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THE INFLUENCE OF DEPLOYMENT POLICIES ON EQUITY INVESTMENTS IN THE SOLAR PHOTOVOLTAIC INDUSTRY

30 ECTS Master's Thesis

Energy Science

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CONTEXT

MASTER'S PROGRAMME ENERGY SCIENCE

I am enrolled in the Energy Science master's programme that is offered by the Department of Innovation, Environmental, and Energy Sciences at the Utrecht University. The program provides insight into how the energy system works and how new technologies can contribute to the transition towards a more sustainable energy system. I have successfully completed all mandatory courses as well as the Young Leaders League honours programme for master students of the Utrecht University. Additionally, I completed three elective courses: "Fossil Resources", "Technology Related Venturing", and "Sustainable Entrepreneurship".

ANNOTATION SUSTAINABLE ENTREPRENEURSHIP & INNOVATION

Students enrolled in the Energy Science master's programme can qualify themselves for the annotation Sustainable Entrepreneurship & Innovation, which is complementary to the Energy Science master's programme. This research qualifies for this annotation because it helps to increase scientific understanding on how environmental policies drive the process of innovation. Currently, most scientific literature agrees that these policies drive innovation for renewable energy technologies, but there is less understanding on how this exact process works and therefore on how this process can be improved. Therefore, this thesis can be valuable for designing future policies, which try to stimulate innovation in the field of renewable energy technologies.

CLIMATE-KIC MASTER LABEL

Climate-KIC is one of the three Knowledge Innovation Communities founded by the European Institute of Innovation and Technology. Climate-KIC tries to stimulate climate related research in Europe. This master's thesis is performed as part of the mobility program of the Climate-KIC master label. This master's thesis is relevant for the Climate-KIC platform "making transitions happen", because it helps to understand the role of deployment policies on fostering innovation for a low carbon future for Europe.

ABSTRACT

Many countries put a deployment policy framework in place to stimulate the diffusion of renewable energy technologies. Various studies showed the positive effects of these policies on country aggregated innovative output and industry growth in the renewable energy sector. However, there still remains less insight in the detailed mechanisms on how deployment policies create these effects. This thesis tests the proposition that equity investments played an important role, by assessing the impact of deployment policies on equity investments. The solar PV industry is used as a research setting, because of its dependence on deployment policies. Data about equity investment deals in the solar PV industry is gathered from Thomson One Banker, Mergerstat, and Zephyr and all combined into a database with 3685 deals. The analysis is split up into a country-level analysis and a firm-level analysis, to check for any discrepancies between the different levels of analysis. The country-level analysis is based on a fixed effects regression using panel data of 39 countries, including both OECD and non-OECD countries, and a 1993-2012 time period. The firm-level analysis is based on a fixed effects regression using panel data of 119 public firms active in the solar PV industry. The results indicate that both domestic and foreign deployment policies are a driver for equity investments in the solar PV industry. Furthermore, some moderators have a significant impact on this relationship. Domestic deployment policies showed to be more important for, (i) firms active in more downstream value chain positions, (ii) the earlier years of the sample, and (iii) firms that are specialized. Domestic and foreign deployment policies did not favour investments into a more mature technology stream in the solar PV industry. From the results, implications for policymakers are derived, in which case domestic deployment policies are more effective in stimulating local equity investments and in which case higher investment spillovers to foreign industries can be expected.

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NOMENCLATURE

AIC	Akaike Information Criterion
BOS	Balance of System
c-SI	Crystalline Silicon
EU	European Union
FE	Fixed Effects
GDP	Gross Domestic Product
GLM	Generalized Linear Model
IEA	International Energy Agency
IPO	Initial Public Offering
IV	Instrumental Variable
M&A	Mergers & Acquisitions
NBREG	Negative Binomial Regression
OECD	Organisation for Economic Co-operation and Development
OLS	Ordinary Least Squares
PE	Private Equity
PV	Photovoltaic
R&D	Research & Development
RD&D	Research, Demonstration & Development
ROA	Return on Assets
RE	Renewable Energy
SIC	Standard Industrial Classification
VIF	Variance Inflation Factor
ZINB	Zero-inflated Negative Binomial

1 INTRODUCTION

Climate change, environmental degradation and resource depletion are problems that society is currently facing. The energy industry is seen as one of the main contributors to these problems, with its enormous demand for resources and its CO_2 emissions. In order to overcome these problems and reach international climate goals, low carbon technologies will be needed to decouple economic growth from environmental degradation. Despite the strong growth of renewable energy technologies over the last decades, the main challenge is to reduce renewable energy prices to a competitive level, as compared with older fossil fuel based technologies. In order to increase the competiveness and the widespread adoption of these renewable energy technologies, governments have implemented a wide range of policies. These policies can be categorised as deployment policies and technology-push policies (Nemet, 2009). Technology-push policies try to steer innovation by increasing the current level of scientific understanding and technological opportunities. Deployment policies try to foster innovation by changing the market conditions, so as to create opportunities for investments (Nemet, 2009). After the rapid rise of technology-push policies in the 1970s, governmental budgets for these policy instruments have since been declining (Smith & Urpelainen, 2013b). Since the 1990s, the emphasis has shifted towards the actual implementation of these technologies (Blok, 2006), which has led to the rise of deployment policies. The emphasis on deployment policies can be seen in worldwide governmental spending on renewable energy funding, which was 4.6 billion dollars for technology-push policies, versus 88 billion dollars for deployment policies (Bloomberg New Energy Finance, 2012).

Since the introduction of deployment policies, several scholars have performed research on their effects. It is generally accepted that deployment policies are one of the main contributors to the rapid diffusion of renewable energy technologies (Jacobsson & Johnson, 2000; Lipp, 2007). In the European Union (EU) the amount of electricity generated by renewables increased 81% during the period 2002-2012 (IEA, 2014). Lund (2009) performed a study on the worldwide effects of deployment policies and concluded that such policies have led to the growth of industrial activities within the renewable energy sector in countries in which these policies have been enacted. Lewis & Wiser (2007) concluded that the (inter)national success of firms within the renewable energy sector is largely dependent on the stability and annual growth of such firms' home market. Porter (1998) also explained the importance of favourable home-country demand conditions for achieving a competitive advantage. An important question that scholars have tried to answer is: Do these policies also stimulate technological change? It is accepted that, in general, deployment policies indeed foster technological change (Newell, 1999), but the level of change can differ substantially among different policy instruments and is therefore strongly dependent on the context (Kemp & Pontoglio, 2011). So far, most research has focused on the effects of deployment policies at the sector level or country level (Cleff & Rennings, 1999). Therefore, Nemet (2009) mentioned that a more disaggregated level should be used for analysing the effects of deployment policies. This should create more insight into the following question: Through which detailed mechanisms do deployment policies affect innovation? Hoppmann et al. (2013) made the proposition that equity investments are important mechanisms through which deployment policies affect innovation in the renewable energy sector. However, scholars have not empirically tested this proposition.

The scientific literature distinguishes amongst different drivers for equity investments. Studies have assessed the effect of indirect country-level factors in driving firm equity investment decisions. Black & Gilson (1998) showed the importance of a well-developed stock market, and Gompers & Lerner (1998) showed a positive relationship between gross domestic product (GDP) growth and interest rates on minority venture-capital investments. However, there is relatively little understanding of how governments can drive these investments (Haleblian et al., 2009). While governments have a long history of directly stimulating such investments, for example by the small business innovation research (SBIR) programme in the United States (US), there is still a lack of understanding of how governments can indirectly drive equity investments by stimulating market growth (Moore & Wüstenhagen, 2004). Zider (1998) found that venture capitalists actively search for investment opportunities in growing markets. This creates the expectation that policies stimulating market growth also indirectly stimulate equity investments. Some authors have even stated that it is expected that these indirect policies have a larger effect on equity investments than direct policies such as tax incentives (Gompers & Lerner, 1999).

Scholars investigating the drivers of equity investments also have not assessed the effects of deployment policies on driving equity investments. Therefore, this study aims to increase scientific understanding on equity investments as a detailed mechanism that is driven by deployment policies. In order to gain new insights, this study addresses the following question:

What is the effect of deployment policies on equity investments?

To answer this question, a quantitative analysis is performed based on equity investments in the photovoltaic (PV) industry. For several reasons, the PV industry is selected as a research setting. Solar PV is playing an important role in reaching future climate goals and reducing CO_2 emissions. So far, the "new renewables[1]", solar PV, wind and biomass, are responsible for most of the increase in global electricity production from renewables (Arent et al., 2011). During the last decade, the worldwide installed capacity of solar PV increased from 2.2 GW in 2002 to 102.1 GW in 2012 (EPIA, 2013).

[1] Hydropower and traditional biomass are excluded when referring to new renewables.

Governmental support for solar PV played an important role in this rapid diffusion of this technology over recent years (Tyagi et al., 2013). Despite its enormous cost reductions, electricity from PV panels is still more expensive than fossil-fuel generated electricity (Tour et al., 2013). PV-generated electricity's dependence on deployment policies creates the expectation that these policies may also play an important role in equity investments in this industry. Earlier research has shown that the solar PV industry can be seen as a global industry (Zhang & He, 2013). Therefore, no geographical constraint is used in this research.

For several reasons, this study focuses on target firms of equity investments. The amount of money invested during the equity deal is primarily dependent on the characteristics of the target firm. Additionally, many studies have investigated what drives acquirers into making an equity investment deal (Haleblian et al., 2006; Lin & Peng, 2009; McEvily & Marcus, 2005). A common limitation of these studies is that they assume that acquirers can freely choose among target firms and that they do not incorporate the existence of these firms. Therefore, additional insight is needed into what drives target firms into equity investments.

Because of the enormous governmental spending on deployment policies, analysing their effectiveness has a large societal relevance. The amount of private investments generated by subsidies is an important measure of the effectiveness of policies (Arrow & Lind, 2014). Therefore, this research is important for assessing the effectiveness of deployment policies. This is especially necessary for the solar PV industry, where scholars have stated their considerations regarding the effectiveness of deployment policies as an industrial policy (Pegels & Lütkenhorst, 2014). This research could furthermore provide valuable insights for managers and investors active in the solar PV industry, as they navigate situations affected by domestic and foreign deployment policies.

In the remainder of this thesis, the theoretical framework and deducted hypotheses will first be presented. This will be followed by a more in-depth overview of the solar PV industry. The research methods and the results of the regression analyses will be presented afterwards. The results will be discussed in greater detail and will form the input for the final conclusions of this thesis.

2 THEORY

This section provides an overview of the relevant literature related to the formulated research question. Section 2.1 provides a short overview of earlier research on the effects of deployment policies, and it is followed by section 2.2, which provides an overview of previously identified drivers for equity investments. Section 2.3 discusses the link between equity investments and deployment policies, and it reviews the formulated hypotheses. Finally, the research framework is presented in section 2.4.

2.1 THE EFFECTS OF DEPLOYMENT POLICIES

It is generally accepted that deployment policies have a positive effect on the innovativeness of the renewable energy sector (Río González, 2009; Nemet, 2009). The effects have been widely investigated on a highly aggregated industry level, for example by looking at the increase in patents at the country level or the industry level (Johnstone et al., 2009), or by looking at industry-level research & development (R&D) expenses (Jaffe & Palmer, 1997). However, the outcomes of these studies have been mixed regarding the effectiveness of different policy designs, partly because of the differences in the techniques used to measure R&D process outputs (Jaffe et al., 2002). Additionally, one should also be aware that the effectiveness of various policy designs is not necessarily indicative of the absolute amount of innovative activities spurred by environmental policies (Newell, 2010).

Scholars assessing the relationship between deployment policies and firm-level effects have primarily tested the Porter hypothesis, which state that environmental regulation can trigger firm innovation and can lead to improved firm competitiveness (Porter & Van der Linde, 1995). Based on patent counts for US manufacturing firms, Brunnermeier & Cohen (2003) found a positive relationship between environmental regulation and firm-level innovative output. Testa et al. (2011) found a positive relationship between environmental regulation and firm performance. Their study focused on the European building and construction sector. Looking at different manufacturing industries in Europe, Lanoie et al. (2001) found a negative relationship between environmental regulation and firm performance. Most likely, the differences between industries, as well as the different policy frameworks affecting these industries, influence the findings regarding the Porter hypothesis at the firm level (Iraldo et al., 2011). Therefore, additional research is needed on the effects of environmental policies in specific industries, as well as the detailed mechanisms that lead to these effects.

2.2 DRIVERS OF EQUITY INVESTMENT

Equity investments can be defined as money that is invested in a target firm by an acquirer/investor firm, in return for an owner's share in the target firm. There are many different types of equity investments, which mostly differ based on the goal of the target and acquirer. In this study, four types of equity investments have been included:

1. Mergers & Acquisitions (M&A): This category can be split up into mergers, majority acquisitions and minority acquisitions. Acquisitions are primarily intended to gain control of a firm, as a method to enter new markets (Cartwright & Schoenberg, 2006; Ietto-Gillies, 2000; Raff et al., 2009), or as an approach for acquiring complementary capabilities (Ietto-Gillies, 2000; McEvily & Marcus, 2005). In a majority acquisition, the investor acquires more than 50% of the shares. In a minority acquisition, the investor acquires less than 50% of the shares. In a merger, both companies survive within one overarching company. This is different from a 100% acquisition, where only one firm (usually the largest) survives.
2. Private Equity (PE) / Venture Capital (VC): Within this category, the investor firm is active in the financial sector and the investment is driven by the desire to see a return on investment. Financial firms could include investment banks, venture-capital firms, private equity or direct investments from various institutional investors (such as pension funds). This differs from the M&A category, in which all of the investors are industrial firms.
3. Initial Public Offering (IPO): This is the stock market launch of a private firm, where the stocks are sold to the public. This type of equity investment cannot be linked to a single investor. Main reason for a firm to perform an IPO is to gather money, which can be used for growing the business.
4. Share Issuance (SI): In the process of share issue, a public firm offers new shares that are then offered to the public. SI differs from IPO, because these firms are already public.

2.2.1 COUNTRY-LEVEL DRIVERS OF EQUITY INVESTMENTS

Different studies have quantitatively assessed the impact of country-level macroeconomic and political determinants of equity investment activity. Studies looked specifically at private equity or venture capital (Bernoth & Colavecchio, 2014; Bonini & Alkan, 2009; Gompers & Lerner, 1999; Jeng & Wells, 2000; Romain & Pottelsberghe de la Potterie, 2003; Schertler, 2003), looked at M&As (di Giovanni, 2005; Rossi & Volpin, 2004; Uddin & Boateng, 2011; Vasconcellos & Kish, 1998), or looked specifically at IPOs (Doidge et al., 2011; Lewellyn & Bao, 2014). These studies showed that stock market activity, GDP growth, labour market rigidities, interest rates and corporate tax rates are significant macroeconomic drivers for overall country-level equity investment activity.

La Porta et al. (1997) showed that a country's legal framework and its enforcement can have a significant influence on the size of its capital market. The underlying assumption of this study is that better laws simplify the investment process (Bernoth & Colavecchio, 2014). The same holds for a higher-quality institutional environment (Beck et al., 2006). Political risk also has a large influence on the amount of equity investments in a country (Bonini & Alkan, 2009). High levels of political risk create an unstable political framework and also reduce governmental efficiency and thus negatively affect equity investment activity (Bonini & Alkan, 2009). Governments can also indirectly simulate equity investment, as Meyer (2006) concluded that national R&D expenditures also stimulate VC activities. According to Gompers & Lerner (1999) & Schertler (2003), R&D expenditures indeed lead to an increase in technological opportunities, which open possibilities for new firm entry and therefore for equity investments.

2.2.2. Firm and industry drivers of equity investments

Many earlier studies showed that venture capitalist prefer to invest in high growth industries and that high growth industries will therefore attract relatively more venture capital funding (Fernhaber et al., 2007; Ge et al., 2005; Zider, 1998). Industry growth is also important for attracting acquisitions (Christensen & Montgomery, 1981). All these findings are in alignment with the shareholder value theory, which states that the sales growth rate drives the value of a firm, which can in turn drive equity investments (Schoenberg & College, 1999). Different authors have empirically tested this relationship. Pagano et al. (1998) measured industry growth in terms of the market-to-book ratio for all public firms active in different industries and showed that this ratio is positively related to IPO activity. Maksimovic & Phillips (2001) used a logit model to show that industry growth is greater in the years in which a firm makes an acquisition. This is in line with Carpron & Shen (2007) who also concluded that M&A behaviour is positively linked to growth in the target industry. Because deployment policies create a market for renewable energy technologies, they are closely related to industry growth. However, a common limitation from earlier mentioned studies is that they only incorporate worldwide industry growth. However, to assess the effectiveness of deployment policies for local governments, a distinction has to be made between industry growth generated by domestic deployment policies and industry growth generated by foreign deployment policies.

2.3 Deployment policies and their effect on equity investments

This section reviews the relationship between deployment policies and equity investments. As explained in the introduction focuses this thesis on target firms. The deducted hypotheses will therefore apply to target firms. First the general relationship is discussed, followed by the potential effects of different moderators.

2.3.1 *GENERAL RELATIONSHIP*

While more general factors, such as increasing public awareness[2] about the climate-change related problems most likely contributed to an increase in investments in the renewable energy sector, favourable policy frameworks have played an even more important role (Bürer & Wüstenhagen, 2009). Different mechanisms can explain the positive effect of deployment policies on equity investments.

The aim of deployment policies is to induce demand for renewable energy technologies and therefore to create a market for them. This then creates opportunities for firms to enter the market and increase their sales. Earlier studies showed that deployment policies do positively influence industrial activities within the renewable energy industry. A study performed by Lund (1999) showed the positive effects of Danish deployment policies on job creation in the domestic renewable energy sector. Based on a sample of several sustainable energy sectors in Europe, Lund (2009) also demonstrated that domestic deployment policies contribute to the expansion of industrial activities in the home country. Sine et al. (2005) showed that public energy policies also have a positive effect on the founding rate of firms using new emerging energy technologies. This relationship between domestic deployment policies and industry growth has also been addressed by other authors (Hoffmann, 2006; Weiss et al., 2003). These previously mentioned studies did not differentiate between foreign and domestic deployment policies and primarily assessed the influence of domestic deployment policies on home-country industry growth and the export activities of home-country firms. Peters et al. (2012) did look at both effects, and found a positive relationship for both domestic and foreign deployment policies in driving innovation in the solar PV industry. Other studies have indicated that this may also be the case for industry growth. Zhang & He (2013) concluded that the Chinese PV industry benefitted from the global increase in demand for electricity from PV systems, as produced by foreign deployment policies. These findings have also been supported by other authors (Grau et al., 2012; Sun et al., 2014). Similar results have been found for Norway, which also benefitted from a global increase in demand for solar cells as it developed its own solar PV industry (Klitkou & Coenen, 2013).

Scientific literature assessing the influence of policies on investments has widely investigated the role of governments in reducing risk (Mitchell et al., 2006; Wiser & Pickle, 1998). Deployment policies do not solely attract new firms, but they also attract investors to the industry. Bürer & Wüstenhagen (2009) showed that deployment policies lower the assessed financial risk for venture capitalists in the renewable energy sector. The market opportunities created by deployment policies help to reduce market uncertainty and therefore also the perceived risk for the investor. It has been argued that a feed-in tariff is more effective in reducing investment risk than a renewable energy obligation (Mitchell et

[2] See Carlos et al. (2014) and Pacheco et al. (2014) for the influence of social movements on industry growth in the renewable energy sector.

al., 2006). However, Dinica (2006) showed that the distinction between these two methods is not crucial, since there are also poorly designed feed-in tariff systems. She argued that the design of a specific policy framework is much more important than the type of deployment policy utilized and that long-term stable policies create less risk for investors. This is in line with Negro et al. (2012), who argued that stop-and-go policies work as a barrier for the diffusion of renewable energy.

Overall there is agreement within the scientific community that deployment policies create a market for renewable energy technologies and therefore: (i) attract new firms to the industry, (ii) drive the revenues of firms in the industry, and (iii) attract investors to the industry. This creates the expectation that both domestic and foreign deployment policies should have a positive effect on number of equity investments in the renewable energy industry.

1a Domestic deployment policies have a positive effect on the number of equity investments in target firms pursuing the supported technology.

1b Foreign deployment policies have a positive effect on the number of equity investments in target firms pursuing the supported technology.

Based on these statements it is also expected that deployment policies drive the overall value of equity investments.

2a Domestic deployment policies have a positive effect on the overall deal value of equity investments in target firms pursuing the supported technology.

2b Foreign deployment policies have a positive effect on the overall deal value of equity investments in target firms pursuing the supported technology.

The hypotheses stated above are framed on the country level. However, presumed country-level effects do not necessarily apply on the firm level (Head et al., 2002). To check for any discrepancies between aggregated country-level findings and less aggregated firm-level findings, additional hypotheses have been deducted on the firm level. Deployment policies most likely affect target firms in the solar PV industry in several ways. An earlier study has already shown the effects of such policies on the number of patent applications (Brunnermeier & Cohen, 2003). As explained in the previous paragraphs, industry growth most likely drives the effect of deployment policies effects on equity investments. Earlier studies focusing on other industries found that industry growth could be a driver for firm growth (Gilbert et al., 2006; McDougall, 1994), as well as a driver for attracting new entrants to the industry (Klepper, 1997). On the other hand, industry growth is determined by firm growth, so these variables positively influence each other. However, in both cases, it is expected that deployment policies positively influence firm growth in the solar PV industry. The size of the firm, as determined by the firm's earlier growth rate, is most likely a determinant for the amount of equity invested within it. Therefore the following hypotheses have been deducted.

3a Domestic deployment policies have a positive effect on the growth of firms pursuing the supported technology and therefore on the value per deal.

3b Foreign deployment policies have a positive effect on the growth of firms pursuing the supported technology and therefore on the value per deal.

2.3.2 THE RELATIVE IMPORTANCE OF DOMESTIC AND FOREIGN DEPLOYMENT POLICIES.

If it is expected that both foreign and domestic deployment policies affect equity investments, an important follow-up question is the following: Which type of deployment policy, foreign or domestic, has the greater effect? Porter (1990) mentioned that the home market is important in achieving a competitive advantage over firms in other countries. The importance of the home market is also part of Krugman's (1985) model. He predicted that countries with a relatively large share of consumers of a given product would be a net exporter. Later models, building on Krugman's earlier model, also showed the importance of the home market for firm growth (Head et al., 2002). These models suggested a more important role for domestic deployment policies in driving equity investments. Another contradictory view suggested that technologies and institutions have been converging among countries and that firm growth is therefore dependent on opportunities all around the world (Tong & Alessandri, 2008). From this perspective, the home market does not create any additional growth opportunities for firms in a given country, while firms from other countries can also benefit from this market.

Earlier research on the solar PV industry gave some indications that both models may apply. Sun et al. (2014) showed that the development of solar PV activities in China greatly benefitted from markets created by other governments. On the other hand, Grau et al. (2012) showed that Germany was capable of building up a local PV industry because of the large demand in the home market. Based on the above statements regarding the PV industry and scientific theories, it is expected that the relative importance of domestic and foreign deployment policies is subject to change. The following sections present two determinants identified in the literature that may play a role in shaping the relative importance of domestic versus foreign deployment policies: time period and value chain position.

Time development

The development of industries over time has been widely investigated by many scholars (Abernathy & Utterback, 1978; Agarwal & Audretsch, 2001; Klepper, 1997). An important insight from the theories developed by such scholars is that the dynamics within a certain industry change over time, during the so-called industry life cycle (Klepper, 1997). The early stages of the industry life cycle go hand in hand with high levels of market and technology uncertainty. This uncertainty and lack of standardization create a need for firms to be closely located to their consumers, in order to obtain information about consumer preferences (Audretsch & Feldman, 1996). This is in line with the literature on user-consumer interaction (Lundvall, 1985), which states that the development of new technologies requires producers to be closely related to their lead users. Over time, the emergence of a dominant design creates a more standardized demand, which decreases technological uncertainty. Therefore, the source of competitive advantage shifts away from technological characteristics towards price competition. At this stage, the standardized demand makes it less necessary for a firm to be closely located to its customers. The above statements are in line with the theory about lead markets, which states that new industries will emerge in a lead market and diffuse over time towards a global market (Beise, 2004). An important factor of this lead market is the advantage offered by local demand (Beise, 2004).

This creates the expectation that industrial development will initially focus on geographical areas with high demand, as created by domestic deployment policies. When the industry life cycle evolves towards maturity, geographical proximity will become less important. Earlier research showed that this could also be the case in the renewable energy industry. Lewis & Wiser (2007) performed a cross-country analysis focusing on the wind industry and found that development occurs in countries with high demand and globalizes over time. This has also been the case for the solar PV industry, where market development has initially been primarily restricted to a few countries with the strongest political support for PV (Dewald & Truffer, 2011). For example, in 2007, 90% of all solar PV capacity was installed in only five countries: Germany, Spain, Italy, the US and Japan (IEA-PVPS. 2013). Sun et al. (2014) showed that the development of a solar industry in China benefitted from the lower price that Chinese firms could offer compared to firms active in other countries. This is indicative of price competition in the solar PV industry and shows that the industry indeed developed over time towards price competition. Based on the above literature, is expected that[3]:

4a Domestic deployment policies have a stronger positive effect on the number of equity investments in the early years of the industry life cycle as compared to the later years of the industry life cycle.

4b Foreign deployment policies have a stronger positive effect on the number of equity investments in the later years of the industry life cycle as compared to the early years of the industry life cycle.

Value Chain position

Value-adding activities performed in a specific industry can be split up into different value chain positions, starting with upstream raw materials extraction and ending with downstream product

[3] As explained in the methods section, this could only be tested on the country level. Therefore, no firm-level hypotheses have been included.

delivery to the end consumer. Typically, there are several other positions between these two extremes. Different value chain positions have different dynamics, which most likely influence the relative importance of domestic and foreign deployment policies.

Firms active in the more downstream value chain positions are generally more closely located to end consumers, compared to firms active in the more upstream value chain positions. For firms active in these downstream positions, contact with end consumers is much more important. Such contact plays no role for firms active in upstream segments. This end-user contact is important for renewable energy technologies, where location-specific characteristics (such as sun irradiation and wind speed) and country specific characteristics (such as renewable energy laws) must be taken into account. Because deployment policies are focused on the end users of the system (Shum & Watanabe, 2009), and these end-users are more locally bounded, it is expected that the domestic market have a larger influence on the development of downstream activities than on upstream activities.

Furthermore, theoretical assumptions regarding the industry life cycle do not necessarily apply to all different value chain positions (Gallouj & Savona, 2008). In some steps of the value chain, standardization cannot be easily achieved, because user-producer interaction remains important during the whole life cycle (Peltoniemi, 2011). Industries in which this is the case will therefore become less globalized, and local demand will primarily determine the development of local industrial activities. (Hamel & Prahalad 1985) Kobrin (1991) empirically assessed which industry characteristics determine the global integration of an industry and found that the technological intensity is the most important determinant. The upstream segments of the value chain are generally more technology-intensive, because of the manufacturing process. Demand is also more standardized in these segments, because the above-mentioned country and location specific characteristics do not have to be fully taken fully into account. Based on the above literature, it is expected that domestic deployment policies play a more important role for downstream value chain positions, because (i) the user-producer interaction is more important, (ii) there is no standardized demand, and (iii) these segments are less technology-intensive. Therefore, it is expected that:

5a Domestic deployment policies have a stronger positive effect on the number of equity investments in targets firms positioned downstream in the value chain as compared to upstream value chain positions.

5b Foreign deployment policies have a stronger positive effect on the number of equity investments in target firms positioned upstream in the value chain as compared downstream value chain positions.

5c Domestic deployment policies have a stronger positive effect on firm growth and therefore on the value per deal in firms positioned downstream in the value chain as compared to upstream value chain positions.

5d Foreign deployment policies have a stronger positive effect on firm growth and therefore on the value per deal in firms positioned upstream in the value chain as compared to downstream value chain positions.

2.3.3 THE ABSOLUTE IMPORTANCE OF DEPLOYMENT POLICIES

As argued in the previous section, it is expected that moderator effects drive the relative importance of foreign and domestic deployment policies. However, it is also expected that moderator effects influence the combined importance of domestic and foreign deployment policies. This section gives an overview of these moderator effects.

Technology stream

The technological development of solar PV has emerged among a range of technologies that differ in maturity levels. Sartorius (2005) showed that the development of thin-film technologies is lagging behind as compared to crystalline silicon solar technologies, because the political framework favours the development of the latter. Overall this may create a lock-in into a technology that does not provide the best performance in the long run. It may also decreases the potential of a promising technology (van den Bergh et al., 2006). A high level of technological diversity will be an important factor for solar PV in reaching higher diffusion levels (van den Heuvel & van den Bergh, 2009), because many studies claim that a considerable amount of technological change is still needed to reach higher diffusion rates (Laird, 2011). Such a lock-in would be influenced by the fact that competition for solar panels is mainly driven by the price of the electricity generated. The lock-in could be further driven by three types of increasing returns to adoption (Sandén, 2005). There is a positive feedback loop for costs, driven by economies of scale and learning by doing. The same holds for the user side, where uncertainty decreases. Finally a lock-in could be encouraged by the interconnected development of technological and institutional frameworks. Research by Hoppmann et al. (2013) showed initial insights into how firms pursuing more emerging technologies can not fully benefit from the opportunities offered by deployment policies It is expected that deployment policies favour more mature technologies and therefore increase the risk for emerging technologies. This increased risk most likely leads to deployment policies having a smaller effect on equity investments in firms pursuing emerging technologies[4]:

6a Deployment policies have a stronger positive effect on the number of equity investments in target firms pursuing a more mature technology than on those pursuing a less mature technology.

[4] This could not be tested on the firm level, as will be further explained in the methods chapter.

Corporate diversification

Target firms involved in equity investments deals are not necessarily solely active in the solar PV industry. Firms can also diversity and participate in other industries. Therefore, in this thesis, a distinction is made between specialized firms, which are active only in the solar PV industry[5], and diversified firms, which are active in other industries as well. Deployment policies create a market for solar panels and are therefore expected to only influence firm activities in the solar PV industry. This creates the expectation that specialized firms are stronger affected by deployment policies than diversified firms are.

Earlier research about this distinction showed that specialized firms are more strongly affected by shocks in demand than are diversified firms (Maksimovic & Phillips, 2002), because diversification is a way to spread risk over different industries. Lamont & Polk (2002) argued that diversified firms misallocate their investments between different industries. For diversified firms active in the solar PV industry, this would mean that in times of rapid growth in this sector, these firms do not fully capture the benefits generated by deployment policies, because their investment levels are suboptimal. Based on the above statements, it is expected that deployment policies more strongly influence firm growth and equity investments in specialized target firms than in diversified firms.

7a Deployment policies have a stronger positive effect on the number of equity investments in target firms if the target firm specializes in the supported technology than if the firm is diversified.

7b Deployment policies have a stronger positive effect on firm growth and therefore value per deal in firms that specializes in the supported technology than if the firm is diversified.

[5] Specialized can be active in more than one value chain position.

2.4 RESEARCH FRAMEWORK

Figure 1 shows the overarching research framework for this thesis. The arrows, representing all of the different hypotheses, link the main concepts. Arrows 1 and 2 represent the two main hypotheses on the country level: domestic deployment policies lead to high number of deals as well as a higher total value of deals. Arrow 3 represents the main hypothesis on the firm level, with firm growth as an important intermediate concept. All the other numbers represent the hypotheses for the moderator effects. On the country level, the moderators are only tested for the total number of deals, because data availability is higher for the number of deals compared to the value of deals.

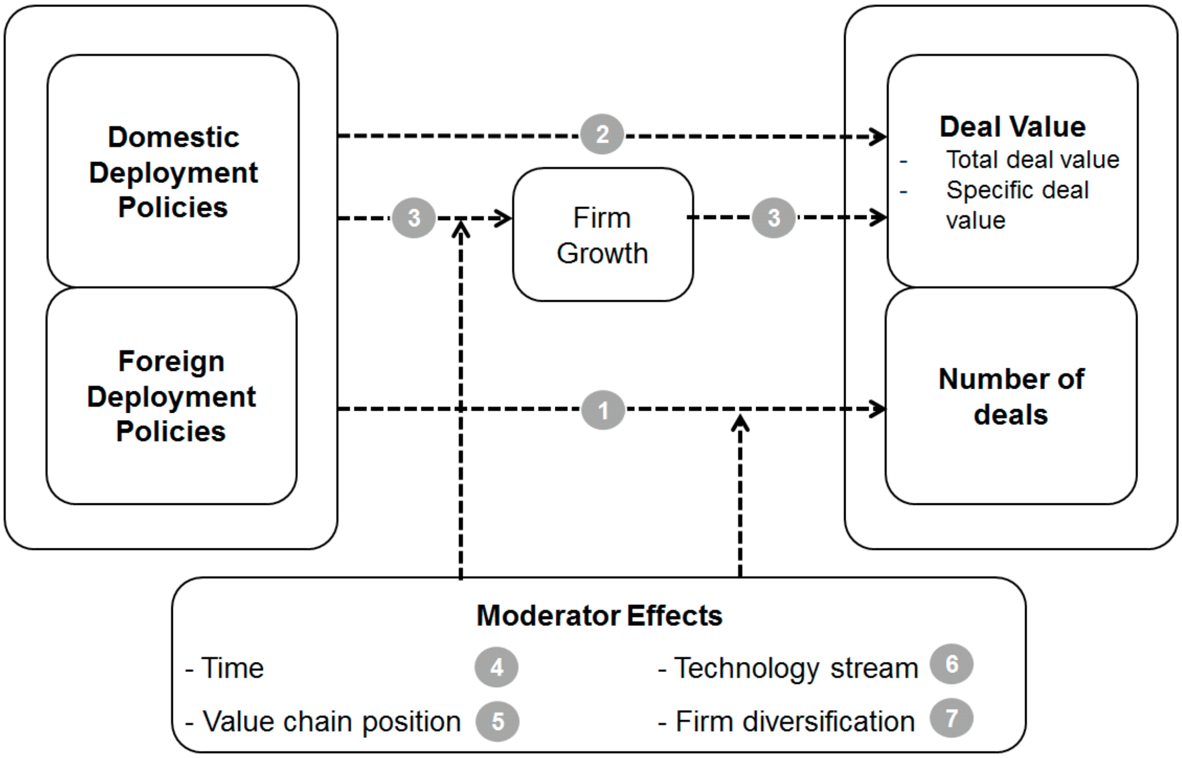

Figure 1 Research framework

3 THE SOLAR PHOTOVOLTAIC INDUSTRY

In order to test the hypotheses, this thesis uses the solar PV industry as a research setting. First, a more in depth overview of the current solar PV technologies is presented. This will be followed by an overview of the solar PV value chain. Finally, the development of the solar PV industry over time is discussed.

3.1 TECHNOLOGY OVERVIEW

Current solar PV technologies can be grouped into first-, second-, and third-generation technologies (Martin A Green, 2006). For each technology stream, a short overview is provided. The more mature first-generation crystalline silicon solar cells can be further divided into monocrystalline silicon (c-Si) and multicrystalline silicon (mc-Si) cells. Development of these technologies benefited from the integrated circuit industry, which had a long history of manufacturing and processing these materials (Bagnall & Boreland, 2008). Additionally, development was driven by the space applications of the first solar cells in the 1950s (Razykov et al., 2011). The main distinction between these two types of first-generation solar cells lies in the production processes. Differences in production processes results in lower capital costs for mc-Si modules (Miles, 2006). However, efficiency drops from 18%-20% (Sunpower, 2014) for c-Si modules on the market to 15-17% (Risen Energy, 2014) for mc-Si modules. Second-generation technologies, or thin-film technologies have an absorbing layer 100-1,000 times thinner than first generation technologies, which offers further cost reductions (M A Green, 2000). In order to make thin-film solar cells, these absorbing layers are deposited on a solid substrate. This requires fewer manufacturing processes than silicon-based technologies (Tyagi et al., 2013). However, overall conversion efficiency is lower compared to first-generation technologies. Within this technology stream, different technologies can be distinguished: amorphous-silicon (a-Si), cadmium-telluride (CdTe) and copper-indium-gallium-selenium (CIGS). Thin-film technologies are not as mature as silicon-based technologies, partly because they did not benefit from knowledge spillovers from other industries (Razykov et al., 2011). The third-generation technology stream consists of a variety of technologies that further reduce material use and increase efficiency. These technologies are currently not competitive on the commercial solar market, making it the most immature group. However, they do have some promising characteristics, such as the flexibility of organic solar cells and the triple-junction cells have been reaching lab efficiencies of 44% (National Renewable Energy Laboratory, 2014).

3.2 VALUE CHAIN

Within the solar PV value chain for crystalline silicon, six different consecutive activities are identified in this thesis, as visible in Figure 2. Two other value chain positions can be defined, Balance of System (BOS) and Other, which cannot be placed into the sequential order. Each step is separately discussed, to make clear what kind of activities are involved in it. For thin-film and emerging technologies, the first three positions do not apply, and so module manufacturing will be the first value chain position for these technologies. However, for all the different technologies, Silicon, Wafer & Ingots, Cell, and Module are considered as upstream, while Development, Operation and BOS are considered as downstream.

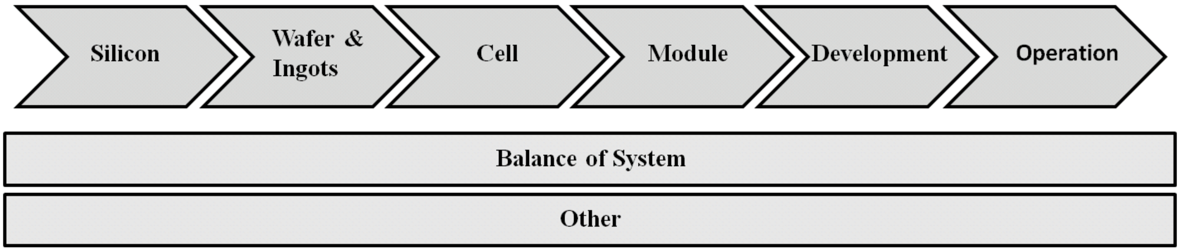

Figure 2 The solar PV value chain

- *Silicon*: This step includes the mining and production of metallurgical-grade silicon, which is the main raw input material for silicon solar cells. This refinement process of the raw silicon is energy and capital-intensive. Historically, mining activities for raw silicon have been driven by the semiconductor industry, which makes the global market for silicon much larger than the demand for silicon from the PV industry alone.
- *Wafer & Ingots*: The pure silicon is casted in large furnaces to produce ingots and then sliced into wafers. This process can be performed using different techniques, leading to different types of wafers. Because wafer cutting is a quite standardized process, almost all ingot-producing firms also slice wafers. Therefore, these processes are seen as one position in the value chain.
- *Cell*: This step includes the production of solar cells from wafers. Several iterative production steps, such as etching, diffusing, and coating are performed to convert wafers into an electricity-producing cells. The same company typically performs these different steps.
- *Module*: The solar cells are converted into solar modules by soldering them together and encapsulating them within layers of glass. This step has relatively low capital requirements, as it is largely dependent on labour. Because of these low barriers to entry, many firms are active in this segment.
- *Development*: This value chain position consists of different activities linked to the development of solar power plants. It includes the development of small-scale residential solar

projects and also the development of large-scale PV power plants. Regarding the development of large-scale projects, several activities are included in this step, which can be performed by separate firms: project development, project design, project financing and installation.

- *Operation*: This step includes the daily operation of PV power plants, which applies to large-scale PV power plants. Firms active in this segment are mainly electric utilities.
- *Balance of System*: Balance of System includes all the other components besides the module that are needed to provide the electric load, for example the inverter, mounting systems, cables and wiring, and current monitoring devices. These components are typically not produced by the firms in the Module or Development segments, but by different external suppliers. These suppliers are mostly also active in other (renewable energy) industries.
- *Other*: All firms that cannot be placed into a value chain position, but still considered as active in the solar PV industry, are categorised as Other[6].

3.3 INDUSTRY DEVELOPMENT

Schmoch (2007) describes the development of the solar PV industry in terms of a double-boom cycle, in which he distinguished three phases: (i) first boom, (ii) stagnation, and (iii) second boom. The first boom between 1974 and 1985 was mainly driven by the patenting of the first solar cell, the oil crisis, and the demand for solar cells in space applications (Peters et al., 2012). In this phase, policy support was mostly technology-push funding for R&D activities. This study focuses on the second boom, which started in the early years of the 90s when demand for solar PV increased due to the development of deployment policies.

The second boom

The second boom marked the starting point for the development of market activities around the PV technology (Schmoch, 2007). This meant an increase in global demand for solar PV, as well as an increase in the number of firms active in the industry. From 1990 to 2012, global installed capacity increased by an average of 40% per year, and growth rates have reached even higher levels in recent years, as visible in Figure 3. The growth in installed capacity has been tremendous over the last five years, with an average growth rate of 64%. Figure 4 shows how the absolute percentage of PV capacity per country has developed over time. It shows only countries that in a certain year had more than 10% of the total installed capacity. As visible, worldwide growth in installed capacity has mainly been driven by five countries: Japan, Germany, the US, Italy and Spain. The total percentage installed in these five countries kept rising until 2008, when it reached a record percentage of 90%. After that, more countries put policy frameworks in place, and the percentage of installed capacity in all other countries rose to 31% in 2012. Figure 4 shows that Japan was market leader based on the total

[6] This are for example venture capital firms focusing on the PV industry, or firms publishing PV journals & newspapers.

percentage of PV capacity installed until 2003. However, limited support for solar PV in Japan in the later years shows the stagnation of local PV capacity additions. The opposite effect is visible for Italy and Spain, where a favourable policy framework gave a boost to local capacity additions.

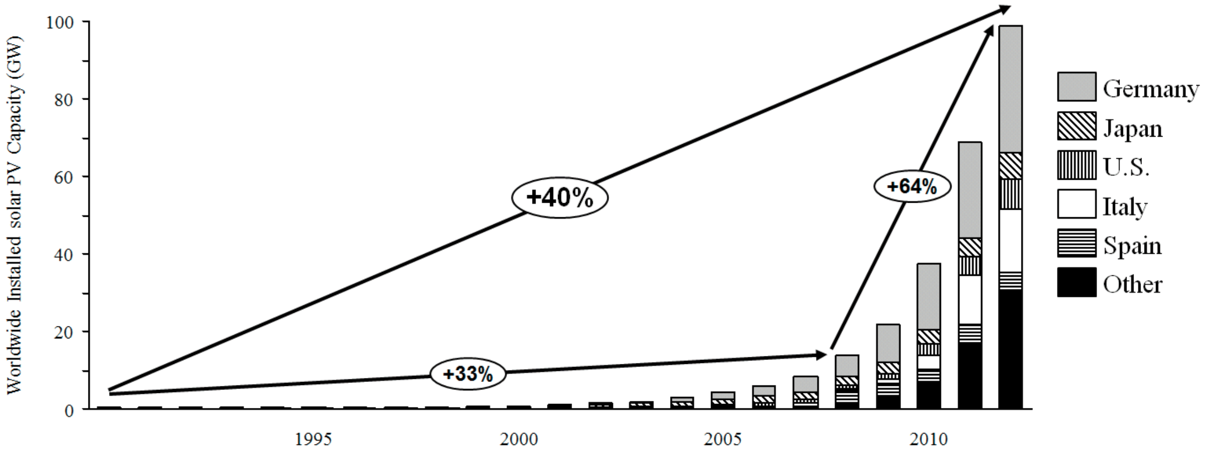

Figure 3 Development of worldwide installed solar PV capacity over time

Figure 4 Development of absolute percentage installed capacity for different countries

Equity investments during the second boom

This section gives a short overview of the development of the equity investments during the growth of the PV industry. It reviews 3685 equity investment deals in the solar PV industry. The methods section gives further details regarding how the data is gathered and categorised. Figure 5 shows a graphical representation of the total number of equity investment deals per year for the PV industry. The bars clearly distinguish between target firms that made one deal in a given year and firms that made second or third deals in a given year. This shows that there has been an increase in activity over time, and that this activity has also been spreading among more firms. The number of deals started increasing rapidly after 2004 and then started stagnating in 2008. The stagnation in that year is in alignment with the financial crisis. But this industry did not suffer that much from the crisis, since there was no substantial decrease in the number of investments after 2008. Interestingly, the number of deals decreased in 2012. This could be explained by the recent shake out in the industry, in which a large number of upstream manufacturers in the US and EU went bankrupt.

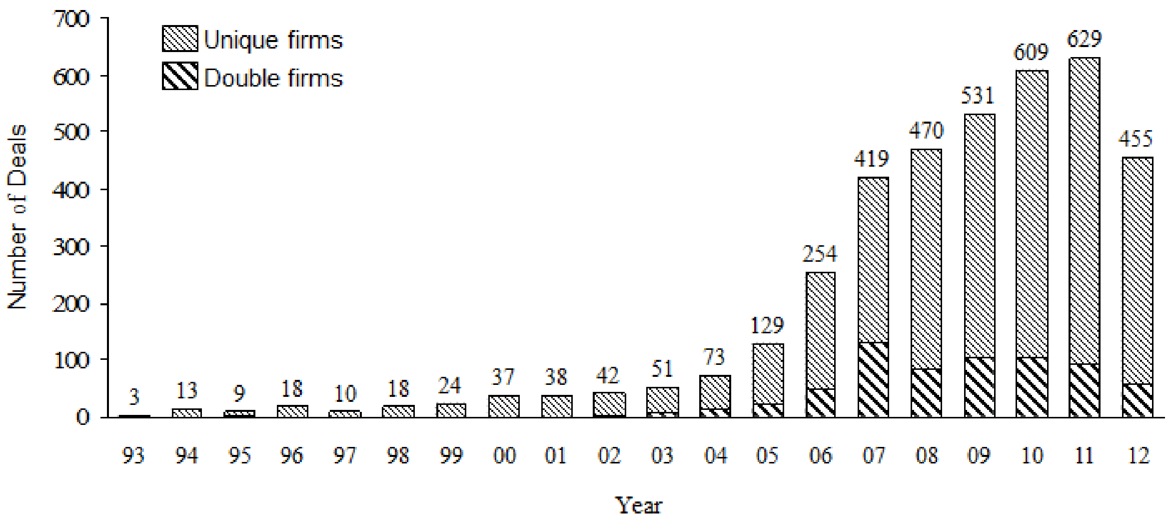

Figure 5 Distribution of equity investment deals over time

Figure 6 shows the distribution of all the cases over the different value chain positions and it divides the cases per country. It is clear that China and Taiwan have a large amount of equity investment deals for upstream manufacturing positions without having a significant amount of solar PV installed domestically. The percentage of deals rapidly decreases for China and Taiwan for more downstream activities, such as Development and Operation. Countries such as Spain and Italy do have a significant amount of solar PV installed and also make up a large share of the development and operation deals, while recording almost no activity for more upstream value chain positions.

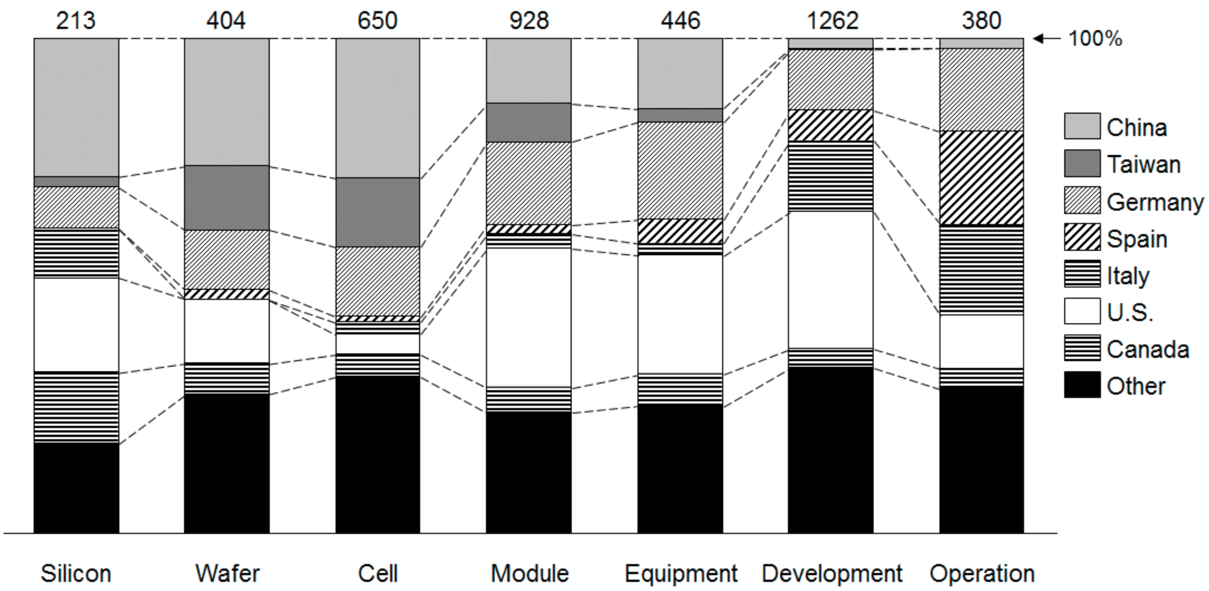

Figure 6 The distribution of the equity deals over different value chain positions and countries

4 METHODS

The hypotheses address two different levels; the country level and the firm level. Therefore, the analysis is split up into a firm level analysis[7] and a country-level analysis. The country-level analysis is based on panel data covering 39 countries and 20 years. The use of panel data creates the possibility of studying the dynamics of the solar PV industry over time and across different countries. Another advantage of using panel data is that one can control for unobserved heterogeneity, which is further discussed in section 4.3. The country-level panel analysis assesses the effects of domestic and foreign deployment policies on the two dependent variables: *total number of deals per country per year* and *total value of deals per country per year*.

The firm-level analysis is further split into two separate analyses, since the presumed firm-level effect is expected to be indirect. It is expected that deployment policies stimulate firm growth, which is expected to be an important determinant of the deal value. The effect of deployment policies on firm growth is tested, based on a panel of 119 public firms and 20 years[8], the firm growth analysis, using total sales as a dependent variable. In the other firm analysis, the effect of firm size on equity investment value is assessed, the firm value analysis. This analysis gauged the influence of total firm sales on equity investment deal value.

Figure 7 visualizes how the simplified research framework is divided into the three different analyses. This chapter first discusses the data collection for all the equity investment deals. Next, it explains how the concepts are operationalized. This is followed by a specification of the models utilized.

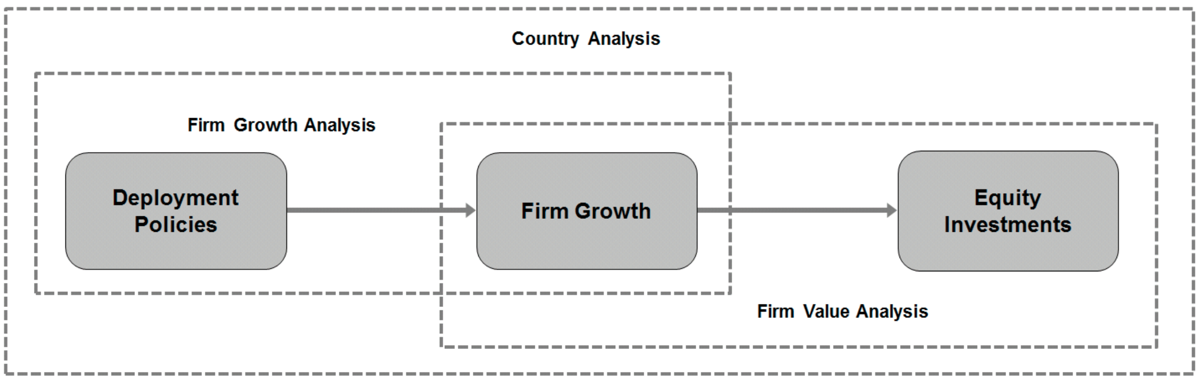

Figure 7 Division of the three analyses over the research framework

[7] This analysis also includes variables on the country level, so it could therefore also be seen as an analysis covering multiple levels.
[8] All available data was gathered for these firms over a 20-year time period, so the average time period for a single firm is lower.

4.1 EQUITY INVESTMENT DATA COLLECTION

Data on equity investments in the PV industry was gathered from three different sources. Research by Hartmann (2005) showed that there is not one comprehensive source for all worldwide equity investment deals. Therefore, using only one source leads to a lower sample size and the possibility of excluding many deals. The following three sources were used: Zephyr, Thomson One and Mergerstat. Zephyr was included because it has a better coverage for European deals than Thomson One and Mergerstat (Huyghebaert & Luypaert, 2010). Mergerstat and Thomson One offer the most data about transactions in the US. Thomson One consists of different modules for different deal types. In this research, the SDC Platinum M&A module and the VentureXpert module have been used. Detailed information about the different sources is visible in Table 1.

Table 1 Overview of data sources

	Zephyr	Mergerstat	Thomson One SDC Platinum M&A	Thomson One VentureXpert
# Deals at 12-2012	1.038.000	420.000	863.000	507.000[1]
Deal Types	M&A, VC, IPO, Share	M&A	M&A	VC
Globally since	2005	2003	1985[2]	1985[2]
Europe since	1997	2000	1985[2]	1985[2]
US since	1997	1992	1979	1970

[1] VentureXpert calculates the number of deals in a different way from the other data sources. VentureXpert calculates the number of deals based on the number of acquirers, whereas the other three databases calculate the number of deals based on targets. Especially in VC deals the number of acquirers is much higher than the number of targets. Therefore the number of deals is respectively higher in VentureXpert.

[2] Although global data is available from 1985 onwards, data is limited for the first years (Doidge et al., 2011)

In these sources, the following search string was used: Solar OR Photovoltaic* in the target business description. The use of more detailed keywords leads to the exclusion of firms, where Solar is the only word in the business description indicating that the firm is active in the solar PV industry[9]. Therefore all deals were manually checked to exclude deals where the target firm is not is active in the PV industry. An overview of the reasons for exclusion can be seen in Appendix A. Two additional constraints were utilized for obtaining data. The announcement date[10] of the deal had to be in 2012 or earlier, because at the time of writing, not all data for the controls was available for 2013. Furthermore, only deals with a status of "completed" or "assumed completed" have been included. From these databases, multiple deal variables were gathered, including deal type, deal comments, deal

[9] The databases include business descriptions such as: "The firm is active in the installation and operation of renewable energy, like solar and wind."

[10] Thomson one Banker defines the announcement date as, "The date one or more parties involved in the transaction makes the first public disclosure of common or unilateral intent to pursue the transaction (no formal agreement is required)".

value in USD, acquired equity stake, acquirer and target business descriptions, and country codes. In order to build one database containing all cases, the deals from the different sources were manually checked for double counting to ensure that specific deals did not appear twice in the larger dataset. Additionally, all of the transactions from VentureXpert were converted into deals, in order to format them in the same manner as data from the other sources. 383 deals were excluded, because there was not enough data available regarding them (for example no data on the country of origin or no company name). Figure 8 shows how all of these steps led to the compilation of the final database.

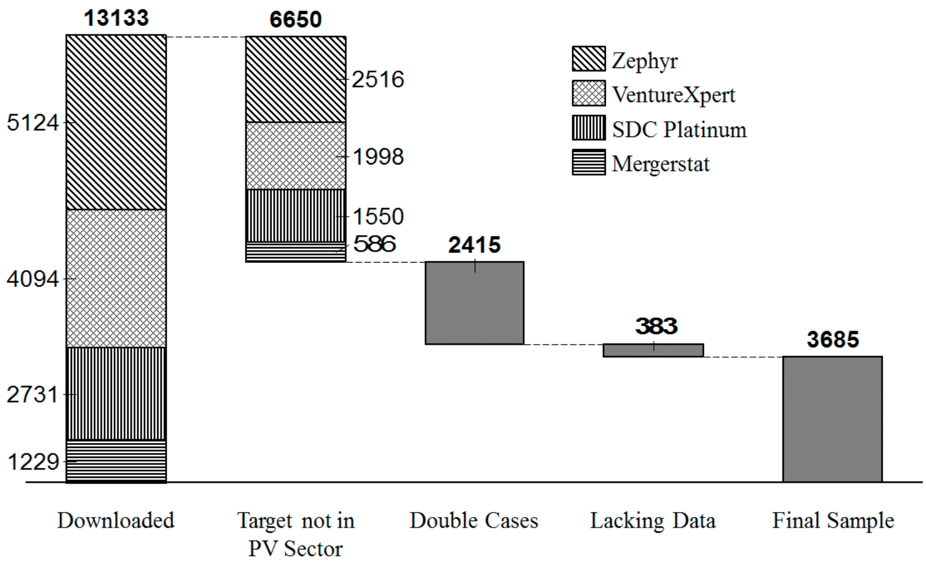

Figure 8 Creation of final sample

Some adaptions have been made to the data. For firms with their headquarters in the tax havens of Bermuda, the British Virgin Islands, and the Cayman Islands, the country code has been changed to the country in which the firm's largest office is located. Country data about these tax havens is not easily available, and it was preferable to keep these cases in the sample, because they include some big PV companies like GCL-Poly Energy Holdings, LDK Solar, and Hanwha Solar. Furthermore, all deal values were converted to 2012 USD values using the Consumer Price Index.

To check the representativeness of the sample, it was compared with large firms active in the PV industry. Data on the ten largest PV module manufacturers from the last 15 years was compared with the firms in the sample. Of the 27 companies that had a top ten position over last 15 years, 25 of them were included in the sample. The entire comparison is visible in Appendix B. Additional searching for excluded deals related to these 27 companies did not lead to any additional deals. Therefore, it can be assumed that this is a representative sample.

4.2 COUNTRY-LEVEL VARIABLES

For the country panel-data analysis, all of the countries and years were selected for which equity investment data and deployment policy data was available. Data about deployment policies was available for 49 countries. Ten countries[11] were excluded because there was no data on equity investment deals available. The final sample of 39 countries covers 99% of all the equity investment cases, excluding only a few countries with no more than five deals. The 39 countries cover 97% of all worldwide installed PV capacity. The first deal in the database took place in the year 1993, so therefore a 20-year time period is used from 1993 to 2012. Data on control variables was not available for all countries from 1993 onwards, so an exact overview of the included timeframes and number of deals per country is given in Appendix C.

Others scholars analysing overall country investment activity or the overall effects of deployment policies used a sample of Organisation for Economic Co-operation and Development (OECD) countries, for data-availability reasons (Bonini & Alkan, 2009; Jeng & Wells, 2000; Peters et al., 2012). For the solar industry, this would mean many primary players on the world market would be excluded, such as China and Taiwan. To increase the representativeness of the sample, non-OECD countries have also been included in this thesis, even though this meant that some data for control variables was not available. Therefore, a robustness check was performed using only OECD countries and some additional variables for which only OECD data was available. Further details about these variables are provided in the control variables section.

4.2.1 DEPENDENT VARIABLE

Country equity investment activity was measured by both the *total number of deals per country per year* and the *total value of the deals per country per year*, in line with other authors analysing country investment activity (Lewellyn & Bao, 2014). Total value is a more accurate measure of activity, but the deal value was not available for all cases. Therefore, the total number of deals is also included as a dependent variable.

The dependent variable consisted of the sum of target firms active in different value chain positions and technology streams and of target firms having different levels of diversification. To test the different hypotheses regarding these separate effects, additional dependent variables have been included for each of the separate categories[12]: For these separate categories, only the number of deals

[11] These countries could have been included with only zero values for investment activities. However as explained in the methods section, fixed effects were used so the focus was only on within country differences. Therefore, countries with only zero values did not add explanatory power to the regression model.

[12] An effort was made to model it by interaction effects, by making a new variable that was the percentage of the single type compared to the total value. However this did not work because these variables were too similar to the dependent variable, due to all of the zero values. Therefore these variables had a very high explanatory power, which made it impossible to assess the effect of the other independent variables.

was used as a proxy for investment activity, because there was not enough data available on deal values. There are six more dependent variables included in this study. Four variables represent the different deal types are included to check for any differences between the different equity investment deal types. And finally, a variable only including cases before 2008 and a variable including cases from 2008 and all subsequent years[13] are included. The year 2008 is selected for several reasons. Since 2008, China has been the largest PV manufacturing nation (Zhang & He, 2013). This can be seen as a major shift in the solar PV industry. Furthermore, the yearly increase in installed capacity changed from around 33% on average per year before 2008 to 64% on average in the years after 2008, as visible in Figure 3.

An overview of all the dependent variables used in the country-level analysis is given in Table 2. This table also gives an overview of the number of deals included in the calculation of the dependent variable, as well as the descriptives of all dependent variables. As visible in Table 2, IPO and share issue are making up a minority of all the deals in the database, with respectively 120 and 482 deals. Furthermore, there is visible that for only 2256 of the 3685 deals, data was available regarding the deal value. The table also shows the sample size (N) for the different dependent variable. The sample size differs between the different dependent variables, because each time, only countries were included for which data was available for that category (For example, Belgium did not include any deals regarding the Silicon and Wafer value chain positions, so Belgium is not included in these analyses)

Firm categorisation

To create the dependent variables, all target firms were categorized according to their value chain position, technology stream and level of diversification. Categorization according to deal type was not needed, because this information could be downloaded from the data sources. In this section, the categorization of the target firms is discussed.

Based on the downloaded business descriptions, all firms were manually placed into a value chain position. This method is favoured over using standard industrial classification (SIC) codes for assigning firms to a value chain position, because using codes for categorisation yields overly generic results. Firms were placed in all positions that applied to their business activities. In case where the business description could not provide enough information or different sources provided contradictory descriptions, the value chain position was determined based on information found on the Internet about the firm's business activities. For contradictory descriptions, a check was performed to see if one of the descriptions was wrong, or if the firm diversified its activities during its development. The

[13] An attempt was made to model this by creating an interaction effect between domestic and foreign deployment policies. Because foreign deployment policies have only been rising over time, time interaction effect could model time differences. Multicollinearity problems made it impossible to include these effects. In such cases, Jaccard et al. (1990) proposes centring the variables around the mean and then creating a new interaction term. However after centring around the mean, the Pearson correlation coefficient was still above 0.7.

business descriptions were also used to categorise firms into a technology stream. In case the business description did not mention the technology stream, for all cell and module manufacturers[14] the firm website was checked to determine the technology stream. Finally, the target firms were also categorized as diversified or specialized using business descriptions. Again, this method is favoured over using SIC codes, because a firm can have one SIC code, but still be diversified according to the definition used in this study[15].

Table 2 Country-level dependent variables

Variable	Name	# Deals	N	Mean	St. Dev.	Min	Max
Target General	Target Total	3685	749	4.482	14.755	0	148
	Target Value	2256	749	158.523	632.041	0	5479
Target Deal Types	Target IPO	120	314	0.382	0.915	0	6
	Target M&A	1678	749	2.230	6.450	0	62
	Target PEVC	1367	640	2.117	7.516	0	82
	Target Share Issue	482	271	1.778	3.394	0	20
Target Value Chain	Target Silicon	194	154	1.247	2.455	0	16
	Target Wafer	358	251	1.406	3.116	0	20
	Target Cell	824	565	1.449	4.898	0	41
	Target Module	864	580	1.470	4.531	0	43
	Target Development	1264	691	1.853	6.155	0	66
	Target Operation	387	351	1.094	3.166	0	24
	Target BOS	464	542	0.848	2.378	0	20
Target Technological Stream	Target CSI	655	500	1.304	3.759	0	30
	Target Thin-Film	370	315	1.171	3.500	0	26
	Target Emerging	234	285	0.804	1.905	0	25
Target Diversification	Target Diversified	1200	695	1.717	4.783	0	42
	Target Specialized	2430	731	3.305	10.614	0	107
Target Time Period	Target Post-2008	1067	554	13.210	23.849	0	148
	Target Pre-2008	2580	195	1.897	7.846	0	114

[14] This is not done for the other value chain position because data about pursued technologies was not available on their websites.
[15] For example, a firm operating renewable energy power plants would fall into one product group but could be in the PV, wind or biomass industry at the same time.

4.2.2 *Independent variable*

Deployment policies are operationalized in different ways in the scientific literature. Johnstone (2010) used the price level guaranteed for feed-in tariffs, while Brunnermeier & Cohen (2003) used governmental inspection activities as a proxy. Other authors utilized energy prices (Popp, 2002) or dummy variables for different years (Snyder et al., 2003) to operationalize policies. More recently, Peters et al. (2012) used the change in installed capacity per year per country as a proxy for deployment policies, with the assumption that this change is mainly driven by deployment policies. The same method was applied by Henderson & Cool (2003) for measuring demand growth in other industries. The wide variety of measures shows the struggle of scientific scholars to determine an unambiguous method for measuring deployment policies. The differences in policy designs, such as feed-in tariffs, cap-and-trade systems, and renewable portfolio standards, are an important reason for the difficulties in operationalizing such policies.

This research uses the operationalization method proposed by Peters et al. (2012) as a proxy, because it provides the possibility to include different policy designs as well as variations between years for the different countries. An important assumption for using capacity additions is that the technology is not yet competitive and that market growth has been policy-induced. This assumption seems reasonable, since the levelized costs of electricity from solar PV are still more expensive than electricity from fossil-fuel technologies[16]. Furthermore, capacity additions in the solar PV industry are primarily driven by demand rather than by the supply of modules.

This proxy measures the change in installed capacity per year per country. However, deployment policies could also be measured by the absolute amount of installed capacity per year per country. No previous research has been performed on the difference between these two drivers and how they influence firms in the solar PV industry. Since it is uncertain which of these two processes drives equity investments, and there is no previous research about the difference between the two, both capacity additions (referred to as "market size") and the relative increase in capacity additions (referred to as "market growth") have been included. To measure the effect of domestic and foreign deployment policies, a variable is included based on the domestic capacity additions, and a variable is included based on the foreign capacity additions. This leads to the creation of four independent variables, *Dsize*, *Dgrowth*, *Fsize*, and *Fgrowth*. The four variables are lagged by one year to ensure the capacity additions took place before the announcement date of the deal.

Data on installed capacity per country per year was gathered from the Trends in Photovoltaic Reports from the International Energy Agency (IEA-PVPS, 2013), which reports data for 49 countries. The sum of these reported capacity additions in 2012 adds up to 99% of total worldwide installed capacity for that year, and is therefore assumed to be adequate for calculating foreign capacity additions.

4.2.3 CONTROL VARIABLES

Various controls are added to the model. There is controlled for other political drivers, equity investment environment in a specific country, and drivers that were discussed in the theory section. All control variables that are presented in this section are lagged by one year.

Policy controls

To control for other policy measures, technology-push policies were included as a control variable. In most previous research, technology-push policies were measured by public R&D funding data for solar PV energy (Peters et al., 2012). This detailed R&D[17] data is only available for OECD countries. To include PV R&D activities for non-OECD countries, industry-aggregated values for R&D spending can be used or data only including worldwide R&D per year can be used. Both measures are assumed to be insufficient in measuring country and year differences in the PV industry; therefore the R&D data was only used for a robustness check within OECD countries.

As explained in the theory section, political uncertainty acts as a barrier for investments in renewable energy. Changing regulations and a lack of long-term, stable policies create uncertainty. Including uncertainty as a control variable faces several measurement challenges. Policy designs can be changed in many different ways, with each change having a different impact on the level of uncertainty. Additionally, measuring the impact of a single case is already challenging. In this thesis, the standard deviation of the four-year percentual market size change (Durand & Georgallis, 2013), was used as a proxy for political uncertainty. This measure indicates if there was stable growth during the pervious years, assuming that this growth was created by political stability. In cases where there was no installed capacity, the uncertainty level was set to 0, the highest possible score. This seems a reasonable score, as it can be assumed that the lack of a market was created by a lack policies and thus by the absence of political uncertainty. For the first year of capacity additions in solar PV per country, the uncertainty level was also set to 0, because no growth rate could be calculated. For respectively the second, third and fourth years after the first capacity additions, the standard deviation was only taken for one, two, and three years respectively.

Country investment activity

Overall country equity investment activity for all industries was included to control for yearly country differences in equity investment activity (*country total*). This control variable was built using separate data for IPOs, M&As, and VCs, which made it possible to control for the same deal types that were included for the solar PV industry. As explained in the section describing data collection, no single source contains all equity investment deals. It was however impossible to combine the deals for all industries, as was done for the solar PV industry. Therefore, data was only gathered from Thomson

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[16] See Branker et al. (2011) for an overview.

One, which is preferable to Mergerstat, because it includes all deal types. It is also preferable to Zephyr, because it includes data for the whole time period. Data was gathered from three different modules within Thomson One: SDC Platinum M&A, VentureXpert, and the Equity module[18]. Data was gathered for the period 1993-2012 only for “completed” deals[19]. In order to construct a control variable for overall equity investment activities, the three deal types were combined. The dependent variable in this study measures equity investment activities both by number of deals and total value. Therefore, both types of data were gathered for creating these control variables. In that way, the control variable and the dependent variable measured the same kind of equity investment activity. In order to control for equity investment activity instead of equity investment amount, all of values were scaled using country population data from the World Bank[20].

Other controls

Other control variables were included based on the literature review in the theory section. In order to control for country size, *population* has been included as a separate control variable. Three variables were included to control for overall stock market activity: *market capitalization/GDP*, *market capitalization growth,* and *stock turnover ratio*. Furthermore, in order to control for countries financial environments, *corporate tax levels*, *inflation*, *unemployment levels*, *GDP growth* and *GDP per capita* were included as controls. Data regarding these variables was gathered from the World Bank World Development Indicators, except for Taiwan where data about stock market activity was gathered from the Taiwan Stock Exchange and all other financial data from the International Monetary Fund. To control for country risk, a sum variable, *governance*, was included, which covers five separate variables measuring different dimensions of governance. The sum variable was proposed by Slangen & van Tulder (2009) because of high correlations between the separate dimensions. The dimensions are: political stability, government effectiveness, regulatory quality, rule of law, and corruption levels. Data about these dimensions was gathered from the Worldwide Governance Indicators project from the World Bank. In order to include the risk of financing in the model, data from Fitch was gathered on the different countries’ credit ratings and was included as the control variable, *credit rating*. The scale from Cantor & Packer (1996) was used to convert all of the Fitch-reported letters into numerical data. When two values were reported for a single year,[21] the average value was used.

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[17] Data is reported by the IEA as research development & demonstration (RD&D). However, demonstration is only a very small part of that.

[18] Data from the equity module was not included in the data related to the PV industry because detailed firm descriptions were not available.

[19] Only Zephyr makes the distinction between “completed” and “assumed completed” deals.

[20] This transformation is not applied to the dependent variable, because this study tries to explain overall number of deals in the PV industry. Whereas, this control variable is primarily added to control for a countries equity investment environment, which is better described by scaling it to population.

[21] Especially around the financial crisis in 2008, Fitch lowered the credit rating of some countries more than once a year.

Furthermore, there exist some control variables that were not included in this study. It is hard to find comparable worldwide interest rate data for a longer time period, a problem also faced by other authors (Bonini & Alkan, 2009). One reason for this problem is the fact that interest rates for countries are measured with different maturity dates, which makes it hard to combine data from different sources. Therefore, comparable interest-rate data could only be gathered for OECD countries and was used for a robustness check. Secondly, there are some variables that explain differences in equity investment activity between countries. This study focuses, as will be explained in the next section, only on differences within countries. The following variables were therefore not included: the anti-director, public enforcement, private enforcement and common-law indexes from La Porta et al. (1998), which were revised by Djankov et al. (2008). Finally, accounting index from the Centre for International Financial Analysis and Research was not included as well.

4.3 COUNTRY-LEVEL ANALYSIS

This section first describes the model specifications for the *number of deals* dependent variable. Details regarding the *value of deals* dependent variable are presented at the end of this section.

The dependent variable consists of count data, creating a highly positively skewed distribution. Many authors apply log transformations on their count data to make sure the data is in line with the main assumptions of parametric tests. However, models specifically developed to deal with count data, such as the Poisson model and the negative binomial model provide better estimates (O'Hara & Kotze, 2010). This thesis used the negative binomial model, because this model was developed to deal with over-dispersion. There was a significant evidence of over-dispersion (G^2 = 180.2 p=0.000), so the negative binomial model was preferable to the Poisson model.

4.3.1 MODEL CONSIDERATIONS

Some transformations have been applied to the variables. The independent variables *Dsize* and *Fsize* were log-transformed, to reduce the impact of outliers. The log transformation was not possible for the *Dgrowth* and *Fgrowth* variables because of the negative values. Therefore, these independent variables were only used for a robustness check.

When modelling complicated, real-life processes such as the ones present in this thesis, many factors influence the outcome. Estimations of the effect of predictor variables will therefore be biased if not all relevant predictors are included. It is not feasible or desirable to include all of these factors in the model, because the goal is to make a simplified version of reality (Halaby, 2004). Therefore, there are two common ways to deal with this unobserved heterogeneity; include either random effects or fixed effects.

Random effects models assume that the individual error terms for the number of deals are independent from each other and are uncorrelated with the unobserved independent variables. Therefore in creating a baseline scenario for the different countries, the intercept is drawn from a random distribution for the whole panel and not based on observations from a single country. Fixed effects models drop this assumption and instead presume that the unobserved independent variables are correlated with the error terms. In order to deal with unobserved heterogeneity, a separate dummy is included for all the countries, which means that it only focuses on within-country differences and all between-country differences are absorbed by the dummy variables. Generally, random effects models are preferred for several reasons. They can include estimates of the effects of variables that are time-invariant, and they support inferences based on the larger population from which the sample is drawn. Fixed effects models only support inferences about the group of measurement. Additionally, imprecise results can result from fixed effects models due to the inclusion of variables that vary greatly in size between the countries but do not differ much over time (Allison, 2006).

Random effects models could not be applied in this thesis for two reasons. Firstly, the countries were not randomly selected from a larger population, but were precisely selected based on their characteristics. Secondly, the error terms are expected to be correlated with unobserved country characteristics, such as public acceptance. Therefore, fixed effects were added to the model to control for unobserved heterogeneity. This inclusion of fixed effects was supported by the Hausman test, which rejected the null hypothesis that the unique errors and regressors are not correlated with a p-value of 0.000. The fact that the results cannot be generalized to a larger population should not be seen as a drawback, because the sample is almost equal to the entire population and the authors of this thesis are therefore not interested in extending inferences to a larger population. Unobserved heterogeneity is also created by unobserved time effects, which are not country-dependent, such as the Kyoto conference on climate-related topics. Therefore, when analysing political effects, it preferable to include both year fixed effects and country fixed effects (Beck, 2001). However, including year fixed effects creates correlation problems with country-invariant independent year variables, such as foreign capacity additions[22], which makes it impossible to properly estimate the effects of these independent variables. The same problem was faced by Peters et al. (2012). These researchers decided to drop the fixed effects and to include a time trend variable. However, this still does not overcome the correlation problem, as visible in their correlation matrix[23]. Therefore, year fixed effects were not included in this study. A model with year and country fixed effects will be reported as a robustness

[22] This variable is not completely country-invariant since it was created by deducting the domestic capacity additions from foreign additions, and domestic capacity additions differ per country. However it is still country-invariant to a large extent and further analysis indeed showed correlation problems with high VIF values above 10.

[23] They report a Pearson correlation coefficient of 0.842 between the time trend variable and the foreign capacity additions.

check. However, this model only included domestic capacity additions as a proxy for deployment policies.

High correlations between predictor variables could affect the estimates of the variables and make it difficult to interpret the results. Correlations above 0.7 are considered to be too high. The correlation matrix is visible in Appendix F and indicates some multicollinearity problems. The four variables *governance*, *GDP per capita*, *credit rating* and *country total* have high mutual correlations. For two reasons it is preferable to include the variable *country total*. First of all, although it is expected that *governance* and *GDP per capita* are the original drivers of equity investment deals, the variable *country total* also incorporates the effect of other drivers for which the model does not separately control. Secondly, the variable *country total* is a sum variable comprised of different types of deals, so for the various dependent variables representing these different deal types, several control variables have been included, which indirectly represent drivers for different deal types.

Analysing multicollinearity with correlation matrixes may miss the more subtle types of correlations (Field, 2013), so the variables were also checked for multicollinearity with the variance inflation factor (VIF). This factor checks one variable's correlations with all other variables. In this way, the correlation between the independent variables and the different dummy variables for the country fixed effects can also be assessed. Although there is no hard rule on the threshold for the VIF value, Hair et al. (1998) reported that a VIF value above 10 should cause some concern. The variable *population*, with a VIF value of 244, creates problems. The high VIF value is most likely because population varies greatly in size between countries but does not differ a lot over time (Allison, 2006). Because of this, *population* was excluded as a control variable. After exclusion and transformation, all of new VIF values were well below the threshold.

4.3.2 Excessive zeros

In 52% of the cases, the dependent variable for the total number of deals consisted of zeros. This may indicate that the zero-inflated negative binomial (ZINB) model provides a better fit. The ZINB model was developed to deal with an excessive amount of zeros. It performs two separate regressions, assuming that there are two separate mechanisms leading to a zero. A zero could be created by a lack of industrial PV activity in a specific country, a so-called, "certain zero", because there is no chance of that value being a 1 in that year for that country. The other possibility is that there was just no equity investment activity in that year, but that there was industrial activity. These cases differ, because in the former case there could never have been an equity investment deal. In order to model these two types of zeros, the ZINB runs two types of models, a normal negative binomial regression with a normal proportion of the zeros, and a logit model to determine if a value is part of the negative binomial model or the "certain zero" group.

However, an excessive amount of zeros does not always mean that the ZINB will provide a better fit (Warton, 2005). If the ZINB fits better to the data than a normal negative binomial model can be tested using the Vuong test, originally developed by Vuong (1989) and adapted by Green (1994) to test between the zero-inflated negative binomial model and the normal model. The results of the Vuong test showed that the null hypothesis that the normal negative binomial will better fit the data can be rejected with a p-value of 0.0001. Therefore, the ZINB model provided a better fit to the count data. However, applying the ZINB model to the data led to the situation where STATA failed to converge the models for all of the different dependent variables, a problem also been faced by other authors (Famoye & Singh, 2006; Gonzales-Barron et al., 2010). Therefore, the normal negative binomial regression model was selected for running the regressions, despite the fact that the ZINB most likely provided a better fit. STATA could converge the ZINB for the main dependent variable, so this model was included as a robustness check.

4.3.3 Goodness of fit

The goodness of fit of the model was assessed using log-likelihood estimations, akaike information criterion (AIC) values, observed versus expected mean, and the maximum fitted value. The AIC value is an extended version of the log-likelihood comparing the relative quality of the statistical models. In the calculation, it includes the number of independent variables and gives a penalty for increasing numbers. A lower AIC value means the data is of relatively better quality. The goodness of fit was compared for the models both including and excluding the year fixed effects for both the negative binomial model and ZINB model in order to assess the impact of changing to a negative binomial model. All of the different goodness-of-fit values are visible in Table 3. For all models the total target number of deals was used as a dependent variable.

Table 3 Goodness of fit for country count model

	Model 1	Model 2	Model 3	Model 4
Type	NBREG	NBREG	ZINB	ZINB
Fixed country	YES	YES	YES	YES
Fixed year	YES	NO	YES	NO
AIC	2058	2094	2037	2071
Log-likelihood	-959	-995	-936	-971
Fitted mean/mean	5.10/4.84	5.88/4.84	4.97/4.84	5.77/4.84
Max estimated value	179[1]	242[1]	156[1]	220[1]

[1] Maximum observed value is 148.

Table 3 shows that the models including the year fixed effects had a better fit. The models without the year dummies overestimated the values from recent years, and there was no year dummy controlling for that. This is visible in the high maximum estimated values and the higher fitted means. It is also clear that, as expected, the ZINB had a better fit than the negative binomial model. This shows the importance of including the ZINB as a robustness check. Since the AIC includes the number of variables in its calculation, it was checked whether the model's quality increased by excluding non-significant control variables. However, this only led to higher AIC values, so it was decided to keep all of the different control variables into the model. All the descriptives for the variables that are included in the country model are visible in Table 4.

Table 4 Descriptives country-level analysis

Variable	Description	N	Mean	St. Dev.	Min	Max
	Independent variables					
Log Dsize	Domestic PV capacity additions	749	1.262	1.919	0	9.137
Log Fsize	Foreign PV capacity additions	749	6.126	2.173	2.826	10.31
	Controls					
Uncertainty	Standard deviation of the 4 years % market size growth	749	0.526	2.373	0	4.545
GDP growth	Percentage change in GDP	749	3.281	3.636	-14.8	14.78
Inflation	Percentage change	749	5.694	12.738	-4.029	154.8
Unemployment	Percentage of national labour force	749	7.248	3.907	0.7	23.9
Corporate tax	Corporate income tax levels	749	30.85	7.893	10	58.15
Stock turnover	Total value of stocks traded divided by the market capitalization	749	77.83	61.07	0.123	538.2
Mcap growth	Percentage change in market capitalization	749	0.204	0.463	-0.839	2.505
Mcap GDP	Market capitalization divided by GDP	749	76.76	74.82	0.038	606.0
Country total	Sum of C_PEVC. C_IPO & C_MA	749	29.89	30.18	0.123	138.1
Country PEVC	Number of PE and VC deals for all industries divided by population	749	5.273	8.063	0.0	57.53
Country IPO	Number of total IPO deals for all industries divided by population	749	2.072	3.405	0.0	32.08
Country MA	Number of M&A deals for all industries divided by population	749	22.56	22.569	0.027	97.51

4.3.4 CAUSALITY

It is likely that deployment policies are adjusted for the development of solar PV energy. In other words, there could be a reverse causality between equity investment activity and deployment policies. Because of this, the causal relationship between deployment policies and their effects remains subject to uncertainty (Smith & Urpelainen, 2013a). It is important to test for potential endogeneity in the independent variables. Endogeneity is created by a correlation between the error terms and the independent variables. This can be tested for by the use of instrumental variables (IV), which must be correlated with the independent variable and uncorrelated with the estimated error terms of the model. Furthermore, one should be certain that there is no causal relationship between the dependent variable and the IV. To check for the causal relationship, an IV was created for *LogDsize*. This was not done for *LogFsize*, because foreign capacity additions are the total sum of all domestic additions in the other countries.

Five different instruments were used: *installed wind capacity*, *wind R&D spending*, *installed biomass capacity*, *installed biogas capacity* and *installed geothermal capacity*. These are strong predictors for a country’s tendency towards developing renewable energy technologies, but they do not influence investments in the solar PV industry. The IV analysis was only applied to OECD countries because of data availability for the different instruments. All the other control variables were also used in the model to develop the instrumental version of domestic deployment policies, except for the uncertainty variable, which was created from the domestic deployment policies variable. The five different instruments were tested on their weakness. The F-statistic for joint significance of the instruments is 17, which is well above the minimum value of 10. Therefore, it can be assumed that the instruments are strong. In order to create the instrumental version of the domestic deployment policies variable, a generalized linear model (GLM) with a logarithmic link function was used with non-logarithmic domestic deployment policies as a dependent variable. The predicted values from this analysis were log-transformed to create the same scale as the logarithmic independent variable.

4.3.5 COUNTRY ANALYSIS VALUE OF DEALS

This section describes the considerations for the model with total value as a dependent variable. It consists of nonnegative real valued data, which is highly positively skewed. Many authors would log-transform this type of data to make it suitable for a normal ordinary least squares (OLS) regression, but given the high number of zeros in the sample, this was not a possibility. Fitting a count model that can deal with such a large number of zeros was also not a possibility. Therefore, for this dependent variable, only cases with a value above zero were included, which brings the sample size down from

749 to 256[24]. There are two variants for analysing data with a lognormal distribution (Manning & Mullahy 2001), the first being an OLS model estimating the logarithmic values of the dependent variables, and the second being a GLM with a logarithmic link function. Based on the Q-Q plots in Appendix G it is visible that the OLS model provided a better fit for the data. Therefore the cases were log transformed and fitted with an OLS model. To make sure the reported differences were created by the usage of this sample or by the usage of another dependent variable, the same sample was tested with the all of the count values as dependent variables. Furthermore, all of the same methodological considerations described above applied to this model, so the same variables were excluded for multicollinearity and fixed effects were included to control for unobserved heterogeneity. Table 5 shows that the goodness of fit for the value model was also better with the year fixed effects included. Therefore, the model with the year fixed effects is also reported in the results section.

Table 5 Goodness of fit and model specifications country value model

	Model 1	Model 2
Type	OLS	OLS
Fixed country	YES	YES
Fixed year	YES	NO
Adjusted R-squared	0.64	0.55
AIC	1026	1067
Log-likelihood	-447	-485
Fitted mean/mean	10.67/10.67	10.67/10.67

4.4 FIRM SIZE VARIABLES

To check the effect of deployment policies on firm growth, a panel data approach was used. The same time period 1993-2012 was applied as in the country analysis. The firms were selected from the data in the equity investment database, which was expected to be representative of the population. All target firms in the equity database were checked using Thomson One Worldscope to determine whether they were publicly listed, which led to a sample of 176 publicly listed companies. A further 57 companies were dropped from the sample because their main business activities were not in the solar PV industry, and therefore their growth and size were not primarily dependent on that industry. Therefore the final sample consisted of 119 companies for which public data was available over an average period of 9.2 years. Appendix D provides an overview off al the included firms and their time frames. In the next sections, the dependent variable and the firm-level control variables are discussed. The independent variable and country-level control variables are the same as for the country analysis.

[24] The percentage change was higher than the percentage of zeros (52%) in the count model, because there were also some years for which data was available on the number of deals but not on the total value of deals.

4.4.1 DEPENDENT VARIABLE

Firm growth could be operationalized by measuring the growth rate of a firm over time or by measuring the size of a firm over time. The second method is preferred because it is a better indicator of absolute growth. There are many different proxies for firm size, with total assets, total sales, and total employees used the most frequently (Hart & Oulton, 1996). Total sales were preferable as a proxy in this study, because it was expected that this variable would be most closely related to deployment policies. To check the validity of this variable, total assets were included as a robustness check, which was preferable over employees, because data about employees was not available for every year. Data on firm assets and sales was gathered using Thomson One Worldscope.

4.4.2 CONTROL VARIABLES

There are a lot of other sources of firm growth, besides growth opportunities created by deployment policies. According to Penrose, (1959) M&As are a major strategy to reach firm growth. More recently, another strategy for firm growth, namely, growth through network and alliances, has received more attention (Lechner & Dowling, 2003). These relationships can be developed in various forms, including joint ventures, strategic alliances and consortia. To control for these external firm growth opportunities, control variables were included for M&A activity and alliance-formation activity. Firm M&A data was gathered from the equity investment sources used for building the database for this research. However, this database only includes targets in the solar PV industry, so data on additional M&A's with targets outside the solar PV industry was gathered using Zephyr. These two datasets were combined and duplicates were excluded. The included variable, *cumulative M&As*, measures the cumulative number of performed M&As by a firm. A similar variable, *cumulative alliances*, was created for firm alliance-activity. Data for alliance-activity by firms active in the PV industry was gathered from a database built by J. Hoppmann at the Chair of Sustainability and Technology at the Swiss Federal Institute of Technology.

Besides growth due to external expansion, firms can also grow because of internal expansion. There are certain firm characteristics that contribute to higher growth rates and increases in size. Mowery (1983) was among the first to show the positive relationship between firm R&D and firm growth. Firm *R&D intensity* was therefore included as a control for firm research activities. Furthermore, *return on assets (ROA)* was included as a control for firm profitability. Similar to the country control variables, there are also many control variables explaining between-firm differences, for example firm legal entity (Beck et al., 2006) or the managerial routines, as explained by Penrose. For the same reason, these variables were not included in the model.

4.5 FIRM SIZE ANALYSIS

In this section, data analysis for the firm size model is discussed. Some methodological considerations that are identical to the country model are not as thoroughly discussed again. Furthermore, all of the same country controls were also added to this model to control for other year differences within countries that could explain firm growth. Only the variable *country total* was not added to this model, because it specifically controls for the equity investment environment.

Gibrat (1931) was among the first to show that firm size distribution is stable over time and approximately follows a lognormal distribution. Based on research, Mata & Cabral (2003) found that the distribution of firm size can only be approximated by a lognormal distribution when firm age increases, because firm size at birth is highly skewed. This study's data showed some signs of suffering from the same problem. However, fitting a lognormal distribution to the data still seemed to give a reasonably good fit. Furthermore, taking the lognormal distribution is in line with the work of other authors who assessed the effects of firm size (Fagiolo. 2006). This means that for this analysis, a GLM model with logarithmic link function or OLS model could be used. Based on the Q-Q plots in Appendix I, it can be concluded that both models had slight problems fitting the high end and low end of the distribution. The GLM model had problems on both sides while the OLS model only had problems on the higher end of the distribution. Therefore, the OLS model was preferred.

4.5.1 MODEL CONSIDERATIONS

To control for unobserved heterogeneity, firm fixed effects were included. The firm sample was not representative of the whole population, because the data suffered from a survival bias as well as an age bias. However, the use of fixed effects had one important drawback for this analysis, it created many dummy variables, which affected the degrees of freedom as well as created multicollinearity problems. These problems are further discussed in the next paragraph. In this case, it was unnecessary to add country fixed effects to the model, because these were already covered within the firm fixed effects. With the inclusion of year fixed effects, inferences can only be drawn from within-year differences. However, deployment policies are only expected to affect relative growth between years. Because of this, year fixed effects were not included in this model.

The effect of domestic and foreign deployment policies is likely influenced by value chain position, technology stream, and firm diversification. To check the hypothesis regarding these moderator effects, it was desirable to include interaction effects. As in the country model, interaction effects in this model suffered from the same multicollinearity problems. Appendix H shows that the Pearson correlation coefficients between the dummies and interaction terms were above 0.7. Also, centring around the grand mean did not overcome these problems. These problems were solved in the same way as the previous model, by adding different dependent variables to the model for the various categories. This was done for value chain position and firm diversification. However, for the value chain position analysis, new dependent variables could only be made for Wafer, Cell, Module and Development firms. For the other value chain positions, the sample was too small to test the hypotheses. Technology stream could not be assessed on the firm level, because the sample was not large enough. Additionally, firms pursuing different technologies were not equally spread over the different value chain position, which made it impossible to assess only the effect of the technology stream on the firm level. Differences in time effects also could not be assessed on the firm level. Splitting the dependent variable up, to test for time differences, led to multicollinearity problems, created by the fact that there were only an average of 9.2 observations per firm.

The variables, *governance*, *GDP per capita* and *population* were excluded because of high VIF values created by multicollinearity problems with the firm dummies. Table 6 summarizes the main model considerations and shows some goodness of fit vales. All the descriptives for the included variables are visible in Table 7.

Table 6 Goodness of fit firm growth model

	Firm growth model
Type	OLS
Fixed company	YES
Adjusted R-squared	0.86
AIC	1712
Log-likelihood	-746.3
Fitted mean/mean	11.47/11.47

Table 7 Descriptives firm growth analysis

Variable	Description	N	Mean	St. Dev.	Min	Max
			Dependent variable			
Log Sales Total	Log th USD sales	1037	10.93	2.101	1.386	15.02
Log Sales Wafer	Log th USD sales	215	11.68	1.921	4.574	15.00
Log Sales Cell	Log th USD sales	318	11.22	1.848	5.730	14.69
Log Sales Module	Log th USD sales	452	10.88	2.096	2.323	15.02
Log Sales Developer	Log th USD sales	298	10.76	2.109	1.386	14.69
Log Sales Specified	Log th USD sales	691	10.98	2.089	1.386	15.02
Log Sales Diversified	Log th USD sales	346	10.83	2.124	2.323	14.47
			Independent variables			
Log Dsize	Domestic PV capacity additions	1042	4.473	2.621	0	9.142
Log Fsize	Foreign PV capacity additions	1043	7.886	1.769	-0.652	10.33
			Firm Controls			
ROA	Return on assets	1035	-0.212	1.475	-35.52	1.223
Cumulative MA	Number of MAs performed by firm	1043	0.950	1.844	0	15
Cumulative Alliances	Number of Alliances performed by firm	1043	1.976	5.799	0	49
R&D intensity	Research development expenditure / sales	662	213.1	113.4	0	1330
			Country Controls			
Uncertainty	Standard deviation of the 4 years % market size growth	1043	0.315	0.377	0	1.705
GDP growth	Percentage change in GDP	1043	3.512	4.023	-5.883	14.20
Inflation	Percentage change	1043	2.110	1.914	-4.028	24.24
Unemployment	Percentage of national labour force	1043	6.098	2.482	0.704	25.00
Corporate tax	Corporate income tax levels	1042	31.57	7.774	16.00	56.80
Stock turnover	Total value of stocks traded divided by the market capitalization	1043	146.5	64.45	0	393.3
Mcap growth	Percentual change in market capitalization	1043	0.302	1.362	-0.657	9.78
Mcap GDP	Market capitalization divided by GDP	1043	100.6	77.49	0	606.0

4.6 FIRM VALUE VARIABLES

There are 3685 equity investment deals in the database. For this analysis, only cases with public targets and a deal value were included. Furthermore, 161 cases were excluded because there was not sufficient data available for the control variables. Figure 9 shows how this process led to the final investment model sample. The independent variable that is used in this analysis is the dependent variable from the firm-size analysis: total firm assets. The dependent variable that was used is the deal value in USD, which is equal to the dependent variable on the country level, only not aggregated. Therefore, only the controls are discussed in the next sections.

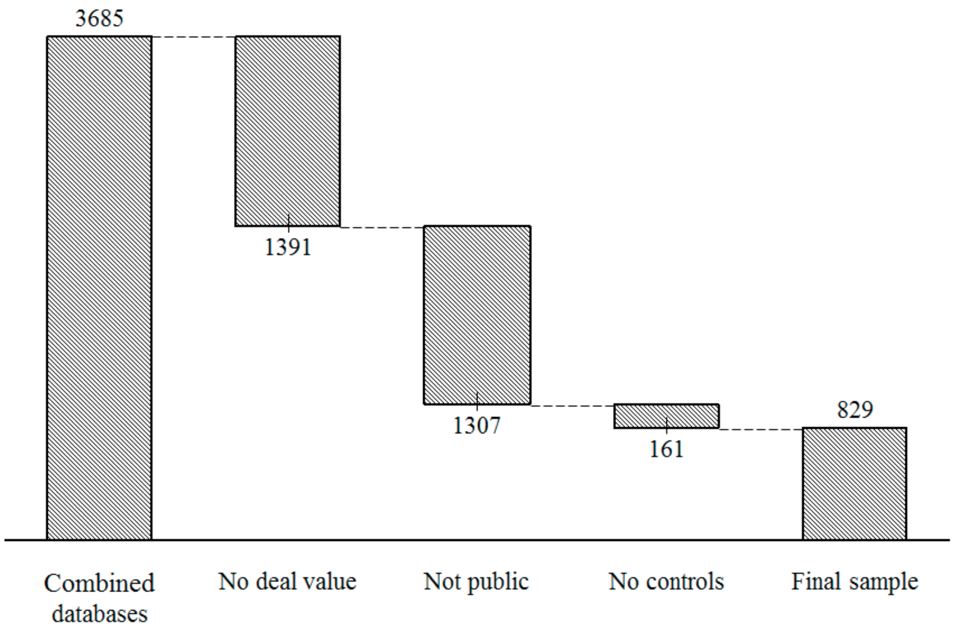

Figure 9 The creation of the final firm value sample

4.6.1 FIRM CONTROL VARIABLES

The control variables are based on drivers of equity investments that were restricted in the theory section. All firm controls were lagged by one year.

Firm performance

Strong firm financial performance attracts equity investments (Gompers & Lerner, 1999). Generally, firm performance ratios can be split into four categories: liquidity, solvency, profitability and turnover ratios. Liquidity and solvency respectively measure a firm's ability to meet its short-term and long-term financial obligations. Profitability determines the ability of a firm to generate profits based on size measures. Turnover ratios measure a firm's ability to generate revenues by selling inventories. For each of these categories, several ratios exist, with no scientific agreement on which is best (Delen et al., 2013). Therefore, data on several ratios was gathered to check which ratio provided the best fit to the data. The fit was checked by adding the different ratios separately to the model, with only the other controls included. The ratio with the highest increase in the adjusted R-squared was eventually included as a control. All of the adjusted R-squared values are visible in Appendix K, as well as all of the tested ratios. Before making a final selection, a check was made for multicollinearity problems among the different ratios. The Pearson correlation coefficient between *return on assets* and *cash ratio* was 0.768. Therefore it was decided to include the *gross margin* as a proxy for profitability instead of *return on assets*. Data for all of the different ratios was gathered from Thomson One Worldscope. The following ratios were included as controls:

Type	**Name of Ratio**	**Formula**
Solvency:	Solvency ratio	Short-term debt / Total debt
Profitability:	Gross margin	(Revenue - Costs of goods sold) / Revenue
Liquidity:	Cash ratio	Cash and cash Equivalents / Current liabilities
Turnover:	Equity turnover rate	Sales / Equity

Innovativeness

Firm innovativeness is an important success factor for long-term firm survival, and therefore it is also expected to play a role in a firm's attractiveness as a target for equity investments. Firm innovativeness can be measured by input variables, such as firm R&D budgets, or by output variables, such as firm patent data. Patent data is preferred because it exclusively measures new ideas (Katila, 2000; Rothaermel, 2002), and it is publicly available for all firms (Hall & Jaffe, 2001). However, not all innovations are patentable or are patented by firms, so patents data does not cover all of a firm's innovative activity (Hall & Jaffe, 2001). The most widely used alternative appropriation regime is secrecy (Arundel & Kabla, 1998). Since secrecy is very hard to measure, this study used patents data as a proxy for firm innovativeness. The number of firm patents is most likely important for long-term survival, however quality is essential as well. Earlier research used several indicators for patents quality, such as forward and backward patent citations (Trajtenberg, 1990), the patents family size[25] (Harboff et al., 2003), and the number of patent claims (Tong & Frame, 1994). Lanjouw & Schankerman (2004) showed that all four proxies measure different aspects of quality but that forward citations have the highest predictive value. Therefore forward citations were used as a proxy for patent quality. Patent data was gathered from a database containing all worldwide PV patents filed in the period 1950-2013, build[26] by J. Hughes at the Chair of Sustainability and Technology at the Swiss Federal Institute of Technology. Number of firm patents and citations were counted only for the patents that were filed before the announcement date of the equity deal.

[25] Patent family size is measured by the amount of countries in which the patent is taken out.
[26] The patent data is gathered from Thomson Innovation

Other Controls

Firm age and the percentual *acquired stake* were included as control variables Data on these variables was gathered from the equity investment databases. Multiple dummy variables were also included to control for the different deal types in the database: *IPO dummy*, *share-issue dummy*, *PEVC dummy*[27], and *cross-border dummy*. The cross border dummy is based on the head offices of the target and acquirer firm. For the firms that have their head offices in one of the tax havens, the home country was determined based on its largest office. Deals between firms active in China and Hong Kong are not seen as cross-border deals. Finally, all of the country variables were also included as control variables, except for the policy related variables *Dsize, Fsize,* and *uncertainty*.

4.7 FIRM VALUE ANALYSIS

The dependent variable consisted of nonnegative real-valued data, which was highly skewed. As in the other firm analysis, this left two options for analysing the data: a GLM model with a logarithmic link or an OLS model with the logarithmic version from the dependent variable. The Q-Q plots in Appendix L show that the GLM model did not provide a good fit for the lower values of the distribution. Therefore, an OLS model was preferred for this analysis.

In the two earlier analyses, fixed effects were included to control for unobserved heterogeneity. The Hausman test, checking for fixed effects or random effects, showed that fixed country effects and fixed year effects were preferable over random effects in this model. Adding firm fixed effects was impossible in this analysis, as there was only one case available among many firms. Appendix J shows the Pearson correlation matric for all the variables, *firm citations* and *GDP per capita* were excluded because of multicollinearity problems. As in the other analyses, the VIF values showed some further multicollinearity problems. Therefore, *population, tax levels, market capitalisation/GDP, fitch rating* and *governance* were excluded from the model as well. All the goodness of fit values are visible in Table 8 and the descriptives are visible in Table 9.

Table 8 Goodness of fit and model specifications for firm value model

	Firm value model
Type	OLS
Fixed country	YES
Fixed year	YES
Adjusted R-squared	0.45
AIC	2335
Log-likelihood	-1119.6
Fitted mean/mean	6.687/6.687

[27] When including dummies, one category always needs to be the reference category, which is the M&A category in this model.

Table 9 Descriptives firm value model

Variable	N	Mean	St. Dev.	Min	Max
			Dependent Variable		
Log deal value	826	9.701	1.792	4.403	14.58
			Independent Variable		
Log net sales	826	11.31	2.164	3.295	17.43
			Firm Controls		
Efficiency	826	0.348	1.082	-7.653	9.732
Profitability	824	-0.177	89.65	-830,1	100,2
Liquidity	811	1.542	7.039	0.001	1.063
Solvency	821	0.722	0.385	0.071	8.962
Acquired Stake	683	15.76	21.93	0.033	100
Age	826	16.87	17.93	0.500	140
Firm patents	826	7.282	20.49	0	134
PEVC dummy	826	0.267	0.442	0	1
IPO dummy	826	0.068	0.251	0	1
Share issue dummy	826	0.420	0.494	0	1
Cross border dummy	826	0.105	0.307	0	1
			Country Controls		
GDP growth	826	3.692	4.392	-5.527	1.478
Unemployment	826	5.593	2.206	0.700	20.10
Inflation	826	2.353	1.807	-1.347	11.99
Stock turnover	826	150.2	59.83	33.70	393.3
Mcap growth	826	0.998	1.192	-0.645	9.783

5 RESULTS

This chapter presents the results for the three different analyses. Some points must be taken into account when analysing the results. There are many different dependent variables in this study, so for most dependent variables only the model with all of the independent variables is directly reported. For the main dependent variables, the following models are reported: the models including the year fixed effects, models with only control variables and models with the separate inclusion of the independent policy variables. The values for the country and year dummies are not reported. The text refers to C and F type models, with C models referring to the country level and F models referring to the firm level. The country-level results are presented first, followed by results for the firm-level results.

5.1 COUNTRY-LEVEL RESULTS

This section presents all results for the country analysis. All the presented models can only be used for analysing within country effects. First, the main model is presented for the total number of targets and the value of target deals, followed by the results for the moderator effects. Finally, the results from the robustness checks and IV analysis are presented.

5.1.1 RESULTS ON MAIN EFFECTS

Table 10 shows the models C1-C5 with the *total number of deals* as dependent variable, and Table 11 shows the models C6-C10 with the *total value of deals* as dependent variable. Models C1 and C6 show the results for only the control variables, and include the year fixed effects as well. Models C2 and C8 augment these models by adding domestic deployment policies. The year fixed-effects are excluded in the models C3-C5 and C8-C10. The first of these models show the results for the separate inclusion of domestic and foreign deployment policies, while the last models, C5 and C10, show the pairwise inclusion.

The log-likelihood values indicate that the inclusion of domestic deployment policies in model C2 and model C7 is an improvement over models that do not take these effects into account. Models C5 and C10 have the highest log-likelihood for the models excluding the year fixed effects, so therefore both domestic and foreign deployment policies add explanatory power to the models. Domestic deployment policies have a significant effect in models C2 and C7, and are therefore robust to the inclusion of year fixed effects. The effect of domestic deployment policies is greater in model C3, indicating that domestic deployment policies have a larger influence on between-year differences in equity investment levels compared to within-year differences in equity investment levels. Models C3 and C4 show that foreign and domestic deployment policies are both significant when they are included separately from each other. Foreign deployment policies have a greater positive effect, indicated by the larger coefficient of 0.608 versus 0.445 for domestic deployment policies. The model fit is also better for model C4 as compared to C3, as indicated by the higher log-likelihood. This difference in effect size is even larger when domestic and foreign deployment policies are added pairwise, as is visible in model C5. Furthermore, this is also indicated by the change in predicted probabilities. When all the variables are held constant at their means, one unit change in *LogDsize* and *LogFsize* respectively leads to an increase of respectively 5.4% and 29% in the number of equity investments. The results support hypotheses 1a and 1b that both foreign and domestic deployment policies have a positive effect on the number of equity investments, but foreign deployment policies have a stronger effect. Figure 10 provides some additional insights into how foreign and domestic deployment policies differ in driving equity investments. It shows the predicted probabilities of zero investment activity for different values of foreign and domestic deployment policies. As can be seen is the chance of having zero activity much lower for high levels of domestic capacity additions than for high levels of foreign capacity additions. Therefore domestic deployment policies are a better indicator for determining whether there is equity investment activity in a given country, where foreign deployment policies are more important than domestic deployment policies in explaining within-country differences in absolute values.

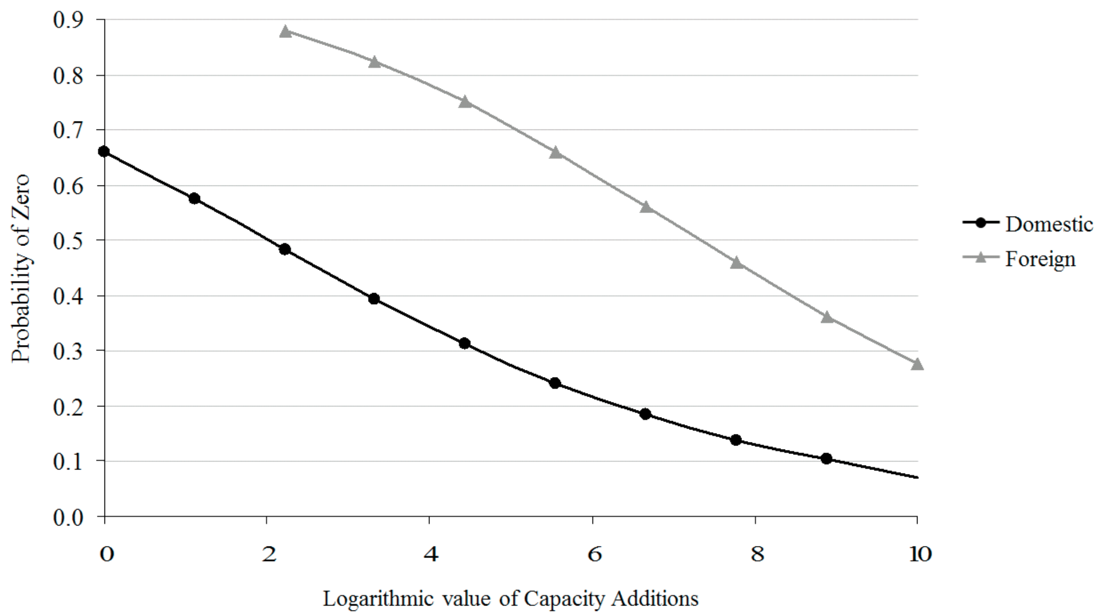

Figure 10 Probability plot for the negative binomial model

Table 10 Results for country level total number of targets

Target Total	Model C1	Model C2	Model C3	Model C4	Model C5
GDP growth	-0.022 (0.021)	-0.016 (0.020)	-0.041 (0.019)*	-0.027 (0.017)	-0.024 (0.017)
Inflation	-0.024 (0.023)	-0.022 (0.021)	-0.025 (0.016)	-0.006 (0.019)	-0.007 (0.018)
Tax levels	-0.005 (0.014)	0.008 (0.013)	-0.120 (0.018)***	-0.044 (0.016)**	-0.036 (0.016)*
Stock turnover	-0.001 (0.001)	-0.001 (0.001)	0.003 (0.001)**	0.001 (0.001)	0.001 (0.001)
Mcap growth	0.111 (0.121)	0.103 (0.116)	0.346 (0.129)**	0.325 (0.117)**	0.338 (0.116)**
Mcap GDP	0.006 (0.002)***	0.006 (0.002)***	0.010 (0.002)***	0.010 (0.002)***	0.010 (0.002)***
Unemployment	-0.043 (0.023)+	-0.032 (0.022)	-0.102 (0.030)***	-0.100 (0.026)***	-0.100 (0.026)***
Uncertainty	0.033 (0.014)*	0.024 (0.014)+	0.031 (0.023)	0.022 (0.018)	0.014 (0.018)
Country total	0.002 (0.005)	0.003 (0.004)	0.017 (0.005)***	0.007 (0.005)	0.009 (0.005)+
Log Dsize		0.136 (0.034)***	0.445 (0.038)***		0.102 (0.039)**
Log Fsize				0.608 (0.034)***	0.542 (0.042)***
N	749	749	749	749	749
Log-likelihood	-972	-964	-1.090	-1.012	-1.009
Country FE	YES	YES	YES	YES	YES
Year FE	YES	YES	NO	NO	NO
Model	NBREG	NBREG	NBREG	NBREG	NBREG

+ p<0.1; * p<0.05; ** p<0.01; *** p<0.001

Model C10 in Table 11 shows that the pairwise inclusion of both policy variables in the value model leads to an insignificant effect for domestic deployment policies. The results show that only foreign deployment policies are significant for the pairwise inclusion. The insignificance of domestic deployment policies in the value model, compared to a significant relationship in the count model is partly explained by differences in the sample size, because models C6–C10 only include all the positive cases. In Appendix M, the results are visible for the same sample with *the total number of deals* as the dependent variable. These results show a smaller effect for domestic deployment policies than models C2, C3 and C5. Although in Appendix M, domestic deployment polices are still significant. So the sample size does not explain the whole difference in effect size and significance level. Domestic deployment policies are significant in the models C7 and C8, so there does seems to be a role for domestic deployment policies in explaining the total value of equity investments. However, the effect of foreign deployment policies seems to be more important. There is mixed evidence for hypothesis 2a that domestic deployment policies positively affect the total value of equity investments. Based on the results, foreign deployment policies have a much stronger positive effect on the total value of equity investments. Therefore, the results support hypothesis 2b. Overall, the results from models C1-C10 indicate that foreign deployment policies are more important than domestic deployment policies in explaining within country differences in overall equity investment activities in target firms pursuing the supported technology.

Table 11 Results for country level total value of targets

Value Total	Model C6	Model C7	Model C8	Model C9	Model C10
GDP growth	0.075 (0.066)	0.097 (0.065)	-0.039 (0.050)	-0.036 (0.048)	-0.033 (0.048)
Inflation	0.116 (0.069)+	0.115 (0.068)+	0.105 (0.067)	0.115 (0.065)+	0.112 (0.065)+
Tax levels	-0.000 (0.043)	0.034 (0.044)	-0.093 (0.045)*	-0.062 (0.043)	-0.046 (0.045)
Stock turnover	0.002 (0.003)	0.002 (0.003)	0.009 (0.003)**	0.007 (0.003)*	0.007 (0.003)*
Mcap growth	0.702 (0.375)+	0.713 (0.368)+	1.016 (0.332)**	0.967 (0.320)**	1.002 (0.320)**
Mcap GDP	0.015 (0.005)**	0.015 (0.005)**	0.024 (0.005)***	0.023 (0.005)***	0.023 (0.005)***
Unemployment	0.006 (0.075)	0.017 (0.074)	-0.087 (0.076)	-0.094 (0.073)	-0.097 (0.073)
Uncertainty	0.001 (0.048)	-0.027 (0.048)	-0.041 (0.054)	-0.026 (0.051)	-0.043 (0.052)
Country total	-0.009 (0.014)	-0.007 (0.014)	0.001 (0.015)	0.001 (0.015)	0.002 (0.015)
Log Dsize		0.335 (0.115)**	0.477 (0.091)***		0.166 (0.116)
Log Fsize				0.630 (0.095)***	0.513 (0.126)***
N	256	256	256	256	256
Log-likelihood	-453	-447	-496	-487	-486
Adj-R squared	0.62	0.64	0.52	0.55	0.55
Country FE	YES	YES	YES	YES	YES
Year FE	YES	YES	NO	NO	NO
Model	OLS	OLS	OLS	OLS	OLS

+ p<0.1; * p<0.05; ** p<0.01; *** p<0.001

5.1.2 *MODERATORS*

The results for four different moderators are presented in this section: value chain position, technology stream, firm diversification and time period. Table 12 shows the results for value chain position as a moderator on the country level. Domestic deployment policies are only significant for Development activities at the 10% level, BOS activities at the 5% level and Operation activities at the 0.1% level. Domestic deployment policies do seem to be more important for downstream value chain positions, so hypothesis 5a can be accepted. There is no support for hypothesis 5b that foreign deployment policies are more important for upstream activities, with *LogFsize* being significant at the 0.1% level for all positions except Silicon. The results instead indicate that foreign deployment policies are important for all value chain positions.

Table 12 Results for country level number of target deals split per value chain position

	Silicon	Wafer	Cell	Module	Development	BOS	Operation
GDP growth	0.069 (0.052)	-0.037 (0.043)	0.012 (0.032)	-0.008 (0.029)	-0.059 (0.022)**	0.001 (0.030)	-0.055 (0.033)
Inflation	0.088 (0.068)	0.076 (0.078)	-0.029 (0.043)	-0.033 (0.040)	0.004 (0.015)	-0.026 (0.038)	-0.029 (0.056)
Tax levels	0.027 (0.055)	0.020 (0.038)	-0.021 (0.027)	-0.043 (0.025)+	-0.033 (0.021)	0.023 (0.021)	-0.024 (0.036)
Stock turnover	0.005 (0.002)*	0.001 (0.002)	0.001 (0.002)	0.002 (0.002)	0.002 (0.001)	0.004 (0.001)**	0.001 (0.002)
Mcap growth	0.337 (0.255)	0.726 (0.243)**	0.655 (0.186)***	0.419 (0.177)*	-0.042 (0.175)	0.013 (0.182)	-0.005 (0.301)
Mcap GDP	0.010 (0.004)**	0.012 (0.004)**	0.014 (0.003)***	0.012 (0.003)***	0.005 (0.003)+	0.001 (0.003)	0.010 (0.005)+
Unemployment	0.133 (0.104)	-0.136 (0.073)+	-0.103 (0.056)+	-0.077 (0.045)+	-0.090 (0.031)**	-0.041 (0.038)	-0.117 (0.037)**
Uncertainty	-0.264 (0.327)	-0.501 (0.273)+	-0.008 (0.037)	-0.026 (0.050)	0.020 (0.021)	-0.035 (0.048)	0.083 (0.034)*
Country total	0.024 (0.013)+	0.008 (0.011)	0.003 (0.008)	0.010 (0.008)	0.016 (0.008)*	0.038 (0.008)***	0.011 (0.017)
Log Dsize	-0.029 (0.137)	0.154 (0.119)	0.070 (0.081)	-0.017 (0.071)	0.094 (0.048)+	0.137 (0.068)*	0.204 (0.062)***
Log Fsize	0.404 (0.142)**	0.434 (0.116)***	0.460 (0.081)***	0.495 (0.072)***	0.521 (0.057)***	0.458 (0.079)***	0.626 (0.103)***
N	154	251	565	580	691	542	523
Log-likelihood	-165	-260	-471	-517	-631	-365	-263
Country FE	YES	YES	YES	YES	YES	YES	YES
Year FE	NO	NO	NO	NO	NO	NO	NO
Model	NBREG	NBREG	NBREG	NBREG	NBREG	NBREG	NBREG

+ $p<0.1$; * $p<0.05$; ** $p<0.01$; *** $p<0.001$

Table 13 shows the results for technology stream and firm diversification as a moderator on the country level. There is no clear difference between the importance of deployment policies for the various technology streams. This indicates that deployment policies also have been an important driver for equity deals in emerging technologies. There is therefore no support for hypothesis 6a that deployment policies have a stronger positive effect for firms pursuing more mature technologies than firm pursuing emerging technologies. The two models on the right of Table 13 show that domestic deployment policies have a stronger positive effect on the total number of equity investments in specialized firms than in diversified firms. These findings are in line with hypothesis 7a, stating that deployment policies are more important for specialized firms than for diversified firms.

Table 13 Results for country level technology stream and diversification moderators

	CSI	Thin-Film	Emerging	Diversified	Specialized
GDP growth	-0.018	0.082	-0.042	-0.023	-0.033
	(0.035)	(0.048)+	(0.043)	(0.021)	(0.019)+
Inflation	-0.027	-0.010	0.087	-0.034	0.004
	(0.045)	(0.078)	(0.055)	(0.030)	(0.015)
Tax levels	-0.042	0.004	0.032	-0.010	-0.033
	(0.027)	(0.038)	(0.036)	(0.019)	(0.019)+
Stock turnover	0.001	0.003	0.002	0.001	0.001
	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)
Mcap growth	0.567	0.471	0.741	0.319	0.293
	(0.194)**	(0.311)	(0.304)*	(0.138)*	(0.135)*
Mcap GDP	0.013	0.011	0.012	0.007	0.011
	(0.003)***	(0.004)**	(0.005)**	(0.002)***	(0.002)***
Unemployment	-0.049	-0.086	-0.069	-0.128	-0.085
	(0.051)	(0.098)	(0.073)	(0.032)***	(0.030)**
Uncertainty	-0.036	-0.165	-0.026	0.032	0.008
	(0.094)	(0.184)	(0.043)	(0.023)	(0.021)
Country total	0.008	0.012	0.026	0.019	0.006
	(0.009)	(0.013)	(0.012)*	(0.006)**	(0.006)
Log Dsize	-0.015	0.120	0.142	0.002	0.144
	(0.087)	(0.125)	(0.117)	(0.050)	(0.044)**
Log Fsize	0.428	0.496	0.430	0.546	0.542
	(0.085)***	(0.123)***	(0.118)***	(0.055)***	(0.048)***
N	486	315	285	695	731
Log-likelihood	-427	-263	-220	-637	-838
Country FE	YES	YES	YES	YES	YES
Year FE	NO	NO	NO	NO	NO
Model	NBREG	NBREG	NBREG	NBREG	NBREG

+ p<0.1; * p<0.05; ** p<0.01; *** p<0.001

The results split per time period are visible in Table 14. Model C5 has been added to the table to make it easier to compare the results. Domestic deployment policies are more important in the early years and are not significant in the post-2008 model, so hypothesis 4a can be accepted. Foreign deployment policies also had a stronger effect in the pre-2008 period, which is visible in the higher coefficient and higher significance level. However, there are two important reasons why the total effect of deployment policies on equity investments was most likely smaller after 2008. Firstly, the number of equity investment deals has been levelling out after 2008, while the capacity additions have been sharply rising at the same time. This could be due to the fact that there is some kind of natural boundary in the maximum amount of equity investment activity in a certain industry, created by industry shakeouts. Secondly, the financial crisis influenced equity investment activities in the post-2008 situation. Therefore, the fit of deployment policies might be smaller for the later time period. Because of these reasons, an additional time check was performed, including only cases from the pre-2005 period. The results for this analysis are visible in Appendix N. The results support hypothesis 4a, with an even higher coefficient for domestic deployment policies. Based on both models, hypothesis 4b must be rejected, because the effect of foreign deployment policies was as strong as in the pre-2008 model.

Table 14 Results for country level number of target deals split per time period

	Model C5	Pre-2008	Post-2008
GDP growth	-0.024	0.036	-0.007
	(0.017)	(0.038)	(0.016)
Inflation	-0.007	0.025	-0.079
	(0.018)	(0.016)	(0.030)**
Tax levels	-0.036	-0.056	0.121
	(0.016)*	(0.020)**	(0.036)***
Stock turnover	0.001	-0.003	-0.000
	(0.001)	(0.002)+	(0.001)
Mcap growth	0.338	0.597	0.109
	(0.116)**	(0.165)***	(0.147)
Mcap GDP	0.010	0.008	0.001
	(0.002)***	(0.003)*	(0.002)
Unemployment	-0.100	-0.036	-0.080
	(0.026)***	(0.045)	(0.031)*
Uncertainty	0.014	-0.160	0.028
	(0.018)	(0.195)	(0.016)+
Country total	0.009	0.007	0.007
	(0.005)+	(0.007)	(0.008)
Log Dsize	0.102	0.176	0.013
	(0.039)**	(0.083)*	(0.038)
Log Fsize	0.542	0.653	0.323
	(0.042)***	(0.079)***	(0.106)**
N	749	554	195
Log-likelihood	-1.009	-459	-452
Country FE	YES	YES	YES
Year FE	NO	NO	NO
Model	NBREG	NBREG	NBREG

+ p<0.1; * p<0.05; ** p<0.01; *** p<0.001

5.1.3 ROBUSTNESS CHECKS

Four different categories of robustness checks were performed, to test the sensitivity of the results to other variables and other model specifications. The categories are: different statistical models, OECD countries, different independent variables and the exclusions of fixed effects and/or the control variables. Table 15 shows the results for the robustness checks. Only the coefficients and significance levels of all independent variables are included. The first row shows the results for model C5, to make it easier to compare the results of the robustness checks. The results for the four different categories are discussed in the next paragraphs.

Table 15 Robustness checks country level

Types	Domestic		Foreign	
Model C5	0.102 (0.039)**		0.542 (0.042)***	
Different models				
	Normal part	*Inflate part*[1]	*Normal part*	*Inflate part*[1]
ZINB	0.076 (0.038)*	-28.04 (10.986)***	0.518 (0.044)***	0.369 (0.355)
Poisson	0.074 (0.018)***		0.455 (0.021)***	
OECD N = 355				
C5 model only OECD countries	0.206 (0.053)***		0.337 (0.055)***	
R&D	0.209 (0.054)***		0.341 (0.057)***	
Interest rate	0.167 (0.073)**		0.411 (0.064)***	
R&D + interest rate	0.199 (0.054)***		0.411 (0.065)***	
Different independent variables				
Dsize Fsize	-0.107 (0.087)		0.081 (0.009)***	
Dgrowth Fgrowth	0.051 (0.126)		0.171 (0.017)***	
Without controls				
No Fixed effects	0.407 (0.037)***		0.453 (0.044)***	
No Controls	0.099 (0.041)*		0.638 (0.041)***	
No Controls + No fixed effects	0.615 (0.039)***		0.355 (0.036)***	

+ $p<0.1$; * $p<0.05$; ** $p<0.01$; *** $p<0.001$

[1] The reported coefficients for the inflate part are IRR values.

As described in the methods section was the fit of the ZINB model slightly better. The robustness check shows the same results for foreign deployment policies in the normal part of the ZINB model[28]. In line with earlier results, the effect of domestic deployment policies is no longer significant when both domestic and foreign deployment policies are included. However, domestic deployment policies are significant at the 0.1% level for the inflate part and have a negative coefficient. This means that the chance of being a "certain zero" decreases when *LogDsize* increases. Figure 11 gives a graphical representation of this and shows that for the ZINB model, the chance of having zero activity is 95% when there is no domestic activity. This is in line with the earlier results of the negative binomial model, which stated that domestic deployment policies are much more important in determining if there is equity activity at all. Based on these results, the chance of benefitting from foreign deployment policies rises when domestic deployment policies increase. However, one has to be aware, that this does not say anything about to which extent countries can benefit from foreign deployment policies. The results from the Poisson model are in line with the negative binomial model, with the Poisson model more conservative on the coefficients and the negative binomial model more conservative on the significance levels. Based on these results, the negative binomial is applicable to test the hypotheses and to produce results in line with the Poisson and ZINB models.

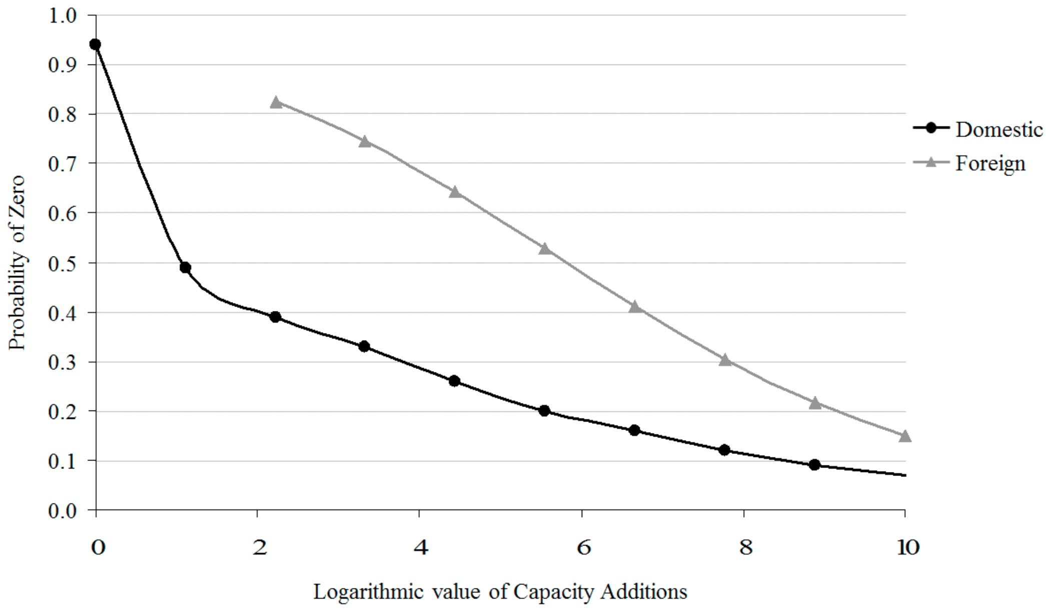

Figure 11 Probability plot for the ZINB model

The OECD robustness check shows some interesting results. The large difference between the OECD models and model C5 can primarily be explained by the different sample size. For the OECD countries, the difference between foreign and domestic deployment policies is much smaller, and domestic deployment policies are also significant at the 0.1% level. This means that for OECD

[28] As explained in the methods section has the ZINB model two parts. The normal part fits a distribution for all the positive cases and the normal share of zeros. The inflate part fits the distribution for the overload of zeros.

countries, domestic deployment policies played a more important role in driving overall equity investment activity than in non-OECD countries. The inclusion of *R&D spending* had no significant impact, with slightly higher coefficients for both foreign and domestic deployment policies when this variable was incorporated. Including *interest rates* in the model had more impact, with domestic deployment policies only significant at the 1% level. The effect of interest rate became less important when both *R&D spending* and *interest rates* were included. Therefore, it can be stated that the results are robust to the inclusion of R&D spending and interest rates.

The coefficients of the different non-logarithmic independent variables cannot be easily compared with the logarithmic variables used in the main model, because of a different distribution and different scale of the variables. The proxies for domestic deployment policies are not significant for the non-logarithmic independent variables. This could mean two things: (i) all of the earlier models overestimated the effect of domestic deployment policies, or (ii) the log-transformed independent variables are a better proxy for deployment policies. Based on the distribution graphs, it can be argued that the latter possibility is more likely to be true. The distribution graphs for the non-transformed independent variables for domestic capacity additions are show very high levels of skewness, with domestic capacity additions sometimes rapidly increasing from one year to the next. Most likely do the equity investment activity levels not change so rapidly from year to year, and are the changes much more smooth. The log-transformed variable for domestic deployment policies does not suffer from these dramatic year-to-year increases, because the log-transformation smoothens the scale. Therefore one could argue that the log-transformed independent variable is a better proxy. The foreign deployment policies variable does not suffer from this problem, because it is already much more smoothened. Most likely, there definitely seems to be a role for domestic deployment policies in explaining country-level equity investment activity. The growth independent variables show the same results as the size non-log-transformed independent variables, so the presumed effect is most likely influenced by both absolute capacity additions and the change in capacity additions.

The model seems to be robust to the exclusion of the control variables. The results show some changes in the relative importance of domestic deployment policies and foreign deployment policies. It is noteworthy that the model without the fixed effects has much higher coefficient for domestic deployment policies. This is also indicated by the change in predicted probabilities, which are for *LogDsize* and *LogFsize* respectively 36% and 40%. Especially the 36% for domestic deployment policies presumes a much stronger effect than the earlier reported 5.4%. This may indicate that domestic deployment policies play a much more important role in explaining between-country differences than within-country differences, and the overall role of domestic deployment policies may be equally important as the role of foreign deployment policies. This is in line with the results from the ZINB model, which indicate that domestic deployment policies are more important in setting the baseline for between country differences.

A final robustness check was performed to determine whether including different deal types in this research is valid. The results for the different deal types are visible in Table 16. The models for the different deal types are generally in line with the models including all deal types, with all models showing a significant positive effect for foreign deployment policies. The results for domestic deployment policies are not the same for all the different deal types and are solely significant for M&A deals. Two additional checks were performed to examine the influence of this. Appendix O shows the results when only domestic deployment policies are included in the model, and when this is the case, domestic deployment policies are significant for all deal types. Therefore, it does not seem to be the case that there is no role at all for domestic deployment policies in driving other deal types. Furthermore, Appendix P shows the percentage of M&A deals for all other moderators. These percentages are roughly the same among the different categories of the moderators. Therefore, although the effect is a bit different for M&A cases, it is expected that this does not influence the results for the other moderators.

5.1.4 INSTRUMENTAL VARIABLES

The results for the causality check are visible in Table 17. This analysis is based on another sample, so model IV1 and IV2 are included to compare the results. Model IV3 is based on *Dsize* as a dependent variable, and it includes the instruments as independent variables. Models IV4 and IV5 use the log-transformed fitted values of *Dsize* as an independent variable. Models IV4 and IV5 show that the instrumental *LogDsize* is still significant at the 0.1% and 5% level, respectively. The effect size for the instrumental *LogDsize* is smaller than the effect size for the normal *LogDsize*. Models IV4 and IV5 indicate that this is created by the *uncertainty* variable, which has a positive significant effect, where a negative effect is expected. Because *uncertainty* has a value of zero in case there are no capacity additions, it could also create a positive relationship. Therefore, the instruments are also tested without the *uncertainty* variable. The results for that analysis are visible in Appendix Q. These results show indeed a much smaller difference between the normal and instrumental *LogDsize*. Overall the results show that there is most likely also a causal relationship between domestic deployment policies and the number of equity investment deals in target firms.

Table 16 Results for country level number of target deals split per deal type

	Target MA	Target PEVC	Target IPO	Target Share
GDP growth	-0.036 (0.018)+	0.004 (0.026)	-0.027 (0.047)	-0.096 (0.038)*
Inflation	-0.013 (0.021)	0.013 (0.024)	-0.002 (0.054)	0.049 (0.068)
Tax levels	-0.017 (0.017)	-0.059 (0.025)*	0.057 (0.033)+	0.043 (0.039)
Stock turnover	0.001 (0.001)	0.001 (0.001)	-0.002 (0.003)	0.001 (0.002)
Mcap trowth	0.091 (0.130)	0.371 (0.161)*	0.575 (0.249)*	0.729 (0.255)**
Mcap GDP	0.008 (0.002)***	0.009 (0.002)***	0.018 (0.004)***	0.012 (0.004)**
Unemployment	-0.090 (0.027)***	-0.109 (0.037)**	0.049 (0.084)	-0.080 (0.075)
Uncertainty	0.022 (0.021)	0.009 (0.024)	0.102 (0.085)	0.105 (0.119)
Country MA	0.020 (0.007)**			
Country VC		0.007 (0.014)		
Country IPO			-0.038 (0.086)	
Country total				0.013 (0.011)
Log Dsize	0.120 (0.041)**	0.087 (0.057)	-0.025 (0.127)	0.087 (0.099)
Log Fsize	0.500 (0.046)***	0.511 (0.063)***	0.416 (0.134)**	0.514 (0.117)***
N	749	640	314	271
Log-likelihood	-763	-629	-175	-336
Country FE	YES	YES	YES	YES
Year FE	NO	NO	NO	NO
Model	NBREG	NBREG	NBREG	NBREG

+ p<0.1; * p<0.05; ** p<0.01; *** p<0.001

Table 17 Results for the country level instrumental variable check

	Model IV1	Model IV2	Model IV3	Model IV4	Model IV5
GDP growth	-0.089 (0.024)***	-0.043 (0.023)+	-0.267 (0.033)***	-0.117 (0.027)***	-0.043 (0.024)+
Inflation	-0.037 (0.047)	0.009 (0.045)	-0.365 (0.093)***	-0.089 (0.058)	-0.004 (0.051)
Tax levels	-0.101 (0.021)***	-0.032 (0.019)+	-0.159 (0.035)***	-0.171 (0.023)***	-0.042 (0.021)*
Stock turnover	0.004 (0.002)*	0.002 (0.002)	-0.006 (0.002)**	0.004 (0.002)*	0.001 (0.002)
Mcap growth	0.119 (0.192)	0.241 (0.177)	0.354 (0.231)	0.039 (0.211)	0.226 (0.183)
Mcap GDP	0.005 (0.003)+	0.006 (0.003)*	-0.017 (0.006)**	0.005 (0.003)+	0.006 (0.003)*
Unemployment	-0.150 (0.035)***	-0.121 (0.032)***	-0.846 (0.066)***	-0.213 (0.039)***	-0.143 (0.034)***
Uncertainty	0.046 (0.030)	0.029 (0.027)		0.120 (0.033)***	0.050 (0.027)+
Country total	0.026 (0.006)***	0.015 (0.006)**	-0.054 (0.013)***	0.025 (0.006)***	0.012 (0.006)*
Log Dsize	0.428 (0.050)***	0.193 (0.049)***			
Log Fsize		0.495 (0.055)***			0.583 (0.051)***
Wind capacity			0.001 (0.000)***		
Biogas capacity			-0.005 (0.001)***		
Biomass capacity			-0.005 (0.000)***		
Wind R&D			-0.028 (0.003)***		
Geoth. capacity			-0.030 (0.006)***		
IV LogDsize				0.160 (0.043)***	0.073 (0.034)*
N	450	450	450	450	450
Log-likelihood	-594	-552	-2.184	-621	-557
Country FE	YES	YES	YES	YES	YES
Year FE	NO	NO	YES	NO	NO
Model	NBREG	NBREG	GLM	NBREG	NBREG

+ p<0.1; * p<0.05; ** p<0.01; *** p<0.001

5.2 FIRM VALUE RESULTS

This section shows the results for the model explaining the relationship between firm size and deal value. As can be seen in model 2, the logarithmic value of net sales, as a proxy for firm size, is significant at the 0.1% level. The adjusted R-squared also increases from 0.44 to 0.51, which shows that this variable increases the model fit quite substantially. This shows that firm size is an important variable in explaining the deal value, and therefore the overall amount of equity invested in the solar PV industry. These results do not yet support any specific hypothesis, but they do support a part of all the firm-level hypotheses, which state that target firm size influences the amount of equity invested in a target firm. These results can therefore be seen as a prerequisite for finding support for all the other firm-level hypotheses. The results also show a significant effect for the number of patents. This indicates that the number of patents may also be an important firm-level driver for equity investments.

Table 18 Results for firm level value analysis

	Model 1	Model 2
Efficiency	0.182 (0.062)**	0.089 (0.059)
Profitability	0.002 (0.001)*	-0.002 (0.001)*
Liquidity	0.001 (0.012)	0.017 (0.011)
Solvency	-0.388 (0.149)**	-0.144 (0.140)
Acquired stake	0.023 (0.003)***	0.023 (0.003)***
Age	0.009 (0.003)**	0.001 (0.003)
Firm patents	0.014 (0.003)***	0.007 (0.003)*
PEVC	0.203 (0.158)	0.108 (0.147)
IPO	1.639 (0.263)***	1.709 (0.245)***
Share issue	0.169 (0.147)	0.052 (0.138)
Cross-Border	-0.021 (0.193)	-0.141 (0.180)
GDP growth	-0.010 (0.041)	-0.037 (0.039)
Unemployment	-0.016 (0.061)	-0.054 (0.057)
Inflation	0.035 (0.069)	0.015 (0.064)
Stock turnover	0.003 (0.002)	0.004 (0.002)**
Mcap growth	0.134 (0.053)*	0.104 (0.049)*
Log net sales		0.380 (0.039)***
N	668	668
Log-likelihood	-1.121	-1.072
Adj-R squared	0.44	0.51
Country FE	YES	YES
Year FE	YES	YES
Model	OLS	OLS

+ p<0.1; * p<0.05; ** p<0.01; *** p<0.001

5.3 FIRM GROWTH RESULTS

Table 19 shows the results for the main firm growth models. Model F1 includes only the controls, and builds up towards model F4, which includes both domestic and foreign deployment policies. The results show that firm growth is positively related to the *return on assets* in the prior year, the *cumulative number of alliances,* and the *cumulative number of M&As*. Firm growth is negatively influenced by *R&D intensity* in this sample, which is not in line with earlier research that found a positive relationship between these two variables. The results support hypotheses 3a and 3b, which state that both foreign and domestic deployment policies positively stimulate firm growth. These findings are robust for both the separate inclusion of these two variables as well as the combined inclusion in model F4. Contradictory to the country-level results, the effect of foreign deployment policies is not larger than the effect of domestic deployment policies on the firm level. Reasons for this are presented in the discussion section. The log-likelihood values for models F2 and F3 are almost identical, indicating an equally important role for foreign and domestic deployment policies.

5.3.1 MODERATORS

Table 20 shows the results for four different steps in the value chain, because there was not enough data available for the other value chain positions. Models F5, F6, and F7 show that foreign deployment policies significantly contribute to growth for firms positioned upstream (Wafer, Cell, Module) in the value chain. These results support hypothesis 5d. The opposite effect is found for Development firms, where only domestic deployment policies are positively correlated with firm growth in model F8. Therefore these results also support hypothesis 5c**.**

Table 19 Results for firm growth analysis

	Model F1	Model F2	Model F3	Model F4
ROA	0.138 (0.023)***	0.137 (0.022)***	0.136 (0.022)***	0.137 (0.022)***
R&D intensity	-0.005 (0.000)***	-0.005 (0.000)***	-0.005 (0.000)***	-0.005 (0.000)***
Cumulative MA	0.219 (0.040)***	0.121 (0.043)**	0.096 (0.045)*	0.087 (0.045)+
Cumulative alliances	0.111 (0.012)***	0.101 (0.011)***	0.098 (0.011)***	0.097 (0.011)***
Uncertainty	0.389 (0.139)**	-0.123 (0.167)	0.173 (0.141)	-0.026 (0.170)
Unemployment	0.123 (0.035)***	0.099 (0.034)**	0.076 (0.035)*	0.080 (0.035)*
Tax levels	-0.096 (0.016)***	-0.059 (0.017)***	-0.049 (0.018)**	-0.046 (0.018)**
Inflation	0.060 (0.029)*	0.059 (0.028)*	0.034 (0.029)	0.042 (0.029)
GDP growth	0.024 (0.015)	0.029 (0.015)*	0.028 (0.015)+	0.029 (0.015)*
Stock turnover	0.002 (0.001)**	0.002 (0.001)*	0.001 (0.001)	0.001 (0.001)+
Mcap GDP	-0.000 (0.001)	-0.001 (0.001)	-0.002 (0.001)	-0.002 (0.001)
Mcap growth	-0.069 (0.026)**	-0.054 (0.026)*	-0.061 (0.026)*	-0.056 (0.026)*
Log Dsize		0.220 (0.042)***		0.118 (0.056)*
Log Fsize			0.235 (0.042)***	0.153 (0.058)**
N	655	655	655	655
Log-likelihood	-767	-750	-749	-746
Adj-R squared	0.82	0.83	0.83	0.83
Company FE	YES	YES	YES	YES
Model	OLS	OLS	OLS	OLS

+ p<0.1; * p<0.05; ** p<0.01; *** p<0.001

Table 20 Results for firm growth analysis split per value chain position

	F5 wafer	F6 Cell	F7 Module	F8 Developer
ROA	0.502 (0.138)***	0.471 (0.131)***	0.700 (0.122)***	0.073 (0.021)***
R&D intensity	-0.013 (0.002)***	-0.004 (0.001)***	-0.005 (0.001)***	-0.008 (0.004)+
Cumulative MA	0.125 (0.124)	0.029 (0.097)	0.031 (0.062)	0.115 (0.071)
Cumulative alliances	0.026 (0.017)	0.076 (0.020)***	0.119 (0.016)***	0.031 (0.034)
Uncertainty	-0.144 (0.311)	0.140 (0.266)	0.057 (0.244)	-0.813 (0.646)
Unemployment	0.117 (0.090)	0.174 (0.060)**	0.087 (0.048)+	0.033 (0.081)
Tax levels	-0.058 (0.034)+	-0.095 (0.030)**	-0.038 (0.024)	0.142 (0.046)**
Inflation	0.139 (0.057)*	0.205 (0.053)***	0.063 (0.036)+	-0.252 (0.129)+
GDP growth	-0.015 (0.027)	-0.043 (0.027)	0.010 (0.021)	-0.034 (0.035)
Stock turnover	0.001 (0.002)	0.001 (0.001)	0.001 (0.001)	0.005 (0.002)*
Mcap GDP	0.011 (0.003)***	0.008 (0.003)**	-0.000 (0.002)	0.017 (0.007)*
Mcap growth	-0.101 (0.039)*	-0.096 (0.037)*	-0.075 (0.039)+	-2.269 (0.444)***
Log Dsize	0.101 (0.112)	-0.011 (0.095)	0.008 (0.077)	0.565 (0.188)**
Log Fsize	0.582 (0.107)***	0.399 (0.099)***	0.269 (0.084)**	0.224 (0.151)
N	152	232	330	113
Log-likelihood	-149	-245	-374	-85
Adj-R squared	0.86	0.83	0.84	0.91
Company FE	YES	YES	YES	YES
Model	OLS	OLS	OLS	OLS

+ $p<0.1$; * $p<0.05$; ** $p<0.01$; *** $p<0.001$

Table 21 shows the results for firm diversification as a moderator. For specialized firms, both foreign and domestic deployment policies contribute to firm growth, although the significance level for domestic deployment policies is only 10%. As visible in model F10, domestic deployment policies are not significant for diversified firms. However, foreign deployment policies seem to be more important for diversified firms. Overall, hypothesis 7b, stating that deployment policies have a larger effect for specialized firms, has to be rejected. The results rather show that deployment policies are equally important for both specialized and diversified firms, but that domestic deployment policies are relatively more important for specialized firms.

Table 21 Results for firm growth analysis split for diversification level

	Model F9 Specialized	Model F10 Diversified
ROA	0.614 (0.096)***	0.112 (0.024)***
R&D Intensity	-0.004 (0.001)***	-0.004 (0.001)***
Cumulative MA	0.029 (0.048)	0.062 (0.081)
Cumulative alliances	0.070 (0.011)***	0.341 (0.083)***
Uncertainty	-0.019 (0.181)	-0.096 (0.310)
Unemployment	0.208 (0.036)***	-0.108 (0.075)
Tax levels	-0.119 (0.019)***	0.088 (0.035)*
Inflation	0.112 (0.029)***	-0.046 (0.058)
GDP growth	0.020 (0.016)	0.051 (0.025)*
Stock turnover	0.003 (0.001)***	-0.000 (0.001)
Mcap GDP	0.002 (0.001)	-0.008 (0.002)***
Mcap growth	-0.029 (0.029)	-0.048 (0.040)
Log Fsize	0.214 (0.062)***	0.303 (0.114)**
Log Dsize	0.110 (0.058)+	0.067 (0.109)
N	421	234
Log-likelihood	-406	-267
Adj-R squared	0.87	0.84
Company FE	YES	YES
Model	OLS	OLS

+ $p<0.1$; * $p<0.05$; ** $p<0.01$; *** $p<0.001$

5.3.2 *Robustness check*

Table 22 shows the results of the robustness checks. Model F4 is included to make it easier to compare the results. The GLM model is a bit less conservative on the significance levels of the variables, with domestic deployment policies only significant at the 1% level and foreign deployment policies significant at the 0.1% level. It can therefore be stated that the GLM model supports the findings. The same applies to the use of other dependent variables, total assets, for which the significance levels are also a bit less conservative. Overall, these results are in line with the earlier statement that both foreign and domestic deployment policies are significant on the firm level.

The models with the non-logarithmic independent variables show a positive and significant effect for both foreign and domestic deployment policies. The coefficients for domestic deployment policies are larger in these models than the coefficients for foreign deployment policies. This is most likely due to the fact that domestic and foreign deployment policies do no longer have approximately the same maximum and minimum values. The values for the foreign deployment policies variable have a higher maximum and lower minimum, so the effect for a one unit change is different from domestic deployment policies. This is much less the case for the log-transformed independent variables used in the other analyses.

The model without the control variables and with only the independent variable and fixed effects dummies is robust to the exclusion of the control variables. Both domestic and foreign deployment policies are still significant, and the adjusted R-squared value is still 0.7. No robustness checks were performed excluding the fixed effects, because this would be a model assessing the relationship between deployment policies and firm size.

Table 22 Results for firm growth robustness checks

	Domestic	Foreign	Adj. R-Squared
Model F4	0.118 (0.056)*	0.153 (0.058)**	0.83
Different models			
GLM	0.062 (0.024)**	0.133 (0.031)***	-
Different dependent variables			
Total assets	0.241 (0.052)***	0.159 (0.053)**	0.81
Different independent variables			
Dsize Fsize[1]	0.022 (0.011)*	0.008 (0.003)**	-
Dgrowth Fgrowth[1]	0.160 (0.059)***	0.028 (0.011)***	-
Without controls			
No Controls	0.177 (0.042)***	0.315 (0.049)***	0.70

+ p<0.1; * p<0.05; ** p<0.01; *** p<0.001

[1] These models are tested using the non-logarithmic dependent variable. Therefore a GLM model is used instead of an OLS model.

6 Discussion

The first part of this section discusses the results from the different analyses. It is followed by the implications for the existing literature and implications for policymakers. Lastly, the generalizability of this study's findings and points for further research are discussed.

6.1 DISCUSSION OF RESULTS

Table 23 summarizes the most important results from the previous chapter, split for the country and firm level, as well as split for all the moderators. All the check marks represent significant effects and all the crosses represent insignificant effects. In case both foreign and domestic deployment policies were significant, the larger check mark represents the strongest effect size and the smaller check mark the smaller effect size. In case they were equally strong, both check marks are equally big. It is visible that the firm-level and country-level results were in line for most of the moderators. However, a few discrepancies between the two levels of analysis show up. Firstly, the country-level results and firm-level results both showed a significant positive effect for foreign and domestic deployment policies. But the country model showed that foreign deployment policies are relatively more important, which was not confirmed by the firm-level models. Secondly, the country analysis found a positive significant effect for foreign deployment policies in downstream value chain positions, where the firm analysis found an insignificant effect. Overall, both discrepancies indicate that the country-level analysis estimates a larger effect for foreign deployment policies, compared to the firm-level analysis. However, for the moderators that could be tested on both levels, the results show that domestic deployment policies are only significant for the downstream value chain positions and for specialized firms.

Table 23 Overview of the results

	Country level		Firm level	
Moderator	**Domestic**	**Foreign**	**Domestic**	**Foreign**
General	✓	✔	✔	✔
Upstream	✖	✔	✖	✔
Downstream	✓	✔	✔	✖
Pre-2008	✓	✔	N/A	N/A
Post-2008	✖	✔	N/A	N/A
Specialized	✓	✔	✓	✔
Diversified	✖	✔	✖	✔
Mature	✖	✔	N/A	N/A
Emerging	✖	✔	N/A	N/A

The conflicting results for foreign deployment policies could be explained by the idea that the use of country fixed effects most likely increased the effect size of foreign deployment policies. There are large differences between the equity investment baselines for different countries. These differences are all absorbed by the different country dummy variables. The robustness check indicated that this most likely predominantly decreases the effect size of domestic deployment policies. This may indicate that the model with country fixed effects underestimates the effect of domestic deployment policies and overestimates the effect of foreign deployment policies. This effect is most likely smaller for the firm-level analysis. On the firm level, this study tries to explain the difference between the size of the firm for different years, so the baseline does not incorporate any effects that the independent variables could explain. Based on this explanation, it is expected that the country-model slightly favours foreign deployment policies over the firm-level models and that the firm-level model is likely closer to reality. The above explanations might also explain why domestic deployment policies were more important in the early years in the country model, but not more important than foreign deployment policies. Unfortunately, these time differences could not be tested on the firm level because of multicollinearity problems.

The analysis on the country level did not support the hypotheses for the technology stream. It showed that deployment policies are also important in driving equity investments in more emerging technologies. However, this does not necessarily mean that deployment policies are not driving a lock-in into more emerging technologies in the solar PV industry. The analysis showed that deployment policies are significant in explaining within differences in equity investment activity for the different technologies. It could therefore still be the case that, when looking at between differences for different technology streams, deployment policies are favouring more mature technologies.

Although not directly tested, there may also be interactions between the different moderators. For example, China and Taiwan were only capable of creating a high amount of equity deals over time for the more upstream positions. This may indicate that the time effect of domestic deployment policies is greater for more upstream value chain positions. Another interaction that could be present is between firm diversification and value chain position. Most likely, the number of specialized firms is higher for the more downstream value chain positions, because there are many large diversified firms active in the more upstream value chain positions.

The country analyses further showed that foreign and domestic deployment policies each have a different unique role in explaining the relationship between deployment policies and equity investments. Foreign deployment policies have a stronger positive role in explaining the within-country differences in equity investment activity. In these models, the country dummies determined the baseline for equity investment activity. Given that foreign deployment policies are roughly the same for all countries, is it very unlikely that foreign deployment policies have any explanatory power in describing differences in baseline levels. For two reasons, it is expected that domestic deployment policies play an important role in setting this baseline level. First of all, the effect of domestic deployment policies became much stronger when the country dummies were excluded from the model, indicating that they play a role in determining between-country differences. Secondly, the probability plots, indicating the chance of zero activity, showed a more important role for domestic deployment policies. Therefore it can be stated that domestic capacity additions increase the possibility that firms in the corresponding country benefit from foreign capacity additions.

6.2 IMPLICATIONS FOR THE EXISTING LITERATURE

The results from this study have several implications for the existing literate. The results are in line with existing theories about lead markets, stating that market development in the early years is limited to a few markets with high demand. Some results are contradictory to Porter's framework, which states that demand conditions in the home country create a competitive advantage for firms. For the upstream value chain positions, there is no relationship between domestic deployment policies and equity investments, indicating that home demand conditions did not help creating a competitive advantage. The high level of standardization for solar cells and the relatively low shipping costs could explain this contradiction. In this way, the feedback from local operators does provide limited value for PV manufacturing firms. Therefore, this study helped creating insight for firms, in which situation local demand is more important and when foreign demand is more important.

This study showed the importance of incorporating industry-level factors when analysing equity investment activity and firm growth. Especially in policy-dense industries such as the PV industry, these factors are the main explanatory variables. Therefore the macroeconomic drivers that have been identified in earlier studies do not necessarily apply on the industry level. This raises the question of whether there is maybe a partially reversed causality for some of these factors, for example equity investments in the PV industry could have a stronger influence on GDP growth than GDP growth influences equity investments in the PV industry. Furthermore, this study showed that, even when a less aggregated industry-level is selected for the analysis, drivers for equity investment could significantly differ within one industry. Therefore, when analysing specific industries, specific industry dynamics have to be taken into account.

Finally, this study showed that a geographical constraint could lead to wrong or biased inferences. When analysing a global industry like the PV industry, all countries active in the sector should be included in the analysis. The robustness check for only OECD countries in this study showed a much higher positive effect for domestic deployment policies. Furthermore, the results showed the importance of foreign deployment policies, which points out the importance of including such policies in future analyses. Analyses including only limited countries could possibly draw incorrect inferences regarding spillover effects between countries. This may furthermore lead to incorrect inferences about causal relationships. For example, only analysing the Chinese market could lead to the conclusion that firm growth and equity investment activity are drivers for deployment policies.

6.3 POLICY IMPLICATIONS

The results show the importance of deployment policies in driving firm growth and equity investment activity. Policymakers have to be aware that they are in the position to determine the extent of these effects. This section first discusses various important points that should be taken into account by policymakers. Afterwards, specific policy implications are presented.

Although the solar PV industry has become a global industry, this study pointed out the importance of domestic deployment policies. Domestic deployment policies are more important in determining if there is equity investment activity in a given country, than are foreign deployment policies. Therefore domestic deployment policies can, to a certain extent, be seen as a prerequisite to benefit from the opportunities created by foreign deployment policies. However, government spending on deployment policies does not necessarily contribute to firm growth and equity investments in only the domestic market. Domestic policies are also an important driver for growth and competitiveness in foreign industries. These investment spillovers could therefore undermine the competitive position of the country in question and its domestic industry. The numbers of spillovers even increases over time, generated first of all by an increased chance for spillovers as time passes, and secondly by an increased amount of funding for deployment policies over time. Spillover effects are also larger for firms located upstream in the value chain, because these firms are less bounded to their domestic industries. Therefore, policymakers can only be sure that a certain portion of the funding actually contributes to increased local competitiveness and the creation of jobs in the domestic industry. This raises the question of whether these deployment policies are effective from the viewpoint of a local policymaker. This is dependent on the viewpoint of the local policymaker. When deployment policies are seen as industrial policy, policymakers should carefully consider funding for deployment policies, in order to decrease the possibility of investment spillovers to foreign manufacturing industries. One has to be aware that this viewpoint could also endanger future domestic investments in the solar PV industry, because the development and operation industry is dependent on local funding. Policymakers faced with this decision should therefore not focus solely on the local manufacturing industry. Rather, they need to take into account the total amount of local activity generated, including project development, project design, installation and operation. In order to ensure deployment policies are an effective industry policy for the whole value chain, additional policy measures are needed to decrease the possibility of investment spillovers. Generally, this viewpoint is in conflict with a domestic viewpoint, in which deployment policies are seen as an effective measure to reduce emissions, which requires higher levels of funding.

6.4 GENERALIZABILITY

This study's analysis is based on the solar PV industry, which therefore raises the question of whether results are also applicable to other renewable energy industries. This study showed that specific industry dynamics play a role in determining the different roles of domestic and foreign deployment policies. However, for all different PV technologies, deployment policies generally play an important role in driving equity investment activity. As for solar PV, almost all other renewable energy technologies are not yet price competitive and therefore is diffusion largely dependent on deployment policies. Because of this, it can be expected that the relationship between deployment policies and equity investments is also valid for other renewable energy industries. Different industry dynamics most likely influence the relative importance of domestic and foreign deployment policies. For example, demand for solar PV is partly characterized the large number of households that install solar PV on their rooftops, where demand for wind turbines shaped much more by firms and organizations. The financial dependence of these organizations on their wind parks may create a more important role for user-producer interactions in the wind industry. Furthermore, these large wind operators have a specific interest in future technological change. Additionally, the wind-turbine manufacturing industry has much higher entry barriers than the solar PV industry. This may be an indication that investment spillovers are not that high in the wind industry as compared with the solar PV industry. Pegels & Lütkenhorst (2014) indeed showed that deployment policies in Germany have been much more successful as industrial policy for the wind energy sector than for the solar PV industry. This has two important implications. Firstly, the results for the moderators affecting domestic and foreign deployment policies cannot easily be generalized to other renewable energy industries. Secondly, this may indicate that deployment policies do not suffer from such high levels of investment spillovers in all renewable energy industries. It may therefore be more effective for domestic policymakers to promote other renewable energy technologies apart from solar PV. However, the diversification of deployment policies over different technologies has several advantages from an emissions reduction perspective, such as an increased security of supply. As a result, diversification may have higher benefits for a country.

6.5 LIMITATIONS AND FUTURE RESEARCH

Based on the limitations of this study, some topics for further research are presented. Within this study, yearly capacity additions for solar PV were used as a proxy for deployment policies. As explained in the methods section, is it hard to identify a proxy that is valid for all deployment policy frameworks. While this proxy is most likely closely related to the actual costs of deployment policies, the question still remains of whether installed capacity is a valid way to measure deployment policies. However, the operationalization is in line with real-life observations that some countries had a more favourable policy framework than other countries. For example, Germany had one of the most favourable policy frameworks in the time period covered by this study and also had the highest value for domestic deployment policies in this study. Therefore, this proxy is expected to be more valid than the dummy variable that is used by other authors (Snyder et al., 2003), which only measures whether there is a policy framework at all.

This study gives first insights into the detailed firm-level mechanisms that drive the aggregated effects of deployment policies. It shows the importance of target firm-level moderators, such as value chain position, diversification and technology stream, in determining the relationship between deployment policies and their effects. Furthermore, this study showed that target firm growth is an important mechanism. However, the overall effects for target firms are most likely not solely driven by this mechanism. Future research could therefore focus on identifying other mechanisms that apply to target firms and on analysing the importance of these mechanisms. Furthermore, this research still gives limited insights into the detailed mechanisms that apply to attracting acquirers to the industry. The overall effects of deployment policies on equity investments indicate that deployment policies most likely also influence acquirers. However, additional research is needed to investigate the detailed drivers that apply to acquirers.

One major drawback from the equity investment sources is that they have a large bias towards cases in Europe and the US. This problem has been partly overcome by merging data from four sources into one database, but the coverage of the final database is most likely still higher for Europe and the US than for Asian countries. This also shows the important of checking the results from the country level on the firm level, which does not suffer from the above-mentioned problem, because the dependent variable is not a sum variable. However, the firm-level analysis is biased for two other reasons. First of all, it only includes public firms, which are generally more internationally active, and secondly, it excludes big multinationals for which the PV division only makes up a very small part of total sales. Future research could increase the scientific understanding of how deployment policies drive growth and equity investments in these firms.

The analysis only focussed on a single technological field: solar PV. For the reasons stated earlier, is it expected that results may differ for other renewable energy technologies. Future research should therefore identify if the found moderator effects between deployment policies and equity investments also apply to other technologies.

7 Conclusion

Based on a panel analysis of 39 countries and a panel analysis of 119 firms for the time period 1993-2012, this study tested the effects of foreign and domestic deployment policies on equity investments in the solar PV industry. Three key findings emerge from the regression analyses. Firstly, the results show that domestic and foreign deployment policies have a significant positive influence on the total number of equity investments on the country level and on the value of deals on both the firm level and country level. Domestic deployment policies will, in almost all cases, lead to a growth in domestic equity investment activity, but they are also a driver for equity investment activity in foreign industries. Secondly, the results show that there are three important moderator effects, which explain the relative importance of foreign and domestic deployment policies on equity investments. The effect of domestic deployment policies is stronger: (i) in early years of the industry life cycle, (ii) for firms positioned downstream in the value chain, and (iii) for firms that are specialized in the pursued technology. Finally, technology stream did not appear to be a moderator. Deployment policies not only drove equity investments in more mature technologies, but were also a driver for emerging technologies. The main implication of this study is that domestic deployment policies suffer from significant investment spillovers, which decrease the effectiveness of these policies as a local industrial policy. However, the moderator effects showed detailed insights in which situation policymakers can expect smaller spillover effects, and domestic deployment can be used as a local industrial policy. This study therefore provides valuable insights for policymakers on the effectiveness of domestic deployment policies. The key findings are robust to the inclusion of year/country fixed effects, different model types, and different (in)dependent variables. Furthermore, the instrumental variable approach showed that there is most likely a causal relationship between deployment policies and equity investment activity.

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Appendix A REASONS FOR EXCLUSION

Table 24 Reasons for exclusion when target and acquirer are both not active in PV industry

Industry	Keywords	Example
Concentrated Solar Photovoltaic	- Solar thermal - Solar concentrator - Thermodynamic solar plant - Solar collector	Concentrated solar photovoltaic panels developer. Concentrated solar photovoltaic panels manufacturer
Solar Water Heating	- Solar boiler - Solar collector - Solar thermal - Solar heating system - Solar pool heating	Solar water heater and space heating device manufacturer
Solar System Applications	- Solar (-powered) battery - Solar (-powered) calculator - Solar (-powered) LED - Solar (-powered) lights	Silicon solar battery manufacturer
Other Industries	- Beauty products (against Solar irradiation) - Solar shading systems	The firm is active in the production and wholesale of solar shading systems

Table 25 Reasons for exclusion when target or acquirer is not active in the PV industry

Type	Explanation	Target Example	Acquirer example
Non Solar related deal	The acquirer firm is active in the solar PV industry. but is a diversified firm. It acquirer a firm that is not active in the solar PV industry	Casual clothing manufacturer	Apparel wholesaler. Food products wholesaler. LNG wholesaler. **Photovoltaic module** wholesaler. Power projects developer
Other type of RE technology	The acquirer firm is active in different renewable energy industry but the target is not active in the solar industry	The firm is an owner and operator of a wind farm, the Spearville 3 Wind Project.	The firm is a holding company, which owns and operates wind and **solar** farms. The company was founded in 2001.

Appendix B REPRESENTATIVENESS SAMPLE

Companies that are checked:

Kyocera, BP Solar, Sharp Solar, AstroPower, RWE/Schott, Photowatt, Isofoton, Sanyo, Mitsubishi Electric, Kaneka, Q-Cells, Motech Industries, Suntech, Sunpower, First Solar, SolarWorld, JA Solar, Yingli Solar, Canadian Solar, Trina Solar, Gintech, NeoSolar, ReneSola, Jinko Solar, Hareon Solar, Hanwha SolarOne.

Only Sanyo and Kaneka are not included in the database.

Appendix C Countries Included

Table 26 The 39 countries that are included

Country	Code	Timeframe	# Years	# Cases
Argentina	AR	1993-2012	20	2
Austria	AT	1993-2012	20	19
Australia	AU	1993-2012	20	69
Belgium	BE	1993-2012	20	27
Bulgaria	BG	1998-2012	15	15
Brazil	BR	1993-2012	20	5
Canada	CA	1993-2012	20	155
Switzerland	CH	1993-2012	20	80
China	CN	1993-2012	20	406
Czech	CZ	1996-2012	17	24
Germany	DE	1993-2012	20	437
Denmark	DK	1993-2012	20	7
Spain	ES	1993-2012	20	186
Finland	FI	1993-2012	20	4
France	FR	1993-2012	20	179
United Kingdom	GB	1993-2012	20	52
Greece	GR	1993-2012	20	10
Hong Kong	HK	1993-2012	20	36
Hungary	HU	1993-2012	20	5
Israel	IL	1993-2012	20	25
India	IN	1993-2012	20	66
Italy	IT	1993-2012	20	287
Japan	JP	1993-2012	20	92
South Korea	KR	1993-2012	20	155
Luxembourg	LU	1993-2012	20	9
Malaysia	MY	1993-2012	20	15
Netherlands	NL	1993-2012	20	34
Norway	NO	1993-2012	20	22
Poland	PL	1993-2012	20	4
Portugal	PT	1993-2012	20	8
Romania	RO	1996-2012	17	4
Russia	RU	1995-2012	18	4
Sweden	SE	1993-2012	20	30
Singapore	SG	1993-2012	20	18
Slovakia	SK	1996-2012	17	7
Thailand	TH	1993-2012	20	30
Taiwan	TW	2002-2012	11	164
Ukraine	UK	1999-2012	14	19
United States	US	1993-2012	20	932

Appendix D FIRMS INCLUDED

Table 27 The 119 firms that are included

Name	Timeframe	Name	Timeframe
3S Industries	2004-2008	**Payom Solar**	2005-2011
Acro Energy Technologies	2007-2010	**Perfectenergy International**	2006-2011
Advanced Energy Industries	1995-2012	**Phoenix Solar**	2002-2012
Akeena Solar	2005-2012	**Power-One**	1997-2011
aleo Solar	2002-2012	**Powerbags**	2006-2008
Alerion Clean Power	1993-2012	**PowerFilm**	2003-2012
Apollo Solar Energy	1995-2012	**Premier Power Renewable Energy**	2006-2011
ARISE Technologies	2004-2010	**PV Enterprise Sweden**	2003-2010
Ascent Solar Technologies	2005-2012	**Q-Cells**	2002-2011
Canadian Solar	2004-2012	**Ralos New Energies**	1996-2010
CBD Energy	2001-2012	**Real Goods Solar**	2006-2012
Centrosolar	2004-2012	**REC Solar**	2010-2012
Centrotherm Photovoltaics	2004-2011	**ReneSola**	2004-2012
Cervin	2006-2009	**Renewable Energy Asia Solar Power**	2003-2012
China Singyes Solar Technologies	2005-2012	**Renewable Energy Corp**	2003-2012
China Solar Energy	1992-2012	**Risen Energy**	2007-2012
China Technology Development	2000-2011	**Roth & Rau**	2004-2012
China Technology Solar Power	2001-2012	**S-Energy**	2008-2012
Clear Skies Solar	2005-2010	**SAG Solarstrom**	2000-2012
Comtec Solar Systems Group	2006-2012	**SDN**	2005-2012
Conergy	2002-2012	**Shanghai Chaori Solar**	2009-2012
Danen Technology	2008-2012	**Shenglong PV-Tech**	2011-2011
Day4 Energy	2005-2011	**Shenzhen Topraysolar**	2007-2012
Delsolar	2004-2012	**Shunfeng Photovoltaic**	2008-2012
Dyesol	2005-2012	**SMA Solar Technology**	2004-2012
E-Ton Solar	2002-2012	**Solar & Tech**	2002-2012
EDF Energies Nouvelles	2002-2010	**Solar EnerTech**	2006-2011
Eging Photovoltaic Technology	2000-2012	**Solar Millennium**	2003-2010
Energy Conversion Devices	1990-2011	**Solar Power**	2006-2012
Entech Solar	1998-2010	**Solar Thin Films**	2006-2009
ErSol Solar Energy	2002-2008	**Solar-Fabrik**	2000-2012
Etrion	2001-2012	**Solar2**	2005-2007
Evergreen Solar	1998-2010	**SolarCity**	2010-2012
Eversol	2008-2012	**Solarfun Power**	2004-2012
First Solar	2003-2012	**Solargiga Energy**	2004-2012
GCL-Poly Energy	2004-2012	**SolarHybrid**	2007-2010
Gigasolar Materials	2007-2012	**Solaria Energía y Medio Ambiente**	2003-2012
Gintech Energy	2005-2012	**Solarparc**	2000-2011
Green Energy Technology	2004-2012	**Solarpraxis**	2003-2011
Greenvision Ambiente	2002-2011	**Solartech Energy**	2005-2012
GT Advanced Technologies	2007-2012	**Solartron**	2003-2011
Hareon Solar Technology	2002-2012	**SolarWorld**	1998-2012
Highlight Tech	2001-2012	**Solon**	1997-2010
ICP Solar Technologies	2005-2009	**Solutronic**	2009-2011
JA Solar	2005-2012	**Sungrow Power Supply**	2008-2012
Jenn Feng New Energy	2001-2012	**SunPack Tech**	2005-2010
Jetion Solar	2005-2009	**SunPower**	2003-2012
Jiangsu Sunrain Solar Energy	2011-2012	**Suntech Power Holdings**	2003-2011
Join Energy	1999-2009	**Sunways**	2000-2011
Kenmec Mechanical Engineering	2001-2012	**Sustainable Energy Technologies**	2005-2012
Kerself	2002-2011	**Systaic**	2005-2009
Kitagawa Seiki	1998-2012	**Tainergy Tech**	2008-2012
LDK Solar	2006-2012	**TerniEnergia**	2006-2011
Meyer Burger Technology	2005-2012	**Trony Solar Holdings**	2008-2011
Mosel Vitelic	1996-2012	**Tynsolar**	2006-2012
Motech Industries	2001-2012	**Ubiquitous Energy**	2007-2012
Neo Solar Power	2005-2012	**Websol Energy Systems**	2006-2012
Nexolon Co	2010-2012	**West Holdings**	2006-2012
NPC	2005-2012	**Yingli Green Energy**	2006-2012
OPEL Technologies	2005-2011		

Appendix E INSTALLED SOLAR PV CAPACITY IN MW

Table 28 Installed solar PV capacity for the 39 countries over 20 years

Country	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Australia	5.3	6.3	7.3	8.9	10.7	12.7	15.7	18.7	22.5	25.3	29.2	33.6	39.1	45.6	52.3	61.0	70.0	82.0	105.0	184.0	570.9	1412.0	2412.0
Austria	0.0	0.0	0.0	0.2	0.5	0.8	1.1	1.6	2.3	3.1	4.3	5.5	9.7	16.2	20.5	22.0	35.0	39.0	49.0	53.0	95.0	173.8	418.0
Belgium	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.2	1.7	2.0	4.0	20.0	62.0	386.0	904.0	1812.0	2650.0
Brazil	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	20.0	30.0	45.0
Bulgaria	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	1.0	6.0	17.0	132.7	933.0
Canada	0.6	0.8	1.0	1.2	1.5	1.9	2.6	3.4	4.5	5.8	7.2	8.8	10.0	11.8	13.9	16.7	20.0	26.0	33.0	95.0	108.0	497.0	765.0
Chile	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	6.0
China	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19.0	23.5	42.0	52.0	62.0	70.0	80.0	100.0	140.0	305.0	825.0	3325.0	8325.0
Czech Republic	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	4.0	40.0	465.0	1000.0	1959.0	2022.0
Denmark	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.4	0.5	1.0	1.5	1.5	1.6	1.9	2.3	2.7	2.9	3.1	3.3	5.0	7.0	16.7	391.0
Finland	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	1.0	1.2
France	1.3	1.5	1.8	2.1	2.4	2.9	4.4	6.1	7.6	9.1	11.3	13.9	17.2	21.1	26.0	33.0	43.9	75.2	80.0	263.0	893.0	2924.0	4027.0
Germany	1.6	2.6	5.7	9.0	12.5	17.8	27.9	41.9	53.9	69.5	113.8	194.7	278.1	431.1	1034.1	1926.1	2759.1	3835.6	5333.0	9800.0	17320.0	24807.0	32698.0
Greece	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.5	0.7	0.9	1.0	5.0	9.0	12.0	46.0	202.0	624.0	1543.0
Hungary	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	1.0	2.0	4.0	3.7
India	0.0	0.0	0.0	0.0	0.0	0.3	0.7	1.5	3.0	4.0	7.0	11.0	23.0	40.0	55.0	85.0	95.0	110.0	160.0	190.0	240.0	500.0	1096.0
Ireland	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.4	0.4	0.5	0.6	0.6	0.7	0.7
Israel	0.2	0.2	0.3	0.3	0.3	0.4	0.4	0.5	0.5	0.6	0.6	0.7	0.8	0.8	0.9	1.0	1.3	1.8	3.0	25.0	70.0	190.0	250.0
Italy	2.6	5.1	8.5	12.1	14.1	15.8	16.0	16.7	17.7	18.5	19.0	20.0	22.0	26.0	30.7	37.5	50.0	87.0	432.0	1142.0	3470.0	12764.0	16361.0
Japan	10.2	14.3	19.0	24.3	31.2	43.4	59.6	91.3	133.4	208.6	330.2	452.8	636.8	859.6	1132.0	1422.0	1708.0	1919.0	2144.0	2627.0	3618.0	4914.0	6914.0
Korea	1.1	1.3	1.5	1.6	1.7	1.8	2.1	2.5	3.0	3.5	4.0	4.8	5.4	6.0	8.5	14.0	36.0	81.0	357.0	524.0	650.0	812.0	1064.0
Luxembourg	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	14.0	17.0	19.0	21.0	24.0	25.0	26.0	29.0	30.0	47.0
Malaysia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	5.5	7.0	8.8	11.1	12.6	13.5	36.0
Netherlands	0.9	1.1	1.3	1.6	2.0	2.4	3.3	4.0	6.5	9.2	12.8	20.5	26.3	45.7	49.2	50.7	52.2	52.8	57.0	68.0	88.0	118.0	321.0
Norway	2.8	3.3	3.8	4.1	4.4	4.7	4.9	5.2	5.4	5.7	6.0	6.2	6.4	6.6	6.9	7.3	7.7	8.0	8.3	8.7	9.1	9.2	9.5
Poland	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.4	0.6	1.0	1.5	2.0	1.8	3.4
Portugal	0.0	0.0	0.0	0.1	0.1	0.2	0.3	0.5	0.6	0.9	1.1	1.3	1.7	2.1	2.7	3.0	3.4	24.0	59.0	115.0	131.0	143.6	228.0
Romania	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	30.0
Singapore	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	1.2	3.5	4.0	5.3
Slovak Republic	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	144.0	488.2	517.0
Spain	1.0	1.0	3.9	4.6	5.6	6.5	6.9	7.1	8.0	9.1	12.1	15.7	20.5	27.0	37.0	60.0	169.0	739.0	3389.0	3488.0	3916.0	4889.0	4516.0
Sweden	0.0	0.0	0.0	0.2	0.5	0.8	1.0	1.3	1.6	1.8	2.0	2.2	2.5	2.8	3.1	3.4	4.0	5.4	8.0	9.0	11.0	18.7	23.0
Switzerland	0.0	1.0	3.0	4.1	5.0	5.8	6.7	8.0	9.8	11.7	13.6	15.9	17.8	19.3	21.4	25.4	28.0	34.5	45.0	71.0	111.0	216.0	416.0
Taiwan	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.4	2.4	5.6	9.5	22.0	117.9	222.0
Thailand	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	40.0	50.0	170.0	377.0
Ukraine	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	190.0	378.0
United Kingdom	0.0	0.0	0.1	0.3	0.4	0.4	0.5	0.6	0.7	1.1	1.9	2.7	4.1	5.9	8.2	10.9	14.3	18.1	22.5	27.0	77.0	925.0	1657.0
United States	39.8	47.9	48.0	50.0	58.0	67.0	77.0	88.0	100.0	156.0	176.0	213.0	255.0	293.0	363.0	493.0	698.0	974.0	1153.0	1614.0	2902.0	4431.0	7777.0

Appendix F CORRELATION MATRIX COUNTRY MODEL

Table 29 Correlation matrix for the country level analysis

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	**LogDsize**	1															
2	**LogFsize**	0.4988	1														
3	**logdsizeXlogfsize**	**0.9711**	0.5831	1													
4	**GDP growth**	-0.1573	-0.0823	-0.1460	1												
5	**GDP / capita**	0.1875	0.1756	0.1598	-0.1883	1											
6	**Inflation**	-0.1741	-0.1854	-0.1464	-0.1174	-0.3062	1										
7	**Taxlevels**	0.0689	-0.4458	-0.0361	-0.0769	-0.0036	0.0105	1									
8	**Stockturnover**	0.3318	0.1442	0.3027	0.0023	0.0320	0.0119	0.0780	1								
9	**McapGDP**	-0.1442	-0.1560	-0.1340	-0.0628	-0.1780	0.2005	0.0344	-0.0266	1							
10	**McapGrowth**	0.1334	0.1186	0.1180	0.1399	0.4428	-0.2303	-0.2445	0.0946	-0.2304	1						
11	**Unemployment**	-0.0516	-0.0716	-0.0320	-0.1597	-0.2991	0.1040	0.1031	-0.1769	0.0744	-0.3527	1					
12	**Uncertainty**	0.2567	0.2881	0.2946	-0.0739	0.0517	-0.0442	-0.1441	-0.0575	-0.0902	-0.0383	0.0209	1				
13	**CountryTotal**	0.0047	0.1212	-0.0028	-0.0495	**0.7362**	-0.2536	-0.1383	0.0213	-0.1378	0.5927	-0.2536	-0.0104	1			
14	**Governance**	0.1003	-0.0792	0.0583	-0.1986	**0.7902**	-0.3814	0.0497	0.0513	-0.1764	0.3914	-0.2042	-0.0015	0.7123	1		
15	**Fichtrating**	0.1983	-0.0515	0.1404	-0.0817	0.6870	-0.4898	0.0991	0.1808	-0.1625	0.3443	-0.2501	0.0189	0.5716	**0.8645**	1	
16	**Population**	0.1742	0.0058	0.1502	0.3451	-0.3771	0.0345	0.1465	0.2630	0.0870	-0.0984	-0.1032	-0.0597	-0.2633	-0.4323	-0.2155	1

Appendix G QUANTILE PLOTS COUNTRY VALUE MODEL

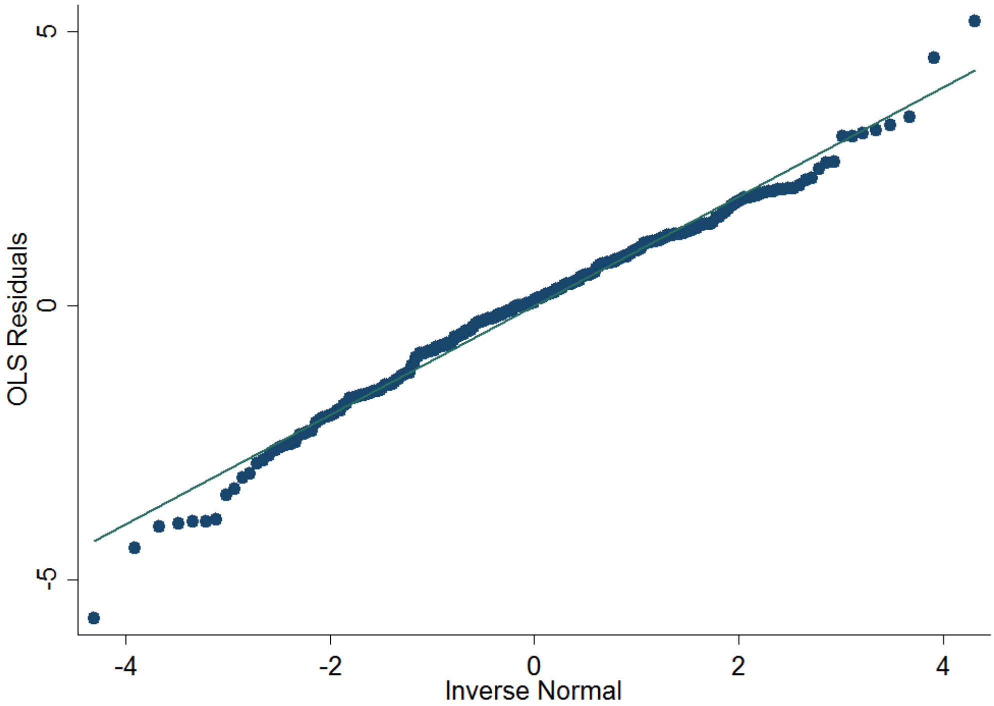

Figure 12 Q-Q plot for the OLS country model

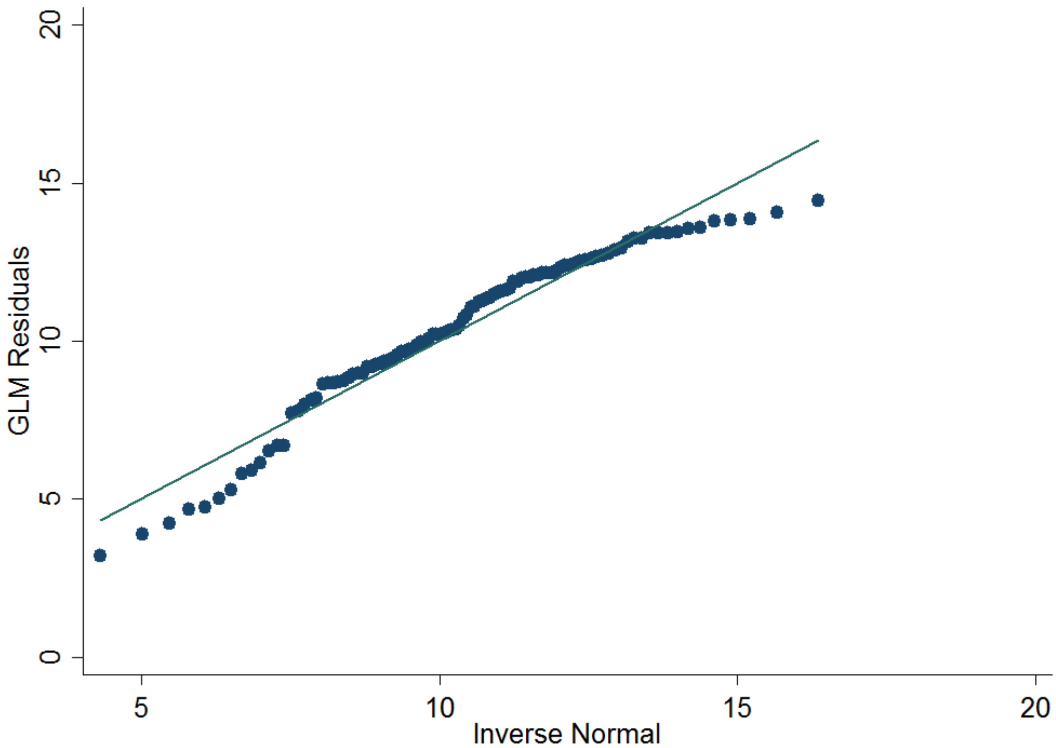

Figure 13 Q-Q plot for the GLM country model

Appendix H CORRELATION MATRIX FIRM GROWTH MODEL

Table 30 Correlation matrix for the firm growth analysis

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1	**LogDsize**	1																						
2	**LogFsize**	0.463	1																					
3	**ROA**	0.040	0.089	1																				
4	**CumMA**	0.398	0.189	0.030	1																			
5	**CumAlliances**	0.106	0.173	0.035	0.166	1																		
6	**RDintensity**	0.024	-0.001	-0.067	-0.039	0.039	1																	
7	**Uncertainty**	0.262	0.523	0.045	-0.044	-0.040	-0.061	1																
8	**Unemployment**	0.420	-0.040	-0.032	0.246	0.082	0.103	-0.110	1															
9	**Taxlevels**	0.270	-0.381	-0.073	0.149	0.080	0.109	-0.491	0.491	1														
10	**Inflation**	0.088	0.030	-0.045	0.032	0.044	0.008	0.136	-0.253	0.041	1													
11	**GDPgrowth**	-0.162	0.046	0.033	-0.128	-0.059	-0.080	0.073	-0.402	-0.290	0.286	1												
12	**Stockturnover**	0.231	0.151	0.056	0.089	0.088	0.083	-0.112	0.157	0.289	0.055	-0.154	1											
13	**McapGDP**	-0.305	-0.015	-0.001	-0.140	-0.140	0.131	0.023	-0.223	-0.389	-0.059	0.083	-0.079	1										
14	**McapGrowth**	-0.047	0.155	0.014	-0.077	-0.054	-0.023	0.432	-0.109	-0.266	-0.099	-0.015	-0.181	0.128	1									
15	**GDP Capita**	0.198	-0.004	-0.084	0.249	0.218	0.148	-0.150	0.438	0.397	-0.102	-0.651	0.179	0.189	-0.025	1								
16	**Population**	0.199	0.122	0.045	-0.021	0.064	-0.026	0.049	-0.220	0.024	0.309	0.625	0.154	-0.220	-0.045	-0.644	1							
17	**Governance**	0.114	-0.167	-0.109	0.211	0.084	0.103	-0.166	0.508	0.320	-0.225	-0.665	-0.056	0.166	-0.056	**0.889**	**-0.802**	1						
18	**Cell**	-0.128	-0.028	0.049	-0.184	0.062	0.071	0.032	-0.025	-0.020	0.055	0.069	0.039	-0.051	0.045	-0.129	0.058	-0.151	1					
19	**Development**	0.339	0.056	-0.063	0.364	0.062	-0.071	-0.111	0.332	0.246	-0.040	-0.212	-0.018	-0.211	-0.086	0.225	-0.148	0.297	-0.254	1				
20	**DevelopXdsize**	0.431	0.122	0.008	0.403	0.090	-0.070	-0.089	0.331	0.219	-0.068	-0.213	0.004	-0.241	-0.084	0.215	-0.131	0.266	-0.247	**0.942**	1			
21	**DevelopXfsize**	0.369	0.122	-0.035	0.379	0.073	-0.072	-0.100	0.307	0.229	-0.042	-0.205	-0.010	-0.208	-0.087	0.231	-0.138	0.284	-0.250	**0.982**	**0.962**	1		
22	**CellXdsize**	0.258	0.129	0.033	-0.059	0.167	0.108	0.157	0.138	0.069	0.095	0.022	0.137	-0.151	0.031	-0.034	0.194	-0.111	**0.788**	-0.171	-0.164	-0.164	1	
23	**CellXfsize**	-0.063	0.135	0.048	-0.156	0.096	0.069	0.124	-0.038	-0.104	0.052	0.087	0.061	-0.047	0.077	-0.140	0.090	-0.187	**0.965**	-0.242	-0.233	-0.236	**0.825**	1

Appendix I QUANTILE PLOTS FIRM GROWTH MODEL

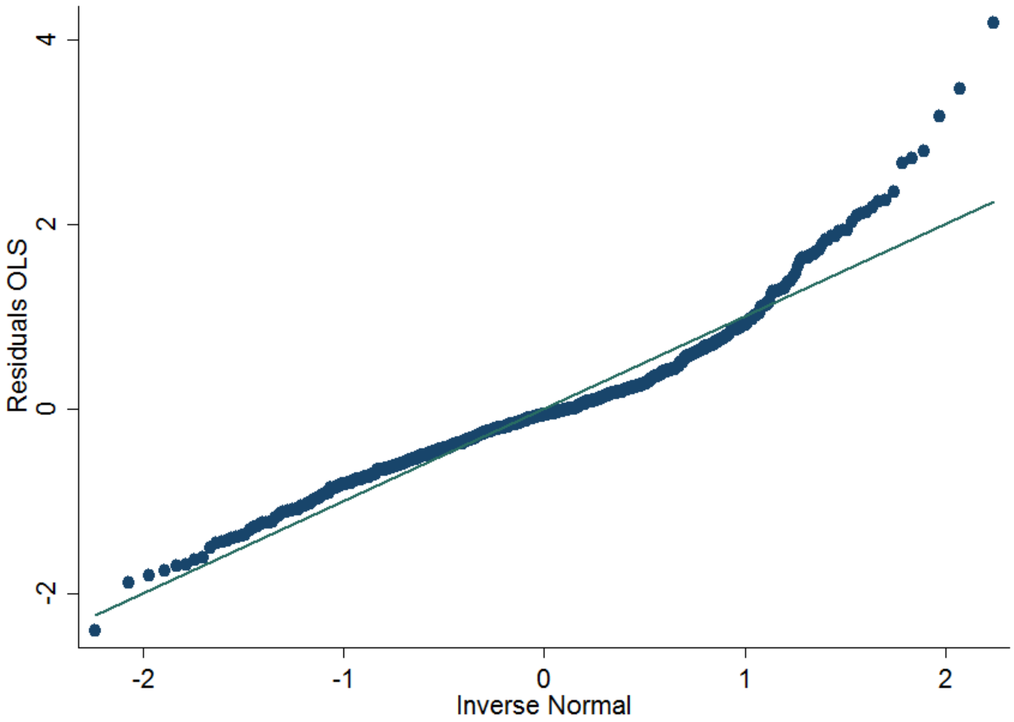

Figure 14 Q-Q plot for the OLS firm growth model

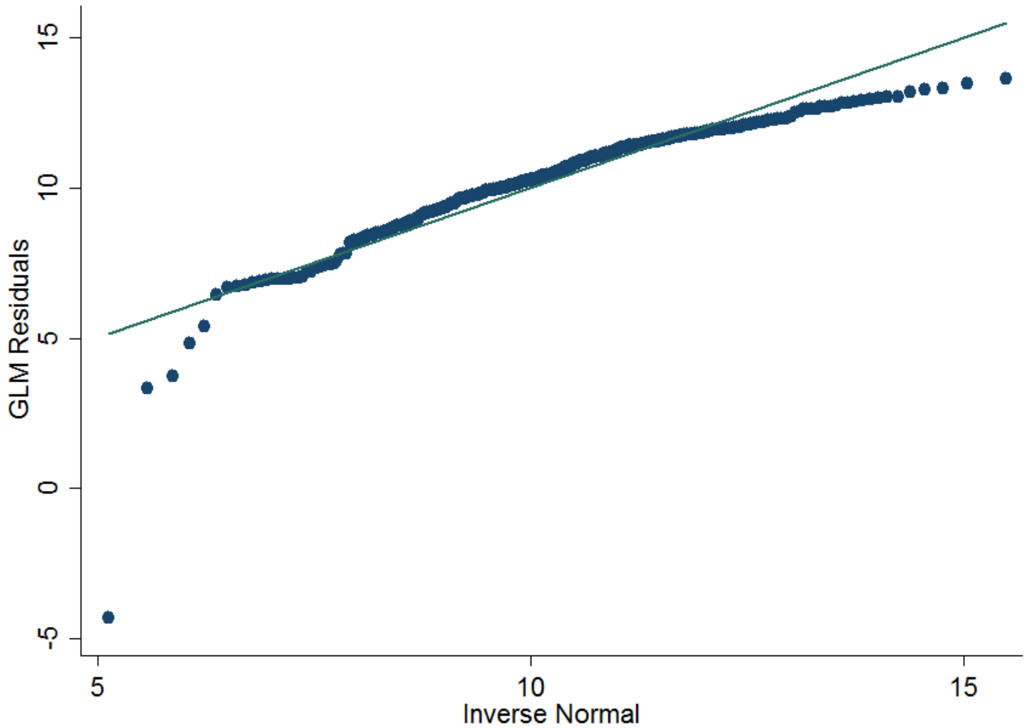

Figure 15 Q-Q plot for the GLM firm growth model

Appendix J CORRELATION MATRIX FIRM VALUE MODEL

Table 31 Correlation matrix for the firm value analysis

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1	**Net Sales**	1																							
2	**Efficiency**	0.058	1																						
3	**Profitability**	0.085	0.578	1																					
4	**Liquidity**	-0.068	0.180	0.081	1																				
5	**Solvency**	0.025	0.031	-0.019	0.045	1																			
6	**Acquired Stake**	-0.104	0.012	-0.007	-0.079	-0.048	1																		
7	**Age**	0.477	0.021	0.037	-0.013	-0.181	-0.005	1																	
8	**Firm Patents**	0.224	0.143	0.094	0.246	-0.086	-0.035	0.387	1																
9	**Firm Citations**	0.486	0.084	0.049	0.201	-0.056	-0.095	0.451	**0.753**	1															
10	**PEVC**	0.016	0.068	0.065	-0.038	0.066	-0.158	-0.089	-0.070	-0.059	1														
11	**IPO**	-0.064	0.011	0.067	0.082	0.071	0.167	-0.087	-0.081	-0.051	-0.137	1													
12	**Share Issue**	0.071	-0.038	-0.042	0.059	0.044	-0.213	0.055	0.147	0.153	-0.498	-0.203	1												
13	**Cross Border**	0.056	0.063	0.023	0.027	-0.091	0.275	0.093	0.084	-0.056	0.078	-0.075	-0.275	1											
14	**GDP / Capita**	-0.041	-0.119	-0.181	0.192	-0.206	0.179	0.038	0.220	0.162	-0.079	-0.072	-0.022	0.086	1										
15	**GDP Growth**	-0.123	-0.005	0.031	0.007	0.008	0.022	-0.043	-0.039	-0.004	-0.008	0.120	-0.055	-0.094	-0.359	1									
16	**Unemployment**	-0.096	0.020	-0.027	0.048	-0.029	0.291	-0.013	-0.025	-0.080	-0.131	0.115	0.039	0.137	0.231	-0.299	1								
17	**Population**	-0.058	0.007	0.034	0.060	0.021	-0.044	-0.008	0.068	0.035	-0.034	0.193	0.069	-0.026	0.528	0.494	-0.127	1							
18	**Taxlevels**	0.134	-0.125	-0.130	0.181	-0.053	0.061	0.226	0.273	0.236	-0.027	0.120	0.093	0.138	0.321	-0.391	0.475	0.036	1						
19	**Inflation**	-0.211	-0.087	-0.082	0.108	-0.188	-0.010	-0.023	0.029	0.003	-0.044	0.021	-0.033	0.057	-0.114	0.373	-0.152	0.335	-0.126	1					
20	**Stockturnover**	-0.005	0.010	-0.015	0.099	-0.039	0.008	0.140	0.132	0.026	-0.045	0.057	0.031	0.156	0.109	-0.154	0.296	0.232	0.457	0.241	1				
21	**Fitch**	-0.233	-0.126	-0.212	0.179	-0.195	0.282	-0.010	0.085	0.061	-0.100	0.037	-0.052	0.084	**0.719**	-0.156	0.514	-0.343	0.260	0.062	0.264	1			
22	**Governance**	0.055	-0.093	-0.167	0.093	-0.047	0.145	0.079	0.073	0.078	-0.038	-0.076	-0.008	0.047	**0.827**	-0.503	0.402	-0.733	0.389	-0.293	0.039	0.688	1		
23	**McapGDP**	-0.110	-0.124	-0.137	0.104	-0.057	-0.009	-0.084	0.092	0.104	-0.033	-0.008	-0.015	-0.054	0.195	0.289	-0.316	-0.057	-0.272	-0.107	-0.330	0.050	-0.048	1	
24	**McapGrowth**	-0.040	0.042	0.025	-0.014	0.044	0.051	-0.110	-0.056	-0.060	-0.040	-0.064	-0.043	-0.052	-0.003	0.019	-0.121	-0.112	-0.379	-0.018	-0.293	-0.110	-0.048	0.092	1

Appendix K FINANCIAL RATIOS

Table 32 The tested financial ratios

Types	Ratio's	Adjusted R Square
Solvency	Debt/Capital	0.413
	Debt/Equity	0.411
	Short term debt/total debt	**0.418**
	Total debt / Total liabilities	0.414
Profitability	Gross profit margin	0.441
	Operating profit margin	0.422
	Return on equity	0.419
	Return on Assets	**0.446**
Liquidity	Current Ratio	0.415
	Quick Ratio	0.415
	Cash Ratio	**0.424**
Efficiency	Inventory turnover rate	0.421
	Asset turnover rate	0.421
	Equity turnover rate	**0.429**

Appendix L QUANTILE PLOTS VALUE MODEL

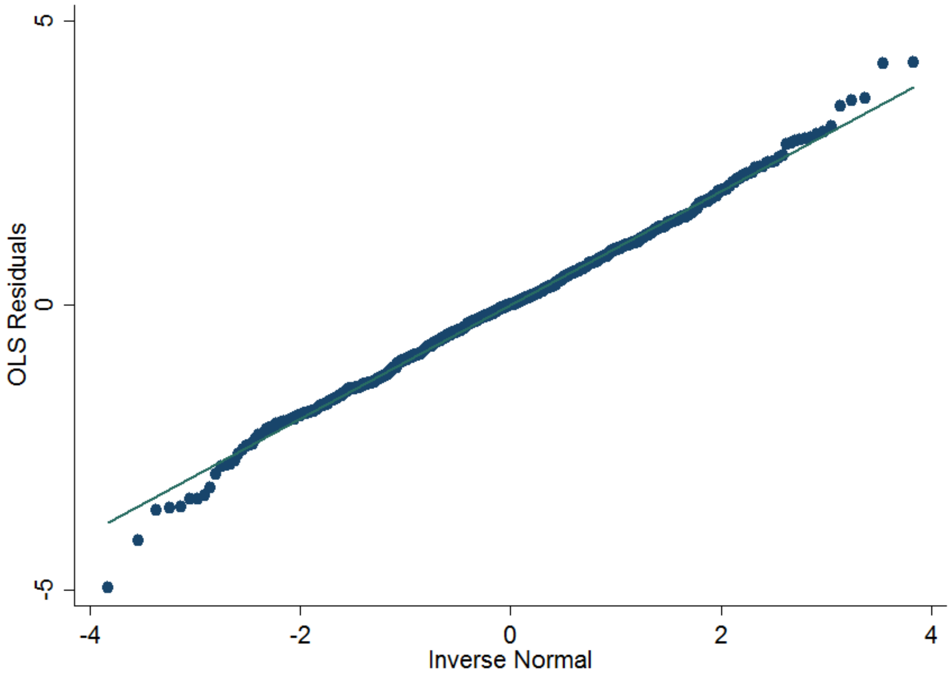

Figure 16 Q-Q plot for the OLS firm value model

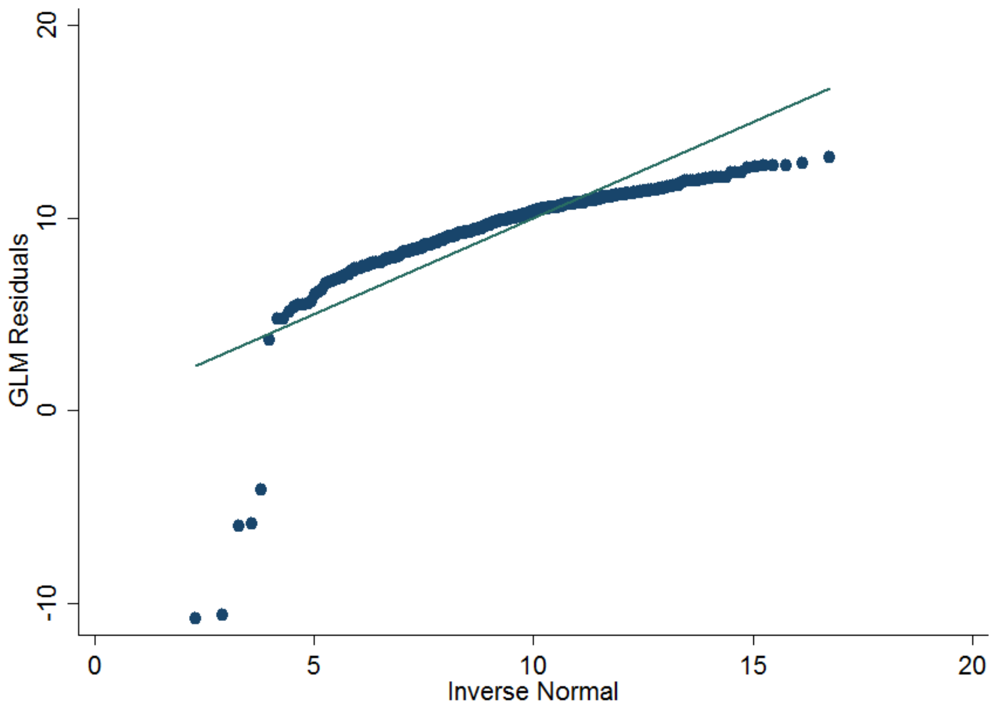

Figure 17 Q-Q plot for the GLM firm value model

Appendix M COUNTRY NUMBER WITH SAME SAMPLE AS COUNTRY VALUE

Table 33 Results for country count model with smaller sample

variables	Model 1	Model 2	Model 3	Model 4	Model 5
GDP growth	0.012	0.023	-0.027	-0.025	-0.024
	(0.021)	(0.020)	(0.019)	(0.017)	(0.017)
Inflation	0.048	0.043	0.059	0.056	0.056
	(0.027)+	(0.025)+	(0.028)*	(0.028)*	(0.027)*
Tax levels	0.012	0.028	-0.051	-0.026	-0.017
	(0.013)	(0.013)*	(0.017)**	(0.016)	(0.016)
Stock turnover	-0.000	-0.000	0.004	0.003	0.003
	(0.001)	(0.001)	(0.001)***	(0.001)**	(0.001)**
Mcap growth	0.025	0.037	0.237	0.186	0.208
	(0.102)	(0.094)	(0.124)+	(0.112)+	(0.112)+
Mcap GDP	0.001	0.002	0.008	0.007	0.007
	(0.002)	(0.002)	(0.002)***	(0.002)***	(0.002)***
Unemployment	0.010	0.022	-0.006	-0.039	-0.036
	(0.020)	(0.019)	(0.027)	(0.026)	(0.025)
Uncertainty	0.026	0.014	0.007	0.011	0.004
	(0.015)+	(0.014)	(0.021)	(0.019)	(0.019)
Country total	0.006	0.005	0.008	0.011	0.011
	(0.005)	(0.005)	(0.006)	(0.006)*	(0.006)*
Log Dsize		0.140	0.303		0.081
		(0.033)***	(0.034)***		(0.041)*
Log Fsize				0.449	0.386
				(0.037)***	(0.048)***
N	256	256	256	256	256
Log-likelihood	-652	-644	-734	-706	-704
Country FE	YES	YES	YES	YES	YES
Year FE	YES	YES	NO	NO	NO
Model	NBREG	NBREG	NBREG	NBREG	NBREG

+ p<0.1; * p<0.05; ** p<0.01; *** p<0.001

Appendix N PRE-2005 RESULTS

Table 34 Results for the pre-2005 period for the country level

variables	Pre-2005	Pre 2005
GDP growth	0.008	0.017
	(0.041)	(0.035)
Inflation	0.028	-0.001
	(0.016)+	(0.014)
Tax levels	-0.043	0.051
	(0.022)*	(0.019)**
Stock turnover	-0.002	0.006
	(0.002)	(0.002)***
Mcap growth	-0.143	0.148
	(0.248)	(0.267)
Mcap GDP	-0.005	0.000
	(0.004)	(0.002)
Unemployment	0.005	-0.018
	(0.056)	(0.031)
Uncertainty	-1.034	-5.784
	(1.567)	(3.839)
Country total	0.029	0.013
	(0.009)***	(0.004)**
Log Dsize	0.230	0.720
	(0.118)+	(0.104)***
Log Fsize	0.580	0.483
	(0.087)***	(0.103)***
N	411	411
Log-likelihood	-275	-366
Country FE	**YES**	**NO**
Year FE	**NO**	**NO**
Model	NBREG	NBREG

+ p<0.1; * p<0.05; ** p<0.01; *** p<0.001

Appendix O RESULTS FOR DIFFERENT DEAL TYPES

Table 35 Resuls for the different deal types with only domestic deployment policies

variables	MA	VC	IPO	Share
GDP growth	-0.044 (0.021)*	-0.012 (0.027)	-0.029 (0.046)	-0.111 (0.041)**
Inflation	-0.029 (0.019)	-0.003 (0.020)	-0.004 (0.040)	0.096 (0.068)
Tax levels	-0.093 (0.020)***	-0.133 (0.026)***	0.044 (0.033)	-0.017 (0.037)
Stock turnover	0.003 (0.001)**	0.004 (0.001)*	-0.001 (0.003)	0.002 (0.002)
Mcap growth	0.116 (0.144)	0.477 (0.167)**	0.660 (0.251)**	0.861 (0.264)**
Mcap GDP	0.008 (0.002)***	0.012 (0.002)***	0.020 (0.004)***	0.015 (0.004)***
Unemployment	-0.075 (0.031)*	-0.094 (0.039)*	0.061 (0.082)	-0.032 (0.076)
Uncertainty	0.034 (0.025)	0.016 (0.027)	0.121 (0.090)	0.078 (0.126)
Country MA	0.025 (0.007)***			
Log Dsize	0.432 (0.039)***	0.404 (0.048)***	0.272 (0.091)**	0.392 (0.083)***
Country VC		0.016 (0.014)		
Country IPO			-0.040 (0.085)	
Country Total				0.007 (0.010)
N	749	640	314	271
Log-likelihood	-821	-664	-180	-346
Country FE	YES	YES	YES	YES
Year FE	NO	NO	NO	NO
Model	NBREG	NBREG	NBREG	NBREG

+ p<0.1; * p<0.05; ** p<0.01; *** p<0.001

Appendix P PERCENTAGE M&A DEALS

Table 36 Percentage of M&A deals for the different moderators

Type	Percentage MA
Value Chain	
Silicon	20%
Wafer	17%
Cell	16%
Module	18%
Development	25%
Equipment	19%
Operation	31%
Technology Stream	
Silicon	35%
Thin Film	26%
Emerging	27%
Firm Diversification	
Diversified	41%
Specialized	47%
Time Period	
Pre 2008	50%
After 2008	46%

Appendix Q RESULTS IV ANALYSIS

Table 37 Resuls for IVM analysis without uncertainty as control

	Model IV6	Model IV7	Model IV8	Model IV9	Model IV10
GDP growth	-0.089 (0.025)***	-0.043 (0.023)+	-0.267 (0.033)***	-0.119 (0.027)***	-0.044 (0.023)+
Inflation	-0.033 (0.046)	0.011 (0.045)	-0.365 (0.093)***	-0.068 (0.055)	0.004 (0.048)
Tax levels	-0.101 (0.021)***	-0.031 (0.019)	-0.159 (0.035)***	-0.159 (0.025)***	-0.022 (0.021)
Stock turnover	0.004 (0.002)*	0.001 (0.002)	-0.006 (0.002)**	0.004 (0.002)+	0.001 (0.002)
Mcap growth	0.101 (0.193)	0.230 (0.178)	0.354 (0.231)	-0.215 (0.209)	0.098 (0.180)
Mcap GDP	0.005 (0.003)+	0.006 (0.003)*	-0.017 (0.006)**	0.004 (0.003)	0.006 (0.003)*
Unemployment	-0.146 (0.036)***	-0.119 (0.032)***	-0.846 (0.066)***	-0.170 (0.039)***	-0.120 (0.033)***
Country total	0.026 (0.006)***	0.015 (0.006)*	-0.054 (0.013)***	0.022 (0.006)***	0.010 (0.006)+
Log Dsize	0.454 (0.048)***	0.206 (0.048)***			
Log Fsize		0.500 (0.055)***			0.582 (0.049)***
Wind			0.001 (0.000)***		
Biogas			-0.005 (0.001)***		
Biomass			-0.005 (0.000)***		
Wind R&D			-0.028 (0.003)***		
Geothermal			-0.030 (0.006)***		
IV LogDsize				0.242 (0.050)***	0.143 (0.042)***
N	450	450	450	450	450
Log-likelihood	-595	-552	-2,184	-625	-555
Country FE	YES	YES	YES	YES	YES
Year FE	NO	NO	YES	NO	NO
Model	NBREG	NBREG	NBREG	NBREG	NBREG

+ p<0.1; * p<0.05; ** p<0.01; *** p<0.001