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The influence of strong and weak ties in the VC network on start-up performance in countries with different levels of governmental economic control

Master's Thesis Innovation & Entrepreneurship

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Abstract

During this research it was investigated whether there is a moderation effect of a country´s level of governmental economic control on the relationship between Venture Capital (VC) firms´ networks and start-up performance. After conducting a qualitative analysis, Singapore and India were found to be countries with respectively a low and a high level of governmental economic control. Samples of VC-backed firms in these countries were retrieved from a database created by Crunchbase and network measures were calculated. Multiple regression analyses were conducted for all samples and the results were compared to each other. No significant moderation effect of governmental economic control was found. There are however indications that with a different research design, future research could find this effect to be significant.

Keywords: Venture Capital, syndication, network structure, weak ties, strong ties, governmental economic control, start-up performance

Acknowledgements

I hope you will enjoy reading my Master's Thesis. It marks the end of my study in Business Administration. A study that I have experienced as very interesting, pleasant and also challenging at times. I am thankful for the valuable lessons that I have learned and I want to thank everyone who has helped me in any kind of way over the years. In particular, I would like to thank my parents and family for supporting me every step of the way.

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Laurens Beldman

Content

1. Introduction

Venture Capital firms (VCs) play an important role in the life cycle of a start-up (Zider, 1998). VCs often provide financial support to start-ups that are looking for funding. The Venture Capital (VC) industry is becoming more and more integrated in daily business life. Since 2010, the amount of yearly invested Venture Capital grew from $ 47.6 billion to $278.8 billion (Schram & Wagemans, 2020). Besides financial support, VCs also provide start-ups they invest in with management know-how, legitimacy and financial expertise (Heirman & Clarysse, 2004). By transferring reputational assets, developing the professionalization of the firm, formulating strategy and providing network recourses and further intangible assets, VC's aid start-ups (Fitza, Matusik & Mosakowski, 2009). It has been found in literature that there is a positive relationship between portfolio firm performance and the fact that a start-up is backed by VCs (Manigart & Wright, 2013).

In most cases VC's invest into a company together, this is commonly referred to as syndication (Zider, 1998). VCs' networks are also called 'syndicates'. For VCs, syndication adds to portfolio diversification, lowers risk and provides validation of investment ideas (De Maeseneire & Van Halder, 2010). Syndication relationships can be seen as a key ingredient of investors´ social capital. Syndication relationships give investors the possibility of building networks that offer informational advantages that can support their investment decisions (Bygrave, 1987; Dimov and Milanov, 2010; Hsu, 2006; Liu & Maula, 2015; Milanov & Shepherd, 2013). A study conducted by Hochberg, Ljungqvist and Lu (2007), suggests that VCs that occupy a more influential or central position in the VC network experience significantly better fund performance. In addition, the portfolio companies of better-networked VCs turned out to be more likely to survive to successive financing and eventual exit. Furthermore, Ter Wal, Alexy, Block and Sandner (2016) found a significant effect of an investors' network structure and actors' knowledge, on a venture's ability to attract a second round of funding. Both of these mentioned studies therefore suggest that that there is an effect of VCs' networks on start-up performance.

Ter Wal et al. (2016) as well as Hochberg et al. (2007) did not focus on researching strong and weak ties in the VC network. The current research is however focused on these dimensions, since they are at the core of the discussion in literature about the advantages of networks (Batjargal, 2003; Jack, 2005; Lechner, Dowling & Welpe, 2006; Uzzi, 1996). Strong ties involve intimacy and emotional intensity, the actors in the network know each other well (Granovetter, 1973). On the other hand, weak ties refer to having a looser network consisting of different

connections to other networks (Elfring & Hulsink, 2007). Weak ties are less intense than strong ties, the actors are not closely related (Nelson, 1989).

In this discussion in literature, some scholars argue that having strong ties gives informational benefits (Adler & Kwon, 2002). The closer the relationship between parties is, the stronger the tie strength. Strong ties facilitate a cost-effective transfer of tacit knowledge and information. In addition, the information itself is more trustworthy because it is more accurate, detailed and richer. This is the case because it usually comes from a continuing relationship and therefore it is more reliable in economic terms (Granovetter, 1985). Furthermore, strong ties lower transaction costs, as social capital is used as governance mechanism (Zaheer & Venkatraman, 1995).

On the contrary, other scientists argue that networks consisting of strong ties can cause a so called 'lock in' effect (Gulati & Garigiulo, 1999). Repeated interactions within groups of actors that have close ties create a risk of a strong convergence of insights and ideas (Uzzi, 1996). These scientists argue that if ventures, in this case VCs, are too embedded in a network that consists of strong ties, they will not be amenable to novel market information or new technologies because the information will become redundant (Rowley, Behrens & Krackhardt, 2000; Uzzi, 1996). These scientists propose that networks should contain weak ties. Weak ties lead to a more diversified stream of knowledge. It is argued that his improves access to novel information and it helps to be more receptive to novel market information or new technologies (Elfring & Hulsink, 2007).

The previously mentioned literature shows conflicting results regarding performance in relationship to strong or weak ties. However, there are indications that the effect of weak and strong ties in the VC network on start-up performance differs across geographic regions. When the results of Hochberg et al. (2007), who conducted their research in the entire United States, were compared to the results in only California, the economic effect of a better network positioning of VCs turned out to be twice as large in California as in the countrywide network. This gives an indication to believe that across different geographical areas, the effect of VCs' networks on start-up performance could be different.

These geographical differences have also been found on an international level, with for instance structural differences in VCs networks within the US compared to other global geographic areas. To exemplify, China's institutional environment is responsible for producing significant differences in comparison to western countries (Bruton & Ahlstrom, 2003).

Furthermore, it has become apparent that statistical properties of VC's networks differ across China and the United States (Nirei, Shoji & Yu, 2020). The findings of these previously mentioned studies show differences in the composition of networks within syndicates based on geographical location. These studies however lack insight on how strong or weak ties within the VC network influence start-up performance and how this varies along geographical locations.

The fact that the statistical properties of the syndication network across China and the United States differ, reflects differences between the conditions of the VC markets in these countries (Nirei et al., 2020). These differences go beyond basic cultural differences to more fundamental elements of a country's regulations and laws, enforcement, commercial traditions and business norms (Kostova, 1997*).* These dimensions are closely intertwined with economic freedom (The Heritage Foundation, 2021). They are also very closely related to a country's level of governmental economic control, since a higher level of governmental economic control generally leads to less economic freedom and vice versa (Lawson, n.d.; Sufian & Habibullah, 2010; Swaleheen & Stansel, 2007; The Heritage Foundation, 2017).

China and the United States also seem to differ quite a lot on their respective levels of governmental economic control and economic freedom (The Heritage Foundation, 2021; United States - Strengths and weaknesses, 2020; U.S. Department of State, 2021; China - The role of the government, 2020; McGregor, 2019; Gong & Cortese, 2017). Therefore, one could expect that a country's level of governmental economic control could moderate the effect of VCs' networks on start-up performance.

Concerning the mentioned dimensions, the following can be stated. In countries that have a low level of governmental economic control, the integrity of governments is generally at a higher level than in countries that maintain a high level of governmental economic control. In addition, regulatory efficiency levels are higher, property rights are better enforced and the markets are freer and more open (The Heritage Foundation, 2021)**.** Furthermore, in countries with a high level of governmental economic control, businesses and investors are often not protected that well by the rule of law (The Heritage Foundation, 2021). In these countries with a high level of governmental economic control, the government is often not bound strictly to regulations and the constitution. The level of judicial effectiveness in such countries is also often at a low level (The Heritage Foundation, 2021). As explained in the previous paragraphs, factors indicating a country´s level of governmental economic control may cause differences in VC markets across countries.

This gives an indication that the level of governmental economic control in a country might have an effect on the relationship between VCs networks and start-up performance. If this moderating effect would be proven to be existing, this insight could help both VCs and entrepreneurs. More specific, if it was to be proven that across countries with different levels of governmental economic control, different types of VCs' networks would be more beneficial to the performance of start-ups, VCs could use this knowledge to better understand the ways in which they can construct their networks in a country in such a way, that enables them to help the start-ups they invest in perform at a higher level. In turn, entrepreneurs could use this information in the process of attracting one or more VCs. This knowledge could enable them to better understand which VCs have the right network to help them perform. Thus, based on this understanding, they would be able to make a better thought-out choice concerning which VCs they want to do business with. Furthermore, insights in this matter could also help a country's government in stimulating VCs to create such networks that enable them to perform better.

There are also theoretical implications associated with the current research. Previous research from Hochberg et al. (2007) and Ter Wal et al. (2016) showed that there is a relationship between VCs' networks and start-up performance. However, Ter Wal et al. (2016) and Hochberg et al. (2007) did not focus on weak and strong ties in the VC network and their relationship with start-up performance. Little research has been conducted concerning the effect of strong and weak ties in the VC network on start-up performance. The current research will focus on this gap in knowledge. Secondly, the current research will add to the discussion in literature about weak and strong ties in general, not specified on venture capital. If a moderation effect of a country's level of governmental economic control on the relationship between strong and weak ties in the VC network and start-up performance will be found in the current research, this could also have implications outside of the VC network. It would indicate that a country's level of governmental economic control could also play a relevant role concerning the question whether weak or strong ties in the start-up's own network are beneficial for start-up performance. Lastly, and most important, this will be the first research that sheds light on a possible moderation effect of a country's level of governmental economic control on the relationship between VCs' networks and start-up performance. Therefore, the current research will contribute to literature by providing new insights into this potential relationship.

The goal of the current research is to extend our understanding of the relationship between VCs' networks and the performance of their portfolio companies. The research question reads

as follows: '*What is the effect of a country's level of governmental economic control on the relationship between VCs' networks and start-up performance?*'

In order to answer this research question, the following sub-questions will be answered:
1: 'What is the relationship between VCs' networks and start-up performance in a country with a high level of governmental economic control?'
2: 'What is the relationship between VCs' networks and start-up performance in a country with a low level of governmental economic control?'

In order to answer the sub-questions and ultimately the research question, a sample of companies and VC investors will be taken from a larger dataset retrieved from Crunchbase. This commercial database contains information about companies in multiple countries that received VC funding (Dalle, Den Besten & Menon, 2017). VC network measures will be calculated in order to be able to measure the influence of VCs' networks on start-up performance. From the dataset, two samples are selected: one sample contains information about companies and VCs in a country with a low level of governmental economic control and one sample contains information about companies and VCs in a country with a high level of governmental economic control. Multiple regression analyses will be conducted to test the hypotheses and answer the research questions.

From here on, the thesis is structured as follows. Chapter two explains the theoretical framework, which includes a review of literature and a research model. Chapter three consists of the methodology and the research design. Chapter four discusses the results from the analysis. Lastly, chapter five consists of a conclusion and a discussion.

2. Theoretical Framework

This chapter contains the theoretical framework. The main concepts as well as the relationships between them will be elaborated on. This will lead to conceptual models together with corresponding hypotheses.

2.1 Venture Capital firms

A venture capital firm invests private equity in companies. VCs provide capital to companies that exhibit high growth potential. In return, they receive an equity stake. Venture capital firms experience high risk, but they can achieve large return on investment rates if companies they invest in realise high performance (Ganti & Scott, 2020). VCs raise funds from numerous parties. These parties function as limited partners in the investment pool, referred to as a venture capital fund (De Clerq, Fried, Lehtonen & Sapienza, 2006). The limited partners are not directly involved in the VCs specific investment decisions. Therefore, the VC manages the fund for the limited partners. This is done by investing in a portfolio of entrepreneurial ventures (Sahlman, 1990).

VCs are primarily interested in growth and increasing the value of the venture when making investments. Two of the most important factors that VCs take into account when deciding on whether they will make a certain investment are the capabilities of the management team and the growth potential of the entrepreneurial venture (De Clerq et al., 2006).

2.2 Syndication and its relation with start-up performance

In the current research, the value that investors' social capital has for start-ups in which they invest, is a central theme. As explained in the introduction, networks of VCs can act as important channels for providing information that can provide start-ups with a competitive edge (Pahnke, Katila, & Eisenhardt, 2015; Hochberg et al., 2007; Lungeanu & Zajac, 2016; Hallen, 2008). In most scenarios, VCs invest together with other VCs (Zider, 1998). Syndication relationships can be seen as a key ingredient of investors social capital.

Syndication relationships give investors the possibility of building networks that offer informational advantages that can support their investment decisions (Bygrave, 1987; Hsu, 2006; Dimov and Milanov, 2010; Milanov & Shepherd, 2013; Liu & Maula, 2015). Being embedded in syndication networks offers VCs information about investment opportunities that is shared within an environment of high trust which is not accessible to parties outside of this network (Sorenson & Stuart, 2001). Ter Wal et al. (2016) exemplify this situation: venture capitalists with a lot of social capital seem to have a higher willingness to invest large amounts

in start-ups. This can be explained by the privileged access to information of the venture capitalist, which results in a perceived lower risk involved with the investment. Furthermore, being embedded in syndication networks increases the evaluation of future cash flows (Alexy, Block, Sandner & Ter Wal, 2012). Syndication provides VCs with further portfolio diversification – this entails that more deals can be invested in per dollar of invested capital (Zider, 1998). Also, it lessens the VC partners' workload because other investors are also involved in the due diligence process and in managing the deal. In addition, investing together with multiple other VCs adds credibility (Zider, 1998). Meanwhile, start-ups can exploit the social capital of these VCs in order to achieve sustainable profitability and long-term survival (Stuart, Hoang & Hybels, 1999; Sorenson & Stuart, 2001).

In conclusion, this means that social capital that is built by VCs trough syndication experience can be seen as an important asset for VCs as well as start-ups (Hochberg et al., 2007; Hallen, 2008). When a start-up has had its first investment round, the VC often takes an advisory role, giving the start-up access to the VCs social capital. This can enhance performance of both the start-up and the VC (Stuart, Hoang, & Hybels, 1999; Sorenson & Stuart, 2001).

2.3 VCs' networks and its relation with start-up performance

For start-ups, the social network of a VC firm is a form of second-order social capital that provides key advantages (Galunic, Ertrug & Gargiulo, 2012). As stated in the introduction, two studies conducted in the United States indicate that different structures of a VC's social network can lead to different levels of start-up performance (Hochberg et al., 2007; Ter Wal et al., 2016). These social networks have different dimensions, of which the mix of strong and weak ties is at the core of the discussion in literature about the advantages of networks (Uzzi, 1996; Lechner, Dowling & Welpe, 2006; Jack, 2005; Batjargal, 2003).

Remarkably, little is known about the impact of these strong and weak ties in the VC network on start-up performance. Both Ter Wal et al. (2016) and Hochberg et al. (2007) do not focus on the effect of weak and strong ties in the VC network. Ter Wal et al. (2016) make a distinction between open and closed networks, which to a certain extent resembles the distinction between weak and strong ties. However, they do not focus on the concrete effects of these open and closed networks. Instead, they first take the actors' knowledge similarity into account by examining whether a network is diverse or specialized. Only after that, the effects of these networks on start-up performance are investigated. Concretely, they distinguish open-diverse, open-specialized, closed-specialized and open-diverse networks of VCs, and examine the effects of these categories on start-up performance. This is in contrast to the current research, which does not take the knowledge similarity of actors into account but is, as already stated in

the introduction, interested in explaining the effects of weak and strong ties in the VC network in general.

As stated in the introduction, some scholars argue that having strong ties gives informational benefits (Adler & Kwon, 2002). The closer the relationship between parties is, the stronger the tie strength. Strong ties facilitate a cost-effective transfer of tacit knowledge and information. The information gained from strong ties can be seen as more trustworthy because it is more accurate, detailed and richer. The reason for this is that it usually comes from a continuing relationship and therefore it is more reliable in economic terms (Granovetter, 1985). Furthermore, strong ties lower transaction costs, as social capital is used as governance mechanism (Zaheer & Venkatraman, 1995).

It has been laid out in the introduction that another stream of scientists argues that networks consisting of strong ties can cause a so called 'lock in' effect (Gulati & Garigiulo, 1999). Repeated interactions within groups of actors that have close ties create a risk of a strong convergence of insights and ideas (Uzzi, 1996). These scholars argue that when businesses are too embedded in a network that consists of strong ties, they will not be amenable to novel market information or new technologies because the information will become redundant (Uzzi, 1996; Rowley, Behrens & Krackhardt, 2000). This stream proposes that networks should contain weak ties because this leads to a more diversified stream of knowledge. It is argued that weak ties improve access to novel information and help to be more receptive to novel market information or new technologies (Elfring & Hulsink (2007). These conflicting ideas give reason to further investigate the effect of strong and weak ties.

There are indications that the effect of weak and strong ties in the VC network on start-up performance differs across countries. This is the case because statistical properties of VC's networks were found to differ across countries (Nirei et al., 2020; Bruton & Ahlstrom, 2003). This gives reason to believe that certain characteristics of these countries differ and that this affects the way in which syndicates construct their networks. This entails that the effect of strong and weak ties in the VC network on start-up performance could differ across countries. If evidence can be provided for the differentiation between countries this could further enhance our understanding of the effect of weak and strong ties in the VC network on start-up performance.

2.4 Level of governmental economic control

That the statistical properties of the syndication network differ across countries, reflects differences between the conditions of the VC markets in these countries (Nirei et al., 2020).

These differences go beyond basic cultural differences to more fundamental elements of a country's regulations and laws, enforcement, commercial traditions and business norms (Kostova, 1997*).* As stated in the introduction, these dimensions are closely intertwined with economic freedom and a country's level of governmental economic control (The Heritage Foundation, 2017; Swaleheen & Stansel, 2007; Sufian & Habibullah, 2010; Lawson, n.d.; The Heritage Foundation, 2021). This raises the suspicion that a country's level of governmental economic control could moderate the effect of VCs' networks on start-up performance.

As stated, concerning these dimensions, the integrity of governments is generally at a higher level in countries that have a low level of governmental economic control than in countries that maintain a high level of governmental economic control. Also, regulatory efficiency levels are higher, property rights are better enforced and the markets are freer and more open in countries that have a low level of governmental economic control (The Heritage Foundation, 2021)**.** In addition, in countries with a high level of governmental economic control, businesses and investors are often not protected that well by the rule of law (The Heritage Foundation, 2021). In these countries, the government is often not strictly bound to regulations and the constitution. The level of judicial effectiveness in such countries is also often low (The Heritage Foundation, 2021). As explained in the previous paragraph, these factors indicating a country´s level of governmental economic control may cause differences in VC markets across countries.

Since businesses are not protected that well from the government and other actors, VCs in countries with a high level of governmental economic control are to a larger extent surrendered to the will of the government. This is likely to lead to economic uncertainty, since it is hard for VCs to act upon unknown future steps of the government. Volatility in future compositions of the government adds to this uncertainty. The lacking protection of businesses' rights also causes VCs to be restrained in these countries for another reason. They will be more hesitant to invest due to a lessened legal protection against being expropriated of their investments by the entrepreneurs who control the firms they invest in (La Porta, Lopez-De-Silanes, Shleifer & Vishny, 2002).

A recent study conducted by PwC (2021), also confirmed that governmental economic control affects economic uncertainty. In 2020 as well as in 2021, CEOs across the world identified over-regulation as a major threat to their companies. In 2020, it was perceived as the biggest threat out there, while in 2021, over-regulation holds third place. Also, in the years before that, over-regulation has held one of the top spots, ruling out the recent covid-19 epidemic as a possible cause of this perceived threat (PwC, 2021). PwC president Ad van Gils stated this year that these findings reflect the uncertainty across companies concerning how governments

will handle societal affairs and how this will affect these companies (Couwenbergh, 2021). This clearly indicates that when a country's government governs with a high level of economic control, this stimulates economic uncertainty among companies.

Findings in literature indicate that, in countries where the level of economic uncertainty is higher, VCs will more likely choose other VCs with whom they have invested together in the past, in the process of making new investments (Podolny, 1994). This can be seen as an indication that VCs, in countries with a high level of governmental economic control, will prefer to have a network consisting predominantly of strong ties. The reason for this is that relational trust and history with contacts give businesses the feeling that the uncertainties surrounding their outcomes and purposes are mitigated this way (Molm, Takahashi & Peterson, 2000). Illustrative, this turned out to be the case in Russia and in the former East Germany. In these countries, there were growing economic shortages in legal markets, high levels of bureaucracy and there was an absence of a legal system that functions in an independent and effective manner. Businesses responded to this by relying increasingly more on strong ties in their networks (Brancato, 2006; Völker & Flap, 2001).

A higher level of economic freedom in a country, and therefore a lower level of governmental economic control, leads to more trust to emerge between businesses. When the level of governmental economic control in a country is high, the level of trust between businesses will be lower (Berggren & Jordahl, 2005). Therefore, it is likely that weak ties will not positively influence start-up performance in countries with high levels of governmental economic control. The uncertainties that VCs try to mitigate by relaying on strong ties are not mitigated when they invest together with VCs with whom they do not have a strong relationship. This is likely to result in a lack of trust in the syndication network, which could neutralize or diminish the – by some scholars suggested - benefits that weak ties can provide.

The benefits that strong ties according to certain scholars provide, are expected to be present in countries with a high level of governmental economic control. Because of the explained lack of trust in weak ties, businesses in these countries try to rely more on strong ties in their network. These strong ties can provide advantages of a cost-effective transfer of information and tacit knowledge, since the information provided by strong ties is more trustworthy than information provided by weak ties (Granovetter, 1985; Adler & Kwon, 2002; Zaheer & Venkatraman, 1995). It is hypothesized that since relational trust is generally on a lower level in countries with a high level of governmental economic control, the benefits of strong ties are larger in these countries. Meanwhile, as stated, it is expected that weak ties in the VC network

are not beneficial for start-up performance in these countries. Consequently, the following hypotheses are stated:

H1: in countries that have a high level of governmental economic control, strong ties in the VC network are beneficial for start-up performance

H2: in countries that have a high level of governmental economic control, weak ties in the VC network are not beneficial for start-up performance

As follows from the information that has been provided above, economic uncertainty is generally at a lower level in countries with a low level of governmental economic control. This means that in these countries, VCs do not need strong ties as much in order to mitigate uncertainties. This means that relational trust can be seen as less important in these countries (Berggren & Jordahl, 2005). In line with this, it can be assumed that VCs in countries with a low level of governmental economic control tend to invest more often with other VCs with whom they do not have a particular strong connection. This results in VCs in these countries having a looser network that consists of different connections to other networks. As Elfring and Hulsink (2007) argue, this improves access to novel information and it helps to be more receptive to novel market information or new technologies.

It is hypothesized that in these countries, in contrast to VCs in countries with high levels of governmental economic control, VCs are more willing to rely on this information because relational trust among businesses is on a higher level (Berggren & Jordahl, 2005). If this were to be true, it could mean that weak ties in the VC network are beneficial for start-up performance in countries with a low level of governmental economic control. Vice versa, being embedded in networks consisting of strong ties could result in missing out of this valuable information, in contrast to competitors with more weak ties in their network. This is in line with the scholars that argue that networks consisting of strong ties can cause a so called 'lock in' effect. This leads to the following hypotheses.

H3: in countries that have a low level of governmental economic control, strong ties in the VC network are not beneficial for start-up performance

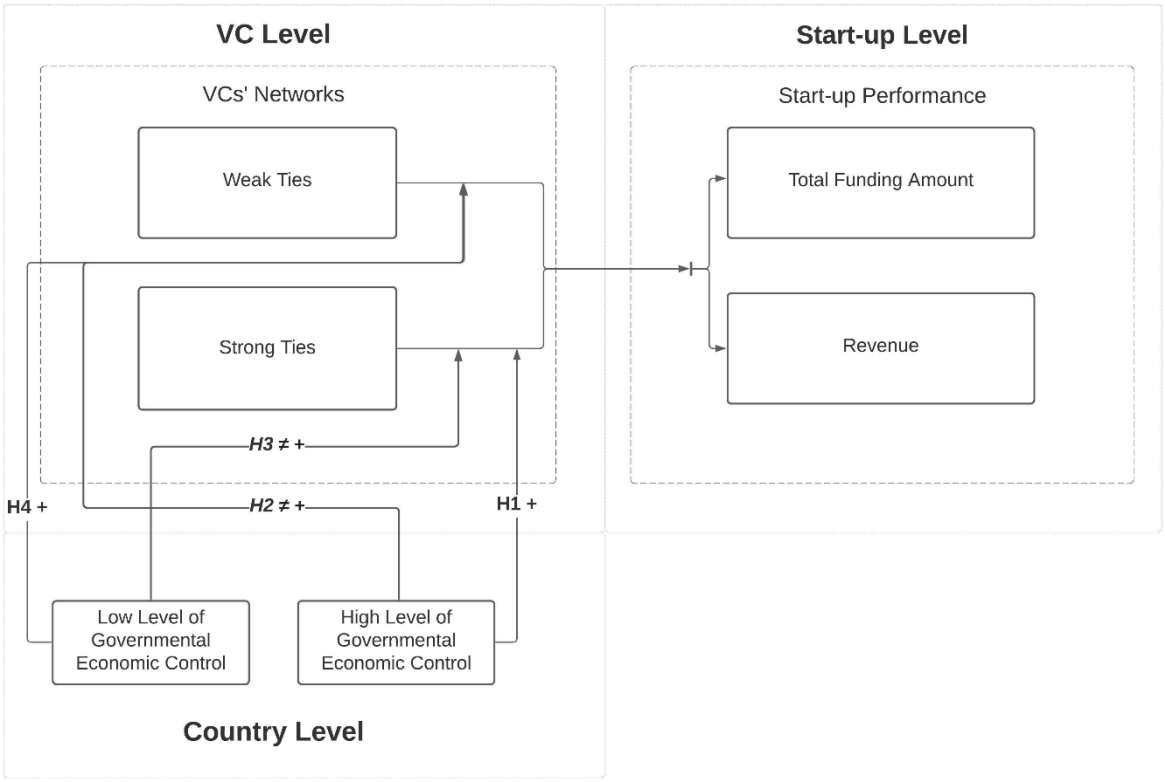
H4: in countries that have a low level of governmental economic control, weak ties in the VC network are beneficial for start-up performance

2.5 Conceptual model

Based on the information above, the following conceptual model is constructed.

Model 1

Conceptual Model

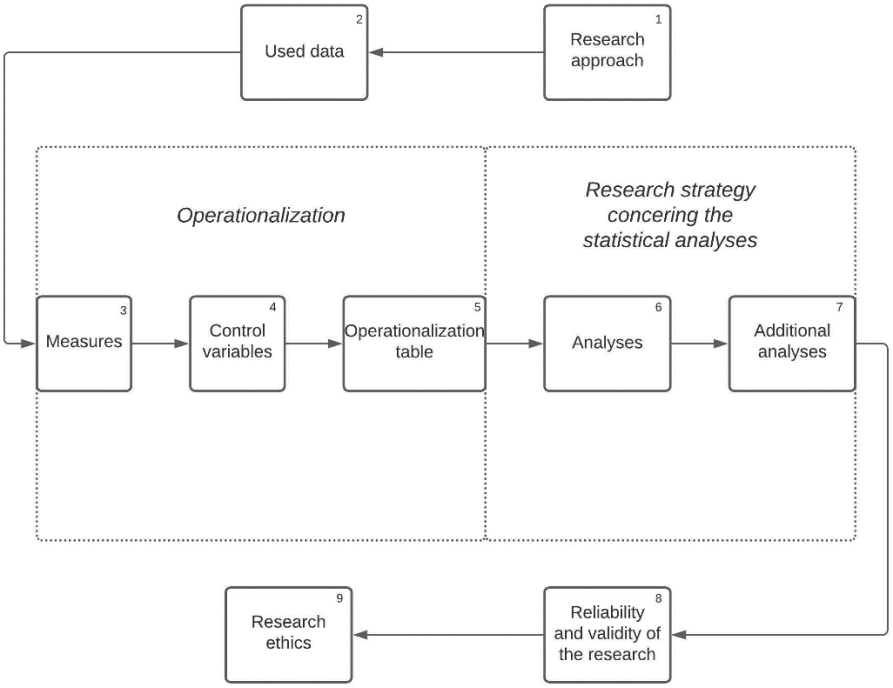


3. Methodology

In this chapter, an elaboration of the methodological decisions is set forth. This chapter starts with providing information regarding the research approach and data sample. After that, information concerning the operationalization of the variables will be given. Consecutively, the research strategy concerning the statistical analyses will be delineated. Lastly the reliability and validity of the research as well as research ethics will be discussed.

Model 2

Flowchart Research Process



3.1 Research approach

Research strategy is about the coherent decisions that affect the way in which the researcher will conduct research (Verschuren & Doorewaard, 2015). A distinction can be made between a broad and a depth research (Verschuren & Doorewaard, 2015). The current research prefers a depth strategy over a broad strategy. This is done by making an elaborate analysis with regard to two countries that will be chosen to reflect a high and a low level of governmental economic control. This is done instead of analysing numerous countries that indicate different levels of governmental economic control, which would go paired a less elaborate methodological framework. Using a depth strategy offers more possibilities with respect to the depth, elaboration and complexity of the current research. The disadvantage of this strategy is the limitation with regard to generalizability (Verschuren & Doorewaard, 2015).

The research units in the current research are VCs, since a statement is made about this in the problem definition (Verschuren & Doorewaard, 2015). The research population is the group of subjects about which a statement is made in this study (Verschuren & Doorewaard, 2015). A statement is made about VCs in a country with a low level of governmental economic control and in a country with a high level of governmental economic control. This follows from the design of the research and the data collection methods.

3.2 Used data

In the current research, a quantitative dataset from Crunchbase is used. Crunchbase is a commercial database (Dalle, den Besten & Menon, 2017). This database is growing and is rapidly becoming a primary information source about businesses. It has more than 60 million annual visitors from all over the world (Crunchbase, 2021). The database is also increasingly being cited in the academic literature, indicating that it is a reliable database to use (Dalle et al., 2017). Furthermore, Crunchbase applies artificial intelligence and machine learning in order to ensure that the data is reliable (Dalle et al., 2017). The dataset contains information about approximately 943.000 start-ups. A part of these start-ups received VC funding. Concerning these funding receiving start-ups, data of the top five VCs that made an investment was included in the dataset. Network measures were calculated in order to indicate the network position of these VCs within the larger network of syndicates. Additional information about the variables in the dataset can be found in Appendix A, Table 11.

In the dataset, information is included concerning in which country a start-up is based. This information is not present with regard to the VCs. Because of the intensity and depth of the relationship between VCs and the start-ups in which they invest, VCs have a preference to fund spatially proximate ventures (Sorenson & Stuart, 2001). This indicates that VCs tend to invest in start-ups which are based in the same country as themselves. Therefore, it is assumed in this thesis that the VCs that are analysed in the current research are based in the same country as the start-ups they invest in.

3.3 Measures

In this section, the methodology with regard to the different measures will be displayed.

3.3.1 VCs' networks

As stated, VCs can have weak and strong ties in their network. Degree centrality can be defined as the measure of the total number of links between a company and other companies (Zhang & Luo, 2017). When a company has a high level of degree centrality, this means that

it plays an important role as an information channel with regard to the overall network. It also means that it has advantages of dominating the network. Besides that, it shows more innovation in outputs and a higher speed of product development when compared to other actors (Ahuja, 2000**,** Deeds & Hill, 1996). When a company is positioned in the central place in a network, this represents that it has powerful control and/or strong connections with other companies. This forms the concept of degree centrality (Wang, Sung, Chen & Huang, 2017). This means that the higher the level of a VCs degree centrality will be, the more strong ties it will probably have. Therefore, degree centrality will be used in order to measure the amount of strong ties in the VC network.

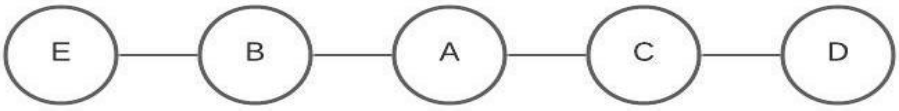
Degree centrality was calculated in line with the equation that is shown in figure 1. Here, $\sum_{j=1}^{n} Xij$ represents the total number of direct relations that have a connection to node N while *N* represents the all the nodes that are included in the focal network (Zhang & Luo, 2017). Because a network can vary over time, this equation was standardized in line with research from Wasserman and Faust (1994). This is represented in the second equation of figure 1 by dividing the first equation by *(n-1)(n-2).* Lastly, figure 1 also contains an example of how this works in practice.

Figure 1

Calculations on Degree Centrality

$$Cd(Ni) = \sum_{j=1}^{n} Xij(i \neq j) \qquad \text{(equation 1)}$$

$$C'd(Ni) = \frac{\sum_{j=1}^{n} Xij}{(n-1)(n-2)} \ (i \neq j) \qquad \text{(equation 2)}$$



Cd	1	2	2	2	1
C'd	0.083	0.167	0.167	0.167	0.083

Note. Adopted from 'Degree Centrality, Betweenness Centrality, and Closeness Centrality in Social Network', by Zhang, J., & Luo, Y., 2017, *Advances in Intelligent Systems Research*, p. 301.

Betweenness centrality is generally seen as a measure of others' dependence on a given node in a network (Brandes, Borgatti & Freeman, 2016). Betweenness centrality measures the undertaking 'mediation' role of this node in the network. If a node is positioned in the only way through which other nodes have to go, then this node is probably important and very likely has a high level of betweenness centrality (Zhang & Luo, 2017). This means that a high level of

betweenness centrality indicates a large number of weak ties. The higher the level of a VCs´ betweenness centrality will be, the more weak ties it will probably have. Therefore, betweenness centrality will be used in order to measure the number of weak ties in the VC network.

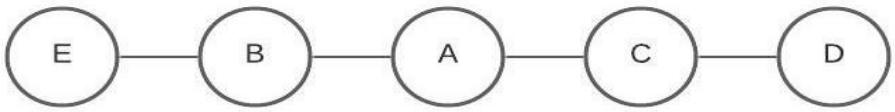
Betweenness centrality was calculated in line with the equations that can be found in figure 2. For both equations, the number of nodes that are located between any two other nodes in the network is represented by $\sum_{j<k}^{n} \frac{Gjk(Ni)}{Gjk}$ (Zhang & Luo, 2017). Also here, a standardized equation is added because a network can change over time, this standardized equation is represented by equation 4. In this process of standardization, betweenness centrality is divided by $\frac{(n-1)(n-2)}{2}$ (Wasserman & Faust, 1994). Here again, the figure also contains an example of how this works in practice.

Figure 2

Calculations on Betweenness Centrality

$$Cb(Ni) = \sum_{j<k}^{n} \frac{Gjk(Ni)}{Gjk} \qquad \text{(equation 3)}$$

$$C'b(Ni) = \frac{2\sum_{j<k}\frac{Gjk(Ni)}{Gjk}}{(n-1)(n-2)} \qquad \text{(equation 4)}$$



Cb	0	3	4	3	0
C'b	0	0.4	0.53	0.4	0

Note. Adopted from 'Degree Centrality, Betweenness Centrality, and Closeness Centrality in Social Network', by Zhang, J., & Luo, Y., 2017, *Advances in Intelligent Systems Research*, p. 301.

Degree centrality and betweenness centrality will be measured by calculating the average scores that VCs score on both of these centralities per start-up. This will be clarified with an example. If three VCs with a degree centrality of respectively 0.25, 0.5 and 0.75 have made an investment in a particular start-up, then the average score that will be used for degree centrality concerning this start-up is: (0.25+0.5+0.75)/3= 0.5.

3.3.2 Start-up performance

The concept start-up performance will function as the dependent variable in the current research. This thesis recognizes that a never-ending discussion concerning how to measure performance of private companies exists, see for instance Brush and Vanderwerf (1992). The concept of start-up performance contains multiple concepts because start-ups take different paths during the process of growing their business; different dimensions of start-up performance are prioritized at different points in time (Davidsson, Steffens, & Fitzsimmons, 2009). This means that a single dimension cannot capture the concept of start-up performance sufficiently (Daily & Dalton, 1992; Murphy, Trailer, & Hill, 1996; Wiklund & Shepherd, 2003). For that reason, the current research follows the advice of Eveleens, van Rijnsoever and Niesten (2017) as well as Wiklund and Shepherd (2003) to include multiple measures of start-up performance. The measures included are: 'revenue' and ´total start-up funding'.

Revenue is used as dimension of start-up performance to illustrate the achieved growth level of the firms (Leendertse, Rijnsoever & Eveleens, 2021). It is measured as the absolute amount of turnover that is generated by the firm in the most recent year (Sullivan & Marvel, 2011; Groenewegen & Langen, 2012; Rothaermel & Thursby, 2005). This variable was transformed to be measured on a six-level ordinal scale (0=$0 to $1M; 1=$1M to $10M; 2=$10M to $50M; 3=$100M to $500M; 4=$500M to $1B; 5=$1B to $10B).

Investments represent the potential growth that a start-up has. Raising funds is a strong validation of a firm's business model and the capability of its founding team. Hence, the greater the amount of funding raised, the greater the likelihood for future success will be (Lange, Mollov, Pearlmutter, Singh & Bygrave, 2007). Therefore, total start-up funding will be used as a dependent variable in the current research. This variable is operationalized as the cumulative amount of external funding (in U.S. dollars) that has been invested in a company between the moment that a start-up was founded and the moment that the database was created.

3.3.3 Methodological framework for selecting countries with different levels of governmental economic control

In order to research the moderation effect of governmental economic control, Singapore and India will be researched and the results will be compared to each other. In line with research from Zaki and Rashid (2016), and Tellis, Yin and Bell (2009), the selection of these countries is based on three criteria in order to ensure that the effects that will be found are indeed explained by a country's level of governmental economic control and not by other variables. First, the countries will need to have different levels of governmental economic control (A).

Second, countries need to have a similar level of development of their respective economies (B). Third, the countries must be comparable in the sense that both of them contain an established VC industry (C).

It follows from the research design that the selected countries need to have different levels of governmental economic control. It enables the researcher to compare the effects of weak and strong ties in the VC network on start-up performance in countries with different levels of governmental economic control.

Criterium B needs some more additional explanation. Countries that have a highly developed economy usually also have a low level of governmental economic control and vice versa. This relationship can be derived from comparing the rankings of the World Economic Situations Prospects, which classifies the level of a nation's economy, with the rankings of the Index of Economic Freedom (The Heritage Foundation, 2021; United Nations, 2020). Several findings in literature also indicate that when the level of governmental economic control is lower in a country, economic growth and thus economic development is on a higher level (Pattanaik & Nayak, 2014; Heckelman, 2000). Also, Anokhin and Wincent (2012) argue that the extent to which a country is a market economy, which implies low governmental economic control, positively impacts economic growth. Researching two countries with different levels of governmental economic control, but with a similar level of economic development, enables the researcher to state with more certainty that the potential effect that will be found is caused by the level of governmental economic control, instead of by the level of economic development. This contributes to the validity of the current research.

Furthermore, criterium C states that it is important that the VC markets in both countries are relatively well established. This makes it easy to compare VCs and their networks in these countries with each other. If one of the VC markets would be very small while the other one would be large, this may negatively affect the validity of the research.

As from here, triangulation will be applied and more depth will be provided in order to come to justified conclusions about whether these countries indeed suit the current research. In Table 1, the conducted qualitative approach is summarized.

Table 1

Selection criteria

Selection criterion	Detailed criterion	Main sources
1. Level of governmental economic control	Country 1: needs to have a high level of economic freedom Country 2: needs to have a low level of economic freedom	Fraser Institute (2020); The Heritage Foundation (2021)
2. Level of economic development	Country 1: needs to have a developing economy Country 2: needs to have a developing economy	The United Nations 2020; WTO 2021b; IMF, 2021
3. Maturity of the national VC industry	Country 1: needs to have an established VC industry Country 2: needs to have an established VC industry	Groh, Liechtenstein & Biesinger, 2018

Interestingly, the mean age of the start-ups that are included in the sample of India is approximately 17 years old (Appendix B, Table 15). Meanwhile, the mean age of the start-ups in Singapore is approximately 22 years old (Appendix B, Table 13). The dataset does not provide information about the year in which VCs funded a certain start-up. It is (logically) to be expected that this differs from company to company in the dataset. This implies that it is not only relevant to know how Singapore and India score on the aforementioned selection criteria in the present, but also how they scored on these criteria in the past. For that reason, in each section, the situation of 20 years ago will also be briefly elaborated upon. A timeframe of 20 years has been chosen because this is approximately the mean age of the start-ups that are included in the analyses.

A. Level of governmental economic control

The concept of economic freedom will be used to indicate a country's level of governmental economic control. This can be seen as a valid method because a higher level of governmental economic control generally leads to less economic freedom and vice versa (The Heritage Foundation, 2017; Swaleheen & Stansel, 2007; Sufian & Habibullah, 2010; Lawson, n.d.). The most comprehensive indexes on economic freedom nowadays are the Economic Freedom Index (Fraser Index) created by the Fraser Institute, and the Index of Economic Freedom created by the Heritage Foundation. The main difference between the two indexes is that the framework of The Heritage Foundation tends to reflect more policy variables that are under direct control of the government, while the Fraser Index is to a larger extent dominated by outcome variables (The Heritage Foundation, 2021; Fraser Institute, 2020; Heckelman and Stroup, 2000). Both The Heritage Foundation as well as the Fraser Institute can be seen as

trustworthy and influential organizations. Both organizations are considered to be one of the top think tanks in the World (McGann, 2020).

Using these indexes to measure economic freedom has been selected as the best method to be able to identify different levels of economic freedom across countries. The researcher also searched for other methods to use, but these were hardly available. It was considered to construct a completely new framework for identifying a country's level of governmental economic control, but it was found that this framework would consist completely out of factors that are also in the framework that the Heritage Foundation and/or the Fraser Institute use to measure economic freedom. For that reason, these indexes will be used to measure a country's level of governmental economic control.

The dimensions that the Heritage Foundation (2021), uses to measure economic freedom in a country and construct the Index of Economic Freedom are the following: 'rule of law', 'government size', 'regulatory efficiency' and 'market openness'. In turn, the Fraser Index uses 'size of government', 'legal system and property rights', 'sound money', 'freedom to trade internationally', and 'regulation' as dimensions to measure economic freedom (Fraser Institute, 2020). Additional information concerning these dimensions has been provided in Appendix H and Appendix I.

When comparing the two indexes, it can be seen that Singapore scores very high on economic freedom. It takes the second place out of 162 countries included on the Fraser Index, and scores 8.65 on a scale of 10 on economic freedom. Meanwhile, India takes the 105th place on this index and scores low on economic freedom with a score of 6.56. On the Index of Economic Freedom, Singapore takes the first place out of 178 countries and scores 89.7 on a scale of 100 on economic freedom. India takes the 121th place with a score of 56.5. These rankings and scores indicate that the level of governmental economic control in Singapore is low while being rather high in India.

Meanwhile, 20 years ago, Singapore scored 9.3 on a scale of 10 and took second place on the Fraser Index, while India scored 5.3 on a scale of 10 and took the 92th place out of 123 included countries (Fraser Institute, 2001). Unfortunately, older data from the Heritage Foundation was not freely available. However, the Fraser Index clearly indicates that the level of governmental economic control in Singapore was high 20 years ago, while in India this was relatively low. This is in line with the current situation.

Sub-conclusion

In conclusion, it can be stated that the level of governmental economic control in Singapore is low. Meanwhile, the level of governmental economic control in India is high.

B. Level of economic development

In order to classify a country's level of economic development, a distinction is made between developed and developing economies. This follows the distinction made by the United Nations (2020) and the WTO (2021b). In order to make a robust classification, it is preferable that both countries have been regarded as a developing country for a longer period of time, since this will provide more certainty that the classification will indeed be justified. The WTO and the United Nations do not have a definition of a 'developing economy'. The International Monetary Fund gives more insights in a definition. It uses three main criteria for distinguishing developed and developing economies. These are: (1) per capita income level; (2) export diversification; (3) the degree of integration into the global financial system (IMF, 2021). These criteria will be used below in order to assess the level of economic development in India and Singapore.

India

Credible institutions such as the WTO (2021c) and the United Nations (2020) classify India as a developing economy. The country is and has been concerned to be a developing economy in literature for a long period of time (Patibandla, 2002; Sarkar & Sarkar, 2000; Khan, Adil & Sadiq, 2019; Basu, Roy & Pal, 2020; Verma, Mandal, Robinson & Bajaj, 2020; Jain, Merchant, Roy & Ford, 2019). The same conclusion can be drawn when India is compared to the three criteria of the IMF. When looking at the first criterium, the per capita income level, it can be seen that this at a low level in India. India has a low GDP per capita of approximately $2.100, which ranks the country 122th of the world (The World Bank, 2021). With regard to the criterium of export diversification, it can be stated that India scores relatively strong on this point. There is a well-diversified export diversification of goods in India (Nielsen, 2011). This can also be retrieved from data of the Export Concentration Index **(**UNCTAD STAT, 1997-2019). However, India's export diversification of services is relatively low when compared to other developing markets (Nielsen, 2011). Overall however, also when compared to other countries, India scores high on export diversification (WTO, 2017). Lastly, India was found to be not very well integrated in the global financial system although the country has been in a process of improvement during the last years (Jain & Bhanumurthy, 2005; Niranjan & Anjaneya, 2018; Lane & Schmukler, 2006).

Worth mentioning for illustrative purposes is yet that, in 2011, more than 50% of the Indian population had an income of less than $3.20 per day (US Dollars), indicating high poverty rates

(The World Bank, 2020). In 2018, results of a survey found that only 22% of Indian households could afford washing their hands with soap before dinner (The World Bank, 2020). Based on the information provided, it can be stated that, although the export diversification is on a strong level, there is enough evidence to classify India as a developing economy.

Singapore

In literature, Singapore in the past regularly used to be classified as being a developing economy (Berger, 1999; Ming Wong, Chua & Vasoo, 1998; Wijewardena & Japa, 1998). Nowadays, there is more discussion about this topic. In literature, Singapore is in general seen as a developed economy (Ortmann, 2011; Diehl, Sia & Chandra, 2018; M'ng, Rahman & Sannacy, 2017; Rahardjo & Sugiarto, 2019; Soong, 2020). The WTO (2021a) and the United Nations (2020) however both classify Singapore as a developing economy. This is at least partly caused by Singapore refusing to give up this status and until now cannot be coerced to do so (Yong, 2019). When Singapore is tested against the three criteria of the WHO, the following can be stated. Singapore has a GDP of approximately $372 billion and a GDP per capita of approximately $60.000. This makes it the sixth country in the world ranked on GDP per capita (Statista, 2021a; Statista, 2021b). According to the IMF, Singapore has a high degree of export diversification (Arbatli & Hong, 2016). This is backed up by data from the Export Concentration Index (UNCTAD STAT, 1997-2019). Furthermore, the degree of integration into the global financial system is high in Singapore (Unteroberdoerster & Pongsaparn, 2011; Phylaktis & Ravazzolo, 2002).

Since all three criteria point in the same direction, it is indicated that Singapore is a developed economy. However, the IMF has stated that other factors than the three used here can also play a role when classifying a country's economy (IMF, 2021). Diving further into this matter, arguments in favour of Singapore being classified as a developing economy can be found.

First, Singapore has one of the most unequal income distributions when compared to developed countries. Many inhabitants suffer from long years of wage stagnation. Also, productivity growth performance lacks behind compared to other Asian economies (Tan & Bhaskaran, 2015). Despite the wealth and high level of savings at a macroeconomic level in Singapore, there are major problems concerning the savings for retirement at an individual level (Tan & Bhaskaran, 2015). Besides that, for the past 10 to 15 years, life quality seems to have declined significantly. This is caused by a rising population and a lack of a necessary increase in infrastructure, general public goods and provision of public services (Tan & Bhaskaran, 2015). Also, Singapore is an island with only 5.5 million inhabitants. Its development relies for a large extent on foreign workers, technology and capital. Major shares

of employee compensation and operating surpluses as well as consumption of fixed capital establishments which are recorded in national accounts, belong to foreign people and enterprises. This makes the country very vulnerable to economic shocks and disasters happening outside of their control (Hiok, 1982; Heng, 2013).

Based on the above, it can be stated that Singapore is generally regarded to be a developed economy. However, the country classifies itself as an developing economy and there are different valid arguments to back this up. It is debatable whether Singapore should be classified as a developed or as a developing economy. This thesis follows the classification made by the United Nations and the World Trade Organization. This means that Singapore is seen as a developing economy. But it is recognized that it possesses many characteristics of a developed economy. This means that controlling for the effect of a country's level of economic development in the current research will only be valid to a certain extent.

Sub-conclusion

India and Singapore have both been classified as developing economies. With regard to India, there was a lot of evidence provided for this qualification. Also, it turned out that India has been regarded to be a developing economy for a longer period of time (at least twenty years). Singapore was also regularly classified as being a developing economy twenty years ago. However, with regard to Singapore, the situation is less obvious nowadays. This thesis qualifies Singapore as a developing economy, while recognizing that this country possesses many characteristics of a developed economy.

C. Maturity of the national VC industry

As stated, the countries to investigate must be comparable in the sense that both of them contain an established and active VC industry. Researching the networks of VCs that are active in countries that both have a relatively established and strong VC market could contribute to the validity of the current research.

Singapore

The Singaporean VC industry is established and growing. In 2019 there were more than 220 deals with a net worth of approximately $4.2 billion (Tan, 2019). In comparison, 20 years ago in 2001, the total amount of VC funding invested in Singapore was $384.4 million (Lee & Wong, 2004). These numbers make Singapore the largest venture capital market in Southeast Asia (Post, 2020). Therefore, it is no coincidence that Singapore is regarded to be the start-up funding hub for all of South East Asia (White Star Capital, 2020). The country takes the 6th

place out of 125 countries on the Venture Capital and Private Equity Country Attractiveness Ranking 2018 (Groh et al., 2018).

India

In India, there also is a growing and established VC market. In 2019, 756 deals took place with a net worth of approximately $11.1 billion (Sheth, Krishnan & Upmanyu, 2021; Statista, 2021c). In comparison, a little longer than 20 years ago, in 1998, the Indian VC market was responsible for deals with a net worth of approximately $750 million (Dossani & Kenney, 2002). The country takes the relatively high 23th place out of 125 countries on the Venture Capital and Private Equity Country Attractiveness Ranking 2018 (Groh et al., 2018).

Sub-conclusion

In summary, it can be stated that both countries have an established VC market, scoring high on the Venture Capital and Private Equity Country Attractiveness Ranking and showing a high net worth of yearly VC deals. Although the VC market has been more than twice as large in India during the past twenty years, the VC market in Singapore is also large and flourishing. Therefore, it can be stated that both VC markets have been and still are large enough in order to compare them to each other in the context of the current research.

Conclusion

It has been found that India and Singapore can be used as countries that represent respectively a country with a high and a low level of governmental economic control. Besides that, the choice for these two countries makes it possible to control for the level of development of a country's economy, although this is only valid to a certain extent. Lastly, both countries have an established VC market of a large size. The mentioned criteria were also checked for other countries than Singapore and India that are included in the database, but this did not lead to improvements. For these reasons, the current research will investigate the effects of VC's networks on start-up performance in Singapore and India, in order to answer the main research question.

3.4 Control variables

Control variables are separated into two different levels: syndicate level and portfolio firm level. On portfolio firm level, there will be controlled for age of the company, number of granted patents and number of granted trademarks. Company age is included because previous research has found that it has a significant and positive relation with start-up performance (Song, Podoynitsyna, Van der Bij & Halman, 2008; Ortín-Ángel & Vendrell-Herrero, 2014;

Soetanto & Jack, 2016). Granted patents and granted trademarks are included for the reason that both of these can be important quality signals of the portfolio firms towards VCs (Ter Wal et al., 2016). Also, it has been found that registering patents and trademarks has a positive effect on firm performance (Greenhalgh & Longland, 2005). Furthermore, in line with VC literature, also the variable ´syndicate size´ will function as a control variable (Ter Wal et al., 2016). This control variable is operationalized as the total number of investors that funded a company. For the ease of interpretation, this variable will be named 'number of investors' throughout the current research.

It was also considered to use the variables ´company size' and 'industry type' as control variables in the current research. It was however chosen to leave these variables out of the analyses since including them would have resulted in very small sample sizes.

3.5 Operationalization table

Based on the information given in chapter 3.1 up to and including 3.4, the following operationalisation table has been constructed.

Table 2

Operationalisation Table

Variable	Dimensions	Measure	Main Sources
VCs' networks	Degree centrality	Average score per start-up	Ahuja, 2000**;** Deeds & Hill, 1996; Wang et al., 2017; Zhang & Luo, 2017; Wasserman & Faust, 1994
	Betweenness centrality	Average score per start-up	Brandes et al., 2016; Zhang & Luo, 2017; Wasserman & Faust, 1994
Start-up performance	Revenue	$0 to $1M $1M to $10M $10M to $50M $100M to $500M $500M to $1B $1B to $10B	Leendertse et al., 2021; Sullivan & Marvel, 2011; Groenewegen & Langen, 2012; Rothaermel & Thursby, 2005
	Total funding amount	The total amount of funding a start-up has received.	Lange et al., 2007; Pearlmutter et al., 2007)
Level of governmental economic control		Singapore=low India=high	The Heritage Foundation, 2021; Fraser Institute, 2020

3.6 Analysis

In this section, the research strategy concerning the statistical analyses is set forth.

3.6.1 Linear regression

In this study, both a direct effect and a moderating effect is measured. The data will be analysed in order to explain the linear regression. Multiple regression analysis is appropriate because there are two independent variables (degree and betweenness centrality) included in the analyses (Field, 2018; Hair, Anderson, Black & Babin, 2019). All variables that will be

included in the analyses, except for revenue, are of metric scale. The variable revenue is of ordinal measurement level.

As stated, the effects of VCs' networks on start-up performance will be assessed. The regression model for this relationship is as follows (Field, 2018):

- *Start-up performance= (b_0+b_1Degree centrality+b_2Betweenness centrality)* + ε_i

More specifically, the following two regression models can be distinguished:

- *Revenue= (b_0+b_1Degree centrality+b_2Betweenness centrality)* + ε_i
- *Total funding amount= (b_0+b_1Degree centrality+b_2Betweenness centrality)* + ε_i

In order test the hypotheses, the data will be split and the analyses will be executed. The moderator influences the strength of the relationship between the dependent and the independent variable (Field, 2018). The data will be split in such a way, that two samples are created. One sample contains data from India, whereas the other sample contains data from Singapore. For both of these samples, regression analyses will be conducted concerning the main effect of VCs' networks on start-up performance. The outcomes of this analysis will make it possible to see whether there are differences across these two countries, which could be explained by their different levels of governmental economic control.

Both regressions will be executed separately while controlling for company age, granted trademarks, granted patents and number of investors. Sequential search methods will be used. For every analysis, model 1 will represent the effect of the control variables on the dependent variable. In model 2 and 3, respectively degree centrality and betweenness centrality will be added. With regard to all regression analyses to be conducted, special attention will be paid to the adjusted R square in the model summary. It shows how much of the variance of the dependent variables is explained by the independent variables while taking into account the complexity of the model. Values in between .01 and .09 indicate a weak explanatory power. Values between .09 and .25 indicate a medium explanatory power while values above .25 indicate strong explanatory power (Cohen, 1988). Furthermore, attention will be paid to the coefficients table. *T*-values indicate the relationships of the independent variables with the dependent variables at a significance level of $p<.05$.

Before applying these analyses, it must be assessed whether the sample data fits the statistical assumptions underlying the multivariate technique (Hair et al., 2019). This will be elaborated upon in section 3.6.2 and section 3.6.3.

3.6.2 Sample size

With regard to the sample size, is known as a general rule that the ratio of observations to independent variables should never fall below 5:1 (Hair et al., 2019). This means that five observations have to be made for each independent variable in the variate. Although this minimum level is 5:1, it is desired to have 15 to 20 observations for each independent variable (Hair et al., 2019).

Concerning Singapore, the dataset contains information about 49 start-ups for which an estimated revenue range as well as corresponding VC network measures are given. Besides that, there are 63 Singaporean start-ups that have values for total funding amount as well as corresponding VC network measures. With regard to India, there are 285 start-ups for which an estimated revenue as well as corresponding VC network measures are given. Besides that, there are 342 Indian start-ups that have values for total funding amount as well as corresponding VC network measures. For all of these cases, values for all the control variables are given. The descriptive statistics of the sample can be found in Appendix B, Table 12-16. Since the current research uses two independent variables in the regression analyses, the desired level of 15 to 20 observations for each independent variable is achieved. The conclusion can therefore be drawn that the sample size of the data used in the current research is large enough for a regression analysis.

3.6.3 Assumptions

Before conducting the regression analyses, there needs to be checked for assumptions. The assumptions to be examined are the following: (1) normality of the error term distribution; (2) linearity of the phenomenon measured; (3) independence of the error terms; (4) constant variance of the error terms (Hair et al., 2019). The first assumption states that all metric independent variables should be normally distributed. This is not a strict assumption, but when it is not met, this has influence on the correlation between the variables. Normality is checked by controlling for skewness and kurtosis as well as visual inspection of the variables trough a histogram. Skewness and kurtosis values should be in between -3 and 3 in order for the variable to be classified as normally distributed (McNeese, 2016). Another measure is that the skewness is divided by the standard error of the skewness and the kurtosis is divided by the standard error of the kurtosis. This should give outcomes between -3 and 3 in order for the variables to be classified as normally distributed (Field, 2018).

The second assumption states that there has to be a linear relationship between the independent and the dependent variable(s). By including polynomic terms in the model, this

assumption will be checked. An independent and a dependent variable have a non-linear relationship when one or multiple polynomic terms are significant (alpha <.05; Mark, 2003). The third assumption states that there should be no or only limited multicollinearity, which is also known as the assumption of independence of the error terms. Tolerance values below .10 indicate strong multicollinearity. When the value is between .10 and .20, the researcher has to be alert. For values higher dan .20, no problems are to be expected (Menard, 2002). Furthermore, the corresponding VIF values should ideally be smaller than 5 (Hair et al., 2019). When these values exceed 10, this indicates a serious problem (Bowermann & O'Connel, 1990). The fourth assumption is that there has to be constant variance of the error terms, also known as homoscedasticity. This will be checked by plotting the residuals against the predicted y-values. The resulting values in the plot should be spread equally across the plot. Also, no pattern should seem to emerge (Tranmer, Murphy, Elliot, & Pampaka, 2020).

3.7 Additional analyses

After conducting the main analyses that have been described above, two additional analyses will be performed. These analyses will test whether the results found in the main analyses will hold when two other countries than Singapore and India are chosen to represent a low and a high level of governmental economic control. Concerning these additional analyses, Australia functions as a country with a high level of governmental economic control, (The Heritage Foundation, 2021; Fraser Institute, 2020). Meanwhile, Ukraine represents a country with a low level of governmental economic control (The Heritage Foundation, 2021; Fraser Institute, 2020). These additional analyses will contain the same variables and models as the main analyses contain, and will therefore be executed in an identical manner.

3.8 Reliability and validity

Internal validity means that during a research, the researchers measure what they actually intend to measure. It reflects on whether there may be systematic bias in the research, specified by the degree to which there has been analysed or observed (Bleijenbergh, 2015). Since the current research works with an already existing dataset, the researcher has not been able to influence the process of data collection. The researcher is however able to influence the process of data analysis by carefully examining the data before deciding whether to use it or not. Also, the researcher can be selective in the sections of the dataset that will be used. By including variables that are extensively used throughout literature, as has been described in section 3.4, validity has been ensured (Field, 2018). Also, in order to ensure validity, two additional analyses will be performed in section 4.4. These analyses test whether the results found in the main analyses will hold when two other countries than Singapore and India are chosen to represent a low and a high level of governmental economic control. Furthermore,

chapter 5 compares the results from the current research with related findings in literature. Unexpected predictions possibly indicate a model that is poorly estimated and therefore invalid results (Snee, 1977).

External validity means that findings are generalizable to a larger population (Bleijenbergh, 2015). The dataset used in the current research contains data from VCs and start-ups from all over the world. Therefore, it is possible to get results that score high on external validity. However, a moderation effect will be measured by comparing just two countries with different levels of governmental economic control. This limits the extent to which the current research scores high on external validity.

Ecological validity means that the findings of a study must be applicable in the real world (Butter, 2014). The current research tries to extend our knowledge with regard to the question whether strong or weak ties in the VC network are most beneficial in their relation with start-up performance in countries with different levels of governmental economic control. VCs could potentially use the outcomes of this study to alter their own networks in such a way that enhances start-up performance. Start-ups could use the findings of this study to identify which VCs have the networks that in general can enhance their performance the best. This implies a strong ecological validity.

Reliability means that findings must not be distorted by accidental deviations (Bleijenbergh, 2015). The dataset used in the current research is very factual. It does not contain information that is based on subjective survey questions. Instead, all information the dataset contains is objective and emotions play no role. This positively affects the degree of reliability of the current research. Furthermore, the reliability of the coefficients will be checked by paying attention to the collinearity statistics. In the case that multicollinearity levels will be insufficient, this could negatively affect the reliability of the estimations that will be made (Midi, Sarkar & Rana, 2010).

3.9 Research ethics

The current research is conducted in line with the principles for research ethics of APA (Smith, 2003). These principles include privacy, confidentiality and considerations with regard to deception. Because this research makes use of an external dataset, it has no influence on the process of data collection, which is usually the most important part with regard to research ethics. To avoid deception, all the data was treated carefully. Data has not been altered or deleted without a good and justified reason.

4. Results

In this chapter, the results from the regression analyses are presented. Firstly, the process of checking different assumptions will be laid out. After that, the final results will be presented.

4.1 Descriptive statistics

In Appendix B, Table 12-16, the descriptive statistics of the dependent, control and independent variables are reported. Information about the variables and the sample size has been provided in chapter three. In section 4.2, the normality of the distributions is assessed together with the other assumptions.

4.2 Assumptions

Prior to the regression analyses, an examination of the corresponding assumptions has been conducted. As stated, the assumptions to be examined are the following: (1) normality of the error term distribution; (2) linearity of the phenomenon measured; (3) independence of the error terms; (4) constant variance of the error terms (Hair et al., 2019).

With regard to the assumption of normality of the error term distribution, the following can be stated. The square root functions of 'meandegreecentrality' and 'meanbetweennesscentrality' present a more normal distribution than the original variables. In Appendix B, figure 3 up to and including 10, visualizations of these distributions can be found and in Table 12 and 14, the descriptive statistics of these variables can be found. Across both samples, skewness and kurtosis values of both square root variables often score between -3 and 3, indicating a normal distribution (McNeese, 2016). Note however that this is not always the case. Also, when the kurtosis and the skewness are divided by the corresponding standard error values for kurtosis and skewness, the outcomes regularly lie outside of the range -3 until 3, meaning that there are deviations from a normal distribution (Field, 2018). A regression analysis is however regarded to be robust enough to handle these deviations (Schmidt & Finan, 2018).

Linearity was checked by centering the independent variables and including these into regression analyses, accompanied by quadratic and cubic polynomic terms (Mark, 2003). The results can be found in Appendix C, Table 17 and Table 18. Concerning the analysis that predicts revenue, no polynomic terms were found to be significant in both India and Singapore. With regard to total funding amount, the second polynomic term of degree centrality was found to be significant in India (t=-2.232, p<.05). All other polynomic terms across both samples turned out to be insignificant. Including the significant polynomic term in the final regression model did only cause a minor increase in the total amount of explained

variance, as can be seen in Table 19 of Appendix C. Therefore, it has been decided to exclude this polynomic term from the analyses.

Regarding the assumption of independence of error terms, which is also known as the assumption of multicollinearity, the collinearity tolerance values and VIF values were checked. The outcomes can be found in Appendix D, Table 22 and 25. As stated, tolerance values should be at least above 0.1 and preferably above 0.2 (Menard, 2002). When checking the collinearity tolerance values, it can be seen in Table 25 that concerning the prediction of total funding amount, the tolerance values in India for both independent variables are .068. Both corresponding VIF values are above 10, which means that the level of multicollinearity here is too high (Bowermann & O'Connel, 1990). In Singapore, the independent variables have tolerance values of .123 and .119, which is barely sufficient. The corresponding VIF values are 8.148 and 8.424, which is also barely sufficient. Regarding the prediction of revenue**,** tolerance values in India are .059 for both variables. In Singapore, these values are .067 and .068. This indicates that for both countries, the levels of the tolerance values are not sufficient. Furthermore, all VIF values here are higher than 10. In summary, it can be stated that the assumption of independence of error terms is not met across both samples. Only in Singapore when predicting total funding amount, the assumption is met, but only with low margins.

Constant variance of error terms has been examined across both samples by using scatterplots in which the residuals are plotted against the predicted *y*-values (Tranmer et al., 2020). The results can be found in Appendix C, Figure 11, 12, 13 and 14. In order to accomplish a sufficient level of homoscedasticity, the variable total funding amount was transformed into a logarithmic function for the sample of both India as well as Singapore. With regard to the variable revenue, the assumption of constant variance of error terms was met instantly. Both the scatterplot of the logarithmic function of total funding amount and the scatterplot of revenue show that no pattern seems to emerge in the plot and the residuals are spread relatively equal across the plot, with sometimes a few minor deviations here and there.

4.3 Multiple regression analyses

In this section the results of the analyses will be presented. These analyses produce results that can answer the two sub-questions of the current research. Two multiple regression analyses have been conducted here. The sample was split to distinguish effects for India on the one hand and Singapore on the other hand. For all analyses, model 1 represents a model in which only the control variables are included. Model 2 and 3 for both analyses represent a model in which respectively degree centrality and betweenness centrality have been added.

India

In this section, the main results concerning the first and the second hypothesis are outlined. The results are presented in Table 3.

Hypothesis 1 states that in countries that have a high level of governmental economic control, strong ties in the VC network are beneficial for start-up performance. This means that it is expected that degree centrality has a significant positive effect on total funding amount and revenue. Concerning the prediction of revenue, model 2 added degree centrality and this effect was found to be insignificant and negative (β=-.824, p>.05). This effect remained insignificant and negative when model 3 is added (β=-2.192, p>.05). With regard to the prediction of total funding amount, the effect of degree centrality was found to be significant and positive (β= 6.441, p<.01). When model 3 was added, this effect becomes insignificant (β=13,891, p>.05). This means that the first hypothesis has to be rejected. An interesting finding however is that the significance value of degree centrality in model 3 remains relatively low, given that this value is set on .091. This indicates that there could be an effect between degree centrality and total funding amount present. In the discussion, this finding will be elaborated upon.

Hypothesis 2 states that in countries that have a high level of governmental economic control, weak ties in the VC network are not beneficial for start-up performance. This means that it is expected that betweenness centrality does not have a significant positive effect on total funding amount and revenue. With regard to the prediction of revenue, model 3 added betweenness centrality and this effect was found to be insignificant and positive (β=2.259, p>.05). Concerning the prediction of revenue, the effect of betweenness centrality was again found to be negative and insignificant (β=-15.660, p>.05). Therefore, hypothesis two is accepted.

Concerning all the analyses in India, it was found that model 1, which includes all control variables, explained the vast majority of the total amount of explained variance. This can be retrieved from the adjusted R square value. The added models 2 and 3 caused, throughout all these analyses, only a very small increase in the total amount of explained variance. Sometimes, the addition of model 2 and/or model 3 even caused a decrease in the total amount of variance explained. This indicates that the (potential) effect size of degree and betweenness centrality on start-up performance and revenue is rather small.

Table 3

Regression Results India

	Total funding amount			Revenue		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Constant	12.274*** (.268)	11.991*** (.299)	11. 928*** (.306)	.412*** (.086)	.455*** (.095)	.462*** (096)
IP – Trademarks	-0.25 (.125)	-.038 (.123)	-.026 (.124)	-.008 (.028)	-.009 (.28)	-.010 (.028)
IP – Patents	.079 (.077)	.078 (.076)	.083 (.077)	.035 (.030)	-.036 (.030)	-.037 (.030)
Age of Company	.071*** (.012)	.072*** (.012)	.072*** (.012)	.022*** (.003)	.022*** (.003)	.022*** (.003)
Number of Investors	.498*** (.046)	.475*** (.046)	.471*** (.046)	.012 (.047)	.014 (.047)	.016 (.047)
Average Degree Centrality (SQRT)		6.441*** (2.169)	13.891* (8.193)		-.824 (.779)	-2.192 (3.172)
Average Betweenness centrality (SQRT)			-15.660 (16.608)			2.259 (5.078)
N	342	342	342	285	285	285
Adj. R Square .	.323	.339	.339	.133	.133	.131
Df (1, 2)	4, 337	5, 336	6, 335	4, 280	5, 279	6, 278
F value	41.755***	35.944***	30.091***	11.877***	9.730***	8.118***

Note. Table 3 presents the OLS regression results in India. Model 1 only incorporates control variables. Model 2 adds the independent variable degree centrality while model 3 adds the independent variable betweenness centrality. ***p<.01, **p<.05, * p<.1.

Singapore

In this section, the main results with regard to the third and the fourth hypothesis are outlined. The results are presented in Table 4.

Hypothesis 3 states that in countries that have a low level of governmental economic control, strong ties in the VC network are not beneficial for start-up performance. This means that it is expected that degree centrality does not have a significant positive effect on total funding amount and revenue. Concerning the prediction of revenue, model 2 added degree centrality and this effect was found to be insignificant and negative (β=-.789, p>.05). This effect remained insignificant and negative when model 3 was added (β=-2.024, p>.05). With regard to the prediction of total funding amount, the effect of model 2 was found to be insignificant and positive (β=3.556, p>.05). When model 3 was added, this effect again remained insignificant

and positive (β=10.561, p>.05). Since all effects are found to be insignificant, the third hypothesis is accepted.

Hypothesis 4 states that in countries that have a low level of governmental economic control, weak ties in the VC network are beneficial for start-up performance. This means that it is expected that betweenness centrality has a significant positive effect on total funding amount and revenue. Concerning the prediction of revenue, model 3 added betweenness centrality and this effect was found to be insignificant and negative (β=-17.530, p>.05). Concerning the prediction of revenue, model 3 again added betweenness centrality. The effect was found to be positive and insignificant (β=2.046, p>.05). Since all the effects were found to be insignificant, hypothesis 4 is rejected.

Concerning the analyses that predict revenue, it was found that model 1, which includes all control variables, explained the vast majority of the total amount of explained variance. This can be retrieved from the adjusted R square value. The added models 2 and 3 caused a small decrease in the total amount of explained variance throughout these analyses. This indicates that the effect size of degree and betweenness centrality on start-up performance and revenue is rather small here. This is also true concerning the analyses that predict total funding amount. The only difference is that here, also model 1 has very low explanatory power, given the low value of the adjusted R square (Cohen, 1988).

Table 4

Regression results Singapore

	Total funding amount			Revenue		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Constant	14.664***	14.832***	14.509***	.256	.284	.292
	(.436)	(.519)	(.492)	(.181)	(.202)	(.214)
IP – Trademarks	-0.071	-.069	-.061	-.196***	-.198***	-.199***
	(.251)	(.254)	(.254)	(.065)	(.066)	(.068)
IP – Patents	.620	.551	.590	1.902***	1.886**	1.833**
	(.507)	(.532)	(.544)	(.691)	(.700)	(.709)
Age of Company	.012	.011	.012	.025***	.025***	.025***
	(.011)	(.011)	(.011)	(.004)	(.004)	(.004)
Number of Investors	.268**	.246**	.260**	-.006	-.006	-.005
	(.112)	(.117)	(.114)	(.102)	(.104)	(.105)
Average Degree Centrality (SQRT)		3.556	10.561		-.789	-2.024
		(5.544)	(15.278)		(2.463)	(9.461)
Average Betweenness centrality (SQRT)			-17.530			2.046
			(35.588)			(15.125)
N	63	63	63	49	49	49
Adj. R Square	.051	.041	.029	.462	.450	.438
Df (1, 2)	4, 58	5, 57	6, 56	4, 44	5, 43	6, 42
F value	1.836	1.536	1.304	11.287***	8.866***	7.223***

Note. Table 4 presents the OLS regressions in Singapore. Model 1 only incorporates control variables. Model 2 adds the independent variable degree centrality while model 3 adds the independent variable betweenness centrality. ***p<.01, **p<.05, * p<.1.

4.4 Additional analyses

In order to make sure that the results are valid and not caused by the choice of two certain countries, two additional analyses have been performed. With these additional analyses, it is tested whether the results found in the main analyses will hold when two other countries are chosen to represent a low and a high level of governmental economic control. The results of these additional analyses are outlined in this section. The additional analyses entail the choice of two other countries, for which the regression analyses have been conducted again. Based on the Index of Economic Freedom and the Fraser Index, two countries have been chosen to function as countries with respectively a high and a low level of governmental economic control. As a country with a high level of governmental economic control, Australia was chosen (The Heritage Foundation, 2021; Fraser Institute, 2020). Ukraine functions as a country with a low level of governmental economic control (The Heritage Foundation, 2021; Fraser Institute, 2020).

4.4.1 Descriptive statistics

The descriptive statistics can be found in Appendix E, Table 26-30. The sample sizes for each of the analyses exceeds the desired 15 to 20 observations for each independent variable and are therefore sufficient. Furthermore, concerning the sample of Australia, no information about the variables stands out. For the sample of Ukraine however, there are a few notable findings concerning the control variables and the dependent variables. Table 29 shows that there are high values for the amount of patents and trademarks granted. The mean amount of trademarks registered per company is set on 64.58 while the mean amount of patents granted is 402.64. There also seems to be a high number of investors per start-up, given the mean of 12.37 investors per start-up. As can be seen in Table 29, the maximum values of these variables in the dataset are also very high. Furthermore, it is mentioned that the descriptive statistics of the (original) dependent variables total funding amount and revenue show that also the values of these variables are very high in Ukraine (Table 30).

Table 5, which is presented below, shows that all of the mentioned variables have values that are a lot higher than the values that were found in Australia, Singapore and India. When investigating the specific companies and VCs that were included in the sample of Ukraine, it was found that there are a relative high number of companies included that have very large values for revenue, total funding amount, number of trademarks granted, number of patents granted and/or number of investors. It was found that these values are likely to be correct, since the companies with large values for these variables that were found are mostly established multinational brands, such as Baxter International and Semiconductor Manufacturing International. However, these companies could bias the results seeming that most other companies in Ukraine that were included in the regression analyses have a lot less revenue, total funding amount, investors, trademarks and patents than these large companies. Therefore, the reader must be conscious that the effects of patents and trademarks granted as well as number of investors on revenue and total funding amount, that were found for the sample of Ukraine, might be inaccurate.

Table 5

Mean values of the identified outstanding variables

Country	Total Funding Amount Currency (in USD)	Revenue Range[a]	IPqwery – Trademarks registered	IPqwery – Patents Granted	Number of Investors
Singapore	12612359.98	.76	.22	.04	1.93
India	17304992.32	.76	.22	.25	1.95
Australia	20050345.21	.85	.20	.36	1.83
Ukraine	573473184.15	2.62	64.58	402.64	12.37

Note. This table displays the mean values for the variables: total funding amount, revenue, number of trademarks granted, number of patents granted and number of investors. All values that are included are extracted from the samples that predict revenue as well as the samples that predict total funding amount. [a] 0=$0 to $1M; 1=$1M to $10M; 2=$10M to $50M; 3=$100M to $500M; 4=$500M to $1B; 5=$1B to $10B.

4.4.2 Assumptions

First, the assumptions for conducting a regression analysis were checked for both countries. The outcomes of these checks can be found in Appendix F. The variables of 'meandegreecentrality' and 'meanbetweennesscentrality´ were transformed into square root functions in order to improve the normal distribution of these variables. The distributions can be found in Appendix E Table 26 and 28 and Figure 15 up to and including 22. When checking for the assumption of linearity, it was found that the quadratic and the cubic polynomic terms of degree centrality are significant (p<.05) for the sample of Ukraine when predicting total funding amount (Appendix F, Table 31 and 32). This indicates a violation of the assumption of linearity (Mark, 2003). Including these polynomic terms in the final regression model did however only result in a minor increase in the total amount of explained variance, as can be found in Appendix F, Table 33. Therefore, the polynomic terms have been excluded from the analysis. Besides these two polynomic terms, all other polynomic terms were found to be insignificant across both samples, implicating that the assumption of linearity was met here (Mark, 2003). Concerning the assumption of constant variance of the error terms, no violations were found, as can be found in Appendix F, Figure 23-26. There are however some problems with regard to the multicollinearity levels to be found, as can be seen in Appendix G, Table 36 and Table 39. Concerning the prediction of total funding amount as well as revenue in Australia, the tolerance values of degree and betweenness centrality are far beneath 0.1 while the VIF statistics have values higher dan 10, indicating very high levels of multicollinearity (Bowermann & O'Connel, 1990; Menard, 2002). For the sample of Ukraine, with regard to both predictions, all multicollinearity levels are sufficient but still in the danger zone.

4.4.3 Results

In this section, the results of the additional analyses are presented.

Ukraine

As laid out, hypothesis 1 states that in countries that have a high level of governmental economic control, strong ties in the VC network are beneficial for start-up performance. This means that it is expected that degree centrality has a significant positive effect on total funding amount and revenue. Concerning the prediction of revenue, model 2 added degree centrality and this effect was found to be significant and positive (β =.3.576, p<.01). This effect remained positive and significant when model 3 was added (β=11.184., p<.01). With regard to the prediction of total funding amount, the effect of degree centrality was again found to be significant and positive (β=3.616, p<.01). When model 3 was added, this effect remained significant and positive (β=10.807, p<.01). Since all coefficients are positive and significant, support for hypothesis 1 is resulting from this additional analysis.

As has also been laid out before, hypothesis 2 states that in countries that have a high level of governmental economic control, weak ties in the VC network are not beneficial for start-up performance. This means that it is expected that betweenness centrality does not have a significant positive effect on total funding amount and revenue. With regard to the prediction of revenue, model 3 added betweenness centrality and this effect was found to be significant and negative (β=-15.957, p<.01). Concerning the prediction of total funding amount, the effect of betweenness centrality was also found to be negative and significant (β=-15.266, p<.01). Since all coefficients are negative and significant, this additional analysis provides support for hypothesis 2.

It was found that model 1, which includes all control variables, explained the vast majority of the total amount of explained variance throughout all the analyses. This can be retrieved from the adjusted R square value. The added models 2 and 3 caused, throughout all these analyses, only a very little increase in the total amount of explained variance. This indicates that the effect size of degree and betweenness centrality on start-up performance and revenue is rather small.

Furthermore, the coefficients of number of trademarks and number of patents granted turn out to have very low values throughout all the analyses. They are also insignificant. As laid out, this could be caused by some companies in the dataset that have very high values for these variables. The coefficients of number of investors seem to have relatively low values throughout the analyses, this could also be caused by these companies. However, these

coefficients are found to be significant throughout all models and their values are not extremely low.

Table 6

Regression results Ukraine

	Total funding amount			Revenue		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Constant	17.684*** (.098)	17.391*** (.140)	17.305*** (.142)	1.767*** (.103)	1.471*** (.146)	1.380*** (.149)
IP – Trademarks	.000 (.000)	.000 (.000)	.000 (.000)	.000 (.000)	.000 .000	.000 (.000)
IP – Patents	2.052E-5 (.000)	2.204E-5 (.000)	2.297E-5 (.000)	1.625E-5 (.000)	1.770E-5 (.000)	1.875E-5 (.000)
Age of Company	.013*** (.003)	.014*** (.003)	.015*** (.003)	.036**** (.003)	.038*** (.003)	.038*** (.003)
Number of Investors	.065*** (.005)	.057*** (.006)	.055*** (.006)	.026*** (.005)	.018*** (.006)	.015** (.006)
Average Degree Centrality (SQRT)		3.616*** (1.230)	10.807*** (2.768)		3.576*** (1.271)	11.184*** (2.830)
Average Betweenness centrality (SQRT)			-15.266*** (5.271)			-15.957*** (5.309)
N	935	935	935	889	889	889
Adj. R Square	.143	.150	.156	.194	.201	.208
Df (1, 2)	4, 931	5, 930	6, 929	4, 884	5, 883	6, 882
F value	39.907***	33.917***	29.887***	54.562***	45.575***	39.830***

Note. Table 6 presents the OLS regressions in Ukraine. Model 1 only incorporates control variables. Model 2 adds the independent variable degree centrality while model 3 adds the independent variable betweenness centrality. ***p<.01, **p<.05, * p<.1.

Australia

As has been laid out, hypothesis 3 states that in countries that have a low level of governmental economic control, strong ties in the VC network are not beneficial for start-up performance. This means that it is expected that degree centrality does not have a significant positive effect on total funding amount and revenue. Concerning the prediction of revenue, model 2 added degree centrality and this effect was found to be insignificant and positive (β=.013, p>.05). This effect remained positive and insignificant when model 3 was added (β=1.386, p>.05). With regard to the prediction of total funding amount, the effect of degree centrality was again found to be insignificant and positive (β=4.654, p>.05). When model 3 was added, this effect remains

insignificant and positive (β=4.019, p>.05). Since all coefficients are insignificant, support for hypothesis 3 is resulting from this additional analysis.

As has also been laid out before, hypothesis 4 states that in countries that have a low level of governmental economic control, weak ties in the VC network are beneficial for start-up performance. This means that it is expected that betweenness centrality has a significant positive effect on total funding amount and revenue. With regard to the prediction of revenue, model 3 added betweenness centrality and this effect was found to be insignificant and negative (β=-2.485, p>.05). Concerning the prediction of total funding amount, the effect was found to be positive and insignificant (β=1.288, p>.05). Since all coefficients are insignificant, this additional analysis does not provide support for hypothesis 4.

It was found again that model 1, which includes all control variables, explained the vast majority of the total amount of explained variance throughout all the analyses. This can be retrieved from the adjusted R square value. The added models 2 and 3 caused, throughout all these analyses, only a very little increase or even a small decrease in the total amount of variance explained. This indicates that the effect size of degree and betweenness centrality on start-up performance and revenue is rather small.

Table 7

Regression results Australia

	Total funding amount			Revenue		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Constant	12.898***	12.656***	12.662***	.242*	.241	.236
	(.403)	(.438)	(.455)	(.136)	(.202)	(.162)
IP – Trademarks	-.457	-.567	-.572	-.049	-.049	-.045
	(.430)	(.435)	(.450)	(.101)	(.101)	(.102)
IP – Patents	.206	.228	.228	-.033	-.033	-.034
	(.146)	(.146)	(.147)	(.037)	(.037)	(.038)
Age of Company	.040**	.042***	.042***	.024***	.024***	.024***
	(.016)	(.016)	(.016)	(.005)	(.005)	(.005)
Number of Investors	.548***	.534***	.534***	.106	.106	.105
	(.081)	(.081)	(.081)	(.065)	(.066)	(.066)
Average Degree Centrality (SQRT)		4.654	4.019		.013	1.386
		(3.337)	(13.589)		(1.323)	(4.935)
Average Betweenness centrality (SQRT)			1.288			-2.485
			(26.737)			(8.599)
N	137	137	137	103	103	103
Adj. R Square	.280	.285	.279	.230	.222	.215
Df (1, 2)	4, 132	5, 131	6, 130	4, 97	5, 96	6, 95
F value	14.209***	11.838***	9.790***	8.548***	6.768***	5.600***

Note. Table 7 presents the OLS regressions in Australia. Model 1 only incorporates control variables. Model 2 adds the independent variable degree centrality while model 3 adds the independent variable betweenness centrality. ***p<.01, **p<.05, * p<.1.

4.5 Comparison of results

It can be summarized that no significant relationships between the independent variables degree centrality and/or betweenness centrality and the dependent variables total funding amount or revenue result from the main analyses. Besides that, the effect sizes of both degree and betweenness centrality on total funding amount and revenue were found to be small throughout all analyses. In India, degree centrality was significant in the second model when predicting total funding amount, but this significant effect disappeared when model 3 was added. The significance value here however remains relatively low, given that this value is set on .091. This indicates that there could be an effect between degree centrality and total funding amount present. Although this gives us an indication that there could be an effect present, it has to be concluded that no effect of strong and weak ties in the VC network on the performance of start-ups has been found. Therefore, hypothesis 1 and 4 are rejected. Meanwhile, hypothesis 2 and 3 are supported.

The results of the additional analyses endorse to a certain extent what has been found in the main analyses. As evaluated upon, the results of the main analyses give an indication that strong ties could be beneficial for start-up performance in a country with a high level of governmental economic control, although strictly taken, hypothesis 1 had to be rejected. The results of the sample of Ukraine show that in this country, degree centrality has a significant positive relationship with both total funding amount as well as revenue. Since Ukraine stands for a country with a high level of governmental economic control, this is an indication that strong ties indeed could be beneficial for start-up performance in a country with a high level of governmental economic control. This indicates that hypothesis 1 should be accepted. Furthermore, the effects of betweenness centrality were found to be significant and negative throughout all analyses that were conducted with regard to the sample of Ukraine. In line with the main analyses, this indicates that hypothesis 2 should be accepted. Furthermore, in Australia, where the level of governmental economic control is low, no significant effects were found. This means that this additional analysis indicates that hypothesis 3 should be rejected, while hypothesis 4 should be accepted. This is similar to the results of main analyses, where no significant effects in Singapore where found.

Table 8

Overview of the Expected Results

	Low control	High control
Weak ties	X (Singapore) X (Australia)	--
Strong ties	--	X (India) X (Ukraine)

Note. Table 8 presents an overview of the results that were expected prior to conducting the regression analyses. The table shows the expectation that in countries with a low level of governmental economic control, weak ties in the VC network are beneficial to start-up performance while in countries with a high level of governmental economic control, strong ties in the VC network lead to more start-up performance.
N sample (total funding amount, revenue) Singapore= 63, 49; *N* sample India = 342, 285; *N* sample Australia= 137, 103; *N* sample Ukraine= 935, 889.

Table 9

Overview of the Final Results

	Low control	High control
Weak ties	X (Singapore) X (Australia)	--
Strong ties	--	X (India) X (Ukraine)

Note. Table 9 presents an overview of the results that were found after conducting the regression analyses. The table shows that the expectations for Singapore, Australia and India were found to be false, while the expectations for Ukraine were found to be true.
N sample (total funding amount, revenue) Singapore= 63, 49; *N* sample India = 342, 285; *N* sample Australia= 137, 103; *N* sample Ukraine= 935, 889.

Table 10

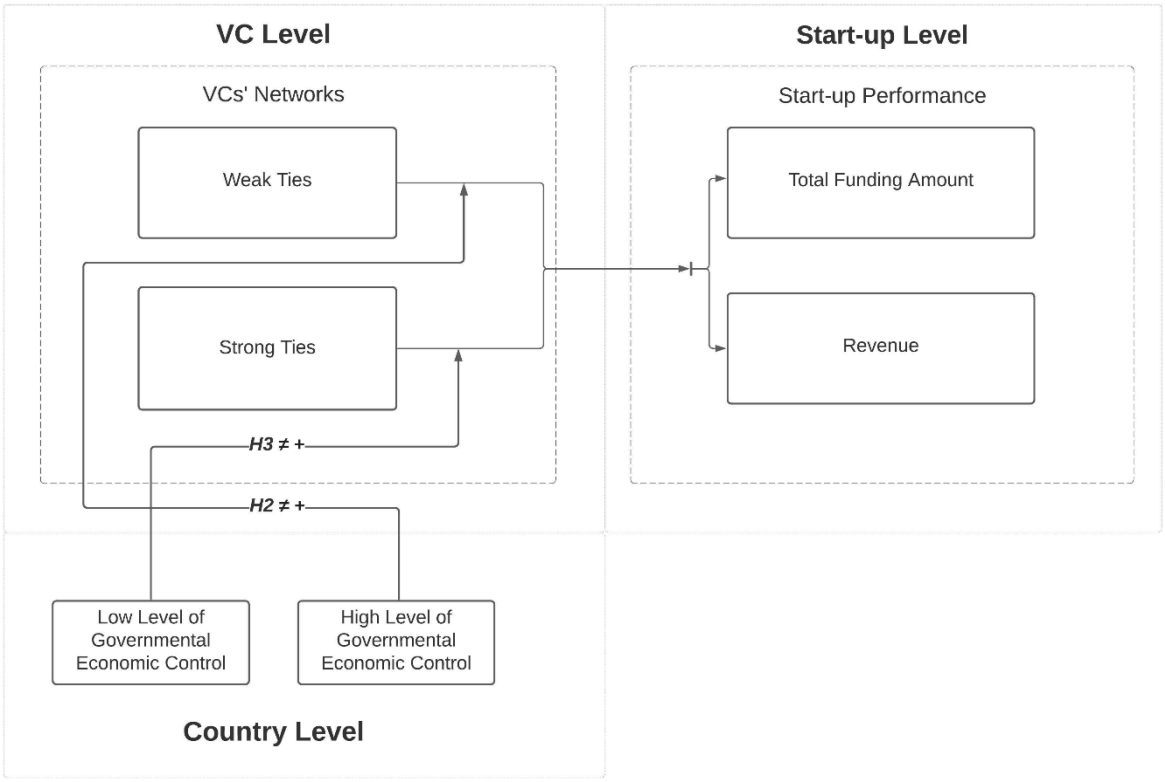
Summary of the Results

Hypothesis	Description	Results following from main analyses	Results indicated by additional analyses
H1	*H1: in countries that have a high level of governmental economic control, strong ties in the VC network are beneficial for start-up performance.*	Rejected	Accepted
H2	*H2: in countries that have a high level of governmental economic control, weak ties in the VC network are not beneficial for start-up performance.*	Accepted	Accepted
H3	*H3: in countries that have a low level of governmental economic control, strong ties in the VC network are not beneficial for start-up performance.*	Accepted	Accepted
H4	*H4: in countries that have a low level of governmental economic control, weak ties in the VC network are beneficial for start-up performance.*	Rejected	Rejected

Based on the information provided above, the following model is constructed. The model shows that hypothesis 2 and 3 are accepted, while hypothesis 1 and 4 are rejected.

Model 3

Definite model



5. Discussion & Conclusion

In this chapter the discussion and conclusion are presented. The chapter includes theoretical and practical contributions, limitations of the current research and recommendations for future research.

5.1 Discussion of findings in comparison with prior research

Bruton and Ahlstrom (2003), and Nirei et al. (2020) found that statistical properties of syndication networks across countries differ from each other, which is caused by differences in some conditions of VC markets in these countries, such as regulations and institutions. It has been stated before that in countries with a high level of governmental economic control, the level of economic uncertainty is generally higher (La Porta et al., 2002; PwC, 2021). In such countries, VCs will tend to invest together with other VCs with whom they already have done investments in the past (Podolny, 1994). The reason for this is that relational trust and history with contacts give businesses the feeling that the uncertainties surrounding their outcomes and purposes are mitigated this way (Molm, et al., 2000). This was found to be in line with a study conducted by Berggren and Jordahl (2005). They found that a higher level of economic freedom in a country, and therefore a lower level of governmental economic control, leads to more trust to emerge between businesses. When the level of governmental economic control in a country is high, the level of trust between businesses will be lower (Berggren & Jordahl, 2005). As elaborated upon in chapter 1 and 2, this raises the suspicion that strong ties in the VC network will be beneficial for start-up performance in countries with a high level of governmental economic control, while weak ties in the VC network are suspected to be beneficial in countries with a low level of governmental economic control. It can be stated that the results of this thesis, to a certain extent, point into the same direction. This is the case since there are indications that there is a positive relationship between strong ties in the VC network and start-up performance in countries with a high level of governmental economic control. This positive relationship seems to be absent in countries with a low level of governmental economic control. It was however not in line with the aforementioned studies that a significant positive effect of weak ties in countries with a low level of governmental economic control was found to be absent.

As stated, there is an indication found that suggests that strong ties in in the VC network could be beneficial in countries with a high level of governmental economic control. Meanwhile, weak ties do not seem to be beneficial in either these countries or in countries with a low level of governmental economic control. This provides new insights into the discussion in literature about whether strong or weak ties in general, meaning not necessarily specified on VCs, are

beneficial for start-up performance. It has been laid out that certain scholars argue that strong ties cause a so called 'lock in' effect, resulting in businesses being not amenable to novel market information or new technologies (Gulati & Garigiulo, 1999; Uzzi, 1996; Rowley et al., 2000). The results of the current research point into the direction that in countries with a high level of governmental economic control, this lock-in effect of strong ties is not large enough to neutralize the informational benefits that these ties can provide according to other scholars (Gulati & Garigiulo, 1999; Adler & Kwon, 2002). On the other hand, the proposed benefits that weak ties offer according to certain scholars (Uzzi, 1996; Rowley et al., 2000; Elfring & Hulsink, 2007) do, according to the outcomes of the current research, not seem to exist in countries with either a high or a low level of governmental economic control.

The findings of the current research are not in line with research conducted by Ter Wal et al. (2016) and Hochberg et al. (2007), which can be seen as the two most high-profile studies that have been conducted concerning the effect of VCs´ networks on start-up performance. Ter Wal et al. (2016) did, in contrast to (the main analyses of) this thesis, find significant effects of VC's networks on start-up performance. This can have multiple different explanations. Firstly, the current research has several important limitations that could have caused these contrary findings. In section 5.4 this will be elaborated upon. Furthermore, Ter Wal et al. (2016) used another indicator for start-up performance, namely the probability that a start-up receives second round funding. It could be that this particular performance indicator has a stronger relationship with VCs' networks. Also, Ter Wal et al. (2016) only used data of software companies. It could be that in certain industries, the effects of VCs' networks on start-up performance are (a lot) stronger than in other industries. That would mean that if the software industry is such a certain industry, the results that Ter Wal et al. (2016) found could be biased and only true for that specific industry. Yet another possible explanation is that weak and strong ties do not represent the significant effect that VCs' networks have on start-up performance well enough. Ter Wal et al. (2016) did not exactly investigate the effect of weak and strong ties on start-up performance. Instead, they distinguished open-diverse, open-specialized, closed-specialized and open-diverse networks of VCs, and examined the effects of these categories on start-up performance. While the distinction between open and closed networks is to a certain extent similar to the distinction between weak and strong ties, this thesis did, as stated, not take into account the actors' knowledge similarity. It is possible that the distinction that the current research made between weak and strong ties is not specific enough, because in reality the situation is more complex and the categories that Ter Wal et al. (2016) distinguished represent this reality more accurately.

Findings are also not in line with Hochberg et al. (2007). They found that portfolio companies of better-networked VCs had a significant higher probability to survive to an eventual exit and/or subsequent financing, which they use as indicators for start-up performance. Hochberg et al. (2007), similarly to Ter Wal et al. (2016), used different performance indicators than those that were used in this thesis. Therefore, the possible explanation that total funding amount and revenue do not correlate with VCs' networks as much as these other performance indicators do, is present here again.

5.2 Conclusion

The first sub-question of the current research is: '*what is the relationship between VCs' networks and start-up performance in a country with a high level of governmental economic control*?' The results show that both strong and weak ties in the VC network do not lead to more start-up performance. However, it has become apparent that there are indications that there could nevertheless be an effect present, since certain significance values of degree centrality that were found in India are relatively low. These indications are backed up by the additional analyses, where it was found that in Ukraine, there is a positive effect of strong ties in the VC network on start-up performance. Summarized, it must be stated that, strictly taken, the current research did not find a significant relationship between VCs' networks and start-up performance in a country with a high level of governmental economic control. Therefore, the results show that both strong and weak ties in the VC network do not lead to more start-up performance in a country with a high level of governmental economic control. There are however indications that there could nevertheless be a positive effect of strong ties in the VC network present.

The second sub-question of the current research is: '*what is the relationship between VCs' networks and start-up performance in a country with a low level of governmental economic control?*' A significant relationship between VCs' networks and start-up performance was not found during the main analyses or the additional analyses. Therefore, the results show that both strong and weak ties in the VC network do not lead to more start-up performance in a country with a low level of governmental economic control.

The main research question answered in the current research is: '*what is the effect of a country's level of governmental economic control on the relationship between VCs' networks and start-up performance?*'. Since all effects that were found in the main analyses were insignificant, no moderation effect of a country's level of governmental economic control on the relationship between VCs' networks and start-up performance was found. However, there are

indications that in countries that have a high level of governmental economic control, there could be a positive effect of strong ties in the VC network on start-up performance, while this effect is absent in countries with a low level of governmental economic control. This means that although a significant moderation effect has not been found, one cannot state that this moderation effect does not exist.

5.3 Theoretical and practical contributions

In section 5.1, the findings of the current research in comparison to prior research have been discussed. This leads to different theoretical and practical contributions that are explicitly highlighted in this section once more. Firstly, as stated, studies conducted by Hochberg et al. (2007) and Ter Wal et al. (2016) found a relationship between the structure of VCs' networks and the performance of their corresponding portfolio companies. The current study adds to this literature by being the very first to investigate a potential moderation effect of a country's level of governmental economic control on the relationship between VCs' networks and start-up performance (on portfolio company level). Therefore, the contribution that the current research makes is that it provides first theoretical insights into this moderation effect. It gives science an indication that there could be an effect of a country's level of governmental economic control on the relationship between VCs' networks and start-up performance. Also, the current research is the first that explicitly focusses on the effect of weak and strong ties in the VC network on start-up performance. Therefore, it provides new theoretical insights into how these ties in the VC network can affect start-up performance at the portfolio company level. In line with studies from Berggren and Jordahl (2005), Molm et al. (2000) and Podolny (1994), the current research gives literature a reason to suspect that strong ties in the VC network lead to more start-up performance in countries with a high level of governmental economic control while weak ties do not seem to lead to higher performance levels in such a country. Furthermore, the current research gives literature a reason to suspect that in countries with a low level of governmental economic control, there is no significant effect of strong and weak ties in the VC network on start-up performance. However, it must be stated that there are some important limitations that temper these suspicions. As stated before, these limitations can be found in section 5.4.

The current research also contributes to the discussion in literature concerning the question whether weak and/or strong ties in general, meaning not specified on VCs, are beneficial for start-up performance (see also Uzzi, 1996; Lechner, Dowling & Welpe, 2006; Jack, 2005; Batjargal, 2003; Adler & Kwon, 2002; Granovetter, 1985; Zaheer & Venkatraman, 1995; Gulati & Garigiulo, 1999; Rowley et al., 2000; Elfring & Hulsink, 2007). The indication that the current research provides by stating that there could be a moderation effect of a country's level of

governmental economic control on the relationship between strong and weak ties in the VC network and start-up performance, also gives reason to suspect that this is true for the networks of other businesses than VCs.

From a practical viewpoint, the current research provides useable insights to VC fund managers who are active in countries with a high level of governmental economic control, since they can use this knowledge to consciously focus on constructing their networks in such a way that it consists of a good amount of strong ties. Entrepreneurs in these countries, in turn, can try to select VCs based in part on the number of strong ties they appear to have. Besides that, governments could potentially also use insights that are provided by the current research. Since the current research provides insights that strong ties in the VC network could be beneficial in countries with a high level of governmental economic control, governments in such countries can try to stimulate VCs to create networks that consist of an adequate number of strong ties.

5.4 Limitations

There are several limitations to this study. Firstly, as already stated, the current research uses a depth strategy by only analyzing two countries, or four countries when the additional analyses are included, to represent the levels of high and low governmental economic control. This limits the generalizability of the current research since it cannot simply be stated that these countries represent the rest of the world. A second limitation is that, as explained, it is assumed in the current research that the VCs that are analyzed are based in the same country as the start-ups they invest in. Although support for this assumption has been found in literature (Sorenson & Stuart, 2001), this will not be true for every case that has been included in the analyses. This negatively influences the validity of the current research. Another limitation is that the current research regards Singapore as a developing economy while it is recognized that this country possesses many characteristics of a developed economy (M'ng et al., 2017; Soong, 2020; Tan & Bhaskaran, 2015; Hiok, 1982; Heng, 2013). This means that controlling for level of maturity of the economy in the current research is only valid to a certain extent.

Also, as already stated but important enough to address once more, the researcher did not have influence on the data collection process. This means that the researcher had no influence on the information that has been collected. This also means that it is uncertain how information about the - in the current research - crucial variables degree centrality and betweenness centrality was gathered. If errors were made during this process, it could have detrimental effects on the outcomes of the current research. Besides that, it must also be stated that although degree centrality and betweenness centrality can be used to measure respectively

strong ties and weak ties, these concepts are not one on one the same (see also Zhang & Luo, 2017). Therefore, a little caution is required when interpreting the results of the current research.

Another important limitation is that the current research, in order to achieve a sufficient sample size, used data of start-ups that sometimes have become relatively older companies already. For instance, as already laid out, the mean age of the companies that were included in the sample of Singapore is approximately 22 years, while in India these companies are approximately 17 years old (Appendix B, Table 13 and 15). The VC network measures were calculated at one point in time which was in the year 2020. However, business networks are generally seen as dynamic and constantly changing (Halinen & Törnroos, 1998). Therefore, it could be possible that the network measures of certain VCs were on a significant different level at the moment that they funded a start-up, and in the years following, when compared to the moment that their network measures were actually calculated. This might have led to a bias in the results.

The assumption of linearity has been violated throughout the analyses a couple of times, as can be retrieved from the results. This was the case for the variable degree centrality with regard to the sample of India when predicting total funding amount. Also in Ukraine, the variable degree centrality was not in a linear relationship with total funding amount. This causes the estimations of the regression models to be less reliable in these cases and this can therefore be seen as a limitation of the current research (Field, 2018). Lastly, with regard to the assumption of the independence of error terms, it is mentioned that this assumption has been violated in all the main analyses except for the prediction of total funding amount in Singapore. However, concerning this last analysis, the assumption was still only barely met. With regard to the additional analyses, this assumption was violated for all the analyses concerning Australia while in Ukraine, the values were sufficient but still in the danger zone. All these low multicollinearity levels will very probably have had an impact on the reliability of the estimations that have been made in the current research (Menard, 2002; Bowermann & O'Connel, 1990).

5.5 Recommendations for future research

Future research can explore the underlying research topic more by using additional independent variables, like Hochberg et al. (2007) and Ter Wal et al. (2016) did, instead of only using degree centrality and betweenness centrality to measure the construct of VCs´ networks. Future research could also focus on conducting a similar research while focusing on other performance indicators than revenue and start-up funding, since it might be possible that

other performance indicators will be significantly affected by weak and strong ties in the VC network. If that would turn out to be the case, it might very well be possible to find a significant moderation effect of a country's level of governmental economic control. Widely used performance indicators out of literature that amongst others could be included are: efficiency, profit, size, liquidity, success/failure rates, market share and leverage (Murphy et al., 1996). Furthermore, future research could also focus on exploring the significant moderation effect that was found in Ukraine. It would be interesting to research whether this is indeed caused by the high level of governmental economic control in that country. Also, future research could extend the current research by researching multiple other countries than those that were investigated during this thesis. Lastly, future research could focus on whether a moderation effect of a country's level of governmental economic control can be found on the relationship between strong and weak ties, in the network of a non-VC company, and the performance of that company. This would add to the discussion in literature about whether weak or strong ties are most beneficial for start-up performance (see also Adler & Kwon, 2002; Zaheer & Venkatraman, 1995; Gulati & Garigiulo, 1999; Uzzi, 1996; Elfring & Hulsink, 2007). In conclusion, the results of this study can be seen as a proper starting point where future research can extend upon.

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Appendix A Additional Information About the Dataset

Table 11
Variables in the Dataset

Organization Name	*Name*
Organization Name URL	*https:// from Crunchbase*
Website	*https:// website organization*
Industries	*Summary of industry*
Headquarters Location	*Location*
Estimated Revenue Range	*Range in USD*
Operating Status	*Active or Closed*
Founded Date	*Date*
Exit Date	*Date*
Closed Date	*Date*
Company Type	*For profit or different type*
Number of Exits	*In numbers*
Number of Exits (IPO)	*In numbers*
Number of Employees	*In numbers*
Number of Funding Rounds	*In numbers*
Funding Status	*Status of funding (e.g., seed or IPO)*
Total Equity Funding Amount Currency (in USD)	*Equity funding amount in USD*
Total Funding Amount Currency (in USD)	*Funding amount in USD*
Top 5 Investors	*Names of top 5 investors*
Number of Lead Investors	*In numbers*
Number of Investors	*In numbers*
IPO Status	*Public or Private*
IPO Date	*Date*
Delisted Date	*Date*
Money Raised at IPO Currency (in USD)	*In USD*
Valuation at IPO Currency (in USD)	*In USD*
IPqwery - Trademarks Registered	*In numbers*
IPqwery - Patents Granted	*In numbers*
Location Country	*Location*
Age of Company	*Age in years*
Investor 1	*Name investor 1*
Investor 2	*Name investor 2*
Investor 3	*Name investor 3*
Investor 4	*Name investor 4*
Investor 5	*Name investor 5*
Degree centrality Investor 1	*Standardized value between 0 and 1*
Degree centrality Investor 2	*Standardized value between 0 and 1*
Degree centrality Investor 3	*Standardized value between 0 and 1*
Degree centrality Investor 4	*Standardized value between 0 and 1*
Degree centrality Investor 5	*Standardized value between 0 and 1*
Betweenness centrality Investor 1	*Standardized value between 0 and 1*
Betweenness centrality Investor 2	*Standardized value between 0 and 1*
Betweenness centrality Investor 3	*Standardized value between 0 and 1*
Betweenness centrality Investor 4	*Standardized value between 0 and 1*
Betweenness centrality Investor 5	*Standardized value between 0 and 1*

Appendix B Descriptive Statistics

Table 12
Descriptive Statistics of the Independent Variables – Singapore

Sample		SQRTDegreeCent	SQRTBetweenCent
Revenue	N	49	49
	Mean	.032	.015
	Std. Deviation	.037	.023
	Skewness	2.055	2.837
	Std. Error of Skewness	.340	.340
	Kurtosis	5.023	9.035
	Std. Error of Kurtosis	.668	.668
	Minimum	.00	.00
	Maximum	.16	.11
Total Funding Amount (Ln)	N	63	63
	Mean	.042	.016
	Std. Deviation	.036	.016
	Skewness	1.028	1.255
	Std. Error of Skewness	.302	.302
	Kurtosis	.833	1.208
	Std. Error of Kurtosis	.595	.595
	Minimum	.00	.00
	Maximum	.16	.06

Table 13

Descriptive Statistics of the Control Variables – Singapore

Sample		IPqwery - Trademarks Registered	IPqwery - Patents Granted	Age_of_Company	Number of Investors
Revenue	N	49	49	49	49
	Mean	.35	.02	21.41	1.43
	Std. Deviation	1.588	.143	23.098	.890
	Minimum	0	0	5	1
	Maximum	10	1	131	5
Total funding amount (Ln)	N	63	63	63	63
	Mean	.11	.05	24.43	2.32
	Std. Deviation	.764	.378	17.336	1.721
	Minimum	0	0	12	1
	Maximum	6	3	131	9

Table 14

Descriptive Statistics of the Independent Variables – India

Sample		SQRTDegreeCent	SQRTBetweenCent
Revenue	N	285	285
	Mean	.047	.024
	Std. Deviation	.056	.035
	Skewness	1.858	2.18
	Std. Error of Skewness	.144	.14
	Kurtosis	3.613	5.64
	Std. Error of Kurtosis	.288	.28
	Minimum	.00	.0
	Maximum	.32	.2
Total Funding Amount (Ln)	N	342	342
	Mean	.048	.019
	Std. Deviation	.045	.022
	Skewness	1.546	2.12
	Std. Error of Skewness	.132	.13
	Kurtosis	3.181	6.26
	Std. Error of Kurtosis	.263	.26
	Minimum	.00	.0
	Maximum	.25	.1

Table 15
Descriptive Statistics of the Control Variables – India

Sample		IPqwery - Trademarks Registered	IPqwery - Patents Granted	Age_of_Company	Number of Investors
Revenue	N	285	285	285	285
	Mean	.31	.25	15.75	1.30
	Std. Deviation	1.656	1.507	13.509	.938
	Minimum	0	0	3	1
	Maximum	24	19	132	8
Total Funding Amount (Ln)	N	342	342	342	342
	Mean	.14	.25	21.34	2.49
	Std. Deviation	.852	1.374	8.131	2.107
	Minimum	0	0	4	1
	Maximum	13	19	95	18

Table 16
Descriptive Statistics of the Dependent Variables

Location_Country			Total Funding Amount Currency (in USD)	LnTotalFunding	RangeRevenue
India	N	Valid	342	342	285
	Mean		17304992.322	15.038	.761
	Std. Deviation		64416454.524	2.165	.782
	Minimum		903.000	6.81	.00
	Maximum		1059000000.000	20.78	5.00
Singapore	N	Valid	63	63	49
	Mean		12612359.984	15.596	.755
	Std. Deviation		14444700.918	1.540	.830
	Minimum		50000.000	10.82	.00
	Maximum		75000000.000	18.13	3.00

Note. In order to provide a clear overview, the original variable of total funding amount was included in this table. This variable was however not used in the regression analyses.

Figure 3

The Distribution of the Square Root Variable Degree Centrality in India – Total Funding Amount

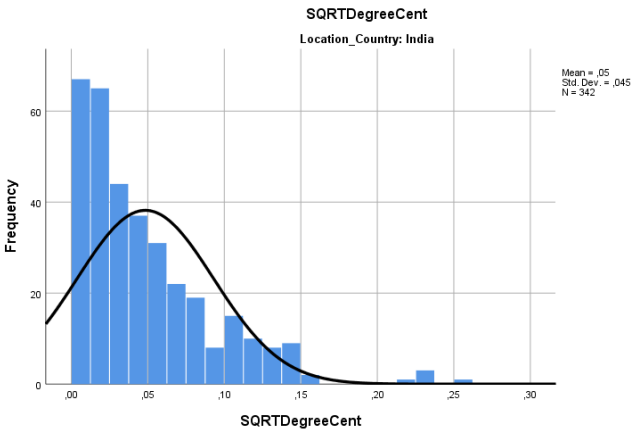


Figure 4

The Distribution of the Square Root Variable Betweenness Centrality in India – Total Funding Amount

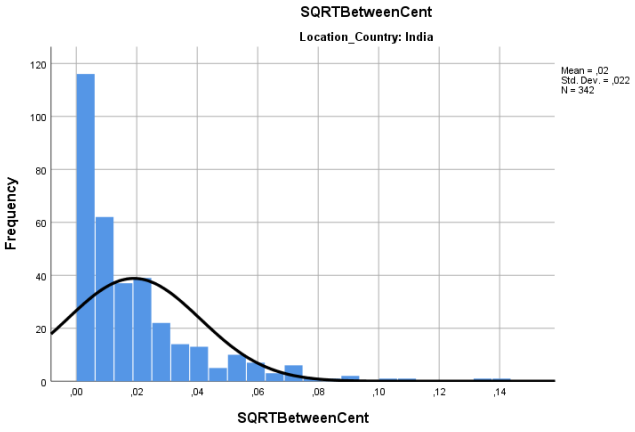


Figure 5

The Distribution of the Square Root Variable Degree Centrality in Singapore – Total Funding Amount

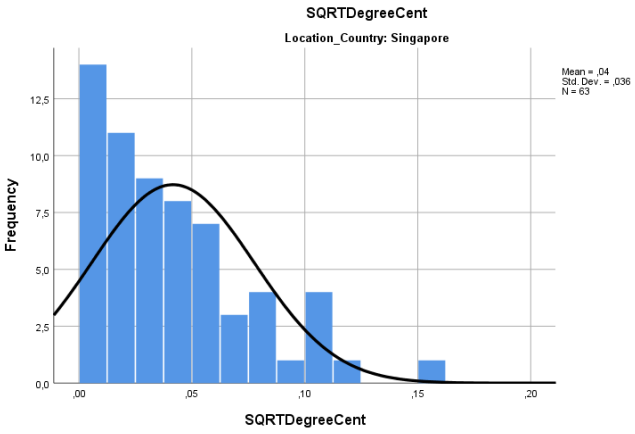


Figure 6

The Distribution of the Square Root Variable Betweenness Centrality in Singapore – Total Funding Amount

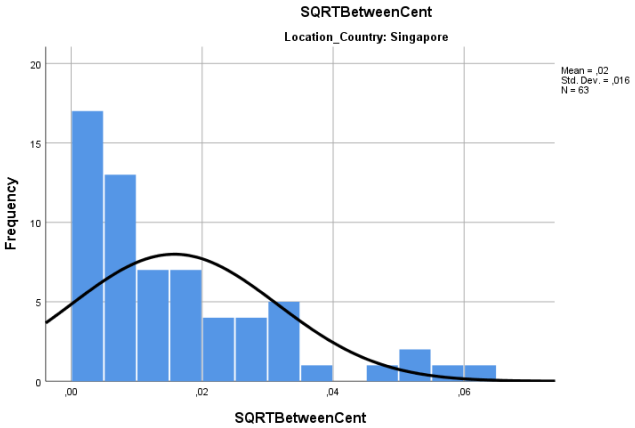


Figure 7

The Distribution of the Square Root Variable Degree Centrality in India – Revenue

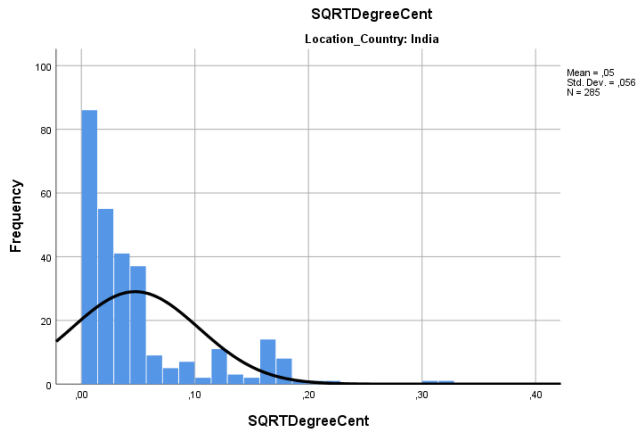


Figure 8

The Distribution of the Square Root Variable Betweenness Centrality in India – Revenue

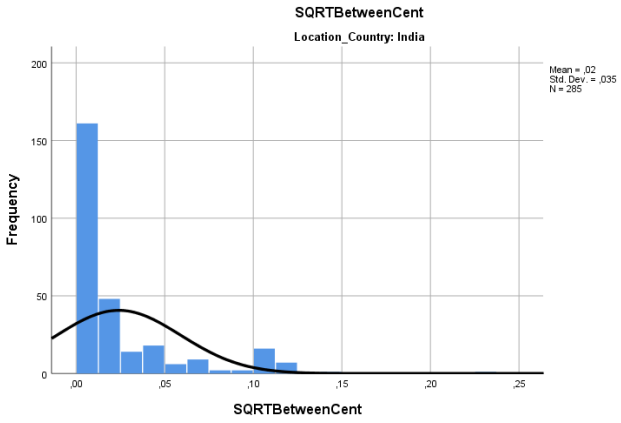


Figure 9

The Distribution of the Square Root Variable Degree Centrality in Singapore – Revenue

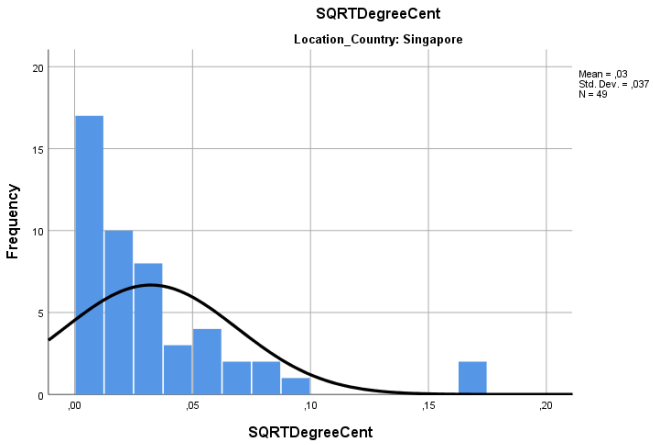
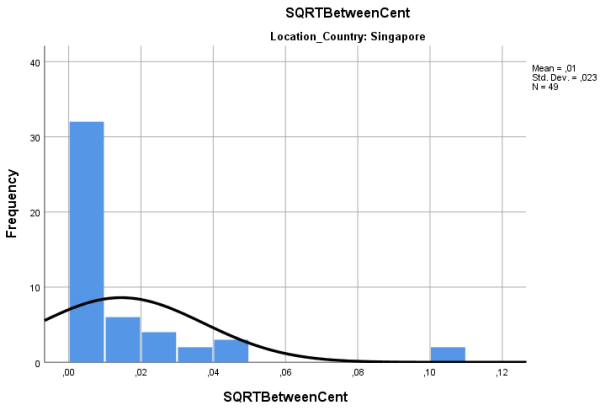


Figure 10

The Distribution of the Square Root Variable Betweenness Centrality in Singapore – Revenue



Appendix C Assumptions Regression Analyses

Figure 11

Checking Homoscedasticity in India - Revenue

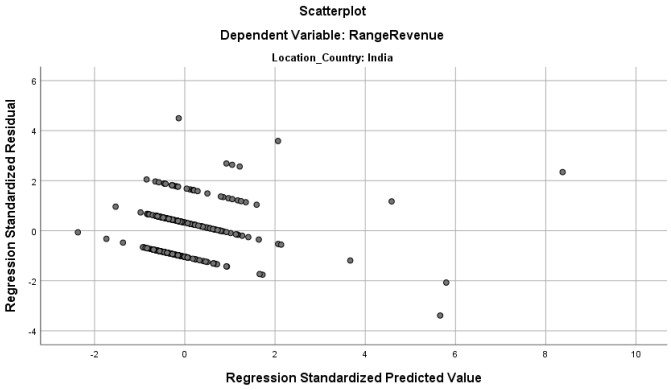


Figure 12

Checking Homoscedasticity in Singapore - Revenue

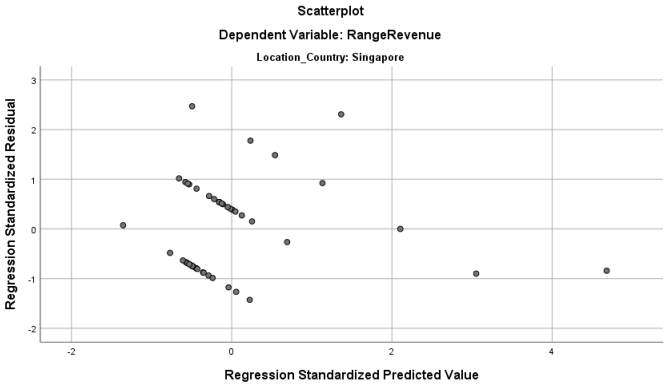


Figure 13

Checking Homoscedasticity in India - Total Funding Amount (Ln)

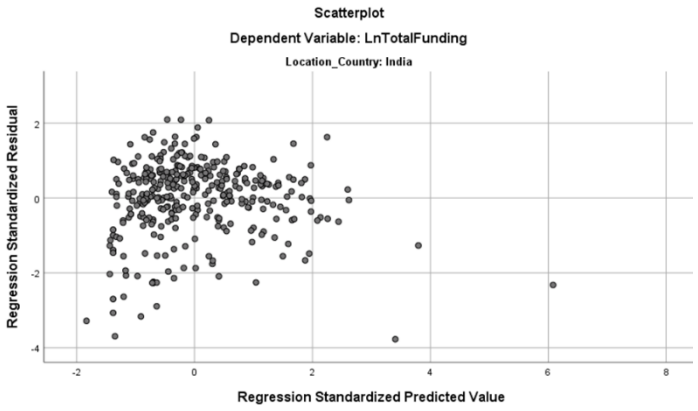


Figure 14

Checking Homoscedasticity in Singapore - Total Funding Amount (Ln)

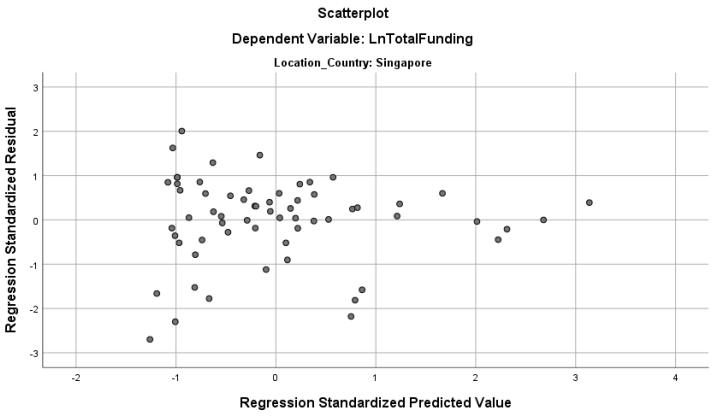


Table 17

Checking for Linearity of the Phenomenon Measured – Total Funding Amount

Location Country	Model		T	Sig.
India	1	(Constant)	36.968	.000
		IPqwery - Trademarks Registered	.033	.974
		IPqwery - Patents Granted	1.354	.177
		Age_of_Company	5.989	.000
		Number of Investors	8.830	.000
		CenteredDegreeCentrality	1.389	.166
		CenteredDegreeCentrality^2	-2.232	.026
		CenteredDegreeCentrality^3	1.605	.109
		CenteredBetweennessCentrality	-.078	.938
		CenteredBetweennessCentrality^2	1.082	.280
		CenteredBetweennessCentrality^3	-1.331	.184
Singapore	1	(Constant)	23.150	.000
		IPqwery - Trademarks Registered	-.428	.670
		IPqwery - Patents Granted	1.429	.159
		Age_of_Company	1.059	.295
		Number of Investors	2.299	.026
		CenteredDegreeCentrality	-.984	.330
		CenteredDegreeCentrality^2	.208	.836
		CenteredDegreeCentrality^3	.350	.728
		CenteredBetweennessCentrality	1.454	.152
		CenteredBetweennessCentrality^2	-.324	.748
		CenteredBetweennessCentrality^3	-.557	.580

Table 18

Checking for Linearity of the Phenomenon Measured – Revenue

Location_Country	Model		t	Sig.
India	1	(Constant)	4.368	.000
		IPqwery - Trademarks Registered	-.536	.593
		IPqwery - Patents Granted	-1.296	.196
		Age_of_Company	6.609	.000
		Number of Investors	.456	.648
		CenteredDegreeCentrality	-2.035	.043
		CenteredDegreeCentrality^2	.969	.333
		CenteredDegreeCentrality^3	-.085	.933
		CenteredBetweennessCentrality	1.989	.048
		CenteredBetweennessCentrality^3	-1.827	.069
		CenteredBetweennessCentrality^3	1.482	.139
Singapore	1	(Constant)	1.274	.211
		IPqwery - Trademarks Registered	-2.917	.006
		IPqwery - Patents Granted	2.615	.013
		Age_of_Company	5.795	.000
		Number of Investors	-.130	.897
		CenteredDegreeCentrality	-.421	.676
		CenteredDegreeCentrality^2	.626	.535
		CenteredDegreeCentrality^3	-.234	.816
		CenteredBetweennessCentrality	.948	.349
		CenteredBetweennessCentrality^2	-.464	.645
		CenteredBetweennessCentrality^3	.178	.860

Table 19

Checking How Much Additional Variance is Explained by the Quadratic Polynomic Term of Degree Centrality When Predicting Total Funding Amount in India

						Change Statistics				
Location Country	Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
India	1	.576	.331	.323	1.780	.331	41.755	4	337	.000
	2	.592	.350	.339	1.760	.019	4.855	2	335	.008
	3	.610	.372	.359	1.733	.022	11.501	1	334	.001

Note. The quadratic polynomic term of degree centrality has been added in model 3. Model 2 consists of all the control variables and independent variables. Model 1 consists of the control variables.

Appendix D Regression Results

Table 20
Model Summary – Revenue

Location Country	Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
						R Square Change	F Change	df1	df2	Sig. F Change
India	1	.381	.145	.133	.728	.145	11.877	4	280	.000
	2	.385	.148	.133	.728	.003	1.118	1	279	.291
	3	.386	.149	.131	.729	.001	.198	1	278	.657
Singapore	1	.712	.506	.462	.609	.506	11.287	4	44	.000
	2	.712	.508	.450	.615	.001	.103	1	43	.750
	3	.713	.508	.438	.622	.000	.018	1	42	.893

Table 21
ANOVA – Revenue

Location_Country	Model		Sum of Squares	df	Mean Square	F	Sig.
India	1	Regression	25.208	4	6.302	11.877	.000
		Residual	148.567	280	.531		
		Total	173.775	284			
	2	Regression	25.801	5	5.160	9.730	.000
		Residual	147.974	279	.530		
		Total	173.775	284			
	3	Regression	25.907	6	4.318	8.118	.000
		Residual	147.869	278	.532		
		Total	173.775	284			
Singapore	1	Regression	16.744	4	4.186	11.287	.000
		Residual	16.318	44	.371		
		Total	33.061	48			
	2	Regression	16.782	5	3.356	8.866	.000
		Residual	16.279	43	.379		
		Total	33.061	48			
	3	Regression	16.790	6	2.798	7.223	.000
		Residual	16.272	42	.387		
		Total	33.061	48			

Table 22

Regression Results – Revenue

Location Country	Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.	Collinearity Statistics Tolerance	Collinearity Statistics VIF
India	1	(Constant)	.412	.086		4.809	.000		
		IPqwery - Trademarks Registered	-.008	.028	-.017	-.289	.773	.901	1.110
		IPqwery - Patents Granted	-.035	.030	-.067	-1.170	.243	.918	1.089
		Age_of_Company	.022	.003	.378	6.729	.000	.966	1.035
		Number of Investors	.012	.047	.015	.264	.792	.981	1.020
	2	(Constant)	.455	.095		4.791	.000		
		IPqwery - Trademarks Registered	-.009	.028	-.019	-.326	.744	.900	1.112
		IPqwery - Patents Granted	-.036	.030	-.070	-1.213	.226	.916	1.091
		Age_of_Company	.022	.003	.372	6.573	.000	.955	1.048
		Number of Investors	.014	.047	.017	.298	.766	.980	1.021
		SQRTDegreeCent	-.824	.779	-.059	-1.057	.291	.982	1.019
	3	(Constant)	.462	.096		4.796	.000		
		IPqwery - Trademarks Registered	-.010	.028	-.021	-.360	.719	.894	1.119
		IPqwery - Patents Granted	-.037	.030	-.071	-1.222	.223	.916	1.092
		Age_of_Company	.022	.003	.373	6.578	.000	.951	1.052
		Number of Investors	.016	.047	.019	.345	.730	.968	1.033
		SQRTDegreeCent	-2.192	3.172	-.157	-.691	.490	.059	16.826
		SQRTBetweenCent	2.259	5.078	.101	.445	.657	.059	16.823
Singapore	1	(Constant)	.256	.181		1.414	.164		
		IPqwery - Trademarks Registered	-.196	.065	-.375	-2.990	.005	.714	1.400
		IPqwery - Patents Granted	1.902	.691	.327	2.752	.009	.792	1.262
		Age_of_Company	.025	.004	.697	6.244	.000	.901	1.110

	Number of Investors	-.006	.102	-.006	-.056	.955	.930	1.076
2	(Constant)	.284	.202		1.403	.168		
	IPqwery - Trademarks Registered	-.198	.066	-.379	-2.977	.005	.708	1.413
	IPqwery - Patents Granted	1.886	.700	.325	2.693	.010	.788	1.269
	Age_of_Company	.025	.004	.697	6.178	.000	.901	1.110
	Number of Investors	-.006	.104	-.007	-.061	.952	.929	1.076
	SQRTDegreeCent	-.789	2.463	-.035	-.320	.750	.971	1.030
3	(Constant)	.292	.214		1.366	.179		
	IPqwery - Trademarks Registered	-.199	.068	-.382	-2.924	.006	.688	1.453
	IPqwery - Patents Granted	1.883	.709	.324	2.658	.011	.788	1.269
	Age_of_Company	.025	.004	.696	6.106	.000	.901	1.110
	Number of Investors	-.005	.105	-.005	-.045	.964	.918	1.089
	SQRTDegreeCent	-2.024	9.461	-.089	-.214	.832	.067	14.852
	SQRTBetweenCent	2.046	15.125	.056	.135	.893	.068	14.645

Table 23

Model Summary – Total Funding Amount

Location Country	Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
						R Square Change	F Change	df1	df2	Sig. F Change
India	1	.576	.331	.323	1.780	.331	41.755	4	337	.000
	2	.590	.348	.339	1.760	.017	8.823	1	336	.003
	3	.592	.350	.339	1.760	.002	.889	1	335	.346
Singapore	1	.335	.112	.051	1.500	.112	1.836	4	58	.134
	2	.345	.119	.041	1.508	.006	.411	1	57	.524
	3	.350	.123	.029	1.518	.004	.243	1	56	.624

Table 24
ANOVA – Total Funding Amount

Location_Country	Model		Sum of Squares	df	Mean Square	F	Sig.
India	1	Regression	529.448	4	132.362	41.755	.000
		Residual	1068.292	337	3.170		
		Total	1597.740	341			
	2	Regression	556.783	5	111.357	35.944	.000
		Residual	1040.957	336	3.098		
		Total	1597.740	341			
	3	Regression	559.538	6	93.256	30.091	.000
		Residual	1038.202	335	3.099		
		Total	1597.740	341			
Singapore	1	Regression	16.530	4	4.132	1.836	.134
		Residual	130.528	58	2.250		
		Total	147.058	62			
	2	Regression	17.465	5	3.493	1.536	.193
		Residual	129.593	57	2.274		
		Total	147.058	62			
	3	Regression	18.024	6	3.004	1.304	.271
		Residual	129.034	56	2.304		
		Total	147.058	62			

Table 25

Regression Results – Total Funding Amount

Location Country	Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.	Collinearity Statistics Tolerance	Collinearity Statistics VIF
India	1	(Constant)	12.274	.286		42.885	.000		
		IPqwery - Trademarks Registered	-.025	.125	-.010	-.197	.844	.826	1.211
		IPqwery - Patents Granted	.079	.077	.050	1.029	.304	.827	1.210
		Age_of_Company	.071	.012	.265	5.909	.000	.987	1.013
		Number of Investors	.498	.046	.485	10.811	.000	.986	1.014
	2	(Constant)	11.991	.299		40.172	.000		
		IPqwery - Trademarks Registered	-.038	.123	-.015	-.304	.761	.825	1.213
		IPqwery - Patents Granted	.078	.076	.050	1.026	.305	.827	1.210
		Age_of_Company	.072	.012	.271	6.098	.000	.985	1.015
		Number of Investors	.475	.046	.462	10.263	.000	.957	1.045
		SQRTDegreeCent	6.441	2.169	.133	2.970	.003	.969	1.032
	3	(Constant)	11.928	.306		38.991	.000		
		IPqwery - Trademarks Registered	-.026	.124	-.010	-.214	.831	.817	1.224
		IPqwery - Patents Granted	.083	.077	.053	1.089	.277	.823	1.216
		Age_of_Company	.072	.012	.272	6.123	.000	.984	1.016
		Number of Investors	.471	.046	.458	10.133	.000	.949	1.054
		SQRTDegreeCent	13.891	8.193	.287	1.696	.091	.068	14.724
		SQRTBetweenCent	-15.660	16.608	-.159	-.943	.346	.068	14.638
Singapore	1	(Constant)	14.664	.436		33.609	.000		
		IPqwery - Trademarks Registered	-.071	.251	-.035	-.284	.777	.987	1.014

	IPqwery - Patents Granted	.620	.507	.152	1.223	.226	.989	1.011
	Age_of_Company	.012	.011	.134	1.077	.286	.990	1.010
	Number of Investors	.268	.112	.299	2.381	.021	.971	1.030
2	(Constant)	14.832	.519		28.593	.000		
	IPqwery - Trademarks Registered	-.069	.254	-.034	-.272	.787	.984	1.016
	IPqwery - Patents Granted	.551	.532	.135	1.036	.305	.919	1.089
	Age_of_Company	.011	.011	.127	.993	.325	.956	1.046
	Number of Investors	.246	.117	.274	2.097	.041	.914	1.094
	SQRTDegreeCent	3.556	5.544	.083	.641	.524	.920	1.087
3	(Constant)	14.509	.492		29.477	.000		
	IPqwery - Trademarks Registered	-.061	.254	-.030	-.238	.813	.984	1.016
	IPqwery - Patents Granted	.590	.544	.145	1.084	.283	.880	1.137
	Age_of_Company	.012	.011	.138	1.097	.278	.986	1.015
	Number of Investors	.260	.114	.290	2.271	.027	.958	1.043
	SQRTDegreeCent	10.561	15.278	.247	.691	.492	.123	8.148
	SQRTBetweenCent	-17.530	35.588	-.179	-.493	.624	.119	8.424

Appendix E Additional Analyses – Descriptive Statistics

Table 26

Descriptive Statistics of the Independent Variables – Australia

Sample		SQRTDegreeCentrality	SQRTBetweennessCentrality
Revenue	N	129	129
	Mean	.052	.026
	Std. Deviation	.057	.034
	Skewness	1.777	1.590
	Std. Error of Skewness	.213	.213
	Kurtosis	3.538	1.544
	Std. Error of Kurtosis	.423	.423
	Minimum	.00	.00
	Maximum	.32	.14
Total Funding Amount	N	151	151
	Mean	.046	.019
	Std. Deviation	.046	.024
	Skewness	1.740	2.184
	Std. Error of Skewness	.197	.197
	Kurtosis	3.688	6.162
	Std. Error of Kurtosis	.392	.392
	Minimum	.00	.00
	Maximum	.23	.14

Table 27

Descriptive Statistics of the Control Variables – Australia

Sample		IPqwery - Trademarks Registered	IPqwery - Patents Granted	Age_of_Company	Number of Investors
Revenue	N	129	129	129	129
	Mean	.29	.40	13.30	1.35
	Std. Deviation	1.040	2.060	16.143	1.157
	Minimum	0	0	0	1
	Maximum	8	19	132	8
Total Funding Amount	N	151	151	151	151
	Mean	.12	.28	19.86	2.24
	Std. Deviation	.599	1.768	11.444	1.900
	Minimum	0	0	0	1
	Maximum	5	19	95	9

Table 28

Descriptive Statistics of the Independent Variables – Ukraine

Sample		SQRTDegreeCentrality	SQRTBetweennessCentrality
Revenue	N	894	894
	Mean	.104	.042
	Std. Deviation	.051	.026
	Skewness	.034	.741
	Std. Error of Skewness	.082	.082
	Kurtosis	-.427	.763
	Std. Error of Kurtosis	.163	.163
	Minimum	.00	.00
	Maximum	.25	.14
Ukraine	N	938	938
	Mean	.103	.042
	Std. Deviation	.052	.026
	Skewness	.060	.737
	Std. Error of Skewness	.080	.080
	Kurtosis	-.477	.736
	Std. Error of Kurtosis	.160	.160
	Minimum	.00	.00
	Maximum	.25	.14

Table 29

Descriptive Statistics of the Control Variables – Ukraine

Sample		IPqwery - Trademarks Registered	IPqwery - Patents Granted	Age_of_Company	Number of Investors
Revenue	N	894	894	894	894
	Mean	66.17	412.74	14.48	12.51
	Std. Deviation	419.086	2958.218	21.272	10.637
	Minimum	0	0	0	1
	Maximum	6861	51617	210	105
Total Funding Amount	N	938	938	938	938
	Mean	63.06	393.01	14.04	12.23
	Std. Deviation	409.368	2889.273	20.676	10.502
	Minimum	0	0	0	1
	Maximum	6861	51617	210	105

Table 30

Descriptive Statistics of the Dependent Variables

Location_Country		Total Funding Amount Currency (in USD)	LnTotalFunding Amount	Estimated Revenue Range
Australia	N	151	151	129
	Mean	20050345.205	14.996	.85
	Std. Deviation	88846109.607	2.121	.936
	Minimum	1000.000	6.91	0
	Maximum	1059000000.000	20.78	5
Ukraine	N	938	938	894
	Mean	573473184.147	18.653	2.62
	Std. Deviation	1943443635.687	1.802	1.848
	Minimum	78217.000	11.27	0
	Maximum	30079814466.000	24.13	7

Note. In order to provide a clear overview, the original variable of total funding amount was included in this table. This variable was however not used in the regression analyses.

Figure 15

The Distribution of the Square Root Variable Degree Centrality in Australia – Total Funding Amount

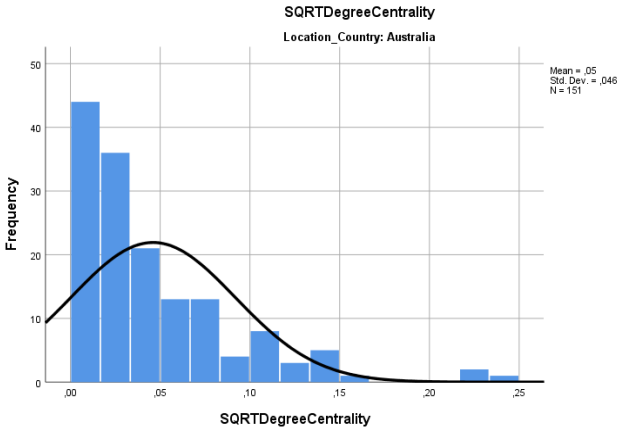


Figure 16

The Distribution of the Square Root Variable Betweenness Centrality in Australia – Total Funding Amount

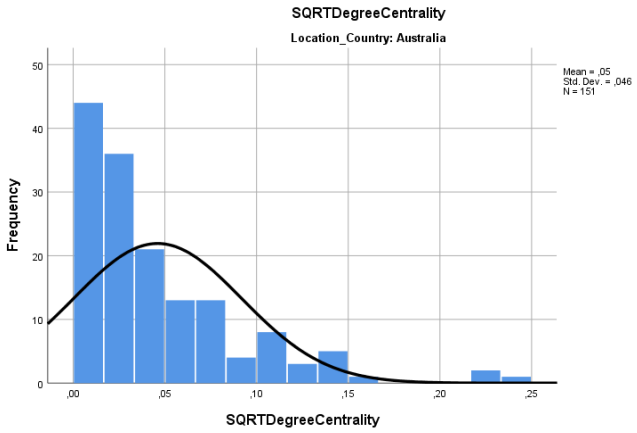


Figure 17

The Distribution of the Square Root Variable Degree Centrality in Ukraine – Total Funding Amount

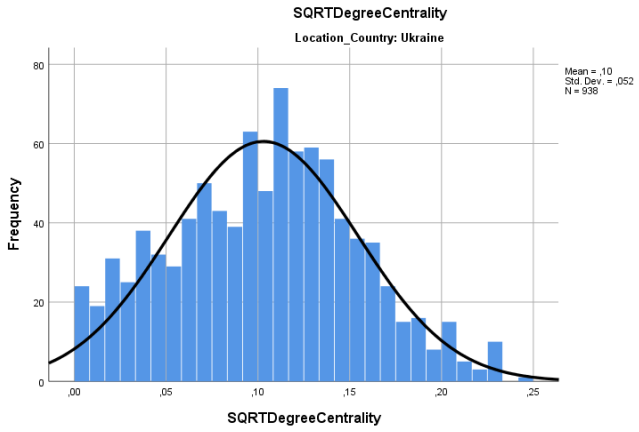


Figure 18

The Distribution of the Square Root Variable Betweenness Centrality in Ukraine – Total Funding Amount

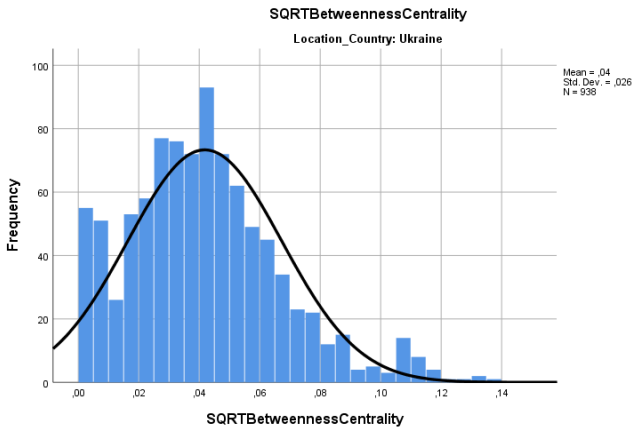


Figure 19

The Distribution of the Square Root Variable Degree Centrality in Australia – Revenue

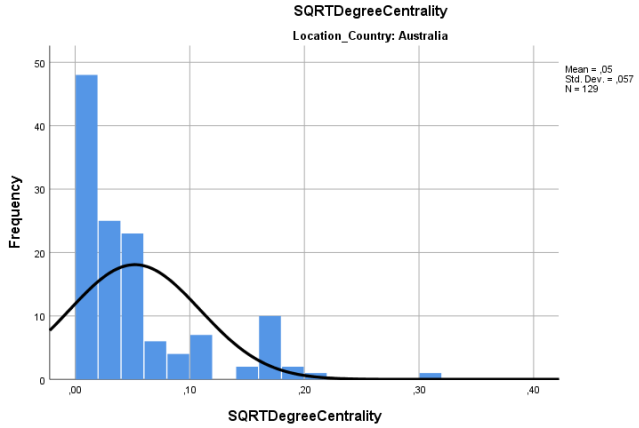


Figure 20

The Distribution of the Square Root Variable Betweenness Centrality in Australia – Revenue

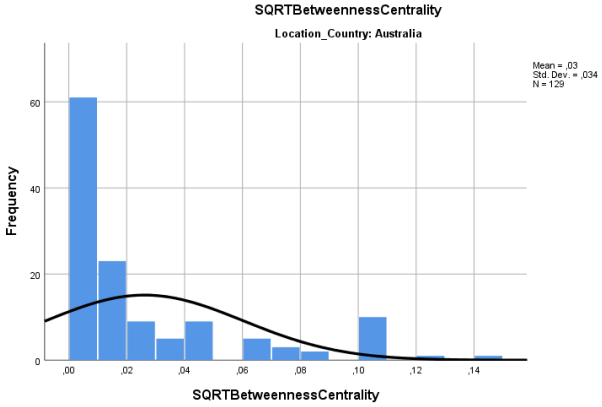


Figure 21

The Distribution of the Square Root Variable Degree Centrality in Ukraine – Revenue

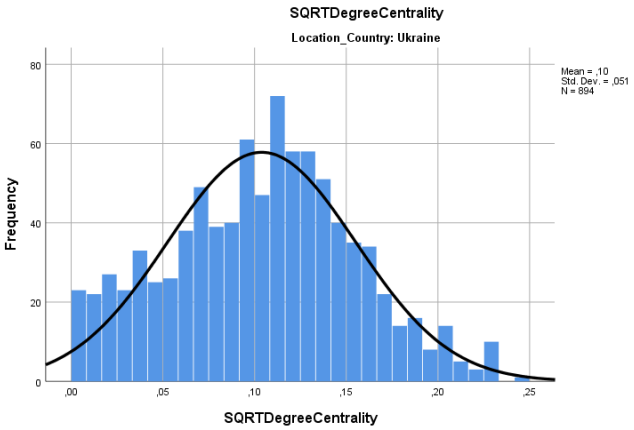
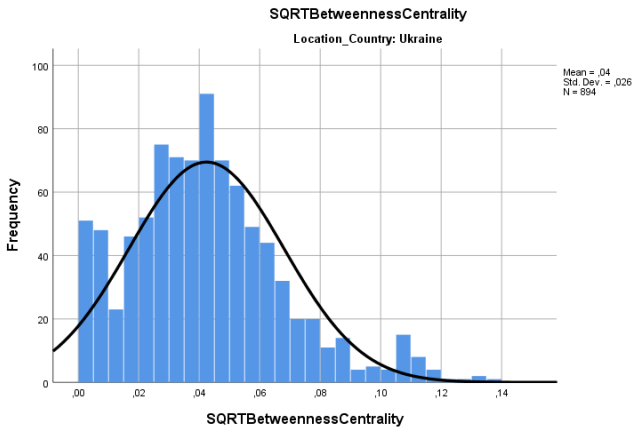


Figure 22

The Distribution of the Square Root Variable Betweenness Centrality in Ukraine – Revenue



Appendix F Additional Analyses – Assumptions

Table 31
Checking for Linearity of the Phenomenon Measured – Revenue

Location_Country	Model		t	Sig.
Australia	1	(Constant)	1.453	.150
		IPqwery - Trademarks Registered	-.664	.508
		IPqwery - Patents Granted	-.909	.366
		Age_of_Company	5.268	.000
		Number of Investors	1.672	.098
		CenteredDegreeCentrality	-1.058	.293
		CenteredDegreeCentrality^2	-.524	.602
		CenteredDegreeCentrality^3	1.197	.235
		CenteredBetweennessCentrality	1.221	.225
		CenteredBetweennessCentrality^2	.513	.609
		CenteredBetweennessCentrality^3	-1.126	.263
Ukraine	1	(Constant)	15.878	.000
		IPqwery - Trademarks Registered	1.265	.206
		IPqwery - Patents Granted	.826	.409
		Age_of_Company	11.756	.000
		Number of Investors	2.576	.010
		CenteredDegreeCentrality	3.284	.001
		CenteredDegreeCentrality^2	.503	.615
		CenteredDegreeCentrality^3	-1.766	.078
		CenteredBetweennessCentrality	-1.671	.095
		CenteredBetweennessCentrality^2	-.379	.705
		CenteredBetweennessCentrality^3	.383	.702

Table 32
Checking for Linearity of the Phenomenon Measured – Total Funding Amount

Location_Country	Model		t	Sig.
Australia	1	(Constant)	25.365	.000
		IPqwery - Trademarks Registered	-.546	.586
		IPqwery - Patents Granted	1.170	.244
		Age_of_Company	2.418	.017
		Number of Investors	5.379	.000
		CenteredDegreeCentrality	.558	.578
		CenteredDegreeCentrality^2	-1.591	.114
		CenteredDegreeCentrality^3	1.104	.272
		CenteredBetweenCentrality	.244	.808
		CenteredBetweennessCentrality^2	.515	.607
		CenteredBetweennessCentrality^3	-.457	.648
Ukraine	1	(Constant)	161.818	.000
		IPqwery - Trademarks Registered	-1.014	.311
		IPqwery - Patents Granted	1.080	.281
		Age_of_Company	5.615	.000
		Number of Investors	9.302	.000
		CenteredDegreeCentrality	1.529	.127
		CenteredDegreeCentrality^2	-3.177	.002
		CenteredDegreeCentrality^3	2.739	.006
		CenteredBetweennessCentrality	-1.350	.177
		CenteredBetweennessCentrality^2	1.202	.230
		CenteredBetweennessCentrality^3	-1.457	.145

Table 33

Checking How Much Additional Variance is Explained in Ukraine by the Quadratic and Cubic Polynomic Term of Degree Centrality – Total Funding Amount

						Change Statistics				
Location_Country	Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
Ukraine	1	.383	.146	.143	1.653	.146	39.907	4	931	.000
	2	.402	.162	.156	1.639	.015	8.552	2	929	.000
	3	.425	.181	.175	1.622	.019	21.562	1	928	.000
	4	.431	.186	.179	1.618	.005	5.597	1	927	.018

Note. Model 1 consists of the control variables. Model 2 consists of all the control variables and independent variables. The quadratic polynomic term of degree centrality has been added in model 3. In model 4, the cubic polynomic term of degree centrality has been added.

Figure 23

Checking Homoscedasticity in Australia - Total Funding Amount (Ln)

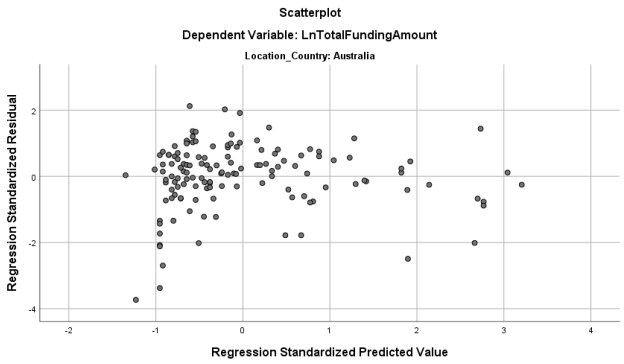


Figure 24

Checking Homoscedasticity in Ukraine - Total Funding Amount (Ln)

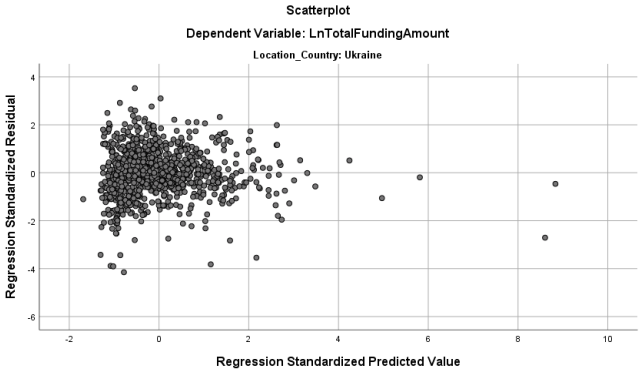


Figure 25

Checking Homoscedasticity in Australia - Revenue

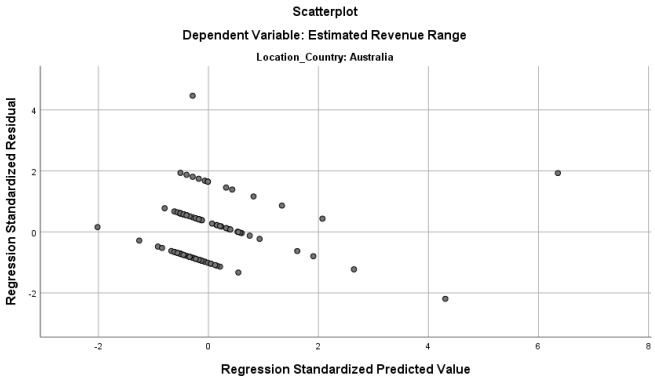
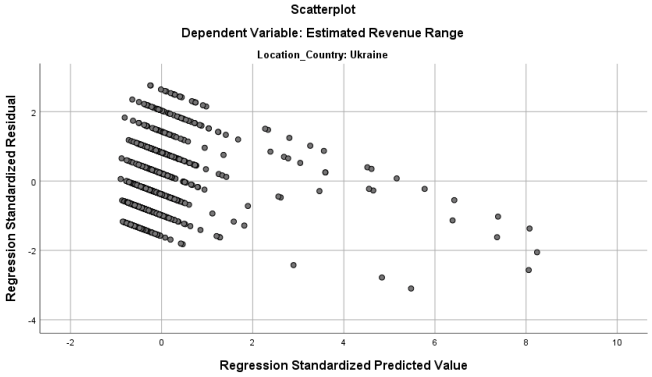


Figure 26

Checking Homoscedasticity in Ukraine - Revenue



Appendix G Additional Analyses - Regression Results

Table 34

Model Summary Additional Analyses - Revenue

Location_Country	Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
						R Square Change	F Change	df1	df2	Sig. F Change
Australia	1	.511[a]	.261	.230	.753	.261	8.548	4	97	.000
	2	.511[b]	.261	.222	.757	.000	.000	1	96	.992
	3	.511[c]	.261	.215	.760	.001	.083	1	95	.773
Ukraine	1	.445[h]	.198	.194	1.656	.198	54.562	4	884	.000
	2	.453[i]	.205	.201	1.650	.007	7.919	1	883	.005
	3	.462[j]	.213	.208	1.642	.008	9.034	1	882	.003

Table 35

ANOVA Additional Analyses - Revenue

Location_Country	Model		Sum of Squares	df	Mean Square	F	Sig.
Australia	1	Regression	19.379	4	4.845	8.548	.000
		Residual	54.974	97	.567		
		Total	74.353	101			
	2	Regression	19.379	5	3.876	6.768	.000
		Residual	54.974	96	.573		
		Total	74.353	101			
	3	Regression	19.427	6	3.238	5.600	.000
		Residual	54.926	95	.578		
		Total	74.353	101			
Ukraine	1	Regression	598.689	4	149.672	54.562	.000
		Residual	2424.956	884	2.743		
		Total	3023.645	888			
	2	Regression	620.244	5	124.049	45.575	.000
		Residual	2403.401	883	2.722		
		Total	3023.645	888			
	3	Regression	644.612	6	107.435	39.830	.000
		Residual	2379.033	882	2.697		
		Total	3023.645	888			

Table 36
Results Regression Analysis Additional Analyses – Revenue

Location Country	Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.	Collinearity Statistics Tolerance	Collinearity Statistics VIF
Australia	1	(Constant)	.242	.136		1.777	.079		
		Ipqwery – Trademarks Registered	-.049	.101	-.048	-.485	.629	.764	1.308
		Ipqwery – Patents Granted	-.033	.037	-.090	-.901	.370	.770	1.298
		Age_of_Company	.024	.005	.465	5.306	.000	.994	1.006
		Number of Investors	.106	.065	.143	1.626	.107	.984	1.017
	2	(Constant)	.241	.160		1.502	.136		
		Ipqwery – Trademarks Registered	-.049	.101	-.048	-.483	.630	.764	1.308
		Ipqwery – Patents Granted	-.033	.037	-.090	-.895	.373	.768	1.303
		Age_of_Company	.024	.005	.465	5.239	.000	.979	1.022
		Number of Investors	.106	.066	.143	1.615	.110	.979	1.021
		SQRTDegreeCentrality	.013	1.323	.001	.010	.992	.975	1.026
	3	(Constant)	.236	.162		1.453	.150		
		Ipqwery – Trademarks Registered	-.045	.102	-.045	-.439	.662	.752	1.331
		Ipqwery – Patents Granted	-.034	.038	-.090	-.896	.373	.767	1.303
		Age_of_Company	.024	.005	.463	5.179	.000	.974	1.027
		Number of Investors	.105	.066	.141	1.579	.118	.973	1.028
		SQRTDegreeCentrality	1.386	4.935	.093	.281	.779	.071	14.148
		SQRTBetweennessCentrality	-2.485	8.599	-.096	-.289	.773	.070	14.244
Ukraine	1	(Constant)	1.767	.103		17.227	.000		
		Ipqwery – Trademarks Registered	.000	.000	.054	1.488	.137	.685	1.459
		Ipqwery – Patents Granted	1.625^{E}-5	.000	.026	.708	.479	.666	1.501
		Age_of_Company	.036	.003	.415	11.571	.000	.706	1.416
		Number of Investors	.026	.005	.149	4.802	.000	.947	1.056
	2	(Constant)	1.471	.146		10.043	.000		

	Ipqwery – Trademarks Registered	.000	.000	.051	1.395	.163	.684	1.461
	Ipqwery – Patents Granted	1.770E-5	.000	.028	.774	.439	.666	1.502
	Age_of_Company	.038	.003	.433	11.933	.000	.684	1.463
	Number of Investors	.018	.006	.103	2.956	.003	.742	1.348
	SQRTDegreeCentrality	3.576	1.271	.100	2.814	.005	.719	1.391
3	(Constant)	1.380	.149		9.265	.000		
	Ipqwery – Trademarks Registered	.000	.000	.046	1.275	.203	.683	1.464
	Ipqwery – Patents Granted	1.875E-5	.000	.030	.823	.410	.666	1.502
	Age_of_Company	.038	.003	.441	12.168	.000	.680	1.470
	Number of Investors	.015	.006	.088	2.521	.012	.727	1.375
	SQRTDegreeCentrality	11.184	2.830	.311	3.952	.000	.144	6.960
	SQRTBetweennessCentrality	-15.957	5.309	-.222	-3.006	.003	.163	6.119

Table 37
Model Summary Additional Analyses – Total Funding Amount

						Change Statistics				
Location Country	Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
Australia	1	.549	.301	.280	1.794	.301	14.209	4	132	.000
	2	.558	.311	.285	1.787	.010	1.945	1	131	.165
	3	.558	.311	.279	1.794	.000	.002	1	130	.962
Ukraine	1	.383	.146	.143	1.653	.146	39.907	4	931	.000
	2	.393	.154	.150	1.646	.008	8.645	1	930	.003
	3	.402	.162	.156	1.639	.008	8.390	1	929	.004

Table 38
ANOVA Additional Analyses – Total Funding Amount

Location Country	Model		Sum of Squares	df	Mean Square	F	Sig.
Australia	1	Regression	182.874	4	45.719	14.209	.000
		Residual	424.719	132	3.218		
		Total	607.594	136			
	2	Regression	189.089	5	37.818	11.838	.000
		Residual	418.505	131	3.195		
		Total	607.594	136			
	3	Regression	189.096	6	31.516	9.790	.000
		Residual	418.498	130	3.219		
		Total	607.594	136			
Ukraine	1	Regression	436.177	4	109.044	39.907	.000
		Residual	2543.898	931	2.732		
		Total	2980.075	935			
	2	Regression	459.607	5	91.921	33.917	.000
		Residual	2520.468	930	2.710		
		Total	2980.075	935			
	3	Regression	482.165	6	80.361	29.887	.000
		Residual	2497.910	929	2.689		
		Total	2980.075	935			

Table 39
Results Regression Analysis Additional Analyses – Total Funding Amount

Location Country	Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.	Collinearity Statistics Tolerance	Collinearity Statistics VIF
Australia	1	(Constant)	12.898	.403		31.975	.000		
		IPqwery - Trademarks Registered	-.457	.430	-.136	-1.063	.290	.325	3.075
		IPqwery - Patents Granted	.206	.146	.181	1.416	.159	.325	3.079
		Age_of_Company	.040	.016	.188	2.548	.012	.971	1.030
		Number of Investors	.548	.081	.499	6.803	.000	.983	1.018
	2	(Constant)	12.656	.438		28.917	.000		
		IPqwery - Trademarks Registered	-.567	.435	-.168	-1.303	.195	.314	3.181
		IPqwery - Patents Granted	.228	.146	.200	1.562	.121	.321	3.115
		Age_of_Company	.042	.016	.201	2.707	.008	.957	1.045
		Number of Investors	.534	.081	.487	6.602	.000	.968	1.033
		SQRTDegreeCentrality	4.654	3.337	.104	1.395	.165	.938	1.066
	3	(Constant)	12.662	.455		27.833	.000		
		IPqwery - Trademarks Registered	-.572	.450	-.170	-1.271	.206	.296	3.376
		IPqwery - Patents Granted	.228	.147	.200	1.556	.122	.319	3.130
		Age_of_Company	.042	.016	.201	2.695	.008	.956	1.046
		Number of Investors	.534	.081	.487	6.576	.000	.967	1.034
		SQRTDegreeCentrality	4.019	13.589	.090	.296	.768	.057	17.537
		SQRTBetweennessCentrality	1.288	26.737	.015	.048	.962	.055	18.047
Ukraine	1	(Constant)	17.684	.098		179.831	.000		
		IPqwery - Trademarks Registered	.000	.000	-.026	-.717	.473	.683	1.463
		IPqwery - Patents Granted	2.052E-5	.000	.033	.895	.371	.664	1.505
		Age_of_Company	.013	.003	.147	4.073	.000	.706	1.417
		Number of Investors	.065	.005	.384	12.401	.000	.955	1.047
	2	(Constant)	17.391	.140		124.435	.000		
		IPqwery - Trademarks Registered	.000	.000	-.030	-.818	.414	.683	1.465

	IPqwery - Patents Granted	2.204E-5	.000	.036	.965	.335	.664	1.506
	Age_of_Company	.014	.003	.164	4.519	.000	.687	1.457
	Number of Investors	.057	.006	.336	9.602	.000	.743	1.345
	SQRTDegreeCentrality	3.616	1.230	.104	2.940	.003	.723	1.383
3	(Constant)	17.305	.142		121.557	.000		
	IPqwery - Trademarks Registered	.000	.000	-.034	-.937	.349	.681	1.467
	IPqwery - Patents Granted	2.297E-5	.000	.037	1.009	.313	.664	1.506
	Age_of_Company	.015	.003	.172	4.737	.000	.683	1.464
	Number of Investors	.055	.006	.324	9.237	.000	.733	1.364
	SQRTDegreeCentrality	10.807	2.768	.312	3.904	.000	.142	7.063
	SQRTBetweennessCentrality	-15.266	5.271	-.218	-2.897	.004	.159	6.285

Appendix H Additional Information Concerning the Dimensions of the Index of Economic Freedom

Rule of law

The dimension rule of law is measured by the indicators: property rights, judicial effectiveness and government integrity. Property rights concern the legal protection level of private property rights and the extent to which these laws are enforced in a country. Judicial effectiveness is about the fairness and efficiency of the judicial system. Government integrity is about the prevalence of different forms of political corruption. Generally, it can be stated that higher scores on this dimension lead to a better protection of businesses against other businesses and the government, therefore indicating a higher level of economic freedom.

Government size

The larger the size of a government, the more control it will generally exert on its economy, therefore this is an important indicator of economic freedom. The dimension government size consists of the indicators: tax burden; government spending and fiscal health. Tax burden refers to the analyzation of marginal tax rates on corporate and personal income level. It also looks at the overall level of taxation as a percentage of the GDP. The indicator government spending is about the quantification of the burden of government expenditures. This includes all transfer payments related to different entitlement programs and consumption by the state. Lastly, the indicator fiscal health regards how well countries manage their budget by quantifying the growing deficit and debt.

Regulatory efficiency

The dimension regulatory efficiency consists of the indicators business freedom, labour freedom and monetary freedom. Business freedom is about the costs, time and freedom in a country to open, close and operate a venture. Monetary freedom regards the stability of prices and the extent to which microeconomy intervenes. Lastly, labour freedom is about labour rights such as minimum wage and regulatory restraints on hiring and working hours. The higher the level of regulatory efficiency, the higher the level of economic freedom will be.

Market openness

The dimension market openness is measured by the indicators: trade freedom, investment freedom and financial freedom. Trade freedom quantifies the degree in which non-tarrif and tariff barriers in a country affect exports and imports of goods and services. Furthermore, investment freedom refers to the extent in which the flow of investment capital of firms and

individual is free or constrained. The indicator financial freedom refers to how independent the financial sector is from the government and to banking efficiency. The higher the level of market openness, the higher the level of economic freedom will be.

Appendix I Additional Information Concerning the Dimensions of the Fraser Index

Size of Government

The larger the size of a government, the more control it will generally exert on its economy, therefore this is an important indicator of economic freedom. The dimension government size consists of the indicators: government consumption; transfers and subsidies; government investment; top marginal tax rate and state ownership of assets. Government consumption is about the quantification of the burden of government expenditures. Transfers and subsidies are about the quantification of government transfers and subsidies as a share of GDP. Government investment is the total amount a government spends on investments. Furthermore, top marginal tax rate refers to the height of the marginal tax rates in a country. Lastly, state ownership is about the degree to which the state controls and owns capital in the agricultural, industrial and service sectors.

Legal System and Property Rights

This dimension is measured by the indicators: judicial independence; impartial courts; protection of property rights; military inference in rule of law and politics; integrity of the legal system; legal enforcements of contracts; regulatory costs of the sale of real property and reliability of police. Judicial independence is about whether the judiciary in a country is independent from political influences of the government, citizens or firms. Impartial courts regard the extent to which the legal framework in a country is inefficient and subject to manipulation. Protection of property rights concern the legal protection level of private property rights and the extent to which these laws are enforced in a country. Furthermore, military inference in rule of law and politics refers to a measure of the military's involvement in politics. Integrity of the legal system assesses the strength and impartiality of the legal system together with the popular observance of the law. Legal enforcement of contracts is about the time and money it costs to collect a debt through the judicial system. Regulatory costs of sale of real property refers to the time and monetary costs required to transfer ownership of property that includes land and a warehouse. Lastly, reliability of police is about the extent to which the police services can be relied upon in order to enforce law and order.

Sound money

The dimension sound money includes the indicators money growth; standard deviation of inflation; the inflation in the most recent year and freedom to own foreign currency bank accounts. Money growth is about the average annual growth of the money supply minus the average annual growth of the GDP. The standard deviation of inflation measures the standard

deviation of the inflation rate over the last 5 years. The indicator inflation in the most recent year speaks for itself, it measures the inflation rate in the most recent year in order to check the stability of prices. Lastly, freedom to own foreign currency bank accounts refers to the extent to which foreign currency bank accounts are permissible without any restrictions, both abroad and domestically.

Freedom to trade internationally

This dimension is measured by the following indicators: tariffs; regulatory trade barriers; black-market exchange rates and controls of the movement of capital and people. Tariffs is about the revenue that the government generates from trade taxes. Regulatory trade barriers refer to the extent to which tariff and non-tariff barriers reduce the ability of imported goods to compete in the domestic market together with the compliance costs of importing and exporting. Black market exchange rates is based on the difference in percentages between the official and the black-market exchange rate. Controls of the movement of capital and people concern the financial openness in a country together with capital controls and freedom of foreigners to visit.

Regulation

Credit market regulations; labor market regulations; and business regulations together form the concept of regulation. Credit market regulations deal with ownership of banks, the amount of private sector credit of the government and interest rate controls. Labor market regulations is about minimum wage, hiring and firing regulations, centralized collective bargaining, working hours regulations, mandated costs of worker dismissal and the duration of military conscription. Business regulations refers to administrative requirements that have to be complied to as well as the indicators bureaucracy costs, starting a business, impartial public administration, licensing restrictions and costs of tax compliance.