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How Mobile Phones Can Spark an Entrepreneurial Revolution

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How Mobile Phones Can Spark an Entrepreneurial Revolution

The Effect of Mobile Phone Networks on Entrepreneurial Activity in Developing and
Developed Countries

by

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Submitted to Scripps College in Partial Fulfillment of the Degree of Bachelor of Arts

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Abstract

In the last decade, there has been an exponential rise in mobile phones in both developed and developing countries. In light of that, this paper investigates whether the expansion of such mobile networks leads to increased entrepreneurial activity. By conducting panel regressions, I find the degree to which various stages of entrepreneurial activity is affected by increased mobile phone subscription rates. I use data from 80 countries from 2007 to 2015 and parse out the different effects between developing and developed countries, and between males and females. I find that larger mobile networks encourage entrepreneurship, particularly in the early stages, with a larger benefit experienced by developed countries compared to developing countries. In addition, more females than males engage in early-stage entrepreneurship due to increased mobile phone subscription rates in developing countries. However, an opposite trend is observed in developed countries. Finally, I also consider potential implications on economic development as a result of such increased business formation.

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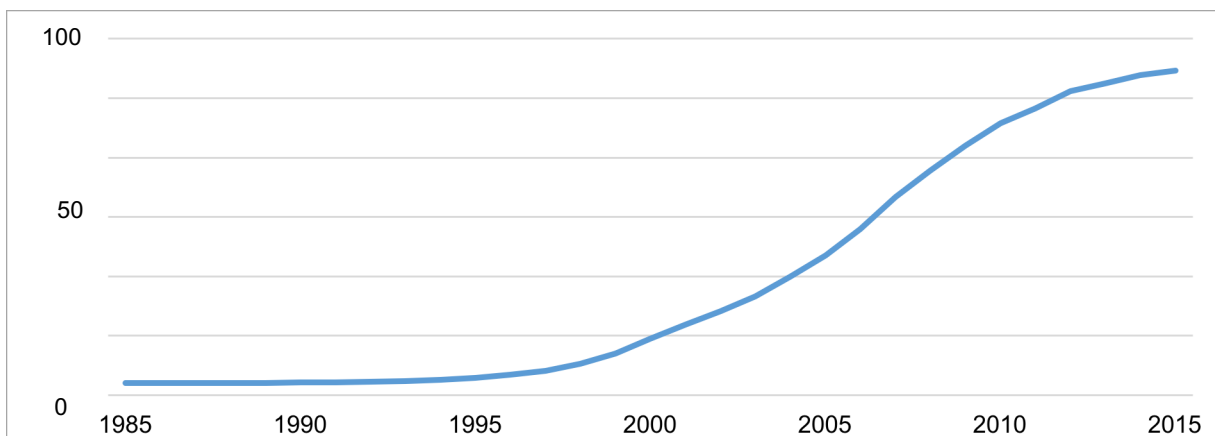
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I. Introduction

Traffic in Indonesia is notorious for being unmanageable. As a result, motorcycles are one of the most efficient ways to travel in the country. This led to the creation of a ride-hailing mobile application for motorcycles, similar Uber, called Go-Jek. While this may seem like a spin-off, Go-Jek has seen exceptional growth. They recently closed a \$550 million round of funding, bringing them to a \$1.3 billion valuation (Russell, 2016). Increasingly, startups in developing countries are leveraging the mobile phone network. Namely, Indonesia has grown exponentially to be the third largest smartphone market in Asia Pacific (Indonesia Investments, 2016). Such rapid growth has been observed in other developing countries and across the globe, as shown in Figure 1. This has led to such an increased penetration of mobile phones, where three-quarters of the world's population has access to mobile phones (World Bank, 2012). The number of mobile subscriptions in use worldwide, both pre-paid and post-paid, has grown from fewer than 1 billion in 2000 to over 6 billion now, of which nearly 5 billion in developing countries (World Bank, 2012). Ownership of multiple mobile subscriptions is becoming increasingly common, suggesting that their number will soon exceed that of the human population (World Bank, 2012).

Figure 1: Global Mobile Subscription Rates (per 100 people) from 1985 to 2015



(Source: World Bank)

This leads to the question of whether the increased mobile phone adoption and expansion of its network is responsible for the jump in entrepreneurial activity. The current literature has focused on specific case studies and anecdotes, or qualitative assessments of how mobile phones have impacted developing countries in particular. This is the first paper that takes a quantitative regression-based approach to analyze the impact of mobile phones on entrepreneurial activity using data from a total of 80 developing and developed countries. Moreover, the difference in the magnitude of the effect between developing and developed countries is also investigated. This paper draws on data from the Global Entrepreneurship Monitor (GEM) an World Bank, and uses econometrics methods to run regressions on an unbalanced panel data set. Through this process, this paper will also look at the effect of other key factors affecting entrepreneurship, such as *fear of failure* or supporting *government policies*.

The paper hypothesizes that the presence of a pervasive mobile network in a country can help promote the formation of new businesses and self-employment. In fact, this has a ripple effect where many of the startups taking advantage of the mobile platform are creating freelancing opportunities, which creates more opportunities for individuals to pursue starting their own ventures.

Through my investigation, I find that the rise in mobile phone subscriptions lead to an increase in entrepreneurial activity, namely in the early stages when a venture is formed and is not paying salaries and wages, or paying for less than 42 months. However, I found that developing countries benefit less from larger mobile networks, compared to developed countries. I also found that there is a smaller effect on entrepreneurial activity of females, compared to males in developing countries, but an opposite effect in developed countries.

This paper provides insight on the importance of establishing a mobile phone network in developing countries, and boosting it in developed countries. The benefits of the mobile phone

network infrastructure on the formation of new businesses, and potentially economic development, has policy implications to promote the expansion of the mobile phone network.

II. Literature Review

The function of entrepreneurship on economic development has been described in previous literature as playing an important role to increase efficiency, competition and product innovation (Hall, 2007). Compared to other economic interventions, entrepreneurship is better able to encourage community-based economic development. Instead of top-down strategies imposed by governing bodies, individuals who form their own businesses are able to understand and create benefits directly for their host location (Desai, 2009). Furthermore, entrepreneurship is able to offer a low-cost yet high impact option of economic development with an immediate effect. Compared to initiatives to build hard infrastructure such as transportation networks, individuals starting their own ventures creatively use existing resources available to meet the current needs of a community. Lastly, entrepreneurship has a cascade effect on reducing unemployment. It creates an employment opportunity and income for the entrepreneur, and additional jobs and financial benefits for others as it grows.

In developing countries, such as Nigeria, Egypt, and Indonesia, micro-entrepreneurs generate 38 percent of the gross domestic product (Neumark, Wall & Zhang, 2011). Analysis of time-series data has demonstrated that small businesses create a disproportionate share of new jobs (Neumark, Wall & Zhang, 2011). By generating new ideas, business models, and new ways of selling goods and services, small businesses contribute to its country's economic development.

Hence, this literature review establishes a background in entrepreneurship and potential factors that affect it. I then delve specifically into the influence of mobile phone networks. Lastly, I consider its implications on economic development.

A. Definitions of Entrepreneurship

There are several definitions of the term 'entrepreneurship.' The three main conceptual approaches are outlined by Naude in the United Nations Policy Brief (Naude, 2011). The first concept is the functional definition, which includes any actors who make decisions on areas including investment, production and innovation. Hence, this definition includes managers of multi-national firms. The second concept defines an entrepreneur more specifically as one who is making an economic contribution and is innovating within an owner-operator firms, state owned firms' joint ventures and subsidiaries of multinationals. Lastly, the third definition takes a narrower focus on owner-operated enterprises. In this case, the owner is also actively running the business, which includes small and medium-sized enterprises (SMEs), startups and self-employment.

This paper focuses on the third definition of owner-operators, since the formation of owner-operator businesses has been shown to be a key factor in promoting economic development. The Policy Brief by United Nations, *Innovation and Entrepreneurship in Developing Countries* explains that SMEs in both advanced and developing countries are important drivers of economic development. This is because SMEs employ a substantial number of people in developing countries. Naude has also synthesized past research that showed such entrepreneurship is a main vehicle of economic development (Naude, 2011).

Within owner-operators entrepreneurs, they are further split into two groups, depending on whether they have paid salaries or wages to employees for more than three months, as outlined in the Global Entrepreneurship Monitor database indicators. For entrepreneurs who are not paying salaries or wages, they are categorized as nascent entrepreneurs, while entrepreneurs who pay salaries or wages¹ are considered new business owners (which can include both incorporated and unincorporated businesses). Thus, nascent entrepreneurs give

¹ This does not include payments to outsourced workers, but includes wages to contract workers.

an indication of individuals involved in an earlier stage of entrepreneurship, since individuals are typically not paid in the early stages, while new business owners indicate individuals in a later stage. For a comprehensive view, this paper looks at both types of entrepreneurs of owner-operators, in both stages of paying and not paying salaries or wages.

Within the category of owner-operators of entrepreneurs, entrepreneurs can be further categorized into three dichotomies that are particularly relevant for developing countries. The first is the distinction between formal and informal entrepreneurship, which is whether a firm has been registered with an appropriate government body and is authorized to do business (Banerjee & Duflo, 2011). The size of informal labor force varies, but can reach more than fifty per cent in certain countries (Ács, 2015). In many developing countries, there are few incentives for entrepreneurs to participate in the formal sector, especially if they operate on a small scale. Entrepreneurs have to weigh the tradeoff between regulatory disadvantages such as taxes, and formalization advantages, such as better access to export markets (Schneider and Enste, 2000).

Lastly, there is a distinction between necessity and opportunity entrepreneurship. This determined by the motivation to work. Necessity entrepreneurs engage in entrepreneurship to avoid unemployment, while opportunity entrepreneurs pursue a recognized opportunity for profit (Reynolds et al. 2002). Necessity entrepreneurs make up an important part of the total set of entrepreneurs in developing countries compared to developed countries. For example, rates of necessity entrepreneurship for Brazil, Argentina, India and Chile ranged between 6.5 per cent and 7.5 per cent in 2002, compared to 0.33 per cent and 0.43 per cent in Denmark and Finland, respectively (Cowling and Bygrave 2002).

These definitions are important to consider as my study eventually focuses on the definition of entrepreneurs as owner-operators, due to their contribution to economic development and importance in developing countries. With a significant share of

entrepreneurship in developing countries in the informal sector, it is crucial to include such activity in my data. In addition, I study the potential effects mobile phone networks have on necessity entrepreneurship, in contrast to opportunity entrepreneurship.

B. Factors affecting Entrepreneurial Activity

After defining entrepreneurship, I consider the factors that affect such entrepreneurship activity. Key factors were identified using Krueger and Brazeal's simplified model of entrepreneurial potential based on Azjen's theory of planned behavior and Shapero's model of entrepreneurial event (Krueger and Brazeal 1994).

Azjen's theory of planned behavior provides insight into analyzing factors that affect an individual's intentions to take certain actions. Azjen finds three principal attitudes that guide an individual's intentions: personal attitude toward the act, social norms regarding the act, and the individual's perception of the self's capabilities to carry out the act (Azjen, 1985). This suggests that even with a positive perception of a certain act, an intention may not be formed if social norms are in conflict.

On the other hand, Shapero's model of entrepreneurial event takes a narrower focus of identifying the factors that play into an individual engaging in entrepreneurial activity. Two of the three factors that Shapero suggests are similar to Azjen's theory of planned behavior: the desirability and feasibility of entrepreneurship (Krueger and Brazeal 1994). The desirability of entrepreneurship aligns with Azjen's social norm factor, emphasizing the importance of societal perceptions on entrepreneurial activity (Krueger and Brazeal 1994). Feasibility of entrepreneurship takes several dimensions, including personal capabilities and external factors such as infrastructure, availability of funding, government support, and regulations (Krueger and Brazeal 1994). The last factor that Shapero looks at is the propensity to act. While Shapero examines it as a personality trait that is unique to certain individuals, Krueger and Brazeal point

out research suggesting that it is possible to develop these characteristics in individuals (Krueger and Brazeal 1994). In this paper, Azjen and Shapero's theories are integrated to create a framework of factors that influence entrepreneurial activity, as seen below.

1. Feasibility

- a. Funding. Is there ample and accessible capital to fund the new business?
- b. Government regulations and support. How do public policy and government programs create a conducive environment for businesses to be formed?
- c. Non-government support infrastructure. How well do other infrastructure factors promote entrepreneurship? This includes commercial, physical, and service, capital markets infrastructure.

2. Social desirability. How do social and cultural norms affect the perception of being an entrepreneur?

3. Personal Competence

- a. Skills. Does the individual have the necessary skill sets to confidently act on new business ideas?
- b. Education. Is there quality education available to foster entrepreneurship and necessary skills?
- c. Risk Taking Attitude. How strong is the fear of failure that prevents an individual from starting a business?

C. Influence of Mobile Technology Networks

Among the various factors influencing entrepreneurial activity, there have been rapid changes and growth to the ease and advancement of the communication and technological infrastructure, specifically due to the rise of the use of mobile phones (Audretsch & Thurik, 2001). The effect of mobile phones and the network infrastructure on entrepreneurial activity in

developing countries has been investigated in specific cases, such as in Africa and India. There has been little research of its general effects across different countries. Hence, this paper aims to further these specific investigations to shed a light on the overarching effects among developing countries.

According to previous literature, there are several ways in which mobile phones have been able to promote entrepreneurial activity. The main factors include: increasing access to capital and market information, facilitating mobile payments, extending access to potential customers, and empowering women and disadvantaged groups. Mobile phones provide a channel that help increase access to capital and facilitate mobile payments through digital finance technologies.

However, lack of access to capital is due to several factors on the supply side: a lack of infrastructure, government regulation and high management costs act as major barriers to entry. On the demand side, distances to bank branches, lack of awareness, social exclusion, cumbersome documentation and procedures, unsuitable products and language barriers act as the key hindrances (Karrer-Rueedi, 2011).

However, the development of digital finance technologies on mobile phones help transfer funds quickly and efficiently. This makes it easier for small and medium-sized businesses to sell their products, improving the efficiency of the marketplace and removing barriers to growth (Karrer-Rueedi, 2011). In India, 41 per cent of the population is unbanked and the number of loan accounts constituted only 14 per cent of the adult population (Karrer-Rueedi, 2011). However, new technologies have increased access and movement of funds. One example is the voice recognition technology developed by Uniphore, a Chennai based start-up. Their technology uses Voice Biometrics in vernacular languages to identify users (Karrer-Rueedi, 2011). Furthermore, customers' requests are recognized and answered in real time. This allows full transaction to take place over the phone. This is especially impactful with the

rise of mobile phones subscriptions in India. It has reached 65% of the total population in 2012 and is adding 20 million new subscribers every month (Karrer-Rueedi, 2011).

Mobile devices also increase the reach to potential customers as they help organizations serve broader geographic areas and increase the information reach. The organization sends agricultural workers daily SMS messages on commodity prices for farmers to determine the best places to sell their products. As a result, participants have been able to market fruits and vegetables over wider areas and earn higher incomes (*Women & Mobile: A Global Opportunity*, 2015).

Lastly, the mobile phones empower women and those less advantaged by increasing work and economic opportunities provided to the female work force. In a survey conducted by the GSMA Development Fund, 55 per cent of women around the world 'earned additional income due to owning a mobile phone,' and 41 per cent "increased their income and professional opportunities" (*Women & Mobile: A Global Opportunity*, 2015). One example is of the Self-Employed Women's Association in India includes 1.1 million workers who pool their resources to improve their bargaining power (West, 2014).

Thus, through qualitative studies, mobile phones have shown to influence entrepreneurial activity through several mechanisms. They provide infrastructure and act as a channel that increases reach to potential entrepreneurs and consumers. Hence, this leads to the question of whether this influence is demonstrated on a global basis in developing countries.

D. Economic Development Stages

We have seen that larger mobile phone networks can potentially encourage business formation and entrepreneurship. I will now examine how entrepreneurship affects economic development. While my empirical approach does not investigate this relationship, this effect is crucial in understanding the potential implications the increase in mobile phone networks have

on economic development through boosting entrepreneurial activity.

Previous studies have referenced economic development as an effect of entrepreneurship. This prompts a review of the way economic development is viewed and defined. An operational view is that economic development focuses on structural change (Syrquin, 1988). This consists of an accumulation of physical and human capital, and shifts in the sector composition of economic activity (production, employment, consumption). Theories on economic development distinguish between different 'stages,' implying discontinuities in development. Wennekers et al. (2005) summarized the three main stages of development and two transitions. This is based on theories from Rostow (1960), Syrquin (1988) and Porter et al. (2002). The lowest level of economic development is production, which is based on mobilization of primary factors of production, such as land and unskilled labor. At this stage, international competitiveness is based on low factor costs and presence of minerals. As the economy progresses, it reaches the second stage of industrialization. This stage is more capital intensive, depending on the country's ability set up effective labor and capital markets, attract foreign direct investments, and educate their workforce to adopt new technologies. Hence, the effect of the adoption of mobile phone technologies could potentially have a larger impact in this stage. The third stage of development produces a technology or innovation generating economy. This stage implies high incomes, with the country innovating on the global technological frontier. There is intensive cooperation with private business, higher education institutions and government. When the economy accumulated a critical mass of knowledge, skills, technology and purchasing power, it can fuel a self-perpetuating process of continued innovation. As expressed by Audretsch and Thurik (2001), the economy has transitioned from a 'managed' to 'entrepreneurial' one. While mobile technologies are typically adopted in the second, industrialization stage of development and widely used in the final stage with high innovation, such technologies can potentially boost all stages, including the first less developed stage. As we have seen with the influence of mobile phone networks, developing countries are using

creative ways to adopt mobile phone applications to their local less developed environment, such as to mobilize basic factors of production in agricultural sectors.

E. The Relationship between Entrepreneurship and Economic Development

It has been established that the level of entrepreneurship varies between countries at different levels of economic development. Specifically, studies have shown a u-shaped relationship between the level of self-employment, as measured through business ownership, and per capita income (Carree et al., 2002). This relationship was also seen in nascent entrepreneurial rates, which is defined as the number of people actively involved in attempting to start a new business, as a percentage of the adult population (Wennekers et al., 2005). This differs from business ownership, which is the percentage of owner managers of incorporated and unincorporated businesses, relative to the labor force.

There are several reasons that explain the u-shaped relationship. In early stages of development with declining entrepreneurial activity, it is due to the shift from agriculture to manufacturing, taking advantage of economies of scales. In addition, as a country accelerates in growth, the country takes advantage of economies of scale as local firms grow in size while multinational firms enter and provide employment opportunities. Hence, there are higher barriers of entry for individuals to start their own ventures (Lucas, 1978). Moreover, rising real wages encourage marginal entrepreneurs to become employees (Lucas, 1978). However, as the country develops to reach advanced levels, the positive relationship between entrepreneurship level and economic development is observed again. This reversal has been statistically observed in several studies before (Lucas, 1978). One reason is due to the shift from manufacturing to services, providing for more opportunities for business ownership. It is relevant to consider the u-shaped trend of entrepreneurship as when a country becomes more developed, the effect of mobile phones may be able to boost entrepreneurship even more

during its increases. Alternatively, mobile phone networks may even lead to a rise in entrepreneurial levels during its predicted dip.

III. Data and Theory

This study uses panel data for various indicators of entrepreneurial activity, and mobile phone adoption rates in various countries across time. The primary sources of data are the Global Entrepreneurship Monitor (GEM) for entrepreneurial activity, and the World Bank Database for mobile phone adoption rates.

A. Entrepreneurship Activity Data

The Global Entrepreneurship Monitor (GEM) was initiated in 1999 by Babson College and London Business School. It conducts 200,000 interviews every year with both experts and adult individuals on their thoughts and opinions on entrepreneurship in their respective home countries. Thus far, the GEM dataset has 17 years of data from up to 10,000 individuals in each of more than 100 countries (Desai, 2009). GEM defines entrepreneurship as ‘any attempt at new business or new venture creation, which may include, but not limited to self-employment, creation of a new business organization, or expansion of an existing business.’

While this includes a broad scope of entrepreneurial behaviors, the GEM breaks down the entrepreneurial business cycle into several main stages. The *Global Entrepreneurship Monitor 2014 Singapore Report* by Chernyshenko (2015) provides a framework for the stages of entrepreneurship that are related to the indicators measured by GEM, which is summarized in Figure 2. GEM collects data on the various stages and dimensions of entrepreneurship. The lifecycle of a new business begins with the first stage of entrepreneurial intention, which involves individuals’ readiness to begin an entrepreneurial venture or their intent to start a business within the next 3 years (Chernyshenko, 2015). The second stage is the early stages of

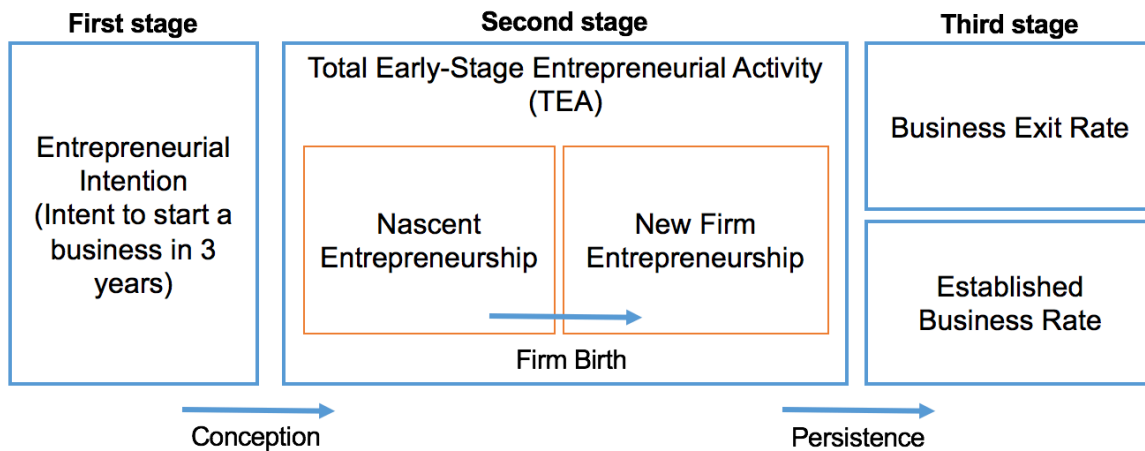
forming a venture, known as the Total Early-Stage Entrepreneurial Activity or TEA. It is one of the key indicators that GEM has historically focused on, including both formal and informal entrepreneurship, estimating the number of residents in a country that are currently participating in burgeoning entrepreneurial activities. This stage of entrepreneurship consists of two phases: (1) nascent entrepreneurship, which is when owners or managers are in the process of starting a new venture, specifically, businesses that are less than three months old. and (2) new firm entrepreneurship, when owners or managers of businesses have a business that is three to forty-two months old. The third stage consists of businesses who are either more than 42 months old, measured through the number of established businesses, or those that have been discontinued (exit rate).

Besides the above way of slicing TEA into nascent and new firm entrepreneurship, it can also be categorized into necessity and non-necessity entrepreneurship. Necessity-driven entrepreneurship refers to being in a situation that forces the individual to be self-employed.

Note that both informal and formal entrepreneurship are accounted for in the various measures of entrepreneurship. *Entrepreneurial intention* and *Total Early-Stage Entrepreneurial Activity* is data collected from surveying individuals to gather information on the initial stages of firm formation when it is still unregistered and in its informal stages. The formal rate is measured through the *Established Business Rate*.

Figure 2 shows a visual framework for the various stages, and Table 1 gives the detailed definitions of the stages of entrepreneurship. A detailed description of each of the variables is elaborated upon in the appendix in Table A1.

Figure 2: Entrepreneurial Stages (related to GEM Data)



The GEM data is gathered by GEM National Teams from a representative national sample of at least 2000 respondents. Surveys are conducted at the same time of year (generally between April and June), usually by an independent survey vendor, chosen by each economy's GEM team. The vendor submits a proposal for the GEM data collection, which is reviewed by the central GEM data team on various criteria. The national approach allows for the surveys to be adapted to the local legislative, cultural and regulatory environments for more accurate collection.

The data is administered using one of the main interview forms that GEM terms as its Adult Population Survey (APS). It is for gauging the general adult population's take on entrepreneurship conditions. Questions are usually in binary yes and no form, asking interviewees to answer from their personal experience or perception. Generally, a 'yes' indicates positive opinion of the current situation for engaging in entrepreneurial activities.

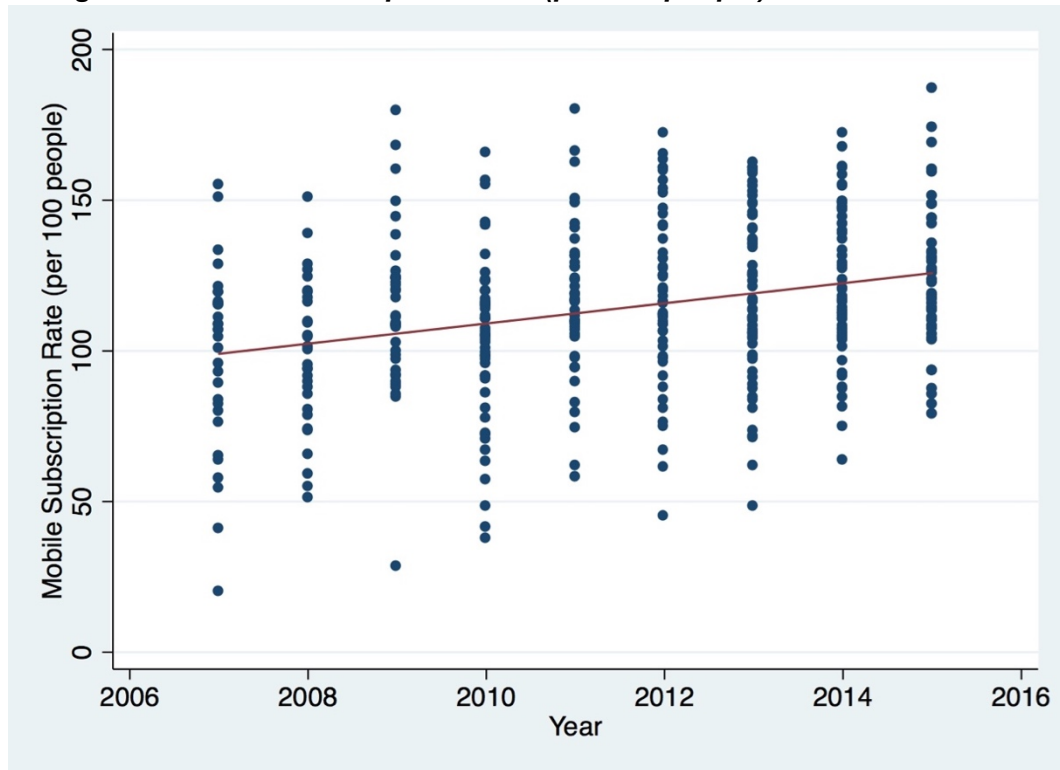
B. Mobile Phone Adoption Data

The second key data set used is measuring the mobile phone adoption rates, sourced from the World Bank dataset. The study draws on the number of mobile cellular subscriptions per 100 people in each country.

The mobile cellular subscriptions (per 100 people) indicator is derived by all mobile subscriptions divided by the country's population and multiplied by 100. These subscriptions are defined as a contract with a public mobile telephone service provide access to the Public Switched Telephone Network (PSTN) using cellular technology. The indicator includes the number of postpaid subscriptions, and the number of active prepaid accounts (used during the last three months). The variable also applies to all mobile cellular subscriptions that offer voice communications. This includes both analogue and digital cellular systems, 3G and 4G subscriptions, but excludes mobile broadband subscriptions via data cards or USB modems. This is a good indicator of the mobile phone network in developing countries, since they predominantly utilize the subscriptions mentioned above (Donner, 2008).

The distribution of the data across the time period used for this paper is shown in Figure 3.

Figure 3: Mobile subscription rates (per 100 people) from 2007 to 2015



(Source: World Bank)

Note: Data is collected from 80 countries, including developing and developed countries. Each data point represents the rate for a country.

C. Other Factors Influencing Entrepreneurial Activity

The mobile phone adoption rate is one factor that can influence entrepreneurial activity, as a form of communication infrastructure that supports business formation. However, as discussed in the literature review, there are several other factors that are considered key in affecting entrepreneurial activity in various countries.

This data is also derived from the GEM data set, but has a different method of collection. As elaborated on previously, the entrepreneurship activity data was based on surveys collected from a sample of the country's population self-reporting their entrepreneurial activity and intentions. On the other hand, data on factors affecting entrepreneurship was collected from

surveys administered not to the general population but to a select group of experts² to evaluate the status quo of entrepreneurship-related factors in their resident country. Termed as the National Expert Survey (NES) by GEM, they consist of responses of at least 36 experts in each country. Most questions ask for responses on a numerical scale of 1 to 7, with 1 being ‘completely disagree’ and 7 being ‘completely agree.’ On the scale of responses, ‘completely agree’ (7) mostly indicates more favorable conditions for entrepreneurs.

Based upon the list of factors influencing entrepreneurial activity derived from Azjen and Shapero’s theories as elaborated upon in the literature review, the indicator variables as gathered from the GEM data is matched to each category. The full list of these categorized indicators is outlined in the appendix in Table A2. Out of these factors, *funding*, *government policies* and *post school education* are identified as the three main factors that influence entrepreneurial activity, and will be focused on in this paper. Table 1 elaborates on these factors and their respective indicators, which are measured on a scale of 1 to 7.³

Table 1: GEM Data Indicators for Key Factors affecting Entrepreneurship

Factor	Indicator
Funding	Funding: The availability of financial resources—equity and debt—for small and medium enterprises (SMEs) (including grants and subsidies).
Government regulations and support	Government Policies: The extent to which public policies support entrepreneurship as a relevant economic issue.

² While experts who were available varied between years, they consisted mostly of entrepreneurs, investors/financers/bankers, policy makers, business and support services providers, and educators/teachers/entrepreneurship researchers.

³ An example list of the questions asked in the surveys administered to the experts to measure for the identified variables is included in the appendix in Table A4.

Education	Post school education (“Education”) : The extent to which training in creating or managing SMEs is incorporated within the education and training system in higher education such as vocational, college, business schools, etc.
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These factors were selected as empirical evidence has suggested that these factors are the key factors affecting entrepreneurship. Among the factors that affect the feasibility of entrepreneurship (the first category as outlined in the literature review), funding and government regulations and support can be considered to be the key factors impacting the feasibility of starting a venture. The amount of capital available and made accessible, coupled with government support and incentives also have an influential effect on non-government support infrastructure, which is another feasibility factor. Non-government support infrastructure which include property rights and market openness, are heavily shaped by government policies (Minniti, 2008).

Among the other two categories of factors influencing entrepreneurship are social desirability and personal competence. Within those categories, education is selected as the most important aspect that has an effect on other factors. The other factors of culture, skills and risk taking attitudes have shown to be shaped by education (Van der Sluis, 2008)

The indicator for education that was selected is post school education, which focuses on how higher education encourages entrepreneurship. Instead of basic school education, which only focuses on primary and secondary school education, post school education is expected to ultimately have a lower impact on entrepreneurial activity. One main reason is that the lack of confidence in starting a business is attributed to the lack of higher-level expertise and skills that can be directly applied (McMullen, Bagby & Palich, 2008).

Moreover, the way the variables are defined in the data collection supports that these factors are all-encompassing and the root influencer on entrepreneurial activity. Namely,

according to the definitions of the variables from GEM, government policies is an all-inclusive variable that is most representative of government regulations and support in a country. This variable includes the other variables such as government programs, education and tax policies, and market openness, and also heavily influences them.

D. Summary Statistics

The combined data from GEM and the World Bank spans from 2007 to 2015, with a total of 417 observations for each variable observed. There are 80 countries in total, with 38 developing countries with a total of 176 observations, and 42 developed countries with 241 observations. On average, there are 5.2 observations per country, with a minimum of 2 and maximum of 9 observations in each country. All data is recorded and aggregated at the country level on a yearly basis. Countries are categorized as either developing or developed, according to the classification by the International Monetary Fund (IMF) in its *World Economic Report* in 2015. Below are some summary statistics outlined for the independent (mobile subscription rate) and dependent variables (entrepreneurship activity indicators), and other control variables.

Table 2: Summary statistics of entrepreneurial activity variables⁴

Variable	All Countries	Developed countries	Developing countries
Mobile Subscription Rate (%)	114.06 (27.83) 20.16 - 187.17	121.95 (20.18)	103.25 (32.86)
Entrepreneurship Activity Indicators			
Entrepreneurial Intent (%)	20.49 (15.48) 2.23 – 90.95	12.84 (8.91)	30.96 (16.41)
Total Early-Stage Entrepreneurship (TEA) (%)	11.79 (7.53) 2.35 – 41.46	8.42 (4.17)	16.41 (8.59)

⁴ The first value in each cell represents the mean, the second value is the standard deviation, followed by the range of values for each variable.

Nascent Entrepreneurship (%)	6.68 (4.76) 0.76 – 28.97	5.09 (2.85)	8.87 (5.86)
New Business Ownership (%)	5.37 (4.17) 0.44 – 27.56	3.47 (1.69)	7.99 (5.05)
Established Business Rate (%)	7.90 (5.38) 0.42 – 37.74	6.51 (2.70)	9.81 (7.25)
Other Control Factors⁵			
Government policies	2.76 (0.77)	2.81 (0.77)	2.68 (0.76)
Funding	2.73 (0.73)	2.82 (0.74)	2.61 (0.70)
Education	2.95 (0.79)	2.94 (0.76)	2.95 (0.84)

Note: Mobile subscription data is obtained from the World Bank, and all other variables are collected from the GEM data set. All variables have 417 observations

From the above table of summary statistics, we see that there is a relatively large range of entrepreneurial activity, as seen from the minimum and maximum values of total entrepreneurship activity that ranges from 2.35% to 41.46%. The spread of the mobile subscription rate and its mean of 114 subscriptions per 100 people indicate that on average, countries have individuals with more than one mobile phone subscription. This shows the relatively high mobile phone adoption across the world, as the highest rate is 187 subscriptions per 100 people. There is also a gender difference for TEA, where the mean for males is 13.9% while the mean for females is 9.59%. Taking into account the level of development of countries, developing countries display higher mean values of entrepreneurial activity across all indicators, compared to developed countries. Developing countries also have a higher variation in their entrepreneurial activity, since they have higher standard deviations than those of developed countries.

⁵ The control factors identified are measured on a scale of 1-7.

IV. Econometric Model

The model for this paper follows the generalized least squares (GLS) regression model where entrepreneurial activity indicators at the different stages are dependent variables, regressed on the mobile phone subscriptions, the independent variable. Since not all countries are measured for all years, the paper uses unbalanced panel regressions. Through the GLS model, the potential correlations between the error term between countries is accounted for. It allows for serial correlation or heteroskedasticity to be present.

In order to control for other factors, two additional measures are taken. First, other variables that also have a correlation with the repressors (factors that have an effect on entrepreneurial activity) are included. Including these variables that vary between countries and over time reduce the likelihood of an omitted variable bias. These indicators, as elaborated upon previously in Table 1, are included in the regressions as a control.

However, it should be noted that the three control factors that were chosen show strong correlation between each other. The *funding* variable has a correlation coefficient with the *government policies* and *education* variables of 0.81 and 0.70 respectively. Since this potentially implies multicollinearity, a check was conducted to identify the factors from the list of indicators in Table A2, that do not have high correlation coefficients (0.7 or lower). These variables include *government policies*, *culture*, *perceived opportunities*, *perceived capabilities*, and *fear of failure*. As a test, the same regressions were run using these variables as control factors, and results were compared to the regressions with the original three control variables. It was found that the results do not differ significantly from each other. These results are included in Exhibit A1 and A2 in the appendix. Hence, the final model that was chosen uses the three control variables selected based on other empirical research that highlight the most key influential factors on entrepreneurial activity.

Besides the selected control variables that have an effect on entrepreneurial activity, the second aspect of controls involve other factors that vary between countries but stay constant over time. By using a fixed effects model, the effect of these unobservable factors is removed. Examples of such effects include certain social norms (eg. the presence of a caste system in India), that may not be captured by the culture variable. It can be argued that such social norms do not change significantly over the time period of 8 years that are of interest. In addition, despite potential factors that might vary across time but have the same effect on all countries, time fixed effects are not controlled for. Since the data is collected on the country level, and not at a more granular level, there are fewer potential time events that will have a significant impact on all the countries. Hence, time fixed effects are unlikely to have a significant impact on the results.

Below is the equation for the final regression model:

Measure of entrepreneurial activity

$$= \beta_0 + \beta_1 \text{mobile subscription rate} + \beta_2 \text{government policies} + \beta_3 \text{funding} \\ + \beta_4 \text{education} + \beta_5 \text{developing} + \beta_6 \text{developing} \times \text{mobile} + \epsilon$$

The y variable, measure of entrepreneurial activity, will take on the various variables for the different stages of entrepreneurial activity. These variables include *TEA*, *entrepreneurial intent*, *nascent entrepreneurship*, *new business ownership*, and *established business ownership rate*. Additional y variables include *TEA* for females and males, and *necessity-driven entrepreneurship*. *Mobile subscription rate* is the independent variable of interest, where its effect on entrepreneurial activity is investigated. The coefficient β_1 can be interpreted as an increase in the number of mobile subscriptions per 100 people, the percentage of the adult population (18-64 years old) participating in the specific entrepreneurial activity, such as *TEA*, increases by β_1 . The other variable included in the model are factors influencing entrepreneurial

activity that are used as controls. As discussed previously, this model above also includes for fixed effects.

In order to account for the differences in developing and developed countries, a dummy variable, *developing*, is added. The coefficient, β_7 , is the percentage point magnitude of which the base level entrepreneurial activity differs between developing and developed countries. Regardless of mobile phone subscription rates, developed countries demonstrate entrepreneurial activity that is higher than developing countries by β_7 percentage points. The dummy variable is also interacted with the mobile subscription rate variable, in order to see the additional effect that being a developing country has on the effect of mobile subscription rates on entrepreneurial activity. As a developed country, for every unit increase in the mobile subscription rate, the country benefits from a higher increase in its entrepreneurial activity of β_8 , compared to developing countries.

Regressions were run on an incremental basis – starting out with a single linear regression of *total entrepreneurial activity (TEA)* on mobile subscription rates, and progressively adding on more factors and eventually including the developing country dummy variable and its interacted variable with mobile subscription rate. Finally, fixed effects are taken into account for. This gradual build-up of the regression model is done for TEA out of the other entrepreneurial activity indicators. TEA is chosen as it is the main variable that accounts for actual entrepreneurial activity, in contrast to simply the intent to start a business or when a business becomes more mature as an established business.

V. Results

Exhibit 1 shows the results for the effect of mobile phone subscription rates on TEA with the explanatory variables added gradually. The coefficient of the mobile subscription rate variable can be interpreted as the percentage of the adult population of a country that rises with

an increase in one mobile subscription per 100 people. In Model 5 and 6, the differing effects between developed and developing countries can be assessed as the effect of mobile networks on TEA in a developing country is simply the coefficient of the mobile subscription rate variable (β_1). In contrast, the effect on a developing country is the sum of the mobile subscription rate variable and the interaction term of developing x mobile ($\beta_1 + \beta_6$).

We see strong evidence for mobile subscription rates to be correlated with TEA, which consists of nascent entrepreneurship and new firm entrepreneurship. This can be interpreted from the final regression in Model 6. For an increase of mobile subscription rates by its standard deviation of about 30 subscriptions per 100 people, TEA increases by 2.124 % points. This result can be considered economically significant if analyzed by taking a population of 100 million, which for instance is the approximate size of the Philippines – a developing country. A 0.327% point increase for a developing country equates to 327,000 more individuals engaging in starting a business and similar activity. Hence, for early stage entrepreneurship, both developed and developing countries benefit from larger mobile networks, with developed countries benefitting to a larger extent.

Another consideration to note is that once the control factors are added, including the *developing* dummy variable, the coefficient of the *mobile subscription rate* variable increases by almost 5 times to 0.0613 and is now statistically significant at the 1% level, as seen in Model 5. The R-squared also increases from 2% to 26%. Hence, whether a country is developed or developing is significant in terms of explaining the variation in my model, and the differences in the effect of mobile networks on entrepreneurial activity. It further increases to 0.0708 when fixed effects are included in Model 6, and still holds at the 1% level of statistical significance.

In the second set of regressions in Exhibit 2, we see the full regression model that was gradually built in Exhibit 1, is applied to all the entrepreneurial activity indicators. We see that *mobile subscription rate*, including its interacted term with the developing country binary variable, has a statistically significant effect on four out of the five stages of entrepreneurial

activity (namely *entrepreneurial intent*, *TEA*, *nascent entrepreneurship* and *new firm entrepreneurship*), for at least the 5% level. Moreover, the models for those four activity measures have R-squared values ranging from 13.7% to 29.0%, compared to insignificant results for the latest stage of entrepreneurship of forming an established business, which has an R-squared of 2.0%. This supports that mobile phones have more of an effect on the earlier stages of entrepreneurship, and my regression models explain variations in the earlier stages to a larger degree.

Table 3 below shows a summary of the percentage changes of the entrepreneurship activity measures for an increase of 30 mobile subscriptions per 100 people for both developing and developed countries. We see that TEA and its components of nascent and new firm formation, benefit from larger mobile phone networks. For an increase of 30 mobile subscriptions per 100 people, the population of a developed country involved in nascent entrepreneurship and new firm entrepreneurship increases by 1.425% and 0.747% respectively. In contrast, there is a lower magnitude of 0.33% and -0.072% for developing countries.

Table 3: Percentage point increase in entrepreneurship activity indicators for an increase in 30 mobile subscriptions per 100 people⁶

	Entrepreneurial Intent (%)	TEA (%)	Nascent Entrepreneurship (%)	New Firm Entrepreneurship (%)	Established Business Rate (%)
Developed	2.883	2.124	1.425	0.747	0.00336
Developing ⁷	-1.197	0.327	0.33	-0.072	-0.18774

⁶ Calculated by multiplying the coefficients by 30, which is the number of mobile subscriptions per 100 people.

⁷ The coefficient was first computed by adding the coefficient of the mobile subscription rate variable and interacted variable of developing country dummy variable and the same mobile subscription rate.

In addition, we see that developed countries benefit from larger mobile networks across all the entrepreneurship activity stages, while developing countries benefit primarily in the early stages. The negative coefficient observed for developing countries in new firm entrepreneurship and other activity measures could be attributed to the limitations in my data which is elaborated on in the next section.

Furthermore, the effect on TEA can be parsed out to see the differential effect between males and females, as summarized in Table 4 below. From Exhibit 2, by taking the difference between the mobile subscription rate coefficients for the regressions with TEA female and TEA male, an increase in mobile subscriptions of 30 per 100 people, males benefit more by experiencing a 0.3% higher rise in TEA than females in developed countries. However, in developing countries, there is less of a difference in TEA between males and females, with females experiencing very slightly higher levels with a differential of 0.123% higher of an increase compared to men, for a rise of 30 subscriptions per 100 people.

Table 4: Percentage point increase in TEA (Male and Females) for developing and developed countries for an increase in 30 mobile subscriptions per 100 people

	TEA Male (%)	TEA Female (%)	Difference (Male – Female) (%)
Developed	2.28	1.98	0.3
Developing	0.279	0.402	-0.123

Exhibit 1: TEA regressed against mobile subscription rates controlled for fixed effects and other factors

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Mobile Subscription Rate	0.0190*	0.0143	0.0127	0.0116	0.0613***	0.0708***
	(0.0106)	(0.0109)	(0.0109)	(0.0110)	(0.0188)	(0.0199)
Government Policies		0.397*	1.035**	1.077**	0.932*	1.015*
		(0.234)	(0.510)	(0.544)	(0.528)	(0.543)
Funding			-0.712	-0.687	-0.522	-0.348
			(0.505)	(0.537)	(0.522)	(0.529)
Education				-0.0666	-0.0997	-0.287
				(0.343)	(0.334)	(0.335)
Developing dummy					15.70***	
					(2.992)	
Developing x mobile					-0.0621***	-0.0599**
					(0.0224)	(0.0236)
Constant	10.37***	9.793***	10.16***	10.30***	0.296	5.320***
	(1.460)	(1.500)	(1.512)	(1.519)	(2.540)	(1.574)
Observations	417	417	417	417	417	417
R-squared	0.0700	0.0631	0.0183	0.0189	0.2643	0.2559
Number of code	80	80	80	80	80	80
Country fixed effects						YES

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Exhibit 2: Entrepreneurial activity regressed against mobile cellular subscription

VARIABLES	(1) Entrepreneurial Intent	(2) TEA	(3) Nascent Entrepreneurship	(4) New Firm Entrepreneurship	(5) Established Business Rate	(6) TEA Male	(7) TEA Female	(8) Necessity-Driven Entrepreneurship
Mobile Subscription Rate	0.0961** (0.0439)	0.0708*** (0.0199)	0.0475*** (0.0156)	0.0249** (0.0116)	0.000112 (0.0157)	0.0760*** (0.0240)	0.0660*** (0.0185)	-0.0139 (0.0443)
Government Policies	1.864 (1.195)	1.015* (0.543)	1.253*** (0.424)	-0.207 (0.317)	0.00574 (0.428)	1.149* (0.654)	0.943* (0.503)	-0.980 (1.206)
Funding	-0.356 (1.164)	-0.348 (0.529)	-0.624 (0.413)	0.254 (0.308)	-0.400 (0.417)	-0.0492 (0.637)	-0.570 (0.490)	-2.136* (1.175)
Education	-1.308* (0.737)	-0.287 (0.335)	-0.0716 (0.262)	-0.199 (0.195)	0.106 (0.264)	-0.600 (0.403)	-0.0656 (0.310)	2.042*** (0.744)
Developing x mobile	-0.136*** (0.0521)	-0.0599** (0.0236)	-0.0365** (0.0185)	-0.0273** (0.0138)	-0.00637 (0.0186)	-0.0667** (0.0285)	-0.0526** (0.0219)	-0.0206 (0.0525)
Constant	15.15*** (3.464)	5.320*** (1.574)	1.309 (1.229)	4.195*** (0.917)	8.934*** (1.241)	6.946*** (1.895)	3.505** (1.458)	29.92*** (3.496)
Observations	417	417	417	417	417	417	417	417
R-squared	0.2904	0.2559	0.1373	0.2578	0.0197	0.2346	0.2480	0.0018
Number of countries	80	80	80	80	80	80	80	80

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: All regressions above control for country fixed effects

VI. Conclusion

A. Overall Findings

In this paper, we have explored the effect of mobile phone networks on the various stages of entrepreneurial activity in developing and developed countries. First, we see that the level of entrepreneurship through the various indicators, is generally higher in developing versus developed countries. This prompts the main question of how factors of communication infrastructure, namely mobile phone networks, affect these entrepreneurial activity levels.

The hypothesis that the increase in mobile phones would result in higher levels of entrepreneurial activity is supported. We see this especially in the early stages of nascent and new firm entrepreneurship for both developing and developed countries. Specifically, an increase in 30 mobile subscriptions per 100 people, the percentage of the population involved in early stage entrepreneurship (TEA) rises by 2.12% and 0.327% for developed and developing countries respectively.

Moreover, we see that developed countries benefit more than developing countries across several of the entrepreneurship activity measures. This could possibly be because developed countries have other support infrastructure such as internet services that help individuals benefit even more from larger mobile networks (Petrazzini, 1999). Developed countries have access to more applications on mobile phones that increase its functionality to boost entrepreneurial activity (Petrazzini, 1999).

Lastly, males benefit more than females from larger mobile networks, while more females engage in early-stage entrepreneurial activities than males in developing countries. This supports previous studies, as elaborated in the literature review, that the expansion of mobile networks empower women by increasing female participation in the marketplace and economy.

B. Limitations & Future Research

Firstly, this paper uses a more focused data set of mobile phone adoption rates, and the model does not include other communication infrastructures such as broadband or cellular networks which could have an impact on entrepreneurial activity. Hence, these could be potential control variables to be included.

Another consideration is that my results rely on the accuracy of the expert opinion, of which the control variables depend on. As many of the assessment questions are very subjective, as seen in the list of questions in the appendix in Table A4, the data may be skewed depending on varying definitions and perceptions. Moreover, the entrepreneurial activity data is based on surveys to the adult population

In addition, entrepreneurial activity data for developing countries was sparser compared to developed countries, resulting in fewer data points. Developing countries have 176 observations in total, compared to 241 observations. Some developing countries may only have a few years of data. In addition, the 8-year time frame that my data spans is relatively short, considering that the exponential rise of mobile phones started around 2000, as seen in Figure 1. Hence, a comprehensive set of data for a longer time period could significantly improve the results.

Another consideration for future research is to take into account the time lag effect between adopting a mobile phone and observing its impact on entrepreneurial activity. It might take time for the individuals to benefit from the functionalities that come with mobile phones and its network.

In addition, this paper can be extended by investigating the effects of mobile phones on examples of entrepreneurial businesses. This could allow me to analyze if mobile phones are encouraging more informal-based businesses, or technology-based businesses, which may have differing impacts on economic development. In addition, it could be further studied if the

entrepreneurs are moving into the gig economy as self-employed individuals engaging in freelancing or contractual jobs. In contrast, entrepreneurs who are founders of high growth startups may increase employment opportunities and have a larger impact on GDP and development. As qualitative and quantitative research has shown the growth of jobs and the subsequent impact on productivity of a country, further studies can delve into quantifying such improvements.

C. Policy Implications

The results of the paper have implications in terms of policies to encourage mobile phone adoption as means to increase entrepreneurship to boost economic development, especially in developing countries. Currently, organizations are collaborating to increase this connectivity and applicability of mobile phones to the local scene in developing countries. For instance, the NGO Grameen Foundation partnered with private sector companies such as MTN Uganda (a telecommunications company) and CARD Bank in the Philippines to develop, deliver and test mobile financial products for poor households (Yoo, 2015). Through this, they were able to develop mobile applications that were more widely used in developing countries (Yoo, 2015). Thus, we see that while the presence of a mobile phone network is crucial and impactful, it is also important that the applications on the phone are effective and appropriate for use by the local population.

Moreover, the growth of the mobile industry itself provides opportunities for entrepreneurship around creating mobile applications, and further employment opportunities. For instance, a World Bank report has elaborated on the economic potential in the expansion of the mobile phone industry that mirrors that of the software industry in the 1990s (World Bank, 2016). Hence, it is essential to support the networking and incubation of entrepreneurs. One such successful effort is through the collaboration of infoDev, a World Bank entrepreneurship

program, with the Government of Finland and Nokia. They have established five regional mobile innovation labs (mLabs) in Armenia, Kenya, Pakistan, South Africa, and Vietnam. Through this, they gathered grassroots entrepreneurs and successfully adapted advanced mobile technologies for local use. Such initiatives are still in progress and have shown traction to be effective (World Bank, 2016). However, they require high levels of cooperation and resources. Therefore, these organizations need to prioritize such initiatives to ensure an impact.

With the larger impact observed on entrepreneurship for females in developing countries, this could imply that policies should be targeted at making mobile phones more accessible and adopted by women. Recent studies by the GSMA, an association of mobile operators supports this. They estimate that closing the mobile phone gender gap could open a \$170 billion market to the mobile industry in the next five years (Gates, 2015). Hence, this supports the rise of initiatives that commit to exploring creative financing options to help make cellphones more affordable for women (Gates, 2015).

We have seen that organizations are actively adapting mobile phones to countries in early stages of development to spur on adoption and use of the phones. This supports that mobile phones can still be used as a tool to potentially encourage entrepreneurship and ultimately boost economic development. Thus, this can help mitigate the observed drop in entrepreneurial activity that takes place as a less developed country grows. As much of the decrease is attributed to individuals joining existing companies, mobile phones can empower individuals with tools, from mobile banking to access to capital information to start their own business. In addition, these less developed countries can increase entrepreneurial workforce through the increased participation of females.

VII. Appendix

Table A1 Definitions of Entrepreneurial Stages as measured by GEM

(All indicators are measured as a percentage of the 18-64 year old population)

Stage	Definition
Entrepreneurial Intention (Intent to start a business in 3 years)	Individuals who are not currently involved in an entrepreneurial venture, but intend to do so in the next 3 years.
Total Early-Stage Entrepreneurial Activity (TEA)	TEA is derived from a combination of the number of nascent entrepreneurs and new firm entrepreneurs. Those that qualify for both definitions are only counted once. This data is also split by gender, to investigate potential differences between male and females.
Nascent Entrepreneurship	Individuals who are actively involved in setting up a business they will own or co-own; this business has not paid salaries, wages, or any other payments to the owners for more than three months
New Firm Entrepreneurship	Individuals who are currently owner-managers of a new business, i.e., owning and managing a running business that has paid salaries, wages, or any other payments to the owners for more than three months, but <i>not more than</i> 42 months
Necessity-Driven Entrepreneurship	Percentage of those involved in TEA who are involved in entrepreneurship because they had no other option for work
Established Business Rate	Percentage of 18-64 population who are currently an owner-manager of an established business, i.e., owning and managing a running business that has paid salaries, wages, or any other payments to the owners for <i>more than</i> 42 months.
Business Exit Rate	Individuals that have left a business that they previously managed or owned in the last year.

Table A2 GEM Data Indicators for Key Factors affecting Entrepreneurship

Factor	Indicator
1) Feasibility	
Funding	<ul style="list-style-type: none"> • Funding: The availability of financial resources—equity and debt—for small and medium enterprises (SMEs) (including grants and subsidies)
Government regulations and support	<ul style="list-style-type: none"> • Government Policies: The extent to which public policies support entrepreneurship - entrepreneurship as a relevant economic issue • Taxes and bureaucracy: The extent to which public policies support entrepreneurship - taxes or regulations are either size-neutral or encourage new and SMEs • Government programs: The presence and quality of programs directly assisting SMEs at all levels of government (national, regional, municipal)
Non-government support infrastructure	<ul style="list-style-type: none"> • Commercial and professional infrastructure: The presence of property rights, commercial, accounting and other legal and assessment services and institutions that support or promote SME) • Physical and services infrastructure: Ease of access to physical resources—communication, utilities, transportation, land or space—at a price that does not discriminate against SMEs. • Internal market openness: The extent to which new firms are free to enter existing markets.
2) Social Desirability	
Culture and social desirability	<ul style="list-style-type: none"> • Culture: The extent to which social and cultural norms encourage or allow actions leading to new business methods or activities that can potentially increase personal wealth and income
3) Personal Competence	
Personal competence skills	<ul style="list-style-type: none"> • Perceived capabilities: Percentage of 18-64 population who believe they have the required skills and knowledge to start a business
Education	<ul style="list-style-type: none"> • Basic school education: The extent to which training in creating or managing SMEs is incorporated within the

	<p>education and training system at primary and secondary levels</p> <ul style="list-style-type: none"> • Post school education: The extent to which training in creating or managing SMEs is incorporated within the education and training system in higher education such as vocational, college, business schools, etc.
Fear of failure	<ul style="list-style-type: none"> • Fear of Failure: Percentage of 18-64 population perceiving good opportunities to start a business who indicate that fear of failure would prevent them from setting up a business

Exhibit A1: Using trial controls - TEA regressed against mobile subscription rates controlled for fixed effects

VARIABLES	(1) Basic	(2) Government policies	(3) Fear of failure	(4) Culture	(5) Perceived capabilities	(6) Perceived opportunities	(7) Developing (dummy)	(8) Fixed effects
Mobile subscription rate	0.0190*	0.0143	0.0136	0.0115	0.0132	0.0117	0.0547***	0.0709***
	(0.0106)	(0.0109)	(0.0109)	(0.0109)	(0.0106)	(0.0103)	(0.0178)	(0.0197)
Government policies		0.397*	0.479**	0.00881	-0.0679	-0.213	-0.176	0.0714
		(0.234)	(0.239)	(0.341)	(0.339)	(0.336)	(0.326)	(0.328)
Fear of failure			-0.0634**	-0.0674**	-0.0275	-0.0520*	-0.0541**	-0.0445
			(0.0266)	(0.0267)	(0.0274)	(0.0274)	(0.0266)	(0.0273)
Culture				0.555*	0.776***	0.720**	0.648**	0.366
				(0.285)	(0.285)	(0.282)	(0.274)	(0.273)
Perceived capabilities					0.216***	0.168***	0.135***	0.0411
					(0.0263)	(0.0282)	(0.0284)	(0.0329)
Perceived opportunities						0.0949***	0.0834***	0.0548***
						(0.0193)	(0.0189)	(0.0201)
Developing (dummy)							11.20***	-
							(2.725)	-
Developing x mobile							-0.0523**	-0.0546**
							(0.0213)	(0.0234)
Constant	10.37***	9.793***	11.82***	11.72***	-1.548	-1.489	-6.691**	1.927
	(1.460)	(1.500)	(1.650)	(1.646)	(2.401)	(2.339)	(2.864)	(2.518)
Country fixed effects								YES
Observations	417	417	417	417	417	417	417	417
R-squared	0.0700	0.0631	0.0109	0.0503	0.5365	0.5961	0.5958	0.0384
Number of countries	80	80	80	80	80	80	80	80

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Exhibit A2: Using trial controls - Entrepreneurial activity regressed against mobile cellular subscription

VARIABLES	(1) Entrepreneurial Intent	(2) TEA	(3) Nascent Entrepreneurship	(4) New Firm Entrepreneurship	(5) Establishe d Business Rate	(6) TEA Females	(7) TEA Males	(8) Necessity-driven entrepreneurship
Mobile subscription rate	0.0965** (0.0431)	0.0709*** (0.0197)	0.0472*** (0.0156)	0.0257** (0.0114)	0.00337 (0.0152)	0.0674*** (0.0181)	0.0747*** (0.0238)	-0.0122 (0.0443)
Government policies	-0.537 (0.719)	0.0714 (0.328)	0.381 (0.260)	-0.259 (0.191)	-0.337 (0.254)	0.0739 (0.303)	0.0879 (0.398)	-1.193 (0.739)
Fear of failure	-0.0173 (0.0598)	-0.0445 (0.0273)	-0.0122 (0.0216)	-0.0357** (0.0159)	-0.0458** (0.0212)	-0.0589** (0.0252)	-0.0262 (0.0331)	0.0911 (0.0615)
Culture	0.772 (0.599)	0.366 (0.273)	0.213 (0.217)	0.130 (0.159)	0.191 (0.212)	0.349 (0.252)	0.402 (0.332)	0.719 (0.616)
Perceived capabilities	0.179** (0.0720)	0.0411 (0.0329)	0.00750 (0.0261)	0.0363* (0.0191)	0.0875*** (0.0255)	0.0460 (0.0303)	0.0378 (0.0399)	0.159** (0.0740)
Perceived opportunities	0.122*** (0.0441)	0.0548*** (0.0201)	0.0346** (0.0160)	0.0215* (0.0117)	0.0213 (0.0156)	0.0461** (0.0186)	0.0630** (0.0244)	-0.153*** (0.0453)
Developing x mobile	-0.119** (0.0512)	-0.0546** (0.0234)	-0.0332* (0.0185)	-0.0255* (0.0136)	-0.00631 (0.0181)	-0.0496** (0.0215)	-0.0585** (0.0283)	-0.0330 (0.0526)
Constant	0.273 (5.517)	1.927 (2.518)	-0.362 (1.998)	2.375 (1.466)	4.384** (1.953)	0.556 (2.323)	2.902 (3.054)	23.81*** (5.672)
Country fixed effects	YES	YES	YES	YES	YES	YES	YES	YES
Observations	417	417	417	417	417	417	417	417
R-squared	0.011	0.038	0.039	0.015	0.102	0.0293	0.0394	0.0145
Number of countries	80	80	80	80	80	80	80	80

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0

Table A4: Examples of GEM Survey Questions for Control Variables used in Model

Funding
In my country, there is sufficient debt funding available for new and growing firms
In my country, there are sufficient government subsidies available for new and growing firms
In my country, there is sufficient funding available from private individuals (other than founders) for new and growing firms
In my country, there is sufficient venture capitalist funding available for new and growing firms)
In my country, there is sufficient funding available through initial public offerings (IPOs) for new and growing firms
Government Policies
In my country, Government policies (e g , public procurement) consistently favor new firms
In my country, the support for new and growing firms is a high priority for policy at the national government level
In my country, the support for new and growing firms is a high priority for policy at the local government level
In my country, new firms can get most of the required permits and licenses in about a week
In my country, the amount of taxes is NOT a burden for new and growing firms
In my country, coping with government bureaucracy, regulations, and licensing requirements it is not unduly difficult for new and growing firms
In my country, a wide range of government assistance for new and growing firms can be obtained through contact with a single agency
Education
In my country, Colleges and universities provide good and adequate preparation for starting up and growing new firms
In my country, the level of business and management education provide good and adequate preparation for starting up and growing new firms
In my country, the vocational, professional, and continuing education systems provide good and adequate preparation for starting up and growing new firms
In my country, self-employed youth learn to develop their business activities largely through their own experience and relationships
In my country, governmental programs effectively train and support youth entrepreneurs

VIII. References

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