed a random assignment of the two classes.

The PCA output showed that Binned_wbc_val, Binned_cr_priv, Martax, and fh_cl were variables that most influenced the bus_reg_urban output. Regarding the

Hierarchical Clustering, other than “10” being a singleton cluster and six showing a reasonable number of clusters for the dataset, the output does not seem to yield meaningful results. It is possible that modifying the choice of distance between clusters, other than Euclidian, could yield good results. Additionally, this could be strongly affected by the outliers previously observed. The Classification Tree was not effective as the success class had a 100% error rate. One possibility is that this model may be missing relationships between some of the predictors especially if early on in the process one predictor is used towards the top of the tree.

To glean the most impactful predictors yielded from the models, domestic credit to the private sector and corporate tax rate are the top tier predictors on how the number of businesses grows. This seems reasonable as new business ventures would be more attractive in countries that invest a significant proportion of capital into domestic businesses as well as firms shying away from countries with high tax rates, with everything else being equal.

The next tier of influential factors would be GDP per capita, the World Bank Governance Indicator, as well as countries Corruption Levels. This also appears to be a reasonable assessment as higher GDP generally indicates a countries economic health and businesses would be able to serving markets with people able to spend more on products and services. Additionally, it is reasonable that countries with less corruption are attractive to businesses as it aids in a firm’s ability to retain profits instead of having to pay out for corruptions and bribes.

Results

Variables involved

Below is a description of the variables included in the regression analysis and their sources of data.

Table 3. Variables involved

Variable name	Description	Source
Registered Business*	Total businesses registered (number) per urban capita	World Bank
WB Corruption	Control of Corruption, World Bank Governance Indicator	World Bank
BBI	Business Bribery Index (BBI), in US dollar, weighted by average annual sale of businesses in the country-year	Farmanesh (2011), using World Bank, etc. data
Credit to Private	Domestic credit available to private sector (% of GDP)	World Bank
GDP	GDP per capita	World Bank
Mar Corp Tax	Highest marginal corporate tax rate (%)	World Bank
CPI	Corruption Perception Index	Transparency Intl.
Freedom House	FH Liberal Democracy Combined Polity Score, standardized This variable is a modified version of the POLITY variable added in order to facilitate the use of the POLITY regime measure in time-series analyses. It modifies the combined annual POLITY score by applying a simple treatment, or “fix,” to convert instances of “standardized authority scores” (i.e., -66, -77, and -88) to conventional polity scores (i.e., within the range, -10 to +10).	Freedom House

Polity IV	Polity IV Constitutional Democracy, standardized	GMU-UMD
PRS	International Country Risk Guide	Political Risk Services
Doing Business	Overall Score, Heritage Index of Freedom	Heritage Foundation
DB Corrupt	Freedom From Corruption, Heritage Index of Freedom	Heritage Foundation
DB Freedom	Business Freedom, Heritage Index of Freedom	Heritage Foundation
Lab_tert	Workforce with tertiary education	World Bank

Summary statistics of key variables

Table below presents the summary statistics of key variables in this study.

Table 4. Summary Statistics of Key Variables

Variable	Mean	Std. Dev.	Min	Max
Bus_capita	26.5756	26.28498	0.120767	164.5732
GDPcapita	21851.81	10990.28	847.1991	45948.72
Pop_urpp	70.70443	13.45077	27.94	100
Lab_tert	26.42973	13.67774	3.1	83.3
Cr_bank	91.42579	62.80642	12.8379	307.2689
Cr_priv	79.79661	57.00963	6.3985	211.8094
avg_WBGov	0.8412929	0.8031756	-1.00039	1.95612
overall	65.32324	9.286687	41.3	88.6
Business_Fr	72.14919	12.03246	46.6	100
Fiscal	65.42432	15.56676	29.8	99.9
POLstand	93.10811	16.39987	5	100

Regression results

Table below presents the regression results of the most applicable cases in this study.

Table 5. Regression results

	Total businesses registered (number)				
BBI		-479.6448	-681.8198	-446.4538	
		0.096*	0.025**	0.005***	
CPI					0.0317085
					0.758
Mar Corp Tax	-0.3399084		-0.9345413	-0.5317121	-0.3261486
	0***		0.01***	0.035**	0.003***
Credit to Private	0.1172443			0.2699735	0.0923646
	0***			0.002***	0***
GDP	0.000951			0.0001875	7.11
	0***			0.714	0***
Constant	13.12414	29.01715	56.382	27.85484	12.85931
	0.004***	0***	0***	0.007***	0.013**
Prob > chi2	0***	0.0960*	0.0017***	0***	0***
R-squared	0.3298	0.3602	0.4815	0.5473	0.3410

Conclusion

The results of this paper indicate that the decision of an entrepreneur to invest on trying out a business idea and to establish a registered business could be influenced by a number of variables. The fundamental premise is that the growth of official business sectors of economic activity requires good regulations, strong economic fundamentals, and a nourishing sociopolitical structure.

This paper analyzed these factors in three general groups: rules and regulations related to the ease of doing business, classic macro policies, and general

business climate. In general, the paper concludes that classic macroeconomics policies are the main effective variables and other variables are only significant if tested without the presence of these macroeconomics policies.

This result is in fact intuitive. An entrepreneur would make his/her decision about registering the business formally more on the basis of whether the tax cost is high and the amount of financial incentives that could be received. While barriers of entry to markets, such as number of days it takes to register a business, are important but compared to the main issues they lose their importance and would have an insignificant effect in the level of a nuisance rather than a true impediment.

Classic macroeconomics policies

Whether the entrepreneur would decide to implement the business idea, to abandon it, or consider implementing it in another country might depend on how the general macroeconomics policies of each country are set up.

As the results indicate, the classic macroeconomics policies are the most influential factors in the growth of the formal business sector. Specifically the amount of corporate tax rate, availability of credit to finance in the private sector, the overall health and growth of the economy measured by different measurements such as GDP were highly and robustly significant in describing the business registration in countries.

Rules and regulations related to the ease of doing business

The objective of this set of factors was to study the effect of regulations on business registration growth. The results of the paper indicate that these variables have significant effect on the number of registered businesses; however their influence is not robust as they lose their significant influence when classic macroeconomics policies are entered into the empirical analysis.

General nation-wide factors like governance and corruption

The results of the paper indicate that some of the general nation-wide factors are significant like the quality of governance, however similar to ease of doing business; they are not robust when classic macroeconomics policies are included. Factors such as democracy and freedom of media are not significant even when they are included alone. The prevalence of corruption is not significant if tested using aggregate indices such as Transparency International Corruption Perception Index (CPI), however, utilizing a specific and disaggregate index such as the Business Bribery Index (BBI) would offer significant and robust results in describing the growth of formal business sectors in different countries.

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Chapter 3: Developing a Business Bribery Index (BBI)

Introduction

Corruption has become a high priority in the international agenda. As an integral part of “good governance” strategies of the international development community, curbing corruption has been given prominence and priority. To this effect, several bilateral development agencies, World Bank, International Monetary Fund (IMF), Organization for Economic Co-operation and Development (OECD), and the United Nations Development Program (UNDP), have developed specific anti-corruption strategies to assist governments in tackling the problem.

In addition, numerous international agreements and specialized agencies have been developed based on the issue. Two prominent examples are first, the UN Convention against Corruption (UNCAC), as the first legally-binding international anti-corruption agreement, entered into force in December 2005. Second example is the OECD Anti-Bribery Convention, which was designed to fight against the bribery practices of multinational companies in international business transactions, which was established on 17 December 1997 and came into force on 15 February 1999.

In the practices of the business world the importance and visibility of the matter has also increased. Prominently, an agreement to control corporate bribery was reached at the 2005 World Economic Forum among 63 multinational corporations.

Proposing an actual global monetary measure for corruption and in particular bribery (rather than the cost of corruption) is of interest in anti-corruption endeavors, enhancing our understanding of the underlying variables and increasing the general awareness of the matter. The examples of such measures are very limited at best and even in those few cases the numbers are not yet academically rigorous.

This paper offers a conceptual review of corruption and governance topics as they interact with the measurement techniques and quantification methods used. This paper also highlights the challenges faced in the measurement of corruption, distinctions between the current measurement approaches, and a review of the strengths and weaknesses of such indices.

This paper presents a new cross-country time-series index and methodology for measuring business bribery, by surveying the actual bribe paid by business managers to the governments worldwide. This paper also provides a comparison with current corruption measurement indices, testing their explanatory power to describe real world variables related to the business environment.

Literature review

Corruption, in general

Corruption empirical literature in economics has witnessed a boom in the past decade. New frontiers in defining and assessing corruption have opened, and numerous papers have been written studying corruption in an annotated format such

as papers by Amundsen & Fjeldstad and Jain (Amundsen & Fjeldstad, 2000; Jain, 2001).

The most standard definition for corruption used by a number of sources is “the abuse of public office for private gain”(Norwegian Agency for Development Cooperation, 2008; Treisman, 2000). A similar broadly used description defines corruption as a transaction between public sector and private sector agents through which the collective goods are illegitimately converted into private possession (Heidenheimer, Johnston, & LeVine, 1989). Another classic definition is provided by Colin Nye as “corruption is behavior which deviates from the formal duties of a public role because of private-regarding (personal, close family, private clique) pecuniary or status gains; or violates rules against the exercise of certain types of private-regarding influence” (Nye, 1967).

The World Bank’s main Governance and Anticorruption (GAC) strategy paper describes this definition further: “public office is abused when an official accepts, solicits, or extorts a bribe. It is also abused when private agents give or offer bribes to circumvent public policies and processes for competitive advantage and profit. Public office can also be abused for personal benefit even if no bribery occurs, through patronage and nepotism, the theft of state assets, or the diversion of state revenues” (World Bank, 2007).

As mentioned, corruption is usually defined within a larger framework of “good governance”. In this framework, Governance is defined as “the manner in which public officials and public institutions acquire and exercise the authority to

provide public goods and services, including the delivery of basic services, infrastructure, and a sound investment climate” (World Bank, 2007).

Corruption is one outcome of weak governance – a consequence of the failure of accountability relationships in the governance system. These failures can span from failure of the citizen-politician relationship, possibly leading to “state capture”, to a failure of bureaucratic institutions and checks and balance measures, possibly resulting to “administrative corruption” (World Bank, 2011a). Poor delivery of services and a weak investment climate could be named as other possible outcomes of bad governance and corruption.

The definition of corruption and its possible active agents has been further expanded to include the corruption where the private sector is involved. Transparency International has defined corruption in a manner which also includes the private sector actors, “the abuse of entrusted power for private gain” (Transparency International, 2011b). The World Bank also recognized the corruption in private sector: “Corruption can also take place among private sector parties, yet interface with and affect public sector performance: for example, collusion among bidders to a public procurement with the intent to defraud the state can seriously distort procurement outcomes.”(World Bank, 2007)

The “abuse of public office” definition of corruption has been criticized as a Western-oriented definition based on the separation of the public and private sector models. Based on this criticism, this model of separation between public-private spheres, does not fit the cultural context of many developing countries (Kolstad, Fritz, & O’Neil, 2008). In response, Kolstad et al. accept the premise that Western ideals

have sometimes been the source of models used by academics and international agencies. However, in their view, any established and well-functioning society would inherently need a level of “productive allocation of tasks if it is to reap the benefits of organization and specialization,” and corruption, in this sense, can “be viewed as a violation of the basic characteristics of any well-ordered society” (Kolstad, et al., 2008).

Corruption, disaggregated

Corruption, by definition, is a larger phenomenon than bribery practices which is the focus of this paper. A few suggestions have been made for disaggregating the concept of corruption. Colin Nye has suggested to categorized corruption as “bribery (use of a reward to pervert the judgment of a person in a position of trust); nepotism (bestowal of patronage by reason of ascriptive relationship rather than merit); and misappropriation (illegal appropriation of public resources for private-regarding uses)” (Nye, 1967).

Utilizing the reviews of the corruption literature (Amundsen, 2000) and an annotated bibliographical survey (Amundsen & Fjeldstad, 2000), another categorization for the definition of corruption has been suggested by Andvig et al. (Andvig, Fjeldstad, Amundsen, Sissener, & Søreide, 2000). Andvig et al. have identified four main forms of corruption as bribery, embezzlement, fraud, and extortion. Each of these four is described below.

Bribery

Bribery is understood as “the payment (in money or kind) that is given or taken in a corrupt relationship” (Andvig, et al., 2000). Depending on the context, different names have been used to describe bribery. Examples of alternative names given to bribery include kickbacks, gratuities, “commercial arrangements”, baksheesh, sweeteners, pay-offs, speed-money, and grease money. Bribery is the focus of this paper.

Embezzlement, Fraud, and Extortion

Embezzlement is the stealing of resources by the people responsible for administering them, e.g., theft of company property by disloyal employees. Fraud is an economic crime involving a level of trickery, swindle or deceit. Fraud includes “manipulation or distortion of information, facts and expertise by public officials for their own profit”. Finally, Extortion has been defined as the “money and other resources extracted by the use of coercion, violence or threats to use force” (Andvig, et al., 2000).

Favoritism and Nepotism

Favoritism has been suggested as another subcategory of corruption by Amundsen. He has defined favoritism as “a mechanism of power abuse implying “privatization” and a highly biased distribution of state resources, no matter how these resources have been accumulated in the first place” (Amundsen, 1999). Amundsen has identified Nepotism as “a special form of favoritism, in which an

office holder (ruler) with the right to make appointments, prefers to nominate to prominent positions his proper kinfolk and family members” (Amundsen, 1999).

Grand vs. Petty corruption

Another usual differentiation in the concept of corruption is between grand and petty corruption. Grand or Political Corruption is when policy procedures and legislation are designed to benefit politicians and legislators, enabling them to exploit their positions to extract large sums of money or in-kind services from the private sector (Doig & Theobald, 2000).

Grand Corruption is different from Petty Corruption. Petty Corruption, also known as “Bureaucratic” Corruption, “Low Level” Corruption, or “Street Level” Corruption, is the illicit practices usually in the lower level of public administration and implementation of policies. It is what citizens will experience in their daily dealings with police, customs, taxing agencies, etc. Doig and Theobald define it as “soliciting or extortion of small payments by low level officials in order to expedite business by cutting through red tape; or to do what they are supposed to do anyway” (Doig & Theobald, 2000).

There is clearly a relationship between Grand and Petty Corruption, supported by studies showing that the Grand Corruption in the political levels increases Petty Corruption at the lower administrative levels (Chand & Moene, 1999). In this paper, the data used does not necessarily differentiate between Grand and Petty Bribery, but considering the proportion of bribes paid to the annual sale of a company we might be able to estimate the difference between these two types of corruption.

Why study corruption?

The negative effects of corruption

Corruption has been a persistent pandemic phenomenon covering every nation and society in our world throughout our modern history. Corruption is “probably as old as government itself” (Seldadyo & Haan, 2006) and “no region, and hardly any country, has been immune” (Glynn, Kobrin, & Naim, 1997) to it.

This pandemic disease much like “a cancer that eats into the cultural, political and economic fabric of society, and destroys the functioning of vital organs,” (Amundsen, 1999) has been called by Transparency International “one of the greatest challenges of the contemporary world”, undermining good governance and public policy making. It “leads to the misallocation of resources, harms the private sector and private sector development and particularly hurts the poor” (Amundsen, 1999). The World Bank has recognized it as “the single greatest obstacle to economic and social development. It undermines development by distorting the rule of law and weakening the institutional foundation on which economic growth depends” (Seldadyo & Haan, 2006).

The consequences and harms of corruption could be named in a long list including “insecure citizens, speculative politicians, and administrators vacillating between huge opportunities, grave risks and much double-pressure” (Amundsen, 1999). Corruption’s destructive effects are especially severe on the poor, as they are “hardest hit by economic decline, are most reliant on the provision of public services, and are least capable of paying the extra costs associated with bribery, fraud, and the misappropriation of economic privileges” (World Bank, 2011b). Attacking corruption

is critical in the achievement of any poverty reduction strategy and development effort as it “sabotages policies and programs that aim to reduce poverty” (World Bank, 2011b).

Potential benefits?

In contrast to the intuition that everything about corruption would be negative, a robust and significant number of literature citations has long argued that the benefits of corruption from an economic point of view, might outweigh the perceived costs (Acemoglu & Verdier, 1998; Braguinsky, 1996; Huntington, 1968; Leff, 1964; Lui, 1985; Nye, 1967). As Huntington has wrote: “in terms of economic growth, the only thing worse than a society with a rigid, over-centralized dishonest bureaucracy, is one with a rigid, over-centralized, honest bureaucracy” (Huntington, 1968).

The often made argument behind this line of literature is that bribery “greases the wheels” by reducing bureaucratic bottlenecks and ultimately improving the overall societal efficiency. This “efficient grease” argument assumes that the economic costs associated with extensive public regulations may be reduced or avoided through bribery. This argument has been refuted by numerous scholars, some suggesting that the regulatory burdens need to be analyzed endogenously (Bardhan, 1997; Kaufmann & Wei, 1999; Mauro, 1995; Shleifer & Vishny, 1993, 1994; Tanzi, 1998; Wei, 1997).

Kaufmann and Wei (1999) have found that “efficient grease” arguments might not necessarily be the case if it being analyzed endogenously, “in a general equilibrium in which regulatory burden and delay can be endogenously chosen by

rent-seeking bureaucrats, the effective (not just nominal) red tape and bribery may be positively correlated across firms” (Kaufmann & Wei, 1999). They have utilized data from three worldwide firm-level surveys, to examine the association between bribe payment, management time wasted with bureaucrats, and cost of capital. They found that “firms that pay more bribes are also likely to spend more, not less, management time with bureaucrats negotiating regulations, and face higher, not lower, cost of capital” (Kaufmann & Wei, 1999). Furthermore, another perceived cost of corruption has been explored by researchers as the “distortions entailed by the necessary secrecy of corruption” which introduce negative effects of their own (Shleifer & Vishny, 1993).

In addition to the abovementioned, some new approaches to categorize corruption have emerged. Aidt (2003) suggests four different analytical approaches to corruption, categorizing them into Efficient Corruption, which “promotes allocative efficiency by allowing agents in the private sector to correct pre-existing government failures”; Corruption with a benevolent principal, where “corruption arises when a benevolent principal delegates decision making power to a non-benevolent agent”; Corruption with a non-benevolent principal, which “arises because non-benevolent government officials introduce inefficient policies in order to extract rents from the private sector,” and Self-reinforcing corruption, where “reward to corruption depends on the incidence of corruption due to strategic complementarity” and the institutional history. (Aidt, 2003)

Principlism vs. Consequentialism

As can be seen from different viewpoints reviewed on corruption, the study of corruption as a phenomenon and the subsequent anticorruption policies are regularly analyzed based on two rationales, Principlism and Consequentialism. The principlist view analyzes corruption from a moral point of view, regarding it as a vice in itself. While a consequentialist approach would rather look to the results and consequences of corruption, e.g., the ease of doing business and the subsequent growth, greater development aid effectiveness.

The current tendency in most development policies are towards the consequentialist approach, where the corruption is denounced mostly in result of its perceived negative consequences. However, this approach “makes the anti-corruption agenda vulnerable to partial – and possibly shifting – interpretations of empirical results” (Kolstad, et al., 2008). This volatility might reduce the stability and effectiveness of anticorruption policies, and would question the commitment of development agencies working on the issue. The alternative would be to undertake a more principled approach, where it’s deceptive nature and it’s undermining effects on the moral and rational capacities of citizens and societies is recognized (Kolstad, et al., 2008).

Corruption between public and private sectors

A central role for the governments

The role of government in relations to the private sector has been studied from many perspectives. The main role has been given to the duty of governments in the

protection of “property rights”. This includes a number of political philosophers with diverse ideological backgrounds such as Karl Marx, David Hume, and Robert Nozick. It also includes a large number of social scientists emphasizing the significant effect that the respect for property rights have had on the development of the western world (North & Thomas, 1973; Rosenberg & Bridzell, 1985).

Acemoglu and Verdier (1998) analyze the potential for misuse of power by bureaucrats in the enforcement of property rights, and the importance this type of corruption holds considering the pre-mentioned central duty social scientists see for the governments’ role in the economy as the protector of contracts made in the private sector. Acemoglu and Verdier propose that “it could be optimal for less developed economies, which may have less productive investment opportunities, to have a lower level of property right enforcement and more corruption” (Acemoglu & Verdier, 1998). Their modified model actually suggests that although corruption is harmful to investments and production, a fully honest bureaucracy without any corruption might be too expensive for those societies to afford (Andvig, et al., 2000).

Corruption and the private sector investment rate

Among different ways that corruption in public sector negatively affects the private sector is in the investment rate. Mauro (1995) has shown that corruption has a negative impact on the ratio of investments to Gross Domestic Product (GDP). Mauro shows that one standard deviation improvement in his quantification of corruption is estimated to be associated with an increase in the investment rate by about three percent of GDP (Mauro, 1995). This finding is again confirmed using a separate

source of quantification for corruption by Political Risk Services (PRS) (Knack & Keefer, 1995).

Campus et al. (1999) took this suggestion further, looking to the fast economic growth East Asian countries have experienced despite their high levels of corruption. Campus et al. ask if Mauro and Knack & Keefer are correct why have East Asian countries been able to receive high levels of investment in comparison to other developing countries? In answering this question Campus et al. argue that “it is not only level of corruption that affects investment but also the nature of corruption. Corruption regimes that are more predictable - in the sense that those seeking favors from government do obtain those favors - have less negative impact on investment than those that are less predictable” (Campos, et al., 1999).

Corruption and Foreign Direct Investment (FDI)

Corruption has been suggested to have a similar effect on the Foreign Direct Investment (FDI). Wei (1997) shows that the effects of unpredictability of corruption on FDI are economically and statistically significant, and that an increase in “the uncertainty level from that of Singapore to that of Mexico, at the average level of corruption in the sample, is equivalent to raising the tax rate on multinational firms by 32 percentage points” (Wei, 1997). A similar effect has also been shown by Hellman et al. (2003) as “corruption reduces FDI inflows and attracts lower quality investment in terms of governance standards” (Hellman, Geraint, & Daniel, 2003).

Considering that international investors who provide FDIs usually are making relatively long-term commitments of resources to the destination country/sector and

are to a degree 'hostage' to the invested enterprise, they tend to consider the general climate of the host country/sector in depth before entering into any such commitment. The level of corruption, strength of governance and rule of law, and respect for property rights are important factors that the private sector would need to be informed about before entering into a market. These are factors which are all in the realm of the public sector and if not taken seriously would easily discourage investors. As Arndt and Oman (2006) describe "the research departments of multinational corporate investors and banks now widely construct or use governance indicators to try to assess the general country risk and governance situation in potential investment locations" (Arndt & Oman, 2006).

Bribery between public and private sectors

A central channel for corruption between public and private sectors is the practice of bribery. Myrdal and Fund (1968) explained bribery as a product of personal incentives public officials have by putting pressure on the private sector and businesses through bureaucratic delays (Myrdal & Fund, 1968). Kaufmann and Wei (1999) also describe that "in an environment in which bureaucratic burden and delay are exogenous, an individual firm may find bribes helpful to reduce the effective red tape it faces" (Kaufmann & Wei, 1999).

When studying the approach public officials take in dealing with private sector Downs (1967) introduced the notion of "territoriality," which is the "expansion of bureaucracies into new regulations"(Downs, 1967). Shleifer and Vishny (1993) expanded this notion further by elaborating on its consequences for resource

allocation. They showed the high cost of territoriality when different agencies are not controlled by a central authority and are not honest. They explored the effects of territoriality further in the case of agencies imposing regulations independently with the specific purpose of maximizing their individual bribe revenues.

Shleifer and Vishny (1993) and Rose-Ackerman (1978) argued that economic and political competition can reduce corruption and its effects, “If different agencies compete in the provision of the same services, corruption will be driven down provided that agents cannot simply steal” (Shleifer & Vishny, 1993). Similarly Svensson (2003) shows in the case of Ugandan firms, the firms likely to be involved in corruption depends on the regulatory system in their sector of business and the extent of required interaction with the public sector. They conclude that the business’s “ability to pay” and their “refusal power” are a large part of the variation in bribes paid and reported by firms and that “these results suggest that public officials act as price (bribe) discriminators, and that prices of public services are partly determined in order to extract bribes” (Svensson, 2003).

Clarke and Xu (2002) have also corroborated this notion in their study of utility firms in Eastern Europe and Central Asia. They found that “on the side of bribe takers, bribes paid to utilities are higher in countries with greater constraints on utility capacity, lower levels of competition in the utility sector, and where utilities are state-owned” (Clarke & Xu, 2002). They also showed that utility sector bribes are correlated with a number of macroeconomic and political variables confirming previous studies on the overall effects of corruption.

Due to the very limited availability of empirical data on bribery practices, our knowledge of the internal dynamics of the relevant variables is to an extent that “the connection between competition and firms' propensity to offer bribes is not clear in the literature on corruption” (Soreide, 2006b). In addition the role of risk and attitudes towards it, on either the supply or demand sides, has not been explored (Soreide, 2009).

Across the limited literature on bribery (Batra, Kaufmann, & Stone, 2003; Hellman, Jones, Kaufmann, & Schankerman, 2000; Soreide, 2008, 2009; Transparency International, 2008a), there is no consensus or even prediction as to who initiates the bribe nor a distinction between the supply and demand sides of bribery. While bribery is as old as human trade the empirical estimation of this inherently human phenomenon has not been explored. This paper is trying to enhance our knowledge of this important topic.

Measurement of the non-observed

Inherently unobservable

Besides the mentioned difficulties and diversities in defining the phenomenon of corruption, we face a new set of challenges when trying to measure it. By nature non-observable phenomenon like governance, happiness, and corruption are difficult to measure. Corruption has an added layer of difficulty as it is usually carried out covertly, hidden from the public and official records.

The ‘true’ level of corruption is extremely hard to measure and in some dimensions it is inherently unobservable. “Despite all the progress and insights and

hypotheses made through the quantitative perception data, the challenge of corruption as a field of empirical research is still its secret nature” (Andvig, 2004).

Some scholars have considered measuring corruption virtually impossible (Arndt & Oman, 2006; Sik, 2002). For example, Sik (2002) writes “I suggest as an axiom that it is impossible to measure the level of corruption” (Sik, 2002). Arndt et al. describes this difficulty further for governance indices as “based on perceptions, interpretations, and changing underlying data, these indicators pose many pitfalls for those who would use them as a scientific basis for decision-making and strategic planning, or to determine the progress of reform over time” (Arndt & Oman, 2006).

Challenges

Aggregated and general corruption measurement indices face a challenge due to their large wide range, which might make them too general to meaningfully explain anything. When they are supposed to cover all different types of corruption, from national oil contracts to the facilitation of payments made to get a basic government service, the all-encompassing indices ranges are too wide to be meaningful. As a result, they would not be able to “distinguish between the forms of corruption that represent welfare problems, and the corruption that functions as a substitute for prices or public solutions in cases of weak or absent public institutions” (Soreide, 2006c).

Another challenge in quantifying corruption is the comparative study of the different suggested quantification strategies. Since there are multiple definitions for corruption and multiple quantification approaches, it is hard to compare and comparatively analyze current corruption estimates. The polls and surveys utilized in

estimating corruption ask a diverse list of questions related to corruption and are not precisely covering the same issue. For example, “some sources aim at political corruption, while others ask about lower-level bureaucratic corruption” (Soreide, 2006c). This shows the importance of discussing the “definitional and methodological differences among data sources that may account in large part for the apparently conflicting messages they often provide” (Knack, 2006).

However, as in any scientific field, for a better understanding of corruption we need to be able to estimate it and have alternative methods of measuring its quantity and consequences. In order to improve our anti-corruption strategies, we need to be able to estimate the impact of anti-corruption initiatives that have been introduced. For example, “when it comes to the OECD Convention on Combating Bribery of Foreign Public Officials in International Business Transactions, there have been few court cases of cross-border corruption since its implementation, and the effect of the reform has been difficult to determine” (Soreide, 2006c).

It is likely that we will never be able to determine the exact amount of corruption or to be able to rank countries accurately. However, this should not discourage us, “but rather encourage continued critical debate about presentation and methodological improvements” (Soreide, 2006c). To achieve this, we emphasize “the need for scaling up data initiatives to fill significant gaps between our conceptual definitions of corruption and the operational definition embodied in the existing measures” (Knack, 2006).

Corruption measurement methodologies

To quantify a measure of corruption, one first needs to identify a definition of corruption which is both plausible and functional. Second, as corruption is a non-observed phenomenon the scholar needs to find proxies which would estimate corruption in an acceptable level based on the chosen definition. And finally, the scholar needs to devise a data collection methodology based on the chosen proxy which can provide an estimated measure for the type of corruption the researcher aims to quantify.

Different scholars have categorized and studied corruption quantification methodologies in a few different manners (Kenny, 2006; Lambsdorff, 2006; Reinikka & Svensson, 2003; Seldadyo & Haan, 2006; Soreide, 2006c; The Hungarian Gallup Institute, 1999; UNDP & Global Integrity, 2008; Weber Abramo, 2005). All of these different measures have been reviewed and this paper categorizes them into four basic approaches of corruption measurement. This paper presents each approach with its strengths, weakness, and available examples. At the end, this paper presents the methodology it has chosen to construct the corruption index that it has introduced in this paper.

Anecdotal and case by case method

While there is regular coverage of corruption in the news, frequent journalistic accounts of corruption cases, and numerous personal stories of people who have faced corruption, it is still a challenge to estimate the extent of corruption based on

this anecdotal information. The anecdotal method includes specific case studies of corrupt activities in a particular time and in a specific sector of one country.

Strengths

The papers using this method tend to be focused on a specific situation, covering it in detail with a high level of contextual information. The papers' strength is that they tend to be more accurate in their estimation of corruption than other methods, even to a level useful in forensic analysis. With their focus on the details of the context, they provide excellent sources for case studies and for understanding the behaviors involving corruption.

Weakness, lack of comparability

The main challenge academic papers written using this method face is the lack of comparability, as due to their narrow focus these would not provide a proper source for comparative studies (Seldadyo & Haan, 2006). As they delve deep into a specific case it becomes harder to compare them with other cases in other countries or sectors.

Examples

Olken's research in Indonesia is a good example of this approach, where he measured the discrepancies between officially declared project costs and the costs estimated by independent engineers for over 600 Indonesian village road projects (Olken, 2007). Another example is the work done by Svensson on Ugandan firms and

their likelihood for being involved in corruption, cited above in the literature review section of this paper. (Svensson, 2003)

General or target-group perception-based method

Papers and indices produced utilizing the general or target-group perception-based method reflects the perception of corruption held by the public or a specific group of respondents. The surveys relying on collecting the data from a specific group of respondents are usually called “expert surveys” and may include a diverse group including academics, lawyers, journalists, etc. In a typical form of this method respondents would answer such a question as “How corrupt do you think country X has been in the past year on a ten-point scale, ten being the most corrupt?” This method by nature is subjective and is an indirect measure of the actual level of corruption based on perceptions.

Strengths

As the meaning of corruption has relied on the perception of the respondent, the researcher would not get involved in defining corruption. This makes using the perception-based method relatively easier to collect and compare over time and across different countries. In addition, due to their generality, they estimate corruption in an aggregate form which offers us a snapshot of corruption if needed. Measuring perceptions of corruption, instead of the actual level of corruption, is “meant to be a best possible solution to get indications of true levels of corruption in a situation with vast measurement challenges” (Soreide, 2006c).

As a result of the mentioned strengths, these indices are widely used by media, donors, governments, and even academia as a measure for corruption. They are also used in political contexts by pressuring politicians regarding the rank of the country in the corruption indices compared to other countries.

Many of the indicators in this category have a wide conceptual breadth with a multidimensional perspective of corruption as they are estimating the general perceptions about corruption and not a specific type of corruption. In some research contexts this might be what is needed since there is not enough corruption data available disaggregating the negative effects of corruption by type.

Weaknesses

These indicators have been largely criticized and cautioned against misuse by academics (Arndt & Oman, 2006; Galtung, 2005; Kenny, 2006; Knack, 2006; Sik, 2002; Soreide, 2006c; The Hungarian Gallup Institute, 1999; UNDP & Global Integrity, 2008; Weber Abramo, 2005) and even the developers of the indices themselves (Transparency International, 2008b).

Galtung (2005) has provided a detailed list of criticisms: “1: Only Punishing the Takers, not the Givers or Abettors; 2: Irregular and Uncontrolled Country Coverage; 3: Biased Sample: More Than 90% of the World is Missing; 4: Imprecise and Sometimes Ignorant Sources; 5: Far Too Narrow and Imprecise a Definition of Corruption; 6: Does not Measure Trends: Cannot Reward Genuine Reformers! 7; Guilty by Association - Aid Conditionality” (Galtung, 2005).

The criticisms in the literature include a long list, many of them focusing on the Transparency International Corruption Perception Index (CPI) as it was one of the earliest examples of such indices “first published in 1995” (Soreide, 2006c) and it has been widely cited by both academics and media.

Below is a summary of these weaknesses;

1. Perception of corruption vs. the real level of corruption

The usage of “perception of corruption” and the consequences of utilizing it as a proxy for “the real level of corruption” has been regularly criticized. These surveys intentionally do not provide respondents with explicit definitions and they would ask respondents to quantify “the misuse of public office for private or political party gain” and to rate “the severity of corruption within the state”. Utilizing perception basically means asking for “people's subjective intuition of the extent of something unobservable” (Soreide, 2006c) in which it is not clear what this unobservable phenomenon is from each respondents’ point of view.

2. Potential for systematic bias

Perceptions can be systematically biased, for example they can be affected in large parts by media coverage and the “actual events surrounding the data collection can significantly influence the results we get” (The Hungarian Gallup Institute, 1999), whereas regular media coverage of corruption might inform us more on the extent of freedom of speech or political intergroup power plays in the country or on a specific subject than the real level of corruption. In addition, the “media can be biased and

interested in scandalizing the problem, or it may be controlled by the state” (Soreide, 2006c).

3. Ordinal vs. interval variable

There is an important quantitative aspect about the nature of the data obtained from most perception-based corruption measurements. When respondents are asked to estimate the corruption on a Likert or other rating scales, the important quantitative question would be whether the gathered data is ordinal or interval.

In most cases, they should be considered as ordinal data, because researcher could not simply assume that the respondents perceived all pairs of adjacent levels of their response scale as equidistant. This means that the numbers indicate the relative position of corruption and not the magnitude of their difference. For example, a questionnaire could ask the respondents to estimate the amount of overall corruption they perceive country X has on a scale of 1 to 10. Here a score of 8 means more perceived corruption than a score of 6. However, in the view of all respondents, the difference between scores 8 and 6 may not necessarily be the same as that between scores 5 and 3. This is an important distinction as many of the statistical and regression analysis methods are not readily useable in ordinal data.

To account for this problem, the wording of response levels could be selected in a fashion which would imply symmetry of response levels about a middle category, and the questionnaire could be accompanied by a visual analog scale, which clearly shows the equal spacing of response levels. While these measures might make the argument for treating the gathered data as an interval-level data stronger, however,

this is still a matter of quantitative concern about the usage of the resulted indices in simple regression analysis without proper justification and considerations.

The issue becomes even more clear when dealing with aggregate indices like Transparency International CPI and World Bank Institute Governance Indicators in which “the relation between numbers on the [perception-based corruption] ranking is unclear, and the ranking must be considered ordinal” (Soreide, 2006c). In such indices where countries are ranked based on their perceived corruption level, a ranking of 6 does not necessarily mean that the country in question has twice the amount of corruption compared to a country with a ranking of 3. As an ordinal variable, this difference only means that one country has more corruption than the other.

4. Instinctively based on comparison

As the name indicates, perception-based surveys rely on people's perceptions in giving an estimate for the corruption. However, people's perceptions are “instinctively based on comparison”, which raises the question, what is the point of comparison for each respondent? Is it the neighboring country, the last heard rumor, the respondent's personal values, the ideal situation respondent can imagine for that country, the situation of corruption in that country in last year, or other.? If this is not clearly mentioned to respondents in the questionnaire, respondents may hold very diverse points of comparison in their rating scale answers, making such surveys not necessarily comparable across respondents, year, field of work, or country.

Considering these diverse points of comparison, “while corruption must be expected to vary between state institutions, economic sectors and professions, we cannot expect respondents to describe the average level of corruption within the country in question” (Soreide, 2006a) and as a result we cannot claim perception-based corruption indices to represent an indicator for this average.

5. Petty vs. Grand Corruption

When respondents are answering based on their perception, their perception would mostly be limited to their personal experience and what they have heard from friends and the media. This would potentially introduce a level of “tunnel vision syndrome”, as for example when asked the perception of households; the respondent would potentially base their response on their limited experience which is mainly of the corruption in daily life such as petty corruption they face in their daily dealings.

This weakness was shown in research by Kenny (2006) where he concluded that “there is considerable evidence that most existing perceptions measures appear to be very weak proxies for the actual extent of corruption in the infrastructure sector, largely (but inaccurately) measuring Petty rather than Grand Corruption.”(Kenny, 2006)

6. Inconsistency in data collection and measurement methodologies

The underlying data in aggregate indices have not necessarily been collected and measured consistently over time and across countries. This would undermine the

accuracy of the researchers which use these indices on a time series or panel data analysis.

The Transparency International CPI developers mentioned several times that “year-to-year changes in a country's score can either result from a changed perception of a country's performance or from a change in the CPI's sample and methodology. The only reliable way to compare a country's score over time is to go back to individual survey sources, each of which can reflect a change in assessment” (Transparency International, 2008b).

7. Automatic correlation, spillover effect, and informational cascade

Another significant weakness is with automatic correlation and spillover effects (Soreide, 2006c). Many of the “expert” respondents already are aware of the level of corruption published in the previous year of the index they are being interviewed for, and the most recent index would automatically be highly correlated with the previous years' indices.

This issue could be further explained by the “informational cascade” theory. As Bikhchandani et al. (1992) show “when it is optimal for an individual, having observed the actions of those ahead of him, to follow the behavior of the preceding individual without regard to his own information”. They argue that “localized conformity of behavior and the fragility of mass behaviors can be explained by informational cascades” (Bikhchandani, et al., 1992).

Andvig (2004) describes the informational cascades in this context: “The experts read the same reports and gauge other experts' statements. Since the

assessments are often not based on individual experience, when expert X claims corruption in A is very high, expert Z has no clear evidence to the contrary, so when knowing X's statement it may be optimal to make an assessment close to his. Informational cascades may easily develop in this context. The fact that the TI index in particular is widely published, reinforces the argument" (Andvig, 2004).

8. Independence of stochastic errors across sub-indicators

In the aggregated indices like Transparency International CPI and World Bank Institute Governance Indicators, there is an important assumption that the stochastic errors across the sub-indicators of their indices are independent. Considering how respondents develop their perceptions of corruption, this assumption might not necessarily be correct "as the different underlying surveys seldom ask for each individual respondent's own experience, but rather their general impression of the problem" (Soreide, 2006c). This could potentially result in responses being influenced by the same error.

The mentioned assumption that all these sources are independent from each other has not yet been substantiated by researchers; however, the aggregate rankings are still made assuming that the margins of error are uncorrelated. While Weber Abramo (2005) has offered some evidence for this type of bias among the subjective variables, there is more work needed studying this assumption and the extent of significance it has.

Aggregate vs. non-aggregate perception-based indices

Some indices in this category are composite and aggregate of other indicators. This means they have compiled a number of perception-based surveys into one ranking by some averaging methodology and are in result an “index of indices”.

While aggregation has the advantage of reducing potential errors from single sources, however “depending on one's purpose, it may be more appropriate to use data from a single source rather than a composite index because of the loss of conceptual precision in aggregation” (Knack, 2006). Even the statistical accuracy advantages supposedly resulting from aggregating sources of corruption data have been questioned as being “likely far more modest than often claimed because of interdependence among data sources” (Knack, 2006).

Examples of aggregate perception-based indices

Transparency International Corruption Perception Index and World Bank Institute Governance Indicators are the two most cited examples for this approach. The two are not very different from each other as “several of the sources are the same, and the two indices correlate well” (Soreide, 2006c).

Their main differences are that the World Bank Institute Governance Indicators has a broader goal of presenting estimation for Governance and has corruption as a sub category. In addition, World Bank Institute Governance Indicators focuses on calculating the statistical errors produced by aggregating the individual statistical errors of each survey used in their index. In scholarly practice, there are a

number of papers published using this type of data, for example (Fisman & Gatti, 2002).

Examples of non-aggregate perception-based indices

Aside from Transparency International Corruption Perception Index (CPI) and World Bank Institute Governance Indicators, there are few other indices that could be fit in this category including Freedom House's Nations in Transit (NIT) which has a sub-category for corruption and the Political Risk Service's International Country Risk Guide (PRS/ICRG)

The main difference from Transparency International CPI is that they are not aggregate indices of different surveys. Both NIT and ICRG are expert-driven perception-based indices which have the advantage of being consistent over the years as the pool of experts grading countries has been claimed to have been kept relatively constant (Howell, 2011; Walker, 2011). Their main strength relies on this consistency over time, making them more suitable for time series analysis than aggregate indicators like CPI.

However, they have the downside of being just the views of few experts where their "final ratings are determined centrally by a very small number of people"(Knack, 2006), without full transparency on who they are and how they have arrived at the corruption measures they assign to each country each year.

Numerous scholarly research papers have been published utilizing this type of data, a list of which can be found in Lamdsdorff (2006) and (Amundsen & Fjeldstad, 2000). However, based on Lambsdorff (2006), the results of these studies "must be

taken with a grain of skepticism, as this variable does not depict corruption itself but the political instability that increases with corruption but also with the public's intolerance towards corruption. In this regard, instability is assumed to increase with the time a government has been in power continuously – a theoretical assumption that not all observers are willing to follow” (Lambsdorff, 2006).

Considering the abovementioned weaknesses in this corruption measurement method, the quality of the outcome of research using “general or target-group perception data” is of concern and “the extent to which we can rely on the conclusions is uncertain when the underlying information is weak” (Soreide, 2006c).

Rule-based or de-jure method

While perception-based indices focus on the perception of people on ‘how things work in reality’, rule-based assessments focus on the laws on paper and the formal institutional environment. This is why they are called “de-jure” in comparison to the other three methods which are “de-facto” and based on what is happening in reality.

Strengths

The central defining characteristic of this method is that its data are based on actual laws and institutional regulations. For example, country X either has an anti-money laundering regulation or it does not and the data could be collected objectively. As a result, this method does not rely on the perception of respondents but rather on the actual data from each country.

This eliminates the problems mentioned before resulting from perception of respondents. In addition, this data collection method could be highly consistent over time and across countries if the definition for each variable were clearly stated.

Weaknesses

An example of objective measures for corruption could be the number of actual court cases or police arrests related to corruption. However, the number of corruption court cases and police arrests might not necessarily be an ideal indicator as “the judicial system may not have the capacity to investigate and prosecute all the cases that emerge. In addition, the police force may lack the necessary independence, or may even be corrupt itself” (Soreide, 2006c).

Example

A good example for this type of measurement is the work done by The Global Integrity which “quantitatively assesses the opposite of corruption, that is, the access that citizens and businesses have to a country's government, their ability to monitor its behavior, and their ability to seek redress and advocate for improved governance” (The Global Integrity, 2010).

Incidence of corrupt activities, experience-based or the proxy method

The incidence-based approach is based on surveys by those who have potentially been involved in a specific form of corruption e.g., paying or receiving

bribery. In this method, the person's actual experiences with corrupt practices in their specific and narrow field of work would be assessed.

Strengths

This method has some specific advantages compared to each of the abovementioned three methods. Compared to the anecdotal method this method would enable large scale data collection across different sectors and countries. Compared to the perception-based method this approach would potentially result in a less subjective estimate for corruption as it is asking about actual incidences rather than perceptions. And compared to the rule-based method, this approach enables us to collect data even for de facto questions.

Numerous scholars who have reviewed different corruption quantification approaches have stated their preference for this approach to different degrees (Hellman, et al., 2000; Kenny, 2006; Knack, 2006; Sik, 2002; Soreide, 2006c). Sik (2002) takes a supportive view of this type of corruption measurement stating: "I argue against a corruption-perception method and for a corruption-proxy method" (Sik, 2002). He describes that the corruption-proxy method assumes that "one can reliably measure certain (less hidden) forms of corruption, and that the volume of this 'tangible' subsample positively and strongly correlates with the general level of corruption" (Sik, 2002).

A similar conclusion has been made by Soreide (2006c) stating "[...] business surveys in particular are able to provide more accurate information for the

quantification of corruption locally, and also its implications and its geographical and sector-related variation” (Soreide, 2006c).

As mentioned in the section on weaknesses of perception-based methods, perception-based surveys rely on people's perceptions which are “instinctively based on comparison”, and the question arises about the point of comparison for each respondent. An important advantage of the incidence-based method is that respondents have clear points of knowledge and comparison when answering the questionnaire.

Experience-based surveys like World Bank Business Environment and Enterprise Performance Survey (BEEPS) (World Bank, 1999-2009) and World Bank Enterprise Surveys (World Bank, 1999-2011) have a range of features ensuring a higher level of reliability and depth in their assessments. In particular, “questions are based on the direct experience of firms rather than subjective comparisons across countries. Where possible, numerical cardinal estimates of problems are used (such as share of annual revenue spent on bribes) as opposed to subjective assessments of the extent of the problem” (Hellman, et al., 2000).

Another important advantage of this approach is that the changes over time in corruption levels as measured by these surveys can produce valid inferences as their survey questions and sample designs remain similar in the years of data collection, and if other factors are controlled where necessary. (Knack, 2006).

Weaknesses

1. Not entirely free of perception

This type of data is not purely “non-perception”, as to an extent it also includes a level of perception from respondents, for which a level of precaution is necessary while using the data. For example, in order to gain answers about the level of bribery businesses have experienced, the questions have to be phrased indirectly by asking respondents about the corruption faced by “firms like yours”. Despite the precautions taken, this is not the same as reporting personal experience and may include a level of perception potentially influenced by “other agents’ communication of their perceptions” (Andvig, 2004).

2. Targeted and not aggregate

While this approach benefits greatly from being a targeted indicator for corruption and a strong estimator for the specific aspect of corruption it is measuring, it would not be as useful in the assessment of corruption as a general concept or for assessing other types of corruption other than what it is intended to measure.

For example, the business bribery index which this paper utilizes would not be directly helpful when bribery occurs between politicians and bureaucrats or when public funds are illegally diverted. Also, many other types of conflicts of interest would not be easily captured by this approach, “for example equity stakes of public officials, or employment promises to them by firms” (World Bank, 2000).

3. Shame-bias, lack of truthfulness, and the routine-bias

As this mode of data collection is closer to the actual people potentially involved in corruption, the chances of non-response and lack of truthfulness increases. As a result, we are unable to “control the shame-bias and the routine-bias, that is, we will never know the exact ratio between actual corruption attempts and the reported number” (The Hungarian Gallup Institute, 1999).

To explore this more, we consider two countries with a large difference in their prevalence of corruption. In the case of a routine-bias, the business person in a more corruption-prone country may not even recognize or remember the number of times that he was involved with bribery. This is while the business person in a less corrupt environment may fully recall the number of cases of bribery she was involved with in the last five years.

This problem could be mitigated by making the comparison in a time series format, as “the best cross-validity we can hypothesize is between several waves of the same research in the same country” (The Hungarian Gallup Institute, 1999).

Examples

Two strong examples for experience-based surveys are the World Bank Business Environment and Enterprise Performance Survey (BEEPS) (World Bank, 1999-2009) and the World Bank Enterprise Surveys (World Bank, 1999-2011). Their data collection approach is covered with more details in the data section of this paper. However, there have been few concentrated efforts in producing the available data into a standardized usable index for business bribery which is the goal of this paper.

Business Bribery Index (BBI)

A new “experience-based” index

Having mentioned all of the downsides of different approaches for the quantification of corruption does not reduce the importance of the subject. It is likely that we will never find a perfect measurement for corruption but as Arndt et al. put it “the production and use of more transparent indicators would better serve both developing countries and external groups seeking to improve the quality of local governance” (Arndt & Oman, 2006).

This paper is an attempt to introduce a new measure of estimating corruption with a specific focus on the amount of bribes businesses pay to the government. The Business Bribery Index (BBI) introduced in this paper is an example of the “experience-based” method in corruption quantification.

BBI offers an estimation of national annual bribes paid by the business sector to governments in each country worldwide. BBI utilizes multiple surveys done in this regard, mainly the World Bank Enterprise Survey which has been surveying business owners worldwide for over 10 years. More discussion about the nature of data will be provided in the data section of this paper.

Available bribery estimates

BBI is the only index which estimates business bribery as a targeted form of corruption inside each country. The closest other index to BBI is Transparency International’s Bribe Payers Index which ranks 28 exporting countries by the likelihood of their firms to bribe abroad based on Transparency International’s annual

Bribe Payers Survey. In this survey, “international business leaders reported the widespread practice of companies paying bribes to public officials in order to, for example, win public tenders, avoid regulation, speed up government processes or influence policy” (Transparency International, 2011a).

Transparency International’s Bribe Payers Index utilizes the “perception-based” method in gathering data. Its key question is asking respondents “could you please tell us, using a scale of 1 to 5 where 1 means never and 5 means almost always, how often do firms headquartered in that country engage in bribery in this country?” (Transparency International, 2011a)

The key difference between BBI and Transparency International’s Bribe Payers Index is that BBI is focused on the business bribes paid inside the country by domestic businesses to their own government, while the Bribe Payers Index estimates the bribes paid by foreign multinational companies to local governments in order to secure contracts and sales. BBI is mostly about bribes paid for the ease of doing business locally while the Bribe Payers Index is about potential foreign actors’ effects on corruption in local business environments.

Another publicly cited example for the estimation of bribery is the aggregate global amount suggested by Daniel Kaufmann (Kaufmann, 2005). This estimate was publicized for the first time through a news piece published in 2004 on the The World Bank website (World Bank Institute, 2004). Since then this estimation has received numerous media citations, however, it has not received the same level of attention in academic citations. Kaufmann has summarized that estimation as the following: “an estimate of the extent of annual worldwide transactions that are tainted by corruption

puts it close to US\$1 trillion. The margin of error of this estimate being obviously large, it may well be as low as US\$600 billion; or, at the other extreme of the spectrum, it could well exceed US\$1.5 trillion” (Kaufmann, 2005).

Data

Data sources for BBI

The estimation presented in this paper is based on enterprise and business corruption surveys collected to enhance our understanding of the actual amount of corruption and bribery in the business sector of each country rather than the perceptions of the existence of such corrupt practices.

The World Bank defines an Enterprise Survey as “a firm-level survey of a representative sample of an economy’s private sector” (World Bank, 2011c). These surveys include questions about personal direct experience of respondents with bribery and corruption such as the amount paid in bribes as a percentage of the total project the firm was contracted or the annual sale of the company.

The main sources of information for BBI are two World Bank surveys listed below:

- 1. World Bank Business Environment and Enterprise Performance Survey (BEEPS):**

World Bank Business Environment and Enterprise Performance Survey (BEEPS) is a joint initiative of the European Bank for Reconstruction and

Development and the World Bank. The BEEPS has been carried out in three rounds in 1999, 2002, and 2005 and covers virtually all of the countries of Central and Eastern Europe and the former Soviet Union, as well as Turkey. It includes detailed information such as bribes paid by a firm as a share of its annual sales and percent of annual sales used for protection payments. (World Bank, 1999-2009)

The quality of data collection in BEEPS has been tested and cited by multiple academic papers and has generally received very positive reviews. For example, Hellman et al. (2000) tested the quality of BEEPS data and concluded that “cross-country surveys may suffer from bias if firms tend to systematically over- or underestimate the extent of problems within their country. The authors provide a new test of this potential bias, finding little evidence of country perception bias in BEEPS” (Hellman, et al., 2000).

2. The World Bank Enterprise Survey (WBES):

The World Bank Enterprise Survey (WBES) is one of The World Bank’s largest and longest surveys covering a broad spectrum of business climate topics including access to finance, corruption, infrastructure, competition, and performance measures. The World Bank has collected this data from face-to-face interviews with top managers and business owners in over 130,000 companies in 125 economies (World Bank, 2009).

The sample size in both BEEPS and WBES varies between 150-1,320 business managers in each country depending on the size of the country. The data used in the current version of BBI includes data for 127 countries from 132,627 face-

to-face interviews with business managers. The interviews are distributed as 71,789 between the years 2002 and 2005, and 60,838 interviews between the years 2006 and 2011.

The main question utilized in creating BBI to which respondents answered (same in all countries and over the years) in these surveys is:

“We’ve heard that establishments are sometimes required to make gifts or informal payments to public officials to “get things done” with regard to customs, taxes, licenses, regulations, services etc. On average, what percent of total annual sales, or estimated total annual value, do establishments like this one pay in informal payments or gifts to public officials for this purpose?” (World Bank, 1999-2009, 1999-2011)

Data sources used as a BBI validation set

The following two enterprise surveys have been utilized as a quality check measure for the BBI data as they are both asked in an experience-based method from business managers. The reason they are not directly included in BBI is their lack of comparability for direct inclusion, however, they are useful as a validation set for BBI.

1. World Economic Forum Global Competitiveness Survey

The Global Competitiveness Survey is an annual international survey conducted by World Economic Forum. The 2011–2012 report covers 142 major and

emerging economies drawing from its survey of about 9,000 respondents from the business community (in 2004 it included 8,729 firm responses) (Schwab, 2011).

Related to BBI, The Global Competitiveness Survey includes a measure of bribery under its institutions pillar. This is a measure of the extent of bribery and irregular payments derived from the Executive Opinion Survey which has been added under ethics and corruption in the index. The typical question asked related to BBI is: “When firms like yours do business with the government, how much of the contract value must they offer in additional payments to secure the contract?” (World Bank Institute, 2006)

2. IMD World Competitiveness Yearbook (WCY)

The World Competitiveness Yearbook (WCY) is an annual business competitiveness ranking published by the International Institute for Management Development (IMD) analyzing how “nations and enterprises manage the totality of their competencies to achieve increased prosperity” (International Institute for Management Development, 2011a). World Competitiveness Yearbook (WCY) covers 59 countries using 331 variables from a variety of data sources.

Among its 331 variables under the Government efficiency/State Efficiency section, it includes a variable called “Bribing and corruption” defined as whether “Bribing and corruption do not exist”. The data for this variable is from the IMD survey and can be used as a check and balance component for BBI. The survey component, called “Executive Opinion Survey”, is answered by a panel of 5,000

business executives worldwide every year (International Institute for Management Development, 2011b).

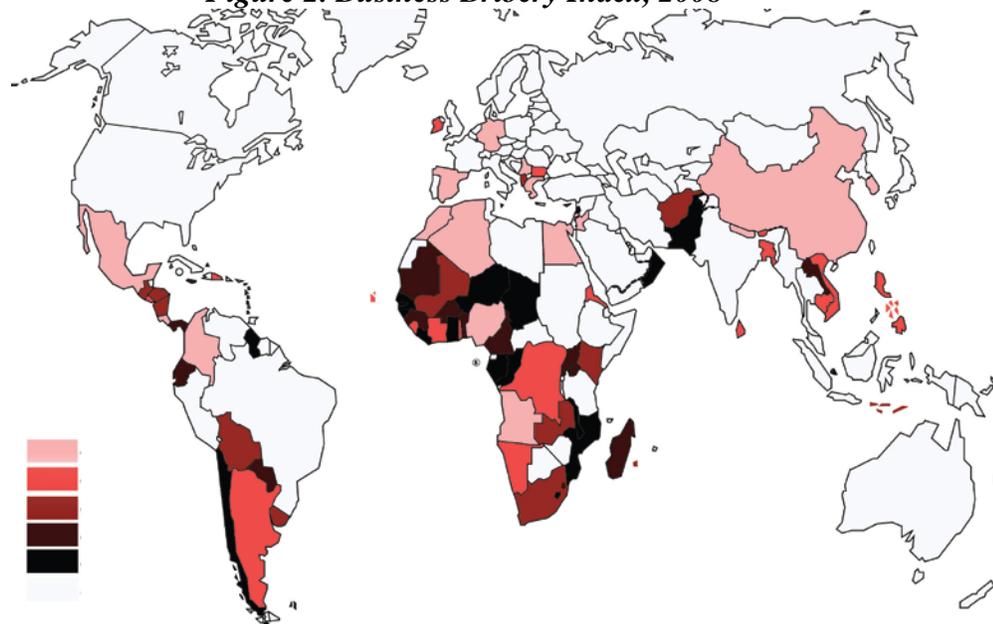
Results

BBI map

The depth of data used in creating BBI enables it to be both an aggregate panel data on bribery and corruption of countries over time and across countries, and a disaggregated source of bribery data for a particular country, in a specific year, in a certain sector of business (i.e., manufacturing, agriculture, or service), and for a specific business size (i.e., small, medium, and large businesses).

For example, BBI can answer what the “going rate” for business bribes were in Argentina in 2006 in \$US, and it can answer what the “going rate” for business bribes were in the middle size service sector of Argentina in 2006 in \$US.

Figure 2. Business Bribery Index, 2008



*Darker color indicates more bribery reported.
Colors range from dark red to lighter red each indicates 20 percentiles.*

Empirical analysis of the BBI

While BBI benefits considerably from the high quality of its data sources, to ensure the reliability and relevancy of BBI for research, a number of tests have been conducted on BBI. Below a battery of tests and a list of such variables and their sources is presented utilizing a number of related indices to BBI.

Table 6. Variables Involved in the Empirical Analysis of BBI

Variable name	Description	Source
BBI	Business Bribery Index (BBI), in US dollars, weighted by average annual sale of businesses in the country-year	Farmanesh (2011), using The World Bank, etc. data
WB Corruption	Control of Corruption, World Bank Governance Indicator	The World Bank
GDP	GDP per capita	The World Bank
CPI	Corruption Perception Index	Transparency Intl.
Freedom House	FH Liberal Democracy Index, standardized	Freedom House
Polity IV	Polity IV Constitutional Democracy, standardized	GMU-UMD

The table below summarizes the above mentioned tests in one table. It includes a correlation matrix between BBI and the abovementioned variables, a regression analysis to study the relationship between the variables, a Levene's test and an unpaired ttest to compare BBI with these variables.

The correlation matrix indicates a clear lack of correlation between BBI and other indices. The regression results also present the same conclusion that the variables are not significant in any of the chosen significance levels and the signs of the coefficients confirm the assumptions of the model as BBI being negatively defined compared with CPI and WB corruption. For example, in CPI higher numbers show lower corruption while in BBI higher numbers show a higher amount of bribe paid, hence we expected the coefficient to be negative. Finally, Levene's test and unpaired ttest to compare BBI with other indices presents significant difference between in 99% level.

In general, it could be concluded that BBI is not a copy or proxy for other indices tested here. BBI shows distinct data not available through other indices and not duplicable using transformation of those indices.

Table 7. Empirical Analysis of the BBI, Compared with Other Related Indices

	BBI						Correlation
CPI	-0.00327	-3.14E-03					-0.1071
	0.269	0.293					
GDP capita		0.00		-1.93E-06	-9.30e-07	-8.11e-07	-0.1433
		0.165		0.063*	0.239	0.340	
WB Corrupt			-3.99E-04	1.45E-02			-0.0137
			0.952	0.174			
Freedom House					.0001073		-0.4184
					0.652		
Polity IV						.0000588	-0.3298
						0.782	
Constant	0.046465	5.31E-02	0.033746	0.051269	.0327393	.0370012	
	0***	0***	0***	0***	0.029**	0.016**	
Levene's test	0.0005		0.0022		0	0	
	0***		0***		0***	0***	
ttest unpaired	-62.8912		2.3253		-90.3663	-63.6839	
	0***		0.0202**		0***	0***	

P-values are reported in the second row of each regression result.
 * significant at 10%; ** significant at 5%; *** significant at 1%.

Empirical analysis of the validity of BBI

As shown in the previous section, BBI is significantly different from other available measurements of corruption. However, this does not necessarily indicate that BBI is in fact useful in describing the real world. To test for the validity of BBI a second series of empirical tests has been performed which has a real world and objective variable as its dependent variable and includes BBI as an independent variable along other variables.

Below is a description of the variables included:

Table 8. Variables Involved in the test of BBI validity

Variable name	Description	Source
Registered Business*	Total businesses registered (number) per urban capita	World Bank
WB Corruption	Control of Corruption, World Bank Governance Indicator	The World Bank
GDP	GDP per capita	The World Bank
CPI	Corruption Perception Index	Transparency Intl.
Credit to Private	Domestic credit available to private sector (% of GDP)	World Bank
Mar Corp Tax	Highest marginal corporate tax rate (%)	World Bank

* Registered business data are collected directly from the Registrar of Companies, which is the entry point for businesses joining or transitioning to the formal sector. This is discussed in details in the “Enabling environments, Policy variables affecting the growth of the formal business sector” paper.

Using the mentioned variables, the following quantitative analysis has been performed. The method used is panel data OLS regression utilizing the random effect

model. Utilizing the panel data the quality of the econometrics analysis would be significantly enhanced as with “the combination of time series with cross-sections can enhance the quality and quantity of data in ways that would be impossible using only one of these two dimensions” (Gujarati, 2003) In addition, panel data enables to control for unobserved variables or factors which are known but are impossible to quantify “like cultural factors or difference in business practices across companies; or variables that change over time but not across entities (i.e. national policies, federal regulations, international agreements, etc.). This is, it accounts for individual heterogeneity” (Baltagi, 2005).

In the results, as R-squared of xtreg (random effects) does not have all the properties of the OLS R-squared, here R-squared is reported using OLS with year dummies. As shown below, BBI is highly significant in describing the number of registered businesses worldwide while CPI is not significant in the same situation.

Table 9. Test of BBI validity

	Total businesses registered (number)				
BBI		-479.6448	-681.8198	-446.4538	
		0.096*	0.025**	0.005***	
CPI					0.0317085
					0.758
Mar Corp Tax	-0.3399084		-0.9345413	-0.5317121	-0.3261486
	0***		0.01***	0.035**	0.003***
Credit to Private	0.1172443			0.2699735	0.0923646
	0***			0.002***	0***
GDP	0.000951			0.0001875	7.11
	0***			0.714	0***
Constant	13.12414	29.01715	56.382	27.85484	12.85931
	0.004***	0***	0***	0.007***	0.013**
Prob > chi2	0***	0.0960*	0.0017***	0***	0***
R-squared	0.3298	0.3602	0.4815	0.5473	0.3410

P-values are reported in the second row of each regression result.
 * significant at 10%; ** significant at 5%; *** significant at 1%.

BBI and the next steps

BBI is in its first steps and has a long list of further progress needed to increase its quality.

1. More disaggregated

BBI and its underlying data have the potential to become more disaggregated.

The disaggregation would be based on the following:

BBI could be presented disaggregated by the characteristics of the firms like their sector and size. For example, the average bribe paid by medium size businesses in the service sector in Argentina in year 2009 could be estimated by BBI.

BBI could also be disaggregated by the characteristics of the firm managers like their gender and education. For example, the average bribe paid by large firms managed by well-educated executives in Argentina could be estimated by BBI and could be compared based on the gender or education of the executives.

BBI could also be disaggregated by the characteristics of the business environment in the specific year like their annual sales and corporate tax rates. For example, the average bribe paid by firms in high taxed countries could be studied compared to lower taxed business environments.

2. Sister indices

BBI could be enhanced by the development of its sister indices such as Household Bribery Index (HBI) for which the data for 40 countries is already collected. BBI and HBI together could result in an estimation of the annual worldwide bribery disaggregated by the country-year.

3. More detailed study

BBI could be enhanced by a more detailed study of “non-respondents” and the “margins of error”. While respondents have the option of answering that “no bribe” is paid in their business, some decide not to respond to such questions. This type of response could be further studied based on its characteristics to enhance our understanding of underlying corrupt behaviors.

Furthermore, the responses claiming that no bribe is being paid in their line of business could contain further grounds for study. For example, some respondents

have answered “no bribe is being paid by people in this sector”, which depending on the sector could be a questionable response. A further study in the nature of such responses could be helpful to enhance BBI.

Causes and effects of business bribery by region-countries-year-specific situation and studying their association with social, political, and economic factors could be of interest. To see an example of such a paper, please refer to (Farmanesh, 2011).

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Chapter 4: Regional dimensions of economic development in Iran

Introduction

The spatial relation between economic agents is an important determinant of how they interact, what they do, and how well off they are. Based on NEG theories, economic activities and interactions fall off rapidly with distance, and production structures are shaped both by factor endowments and by distance to markets and sources of supply. In recent years a number of theoretical tools have been developed to address the role of geography in shaping these relationships. There is also a newly developing body of empirical work, based mainly on cross-country and sub-national studies. This is now being supplemented by empirical work which is being developed by recent developments in theory using international as well as sub-national data.

This paper studies the spatial distribution of economic activity in the Iranian provinces and the strength of product-market linkages between them. It presents a spatial analysis on regional dimensions of poverty and economic development across 28 provinces of Iran. As far as the author of this paper found, this paper is the first estimation made in any developing country using this strand of “New Economic Geography” (NEG) models.

The goal of this study is to offer an analysis of the effects of agglomeration and dispersion economies on the patterns of regional economic development in Iran.

It analyzes the linkages among adjacent provinces as well as effects of agglomeration and dispersion economies on the patterns of Iran's regional economic development through empirical estimation of two NEG models.

NEG models are based on the idea that the level of market access to goods is an imperative condition for the scale of economic activity in any location. They emphasize the importance of the market access characteristics compared to the set characters of a location. This approach presents an alternative approach in characterizing the economy of scale and the geographic agglomeration of economic activities.

The effects of physical location and distance on the economic situation have long been studied. The Neo-Classical Theory (NCT) takes location as exogenous and explains agglomeration derived from endowment and/or technology. The introduction of increasing returns to scale at the firm level and consumers' preference in the variety of goods were the New Trade Theory (NTT) improvements which all were the basis for the development of NEG theory.

Overman et al. (Overman, Redding, & Venables, 2003) mentions the differentiation between first- and second-nature geography and their important roles as determinants of trade, income and production structure. The first-nature is defined as the physical geography of coasts, mountains, and endowments of natural resources, while second-nature is defined as the distance between economic agents. With this definition, first-nature elements are the main subject of factor endowment based trade theory. While, NEG models primarily use the second-nature definition. NEG models

are concerned with how the spatial relationship between economic agents determines their interaction, what they do, and how well off they are?

NEG theories combine the above mentioned aspects with the new feature of “agglomeration” effects which endogenously arise for some parameter values. NEG theories take location as endogenous and assume labor mobility. The models suggest higher wages at the centre of production and lower wages on the periphery. They predict that the access of a location to markets for its goods determines its level of economic activity. Therefore, less proximity to consumer markets would result in higher economic activity, which in turn increases the level of employment and wages.

NEG predicts that with higher economies of scale, agglomeration would increase as economies of scale encourage firms to concentrate their production in few locations to utilize scale gains. Also lower trade costs allow firms to supply even the markets that are far from one central location, this in turn would increase agglomeration as predicted by NEG. NEG also predicts stronger agglomeration if demand patterns are biased for industrial and manufactured goods as they support larger agglomerations of firms.

Harris (Harris, 1954) presents the idea which later NEG models used. It proposes that, weighted by transportation costs, the demand for produced goods in a specific location is the total of purchasing power in other locations. Krugman’s (Krugman, 1991) paper re-initiated mainstream economics interest in the spatial distribution of economic activity. It uses the interaction of firm-level economies of scale and transport costs as an explanation for agglomeration and city formation.

Hummels (Hummels, 1999) studied the relationship between per capita income and market access and showed the high correlation between residuals from the augmented Solow growth model with measures of geographical location.

Fujita et al. (Fujita, Krugman, & Venables, 1999) showed that spatial demand linkages are created by a combination of transportation cost and scale economies contributing to agglomeration. The possibility of serving large local markets draws firms to cities, however costs related to congestion limit the geographic concentration. Fujita et al. (Fujita, et al., 1999) by deriving the Harris (Harris, 1954) “Market Potential Function” (MPF) from formal spatial models revived its concept. Modern forms of MPF show that near consumer and industrial agglomerations nominal wages are higher.

The determinant characteristics of firm size have been studied separately through different approaches. For example, Axtell (Axtell, 2001) showed that Zipf distribution characterizes firm sizes and that some large firms pay higher wages for the same job. Connecting this to NEG insights about the interplay between distance, agglomeration and wages, we can study factors effecting wage inequality in different regions.

Distance and geographical location affect wages and income through influence on the flow of production factors, goods, and ideas. There are different mechanisms to determine the influence of distance. On the one hand is a province’s distance from the markets buying their output, and on the other hand is the distance from provinces supplying their needs, providing the necessary capital and intermediate goods for production. The importance of distance translates into

transport costs and other trade barriers. This means that provinces further from markets would effectively pay a tax or penalty on their sales and imports. As a result, firms in these provinces would pay lower wages than others with better access, even if other factors like technology are similar.

The potential impact of these effects has been empirically estimated at country level. Hummels (Hummels, 1999) used customs data to show that while the average expenditure on freight and insurance as a proportion of the value of manufacturing imports is 10.3% in the US, it is 17.7% in Brazil. Limao and Venables (Limao & Venables, 2001) showed that the shipping costs of a median land-locked country are more than 50% higher than those of the median coastal country. As Redding and Venables (Redding & Venables, 2004) mention, these papers narrowly define transportation costs as pure costs of freight and insurance, this may result in possible understatement of the real scale of trade barriers as the cost of distance could possibly be higher due to the costs of transit time or information gathering.

Head and Mayer (Head & Mayer, 2004), Overman et al. (Overman, et al., 2003), Redding and Venables (Redding & Venables, 2004), and Garcia Pires (Garcia Pires, 2006) offer comprehensive surveys of the increasing number of empirical studies published on NEG models in the last strand. An important problem of NEG empirical research is the unobserved variables that affect spatial agglomeration besides market access and distance. For example, workers could come to a province based on factors like family needs or weather choice (Roback, 1982). However, some researchers like Redding and Venables (Redding & Venables, 2004) and Garcia Pires (Garcia Pires, 2006) have reported their results to be robust and that additional control

variables made no significant change in their results. Regardless, this paper addresses issues of unobserved variables through the interpretations in the text.

Neary (Neary, 2001) and Brakman et al. (Brakman, Garretsen, & Schramm, 2004) in a review of NEG empirical works conclude that empirical research is lagging behind NEG theory and that much more empirical validation of NEG theoretical insights is necessary. The reason given for the lag of empirical research is that the NEG models characteristics which are nonlinear and use multiple equilibria. As mentioned in this paper and other empirical NEG works this makes empirical validation relatively difficult and less accurate.

Hanson (Hanson, 2005) categorizes published NEG empirical research into three strands. The first strand is based on Krugman's (Krugman, 1980) home-market effect and the New Trade Theory (NTT) which studies the determinants of production concentration close to large national or regional markets. The second strand is consistent with Eaton and Kortum (Eaton & Kortum, 1999, 2002) which focuses on the diffusion of technology across space and its effects on trade and industry location. The third strand is what Hanson (Hanson, 1998, 2005), Redding and Venables (Redding & Venables, 2004), Head and Mayer (Head & Mayer, 2004), Garcia Pires (Garcia Pires, 2006), and this paper are close to. Based on NEG models, they study whether wage/income is higher in countries/provinces with better access to larger markets for their goods.

This paper first presents Harris (Harris, 1954) estimation of an MPF model in which wages are associated with proximity to consumer markets. The MPF model captures the intuitive idea that distance acts as a barrier to trade. After taking into

account the barriers of distance, the “market potential” is the total amount of trade between all regions that might take place. By assuming that wages would be proportional to the market potential, we can study whether trade in Iran is subject to the distance barrier or not.

Second, the paper estimates an augmented market-potential function derived from the Krugman (Krugman, 1991) model of economic geography. The parameters in this model estimate the importance of transportation costs and scale economies. The Krugman model offers insight into economies of scale and describes the benefits that firms and industries gain by locating near each other. Based on the idea of economies of scale, as more similar firms cluster together, there would be more competing suppliers, greater specialization and division of labor. These factors decrease the cost of production and increase the markets for firms.

Krugman (Krugman, 1991), by studying the relation between agglomeration, increasing returns and market access, endogenously determines wages in a province as a function of wages and income in other provinces. He tests the spatial distribution of economic activity through the estimation of several structural parameters including elasticity of substitution, trade costs and share of income spent on industrial and manufactured goods.

The structural estimation used in this paper is similar to what Hanson (Hanson, 1998, 2005) offered for the first time for the United States. Later empirical studies were done similar to Hanson’s (Hanson, 1998, 2005) in other developed countries. Roos (Roos, 2001) offers an estimation for Western Germany, De Bruyne (De Bruyne, 2002) for Belgium, Brakman et al. (Brakman, et al., 2004) for Germany,

Mion (Mion, 2004) for Italy, and Paluzie et al. (Paluzie Hernandez, Pons Novell, & Tirado Fabregat, 2005) and Garcia Pires (Garcia Pires, 2006) for Spain. The results of these studies have been compared with the results of this study later in the paper.

While this paper and Garcia Pires (2006) use Krugman (1993), the multi-region version of the Krugman (1991), the other papers noted above use Helpman's (1998) variant of the Krugman (1991) econometric formalization. Krugman (1991) assumes that a perfect competitive sector produces a homogeneous good like agriculture which is traded freely. While Helpman (1998) takes the homogeneous good as a non-tradable good like housing. Considering the higher housing price in more populated provinces, an extra centrifugal force is introduced. As a result, the two models have differences in the impact of a trade cost reduction as Helpman (1998) would predict promotion of dispersion but Krugman (1991) would predict promoted agglomeration.

Puga (1999) has shown that the Krugman (1991) and Helpman (1998) models are not necessarily different but that they are two sides of the relationship between regional inequality and transportation costs. Through this bell-shaped curve Helpman (1998) predicts more dispersion in the case of a reduction from low trade costs, while Krugman (1991) predicts an increase in agglomeration in the case of a reduction from high trade costs. As mentioned most empirical works have chosen Helpman's (1998) model over Krugman's (1991) as they see Helpman (1998) predicting less extreme spatial patterns than Krugman (1991). However, Garcia Pires (2006) has shown that while the two-region case of Krugman's (1991) model offers an extreme

configuration of space; Krugman's (1993) model is generalized to multiple regions which makes it suitable for empirical estimation.

Previous empirical studies have focused mostly on NEG estimations in the developed countries. In general, it is appealing to empirically study these models in diverse countries and economies, especially to offer estimations for developing countries versus current estimations for developed countries and study the potentially consistent differences. In particular, considering diversity, mountainous geography, and regional cultures of provinces in Iran, Iran can be an interesting case study for testing NEG models.

A major advantage of this study for Iran is the nature of trade in Iran. NEG models assume a closed economic framework to be able to simplify the factors. This assumption is much more accurate for the nature of trade in Iran in comparison to trade in Europe and America, where the available empirical literature of this model exists. While some other developing countries also fit better in this assumption of a closed economy than developed countries, but Iran, in result of political factors and trade sanctions, would be an even better case to study.

The estimation results suggest that Iran showed generally good fit to both models and satisfied both MPF and Krugman model specifications. Compared to other similar studies in developed countries, Iran shows smaller returns to scale and significantly higher effects of market potential on wages.

Overview of regional diversity in Iran

Iran with the eighteenth largest land mass and seventeenth largest population in the world is a country of great history and diversity. For a more effective management of this wide country, Iran is currently subdivided into provincial divisions, which are called استان (ostān) in Persian, and in plural form استانها (ostānhā). The thirty current provinces or Ostans are each governed from their capital, which is usually the largest local city. Each capital is called the مرکز (markaz) of that province. Every province is headed by a Governor-General or استاندار (ostāndār), who is appointed by the Minister of the Interior subject to approval of the cabinet.

The structure of provinces of Iran has changed a number of times in recent history. Until 1950, Iran was divided into twelve provinces: Ardalan, Azarbaijan, Baluchestan, Fars, Gilan, Araq-e Ajam, Khorasan, Khuzestan, Kerman, Larestan, Lorestan, and Mazandaran. In 1950, there was a reorganization to form ten provinces with subordinate governorates: Gilan, Mazandaran, East Azarbaijan, West Azarbaijan, Kermanshah, Khuzestan, Fars, Kerman, Khorasan, and Isfahan. Between 1960 and 1981, several governorates were raised to provincial status one by one, which has resulted in the creation of several new provinces. The most recent one was the division of Khorasan into three new provinces in 2004.

Each province or Ostan is further subdivided into counties or شهرستان (shahrestān), and each shahrestan is then subdivided into districts or بخش (bakhsh). Each county usually consists of few cities or شهر (shahr) and some rural agglomerations or دهستان (dehestān) which are a collection of a number of villages. According to the Statistical Center of Iran, as of the end of Iranian Calendar year

1383 (March 2005), Iran has 30 provinces, 324 counties, 865 districts, 982 townships, and 2378 rural agglomerations.

Due to the limited availability of data, this study covers the Iranian Calendar years of 1379-1382 (approximately 2000-2004) when Iran had 28 provinces. The only difference since then has been the split of province of Khorasan into three new provinces in 2004. Please refer to Table 10 for more information on provinces of Iran during the Iranian Calendar years of 1379-1382.

Table 10. GRDP and population data of Iranian provinces for years of 1379, 1380, 1381, and 1382

	GDP at market prices				Contribution to GDP				Share of total population			
	1382	1381	1380	1379	1382	1381	1380	1379	1382	1381	1380	1379
Country total	1198390	986269	745536	645256	100	100	100	100	100	100	100	100
Tehran	309426	255350	193374	155793	25.8	25.9	26	24.14	17.6	17.8	17.8	17.66
Khuzestan	161069	140840	96451	90133	13.4	14.3	13	13.97	6.3	6.9	6.8	6.66
Esfahan	75051	57653	45409	40195	6.3	5.8	6.1	6.23	6.5	6.6	6.6	6.55
Khorasan	73330	59928	47252	40238	6.1	6.1	6.3	6.2	9.6	9.2	9.4	9.6
Fars	54236	43227	32224	27371	4.5	4.4	4.3	4.24	6.4	6.3	6.3	6.33
E. Azarbayejan	45691	39378	30287	26363	3.8	4	4.1	4.09	5.2	5.2	5.2	5.28
Mazandaran	43483	35323	27541	22336	3.6	3.6	3.7	3.46	4.2	4.2	4.2	4.24
Kohgiluyeh	41546	36835	30731	32595	3.5	3.7	4.1	5.05	1	1	1	0.94
Bushehr	37459	15039	9501	7079	3.1	1.5	1.3	1.1	1.2	1.2	1.2	1.23
Kerman	29679	25310	20300	21011	2.5	2.6	2.7	3.26	3.5	3.4	3.4	3.36
Gilan	28078	23778	18548	16080	2.3	2.4	2.5	2.49	3.6	3.5	3.6	3.59
Markazi	27152	23370	19182	14725	2.3	2.4	2.6	2.28	2	2	2	2
W. Azarbayejan	24645	20453	16243	14495	2.1	2.1	2.2	2.25	4.3	4.2	4.2	4.21
Hormozgan	21970	17642	14630	11712	1.8	1.8	2	1.82	1.9	1.9	1.9	1.85
Kermanshah	17792	14356	10721	9000	1.5	1.5	1.4	1.39	2.9	3	3	2.99
Hamedan	18131	15800	11543	9364	1.5	1.6	1.6	1.45	2.6	2.6	2.7	2.68
Qazvin	17261	14216	12339	10558	1.4	1.4	1.7	1.64	1.7	1.6	1.6	1.62
Golestan	16847	14207	10465	9377	1.4	1.4	1.4	1.45	2.4	2.4	2.4	2.38
Lorestan	15274	12551	10466	8886	1.3	1.3	1.4	1.38	2.6	2.6	2.6	2.58
Yazd	14507	12140	9511	7545	1.2	1.2	1.3	1.17	1.4	1.4	1.3	1.27
Sistan	13191	11073	8740	7295	1.1	1.1	1.2	1.13	3.2	3.2	3.1	3.08
Ardebil	12492	10246	7884	6879	1	1	1.1	1.07	1.9	1.8	1.9	1.87
Qom	11779	10083	8136	6766	1	1	1.1	1.05	1.5	1.5	1.5	1.46
Kordestan	12118	9853	7203	6414	1	1	1	0.99	2.3	2.3	2.3	2.27
Zanjan	10532	8279	6315	5900	0.9	0.8	0.9	0.91	1.4	1.4	1.4	1.45
Semnan	9211	7187	5800	4819	0.8	0.7	0.8	0.75	0.9	0.9	0.9	0.85
Chaharmahal	7694	6184	4985	4066	0.6	0.6	0.7	0.63	1.2	1.2	1.2	1.23
Ilam	6294	7849	5667	3967	0.5	0.8	0.8	0.61	0.8	0.8	0.8	0.83
Supraregion	42457	38123	24087	24297	3.5	3.9	3.2	3.77	-	-	-	-

Theory and Specifications

Our methodology generally follows Garcia Pires (2006), unless mentioned specifically otherwise. Paper uses (Greene, 2003; Wooldridge, 2003) as the general for econometric references. The first model is a market potential function (MPF), which comes from a line of theory based on Harris (1954). The second model is

based on the Krugman (1993) multi-region version of Krugman's (1991) model. Since the economic theory underlying these models is beyond the scope of this paper, we simply discuss the salient features of the models and present them in an estimable form.

The MPF model captures the idea that distance acts as a barrier to trade. After taking into account the barriers of distance, the "market potential" is the total amount of trade between all regions that might take place. By assuming that wages would be proportional to the market potential, using exponential decay as the functional form of the distance barrier to trade, and taking logs, we find Equation 1. In Equation 1, θ is a scale parameter and α and β are the model parameters. The income (GDP) of region j is Y_j , w_i is the wage of region i , and d_{ij} is the distance between regions i and j . The only strict theoretical restrictions are that α and β should be positive, indicating that wage and market potential are positively related, and that trade drops off with distance, respectively. Equation 1 is a standard empirical MPF in the literature.

$$(1) \quad \log(w_{it}) = \theta + \alpha \log \left(\sum_{j=1}^N Y_j \exp(-\beta d_{ij}) \right) + \varepsilon_{it}$$

In the Krugman model, forces for the agglomeration and dispersion of economic activity act in concert to produce the observed economic geography. The Krugman model considers a homogeneous and a differentiated good, which are often interpreted as agricultural and manufactured goods, respectively. In the model, "peasants" are fixed in place while "workers" can move from one region to another. Workers, who are paid the marginal product of their work, are drawn together to benefit from higher wages that result from economies of scale. They are pushed apart

by the downward wage pressures of increased competition. We estimate a form of the Krugman model given in Equation 2, where θ is again a scale parameter, σ represents inverse economies of scale, μ is the fraction of income spent on manufactured goods, and τ is a trade cost index. In addition, we report $\sigma/(\sigma - 1)$ and $\sigma(1-\mu)$, because they have the interpretations of nationally increasing returns to scale in manufacturing and strong agglomeration forces.

$$(2) \quad \log(w_{it}) = \theta + \sigma^{-1} \log \left(\sum_{i=1}^N Y_{jt} w_{jt}^{\mu} \exp(-\tau(\sigma-1)d_{ij}) \right) + \varepsilon_{it}$$

One important econometric issue is that wages and GDP are jointly determined which could lead to endogenous variable biases. To attempt to control for this, we estimate several different specifications. In particular, we estimate time-differenced versions of Equations 1 and 2, which are given in Equations 3 and 4, respectively.

$$(3) \quad \log\left(\frac{w_{it}}{w_{it-1}}\right) = \alpha \left[\log\left(\sum_{i=1}^N Y_{jt} \exp(-\beta d_{ij})\right) - \log\left(\sum_{i=1}^N Y_{jt-1} \exp(-\beta d_{ij})\right) \right] + \varepsilon_{it}$$

$$(4) \quad \log\left(\frac{w_{it}}{w_{it-1}}\right) = \sigma^{-1} \left[\log\left(\sum_{i=1}^N Y_{jt} w_{jt}^{\mu} e^{-\tau(\sigma-1)d_{ij}}\right) - \log\left(\sum_{i=1}^N Y_{jt-1} w_{jt-1}^{\mu} e^{-\tau(\sigma-1)d_{ij}}\right) \right] + \varepsilon_{it}$$

To avoid the potential issue of technological or other shocks that disproportionately hit the largest areas; we estimate the models with and without the provinces of Tehran and Khuzestan, which are the two regions with the highest Gross Regional Domestic Product (GRDP) with a substantial gap to the third region. Table

10 shows the significant difference between these two provinces and other provinces in the country.

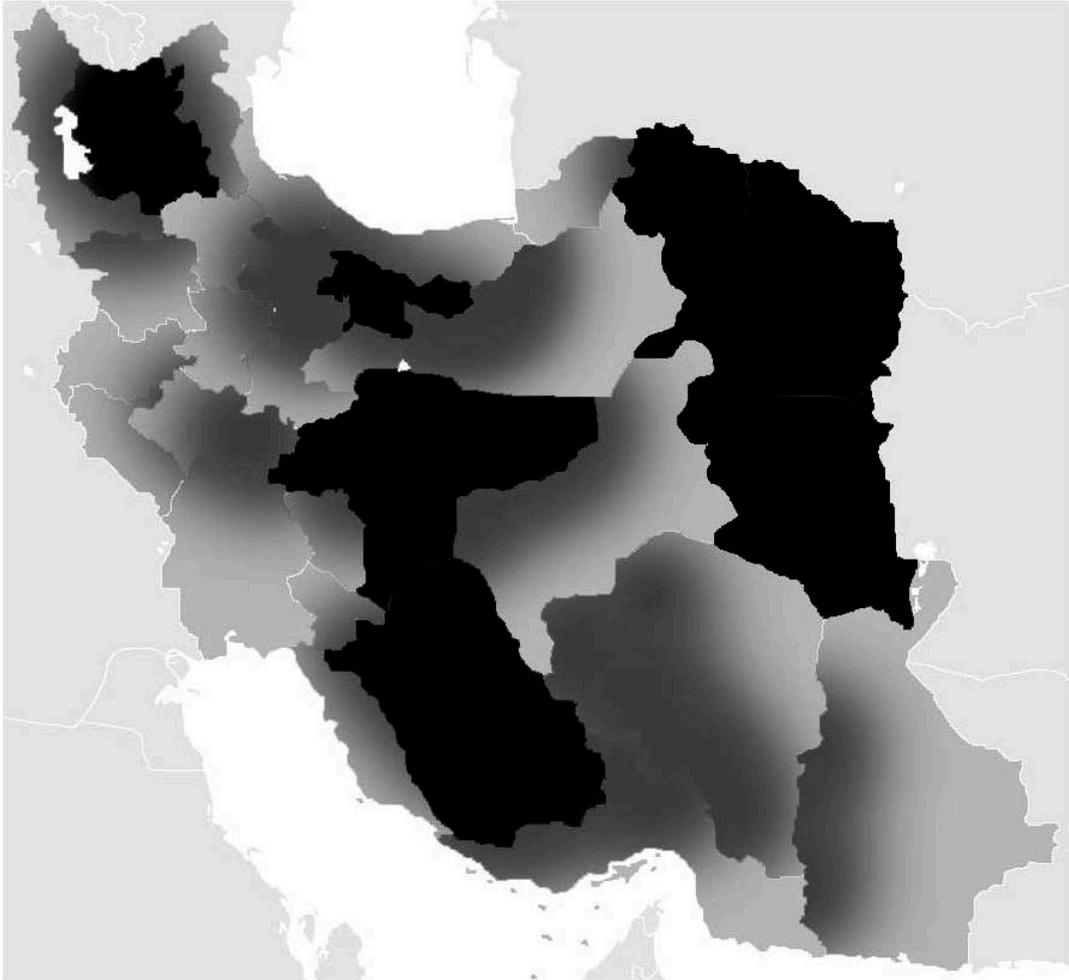
To estimate how goods move around the country, we use three different measures of distance: simple distance, ‘hub and spoke’ (HAS), and extreme hub and spoke. In simple distance, the distance between any two provinces is simply the distance between the capital cities of each. In hub and spoke distance, there are five “hub” provinces, selected based on their higher GRDP than other provinces and their central geographical location, between which all trades must pass (Table 11 and Figure 3).

Table 11. Hubs and Spokes in HAS distance analysis

Hub	Spoke
Tehran	Tehran Mazandaran Gilan Semnan Qom Markazi Hamadan Qazvin Zanjan
Esfahan	Esfahan Yazd Chaharmahal Bakhtiari Lorestan Kermanshah Ilam
East Azarbayejan	East Azarbayejan West Azarbayejan Ardebil Kordestan
Fars	Fars Bushehr Khuzestan Kohgiluyeh & Boyerahmad Kerman Hormozgan Sistan & Baluchestan
Khorasan	Khorasan Golestan

Figure 3. Spatial distribution of Hubs and Spokes in HAS distance analysis

Spokes further from their Hub
Spokes directly near by their Hub
Hubs (Tehran, Esfahan, East Azarbayejan, Fars, and Khorasan)
Shadings are illustrative and not depicting the exact relations.



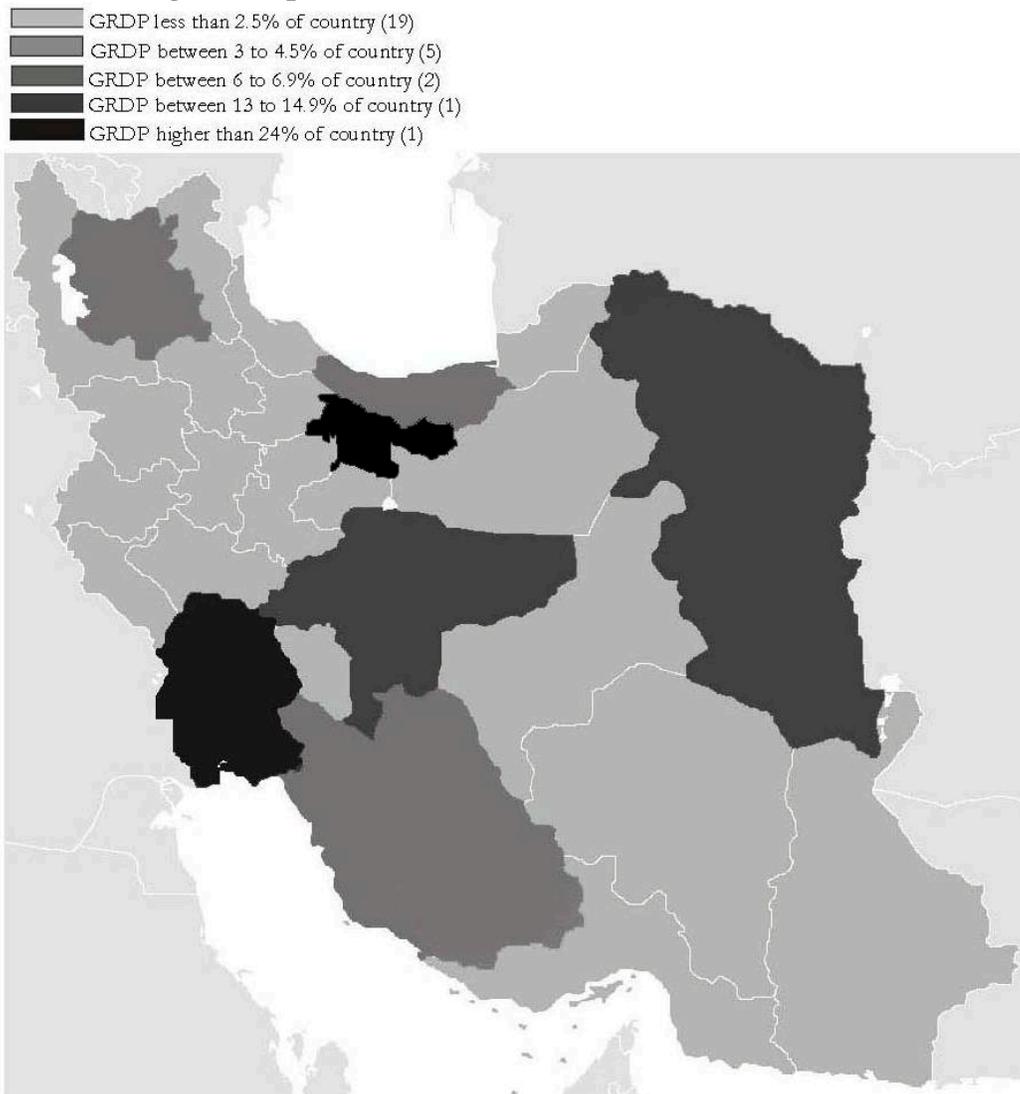
That is, to trade between two outlying provinces, goods are transported from one Ostan to its hub, from that hub to the destination Ostan's hub, and on to the destination Ostan. Finally, the extreme HAS distance supposes that all trade between outlying provinces passes through Tehran with the assumption that most storage and managing facilities are agglomerated in Tehran.

By seeing to what extent each of the distance measurements result in better empirical fits, we can learn something about trade patterns within Iran. However, our ability to do this might be limited by the overall relevance of distance to trade. To cope with this issue, Hanson (2005) uses a categorical variable for distance that takes only a few values. Though we hope to gain policy insights by using more exact distance measures, the exact distance level may not directly matter. Apart from the mentioned econometric problems with endogenous variables and high nonlinear modeling, there is an additional problem with identification of the parameters. For example, in the MPF model, θ and α are not identified when β equals zero as well as β is not identified if α equals zero.

Analysis and Results

The distance data used in this study are provided by the ‘Iran National Cartographic Center’, all other data are provided by the ‘Statistical Center of Iran’. All data used are available for public use from both centers without mentioned restrictions.

Figure 4. Spatial distribution of GRDPs, all Provinces - 1382



To fit the data, we use GRDP (Figure 4) and non-farm wages (Figure 5) in units of effective farmer production, as well as the several distance measures discussed above. Note that in addition to controlling for the difference in farm wages across Iran, using a relative unit of wages and income also might play as an automatic control for inflation, which is relatively large in Iran.

Figure 5. Spatial distribution of Urban Wages, all Provinces - 1382



For time-differenced estimation, we difference each year and the previous year. While differencing allows us to control for some persistence in wage differences, there are costs to differencing as well. Instead of using the full cross-sectional variation in wages and GDP, differencing limits itself to considering the effects on wages of a change in GDP. It fails to take full advantage of the information in the magnitudes of wage and GDP for each period, thus wasting some of our limited information. Since differencing the data loses a significant amount of

information in the data, and since we have only data from 28 provinces per year, the benefit of controlling for persistence in wage shocks over time is at least partially offset by the loss in accuracy.

Since Equations 1 to 4 are nonlinear, we use nonlinear least squares (NLS) to compute parameter estimates. Since NLS estimation must be done by iteration, we chose the Gauss-Newton algorithm for optimization. Because Gauss-Newton sometimes fails to converge, we tested over 1000 different starting parameter estimates for every combination of year, distance measure, set of provinces, and equation. Considering the optimization effort made, the instance of failure to converge has been optimized to the best possible solution and has happened only in one year scenario.

As shown in the final results (Table 12 and Table 13), the instances with a lack of convergence has happened only for one year in the case of extreme HAS analysis scenario. This instance might be interpreted as a sign of a poor fit between the model used in this specific scenario and our data. Alternatively, it could be due to a lack of identification as a result of inadequate information in the data to identify the model used in this scenario, particularly in the differenced data, where there is little variation.

Table 12. Market Potential Function results, 26 Provinces

MPF	Simple distance analysis			
	1379	1380	1381	1382
θ	-6.1657* (1.9725)	-7.0666* (1.9718)	-5.1328* (1.5706)	-8.0743* (2.4129)
α	0.51312* (0.1143)	0.56285* (0.1161)	0.4545* (0.0931)	0.61997* (0.1386)
β	0.0156 (0.0084)	0.0219 (0.0121)	0.0373 (0.0455)	0.0127* (0.0047)
R^2	0.4558	0.5061	0.5438	0.5253
	HAS distance analysis			
θ	-5.4658* (1.8272)	-7.2889* (1.8964)	-5.5173* (1.5209)	-6.2672* (1.7947)
α	0.47538* (0.1082)	0.57347* (0.1113)	0.47748* (0.0905)	0.51988* (0.1074)
β	0.0204 (0.0166)	0.0103 (0.0054)	0.0374 (0.0427)	0.0213 (0.0179)
R^2	0.4462	0.5146	0.5454	0.4853
	Extreme HAS distance analysis			
θ	-1.1102 (29.5740)	-6.641* (2.0246)	-5.6083* (1.5794)	-7.418* (2.2746)
α	0.1469 (1.4541)	0.5382* (0.1190)	0.48278* (0.0933)	0.58236* (0.1316)
β	-0.0025 (0.0237)	0.0088 (0.0051)	0.0122 (0.0150)	0.00574* (0.0017)
R^2	0.0322	0.4944	0.5447	0.5069

Standard errors are in parentheses.

* shows statistical significance.

Table 13. Krugman results, 26 Provinces

Krugman	Simple distance analysis			
	1379	1380	1381	1382
θ	-1.9882* (0.3958)	-2.0832* (0.4157)	-2.1727* (0.4413)	-2.0979* (0.4475)
σ	7.3263* (1.4427)	7.0287* (1.3914)	6.558* (1.2910)	6.9719* (1.4600)
μ	0.98121* (0.0318)	0.97999* (0.0310)	1.0061* (0.0387)	0.97469* (0.0350)
τ	0.0167* (0.0093)	0.0165* (0.0035)	0.00888* (0.0011)	0.00846* (0.0010)
$\sigma/(\sigma-1)$	1.1581* (0.0360)	1.1659* (0.0383)	1.1799* (0.0418)	1.1675* (0.0409)
$\sigma(1-\mu)$	0.1376 (0.2317)	0.1407 (0.2165)	-0.0402 (0.2543)	0.1765 (0.2408)
R^2	0.9793	0.9820	0.9776	0.9804
	HAS distance analysis			
θ	-2.0492* (0.4002)	-2.12* (0.4223)	-1.2791* (0.2515)	-2.042* (0.4152)
σ	7.2286* (1.3948)	6.8749* (1.3531)	11.274* (2.2310)	7.1036* (1.4316)
μ	0.97017* (0.0319)	0.98242* (0.0292)	0.99466* (0.0197)	0.98189* (0.0312)
τ	0.00947* (0.0007)	0.00947* (0.0018)	0.00754* (0.0010)	0.00790* (0.0015)
$\sigma/(\sigma-1)$	1.1605* (0.0360)	1.1702* (0.0392)	1.0973* (0.0211)	1.1638* (0.0384)
$\sigma(1-\mu)$	0.2156 (0.2279)	0.1208 (0.1995)	0.0602 (0.2228)	0.1287 (0.2211)
R^2	0.9807	0.9829	0.9919	0.9811
	Extreme HAS distance analysis			
θ	NC	-2.1443* (0.4283)	-2.0716* (0.4169)	-2.0224* (0.4005)
σ	NC	6.9123* (1.3672)	6.7414* (1.3244)	7.2204* (1.4196)
μ	NC	0.9698* (0.0310)	1.0201* (0.0388)	0.97608* (0.0323)
τ	NC	0.00338* (0.0004)	0.00431* (0.0011)	0.00445* (0.0006)
$\sigma/(\sigma-1)$	NC	1.1691* (0.0391)	1.1742* (0.0402)	1.1608* (0.0367)
$\sigma(1-\mu)$	NC	0.2088 (0.2103)	-0.1357 (0.2602)	0.1727 (0.2321)
R^2		0.9823	0.9764	0.9813

Standard errors are in parentheses. * shows statistical significance.

In the following paragraphs, we discuss general conclusions that can be drawn from the diverse specifications that we used. For each model, we discuss whether parameter estimates were consistent with the theory, reproducible over time, or robust to different versions of each model. We also look qualitatively at convergence across model versions to see which fit the data better.

The single period MPF model (Table 12) was consistent with the data. Single period specifications yielded measures of α that were in the neighborhood of 0.5 and easily statistically greater than zero in accordance with theory. Measures of β were generally in the 0.01 to 0.04 inverse kilometer range, and also significantly greater than 0. The parameter β can be interpreted as the drop off in economic relationships. Our values in the range of 0.01 to 0.04 indicate that economic interaction drops by approximately two thirds for every 25 to 100 km separating two Ostans. Of course, for β much larger than our values, the market potential function drops to zero too quickly. Therefore, our values of β appear to be reasonable. The extreme HAS specification had a harder time fitting the model, though when NLS did converge its results were similar to those of simple distance and standard HAS. Generally, using all provinces and dropping Tehran and Khuzestan, as the highest GRDPs with a significant gap to the rest of the provinces, made little difference. This indicates that the extreme observations associated with the largest centers are not affecting parameter estimates.

The time differenced MPF model performed reasonably well, but was sometimes unable to converge due to limited information. This result is quite intuitive and appealing. By differencing between some sets of years, too much

information was lost and convergence was unattainable. However when convergence was achieved, parameter estimates were more accurate than the single period estimates, suggesting that differencing was a successful control. The time differenced MPF model produced α estimates that were generally around 1.0, while the β estimates were broadly similar to those of the single period model.

Throughout our MPF analysis, there was no reason to question the underlying MPF model's applicability. In general, our estimates are roughly similar to those of the many MPF studies quoted in Garcia Pires (Garcia Pires, 2006), though we generally estimate higher α values and will discuss this in more detail in the conclusion.

The single period Krugman (Table 13) converged less successfully than the single period MPF, though it was somewhat better when omitting Tehran and Khuzestan. This suggests that influential observations of these provinces had a larger effect on the structural parameters of the Krugman model. Parameter estimates for μ were either implausibly high or outside of allowed theoretical ranges, suggesting that the Krugman model does not describe the data perfectly. When the regressions did converge, they tended to find σ around 7 and τ roughly between .008 and .015 with reasonable consistency. Since μ was not estimated accurately, it is not possible to accurately discuss the estimates of $\sigma(1-\mu)$. Note that this is a common problem throughout the empirical literature; it has been difficult to estimate μ accurately in other papers as well. The estimates of $\sigma/(\sigma-1)$ were around 1.15, and statistically greater than 1, implying increasing returns to scale for Iranian manufacturing. Our estimates were a little lower than those reported in Garcia Pires (Garcia Pires, 2006),

suggesting that returns to scale might be smaller in Iran than the western countries surveyed (Table 14). Though simple distance and HAS measurements were reasonably successful, the extreme HAS specification fit the data poorly.

Table 14. Overview of results from similar studies

Paper	Country	α	β	$\sigma / (\sigma - 1)$
Paluzie et al. (2005)	Spain	0.083* to 0.139*	0.077* to 0.102*	NA
Hanson (2005)	USA	0.24* to 0.43*	Not Comparable	1.6* to 2.3*
Brakman et al. (2004)	Germany	0.049*	0.092*	1.25 to 1.48*
Roos (2001)	W. Germany	0.02* to 0.08*	0.03* to 0.12*	1.19
De Bruyne (2002)	Belgium	0.26*	0.65*	1.22
Garcia Pires (2006)	Spain	0.08* to 0.24*	0.008* to 0.032*	1.23* to 1.3*
This Paper	Iran	0.48* to 0.62*	0.01* to 0.02*	1.14* to 1.15*

The differenced Krugman model also had estimated parameters less accurately than the single period analog. This could be expected, again, due to the informational cost of differencing. When the estimates converge the time differenced model yields estimates of σ that are around 3, which is significantly lower than in the single period model. The differenced Krugman model could not estimate τ very accurately, particularly in the model variations that exclude Tehran and Khuzestan. When estimated significantly, τ ranges from .003 to .04. Since σ is lower in the differenced model, $\sigma / (\sigma - 1)$ is correspondingly higher, ranging from 1.3 to 1.5, though often estimated with less precision. Again, the extreme HAS model performs less well, though the difference is not as stark as in other model versions.

Our estimates of parameters in the Krugman and MPF models tend to be significant, particularly when not considering the extreme HAS distance versions. They are broadly qualitatively similar to the estimates of (Garcia Pires, 2006) for

Spain and (Hanson, 2005) for the United States, though with some differences which could point to differences between Iran and the other western countries.

Conclusions

Data from the provinces of Iran showed generally good fit to both models as discussed above, and satisfied both MPF and Krugman models' specifications. This could be interpreted to mean that the provinces of Iran are generally subject to notions of 'New Economic Geography' and exhibit spatial wage structure. Since the theoretical models hold, wages in a province do seem to be endogenously determined by workers choosing to move in order to maximize their effective wage. Distance also seems to affect wages, as they tend to be higher in regions closer to larger markets. In general, our results confirm Harris (1954) market potential hypothesis and similar studies, since in the Iranian provinces nominal wages are positively correlated with the distance-weighted sum of personal income in surrounding regions.

Based on this fit of Iranian data to the NEG model, agglomeration of Iranian industry is promoted when economies of scale are strong, trade costs are low, and people spend a large portion of their income on manufactured goods. The economies of scale encourage Iranian firms to concentrate production in a few central city locations in order to exploit scale gains. Low trade and transportation costs allow firms to serve remote markets from central locations while demand patterns biased for industrial goods support larger agglomerations of firms.

Also as mentioned earlier, in comparing our three different approaches to measuring distance, the Extreme HAS approach was much less able to converge

which might suggest that Tehran does not act as a universal hub for Iran. The convergence of the other two approaches was successful and close in the results, which might suggest that trade in Iran, happens in both patterns. However, σ did not show significant differences between three approaches which might suggest we cannot make a conclusive statement in comparing the three patterns.

Another finding was that the estimates of $\sigma/(\sigma-1)$ were lower than those reported in other NEG empirical literature (Table 14), suggesting that returns to scale might be smaller in Iran than the western countries surveyed. This might be a result of the nature of the technologies used in the non-farm private sector in Iran, which is potentially less industrial and more traditional. This would suggest that by dispersion and decentralization of industry Iran would have a level of loss due to a reduction in economy of scale but such loss would be potentially less than the loss that western countries would face through similar policies. It could be said that if Iran wants to decentralize its industry, it would be better off to do so while the nature of its industry allows for less loss. However, it should be noted that the Krugman model is a static model, and when talking about policies a dynamic view would be more accurate.

We also found significantly and consistently higher α values in comparison to similar analyses of other countries (Table 14). Since α can be interpreted as the size of the effect of market potential on wages, our estimates suggest that Iranian wage levels are more strongly related to geographic market potential. Since the countries that are cited in this paper are rich, developed countries (US, Japan, Germany, Spain, Italy, and Belgium), this is an intriguing result.

One possible interpretation of this might be to suggest that Iran has a more distance-sensitive trade structure than those other countries. The distance sensitivity might be a result of several factors. First, the transportation system between provinces in Iran may be less developed than in those other countries, which enhances the effect of distance on trade. Second, Iran is a highly mountainous country with a very diverse geography. This might have direct effect on the development of transportation systems between provinces.

The overall result of this study corroborates the notion of centralization in the Iranian economy. Industry, trade, and workers all have incentives to agglomerate in larger cities and especially in Tehran to benefit from economies of scale in the form of higher wages and profits. The large wage variations explained by economic geography could cause significant internal migration, beyond that seen in western countries. Indeed, significant internal migration has been observed in Iran in past years.

The size of the effect of market potential on wages in Iran confirms the need for improvement in the transportation sector between provinces. By improving transportation, it is possible to decrease the effective distances across Iran. To the extent that lower effective distance decreases the effects of economic geography, improved transportation could serve to equalize wages throughout the country & decrease incentives for destabilizing internal migration.

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