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Venture capital investment : une perspective asiatique

Muhammad Iqbal

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Muhammad IQBAL

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Venture Capital Investment: An Asian Perspective

Sous la direction de:

Professeure Dr. Stéphanie SERVE

Université Paris-Est, Créteil, France

Soutenance le 25 novembre 2021

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Trois des quatre chapitres de la thèse (2, 3 et 4) sont issus d'articles de recherche rédigés en anglais et dont la structure est autonome. Par conséquent, les termes "papier" ou "article" y font référence, et certaines informations, notamment la littérature, peuvent être reprises dans les différents chapitres de la thèse.

Notice

Three out of four chapters of this dissertation are autonomous essays and so-called "paper" or "article. Consequently, some material, especially related literature, may be repeatedly used in different chapters of the dissertation.

This work is dedicated to my beloved Parents: My father Late Wali Bukhsh and my mother Naz

Venture Capital Investment: An Asian Perspective

Summary

Venture Capital (VC) is the most appealing and tailored form of equity financing for young and innovative companies. Because they are risky and lack track records and collaterals to pledge for loans, these firms suffer from high information asymmetries and cannot rely on credit banking nor financial markets. Two peculiar characteristics of VC distinguishes it from other funding. First, VC firms provide not only financial resources but also managerial and administrative skills to innovative entrepreneurial firms and, consequently, may have value-adding effects. Second, they are risk-takers and believers in the well-known notion of high risk-high return. National Venture Capital Association (NVCA) defines VC as: “Money provided by professionals who invest alongside management in young, rapidly growing companies that have the potential to develop into significant economic contributors”.

However, the VC industry is characterized by strong heterogeneity according to the type of VC firm and to the geographical area. More specifically, in developing Asia, VC industry is less mature and developed than in the US and Europe. Relying both on the institutional specificities of developing Asia and on the peculiar characteristics of different types of VC firms, this thesis explores several aspects of VC financing, from exit performance to drivers of VC activity by comparison to Foreign Direct Investments.

This thesis is composed of four chapters. Chapter 1 provides comparative elements between the US, Europe and developing Asia regarding the history and evolution of VC activity and its economic importance to highlight the specificities of VC industry in the geographical area of the research. It also discusses the key drivers of VC investment and outlines salient differences based on the institutional framework in terms of screening and selection of projects, value addition, and exit mechanism of the portfolio companies.

Chapter 2 investigates the exit performance of companies backed by government venture capital (GVC) compared with that of firms backed by independent venture capital (IVC) in developing Asia. Using a sample of 3,817 firms from 9 Asian developing countries over 26 years (1991-2017), we develop several econometric models with robustness checks and control for endogeneity and selection bias. We first show that GVC-backed firms are more likely to be financed in the early stage than IVC-backed firms. In doing so, GVC absorbs the higher probability of unsuccessful exit associated with firms financed in the early stage. In contrast, we find that in the expansion stage and later stage, GVC-backed firms perform better than IVC-backed ones. Overall, we show that GVC-backed firms outperform IVC-backed firms in terms of successful exits. We thus challenge the hypothesis of GVC underperformance tested in the existing literature

on other geographical areas. Finally, we also provide evidence that mixed syndication (combination of GVC and IVC) improves the exit performance of ventures.

Chapter 3 explores the investment behavior, the exit performance and the optimal exit route choice of Corporate Venture Capital (CVC)-backed entrepreneurial companies in comparison with GVC-backed entrepreneurial firms in developing Asia. We study a sample of 1,198 companies that received their first investment either from a CVC firm or from a GVC firm over the 1999-2013 period, in five Asian developing countries. Using the same kind of econometric tools as in Chapter 2, we first show that CVC firms are more likely to invest in high-tech companies as compared with GVC firms. Our results also highlight that GVC-backed firms are more likely to go successful, especially through Initial Public Offerings (IPO), as compared with CVC-backed companies.

Chapter 4 investigates the impact of Foreign Direct Investment (FDI) on the hosts country's domestic VC industry. We studied a sample of 7 Asian developing countries over the 2000-2018 period. Employing Autoregressive Distributed Lags (ARDL) model (Mean Group (MG) and Pooled Mean Group (PMG) estimators), we find that FDI has no effect on VC activity in the short run. By contrast, our results exhibit the significant and positive effect of FDI on domestic VC activity in the long run: it appears that, due to positive externalities and spillover effects, FDI complements domestic VC investments and helps in the creation of new VC-backed companies.

The last chapter concludes the thesis. After a sum-up of the main results, it highlights the contribution of the thesis and its implications. It also underlines some limitations and suggests several avenues for future research.

Investissements en capital-risque : Une perspective asiatique

Résumé

Le Capital-Risque (CR) est la forme de financement par capitaux propres la plus prisée et, de fait, la plus adaptée pour les entreprises jeunes et innovantes qui ont besoin de lever des fonds mais ont difficilement accès au marché du crédit bancaire ou aux marchés financiers. Ce mode de financement présente des spécificités par rapport aux autres modes précités. Premièrement, le financement par capital-risque se distingue par un accompagnement à la fois financier et non financier. En plus de l'apport de fonds, les entreprises financées par capital risque peuvent, en effet, bénéficier de conseils en gestion et/ou de transmission de connaissances susceptibles de contribuer significativement à la création de valeur. Deuxièmement, les sociétés de capital-risque prennent des risques élevés dans l'optique d'obtenir une rentabilité élevée sur leurs investissements. La définition proposée par la National Venture capital Association (NVCA) résume la double spécificité de ce financement : "argent fourni par des professionnels qui investissent, aux côtés de la direction, dans de jeunes entreprises à croissance rapide qui ont le potentiel de devenir des contributeurs économiques importants".

Cependant, l'industrie du capital-risque présente des caractéristiques hétérogènes suivant le type de fond de capital-risque, mais également selon la zone géographique étudiée. Plus spécifiquement, l'industrie du capital-risque en Asie est sensiblement différente de ses homologues occidentaux - États-Unis et Europe - car elle correspond à une trajectoire d'évolution temporelle plus récente et qu'elle y est donc moins mature. En se basant sur les spécificités de l'industrie asiatique du capital-risque, la thèse a pour objectif d'étudier la performance des entreprises financées par capital-risque en fonction du type de société de capital-risque ainsi que les déterminants de l'activité de capital-risque au regard de celle en termes d'investissements direct étrangers (IDE).

Cette thèse se compose de quatre chapitres : un premier chapitre présente des éléments de contexte institutionnel et économique comparatifs de l'industrie du capital-risque aux États-Unis, en Europe et en Asie afin de mettre en lumière les spécificités de la zone géographique étudiée. Il fait ressortir les différences en matière de sélection des projets, de création de valeur et de mécanisme de sortie des entreprises financées par capital-risque.

Le chapitre 2 étudie les performances de sortie des entreprises financées par des sociétés de capital-risque dites captives car le gouvernement y est majoritaire - ces sociétés sont appelés Government Venture Capital (GVC) - par comparaison avec celles d'entreprises financées par des sociétés de capital-risque dites indépendantes (Independent Venture Capital – IVC). Au moyen d'un échantillon composé de 3 817 entreprises de neuf pays asiatiques en développement sur une période de 26 ans (1991-2017), nous

développons plusieurs modèles économétriques que nous soumettons à des tests de robustesse et de contrôle de l'endogénéité et du biais de sélection. Nous montrons d'abord que les entreprises financées par GVC sont plus susceptibles de l'être dans la phase d'amorçage (early stage) que les entreprises financées par les IVC. Ce faisant, les GVC absorbent une probabilité d'échec de sortie plus élevée. En revanche, nous mettons en évidence qu'au cours des phases de développement et de maturité (expansion et mature stages), les entreprises financées par GVC obtiennent de meilleurs résultats que celles financées par les IVC. Toutes phases confondues, il ressort de notre étude que les entreprises financées par GVC enregistrent un meilleur taux de succès de sortie que celles financées par des IVC. Ce résultat est novateur puisqu'il va à l'encontre des constats de sous-performance associée aux GVC et mis en évidence dans des études empiriques sur d'autres zones géographiques. Enfin, cette étude s'intéresse au rôle de la syndication et met en lumière un autre résultat intéressant : sur notre échantillon, la syndication mixte (combinaison de GVC et IVC) améliore les performances de sortie des entreprises par comparaison avec la syndication pure (IVC) ou le financement non syndiqué.

Le chapitre 3 poursuit l'investigation de la performance des entreprises financées par des sociétés de capital-risque dites captives. Plus spécifiquement, il explore le comportement d'investissement, la performance de sortie et le choix de la voie de sortie optimale des entreprises financées par des sociétés de capital risque d'entreprise (Corporate Venture Capital, CVC) par comparaison avec des entreprises financées par GVC dans les pays asiatiques en développement. C'est, à notre connaissance, la première étude qui compare la performance de deux types de société de capital-risque captives. Nous avons étudié un échantillon de 1 198 entreprises qui ont reçu leur premier investissement d'un GVC ou d'un CVC entre 1999 et 2013 (15 ans) dans cinq pays asiatiques en utilisant le même type d'outils économétriques que dans le chapitre 2. Nous montrons, en premier lieu, une appétence des capital risqueurs d'entreprise (CVC) pour l'investissement dans les secteurs de haute technologie par comparaison avec des entreprise de capital risque gouvernemental (GVC). En matière de performance de sortie, les entreprises financées par des CVC affichent un meilleur taux de succès, plus spécifiquement par le biais d'une introduction en bourse (IPO), par comparaison avec des entreprises financées par des GVC.

Le chapitre 4 étudie, pour la première fois à notre connaissance, l'impact de l'investissement direct étranger (IDE) sur l'industrie du capital-risque du pays hôte au moyen d'un échantillon de sept pays en développement asiatiques sur la période 2000 à 2018. En utilisant le modèle ARDL (Autoregressive Distributed Lags) - estimateurs Mean Group (MG) et Pooled Mean Group (PMG) - nous constatons que les IDE n'ont aucun effet, à court terme, sur cette industrie. En revanche, nos résultats mettent en exergue un effet significatif et positif des IDE sur l'activité de capital-risque domestique en raison des externalités positives et des effets d'entraînement, à long terme.

Le dernier chapitre conclut la thèse. Ce chapitre récapitule les résultats et la contribution de la thèse et présente les implications. En outre, ce chapitre souligne également les limites de la thèse et suggère des pistes pour les recherches futures.

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List of Abbreviations

| | |
|--------|--|
| ADF | Augmented Dickey-Fuller |
| AIC | Akaike Information Criterion |
| ARDL | Autoregressive Distributive Lags |
| CVC | Corporate Venture Capital |
| ECT | Error Correction Term |
| FDI | Foreign Direct Investments |
| FE | Fixed Effects |
| GFC | Global Financial Crisis |
| GMM | Generalized Method of Momentum |
| GVC | Government Venture Capital |
| Heckit | Heckman Two-Step Estimators |
| IPS | Im, Pesaran and Shin |
| IVC | Independent Venture Capital |
| LLC | Levin Lin and Chu |
| MG | Mean Group |
| MNC | Multinational Companies/corporations |
| NVCA | National Venture Capital Association |
| PMG | Pooled Mean Group |
| PSM | Propensity Score Matching |
| RE | Random Effect |
| TGCF | Total Gross Capital Formation |
| UNCTAD | United Nations Conference on Trade and Development |
| US | United States of America |
| USD | United State Dollar |
| VC | Venture Capital |
| VCI | Venture Capital Investments |
| WDI | World Development Indicator |
| WW-II | World War II |

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General Introduction

General Introduction

1 Definition of Venture Capital and Typology of VC firms

Technology-based companies are generally viewed as drivers of economic growth because they proved to be the key component of knowledge-based economies, significantly contributing to the national innovation system and employment generation (Audretsch, 1995). Therefore, their survival and growth have been the prime concern for policymakers. However, high-tech entrepreneurial firms face severe financial constraints. Because they are risky and lack track records and collaterals to pledge for loans, they suffer from high information asymmetries and cannot rely on credit banking nor financial markets (Alperovych *et al.*, 2020; Naqi and Hettihewa, 2007).

Businesses and the modes of doing business globally are changing at a fast pace due to globalization and innovation. The technological revolution, expanding economies, and the internationalization of entrepreneurial activities have completely reshaped the business arena (Sung *et al.*, 2003). Indeed, innovation and technology bestow investors, investees, and entrepreneurs with both never-ending and never-before-seen opportunities (Dhochak and Sharma, 2016). Consequently, financial intermediaries such as Venture Capital firms (hence, VC firms) emerged in the business world. These firms employ industry professionals and expert investors in high-tech companies and play the role of bridging the financial gap left by traditional funders by investing, sponsoring, and nurturing neonatal ventures (Gompers and Lerner, 2004). Thus, Venture Capital is the most appealing and tailored form of equity financing for young and innovative companies. VC firms recognize, assess, and finance new and risky ventures that private investors are reluctant to invest in (Pearce and Barnes, 2006). They are risk-takers and believers in the well-known notion of high risk/high gain. National Venture Capital Association (NVCA) plausibly defines VC as, “Money provided by professionals who invest alongside management in young, rapidly growing companies that have the potential to develop into significant economic contributors”. The peculiar characteristic of VC, that distinguishes it from other funding, is its governance and value-adding effect for investee companies (Gompers and Lerner, 2001; Cumming *et al.*, 2017). Venture Capitalists actively participate in the management of the investee companies, thus making VC firms intermediaries which provide not only financial resources but

also managerial skills to innovative entrepreneurial firms (Hain and Wang, 2016; Groh and Wallmeroth, 2016). For instance, VC firms bestow appropriate guidance, mentoring, and administrative support (Hellmann, 1998; Repullo & Suarez, 2004).

However, VC firms are heterogeneous and differ in several dimensions: organizational structure and ownership, governance mechanisms, objectives, employee skills, screening process, valuation techniques and investment targets (Gompers *et al.*, 2009; Bertoni *et al.*, 2013; Bertoni *et al.*, 2015; Alperovych *et al.*, 2020). Independent Venture Capital (hence, IVC) firms are the most conventional and prevalent type of VC firms. They pool funds and resources from private investors like pension funds, hedge funds, endowment funds, and wealthy individuals which are limited partners. Venture capitalists, who manage these funds, are general partners (GP) and look after the day-to-day activities of the company (Sahlman, 1990; Wright and Robbie, 1998). Venture capitalists invest funds in high-growth potential technology firms. These technology firms are commonly referred to as entrepreneurial firms, investee companies, or ventures. Venture capitalists are professional investors and are experts in deal selections *ex-ante* investments and value addition *ex-post* investments and their sole motive is profit maximization of the limited partners. By contrast, other types of VC firms, called captive VC, pool resources from parent organizations such as large corporations, banks, or public organizations. Finally, VC firms can also co-invest in a single firm, thus relying on syndication.

1.1 Government Venture Capital

Government Venture Capital (hence, GVC) is one type of captive VC, a government-backed entity — financed and managed by the government — that provides equity or equity-like investments in young companies. In the extant literature, researchers have used different terminologies for GVC: publicly sponsored venture capital (Buzzacchi *et al.*, 2013), government-managed venture capital (Grilli and Murtinu, 2014), governmental venture capital (Colombo *et al.*, 2016), government-sponsored venture capital (Brander *et al.*, 2010; Brander *et al.*, 2015). Innovation Investment Fund (IIF), YOZMA, and Small Business Investment Companies (SBIC) are prominent and successful examples of GVC funds in Australia, Israel, and the US, respectively.

Governments around the world, directly or indirectly, intervene in the capital market and tend to alleviate the market imperfections caused by moral hazards and information asymmetries between the investors and entrepreneurial companies (Cumming, 2007). GVC firms are examples

of government intervention in the VC activity (Brander *et al.*, 2015). While launching public programs, governments and policy makers target and consider specific objectives like spurring innovation, encouraging entrepreneurship, developing economically lagging areas, generating employment, and more generally bolstering the economy and research and development programs by injecting financial capital into the start-ups, (Mason and Harrison, 1999; Lerner, 2002; Hellmann, 2002; Leleux and Surlemont, 2003; Bertoni and Tykvova, 2011; Criscuolo *et al.*, 2014). GVC thus fill the financing gap left behind by the private investors, especially for young and innovative firms (Sunley *et al.*, 2005).

Existing literature highlights both strengths and weaknesses of GVC when compared to traditional IVC. Among strengths, GVC firms may benefit from strong social ties with officials: consequently, they may have greater access than IVC to key regional innovative actors like governmental research institutions and incubators, university laboratories, and science parks (Pierrakis & Saridakis, 2017); they may also receive preferential treatment from public institutions like subsidies or tax exemptions, funds for R&D and innovation, more information sharing and access to other funders like banks (Alperovych *et al.*, 2020). Among weaknesses, they are run by bureaucrats with several mandates on behalf of the public (Pahnke *et al.*, 2015) but who may lack skills in screening and selection *ex-ante* investments and value addition of *ex-post* investments (Munari and Toschi, 2015; Leleux and Surlemont 2003). The agreements and contracts play a significant role in VC investments, and the covenants between GVC and entrepreneurs are not always properly addressed (Cumming *et al.*, 2017). Moreover, GVC firms suffer inadequate industrial connections and marketing strategies which are very important in supporting technology-based companies (Grilli and Murtinu, 2014; Leleux and Surlemont, 2003). Finally, GVC may lack incentive to coach and monitor technology-based companies (Leleux and Surlemont, 2003), both because their decision-making power could be curtailed given the political pressures, and because the compensation mechanism of GVC managers is quite frail as compared with IVC firm managers (where the compensation of IVC is contingent on the success of portfolio firms: 2% management fee and 20% carried interest according to Sahlman, 1990 and Chemmanur *et al.*, 2014).

1.2 Corporate venture capital

In the extant literature, Corporate Venture Capital firms (hence, CVC) are defined as investment vehicles of non-financial companies such as established corporations (Dushnitsky and Lenox,

2006). More precisely, Wadhwa *et al.* (2016) and Yang *et al.* (2014) define CVC as the direct financial and strategic stakes of established corporations to risky, high growth potential privately owned investee companies. Their investing arms are generally comprised of 3 to 30 corporate employees who report to their chief officer who possesses a sound knowledge of the parent firms' resources like production facilities, distributional channels, and R&D (Dushnitsky and Lenox, 2006).

The stronger product market competition and the shorter product life not only made the R&D an expensive but also unprofitable activity. Consequently, corporations began to look outside their frontiers for R&D innovation. In this context, CVC emerged in the 1960s in the US (Gompers, 2000; Chemmaur and Loutskina, 2008) to meet the external R&D development requirement of the established firms and to gain a window to new technology for the parent companies. Dushnitsky and Lenox (2005) consider CVCs as a breeding ground for external R&D that enhances parent firms' innovation and organizational learning, while Wadhwa *et al.* (2016) contend that it helps incorporate growth. Similarly, Keil (2004) writes that CVC firms have been set up to explore and exploit knowledge, and to monitor the development of new technologies. In the same vein, Narayanan *et al.* (2009) consider it as the external corporate venturing by utilizing internal and external resources through a bundle of organizational systems to flourish and thrive in existing or novel industries, fields, and markets.

Capitalizing on distinctive and specialized assets of the parent company, corporate investors augment both financial and complementary resources to high-growth innovative entrepreneurial firms that lack funds to commence their operations (Dushnitsky and Shapira, 2010). For example, CVC firms provide manufacturing resources, technological expertise, marketing strategies, distribution networks, and access to potential customers and supplier networks of the parent organization to the portfolio companies (Colombo and Murtinu, 2017; Dushnitsky and Lenox, 2005; Bertoni *et al.*, 2013). In turn, they expect both financial and strategic benefits from entrepreneurial firms like a window on new technology and may explore new markets to further their innovative tendencies (Dushnitsky and Lenox, 2005; Benson and Ziedonis, 2009; Keil, 2004; Dushnitsky and Shapira, 2010). The established firms consider CVC as corporate venturing (Dushnitsky and Lenox, 2006), and the entrepreneurial companies view it as a source of financing

(Chemmanur *et al.*, 2014). This mutual ‘give and take’ engender a dyed investment relationship between the investee and investor firms.

When compared to IVC, CVC firms also exhibit advantages and inconvenience. Among advantages, CVC firms are run and managed by corporate employees who possess a sound knowledge of the parent firms’ resources like production facilities, distributional channels, and R&D (Dushnitsky and Lenox, 2006). They provide manufacturing resources, technological expertise, marketing strategies, and distribution networks to the portfolio companies (Dushnitsky and Lenox, 2005; Dushnitsky and Lenox, 2006; Bertoni *et al.*, 2013), and investee companies outsource complimentary assets externally at an arm’s length transaction. However, among drawbacks, entire resources of CVCs are centralized to the parent company and managers operate along a long chain of command. CVC managers need to cooperate and comply with the corporate hierarchal structure, which limits their power and authority and may diminish their performance (Pahnke *et al.*, 2015). This hierarchal structure may impede the timely and accurate decision-making process and allocation of resources. Consequently, the administrative abilities of CVC firms may not be as efficient as IVC firms’ (Busenitz, Matusik, Anglin, & Dushnitsky, 2017). Additionally, the compensation mechanism of CVC managers is quite frail as compared with IVC firm managers.

1.3 VC syndication

Syndication is a salient feature of VC activity. It means that two or more VC firms co-invest in a single entrepreneurial firm (Bander *et al.*, 2002). Jaaskalein (2012) termed it as “inter-organizational cooperation” that functions as a financial intermediary. Syndication has been a common and growing practice in the venture industry (Manigart *et al.*, 2006), and VC firms prefer to syndicate their investments rather than investing alone (Brander *et al.*, 2002; Lockett & Wright, 2001; Gompers and Lerner, 2004). There are two chief purposes behind VC syndication, the information aggregation *ex-ante* investment and the value-addition *ex-post* investments. Bygrave (1987), Ferrary (2010), and Hopp and Rieder (2011) contend that it supplements both monetary and non-monetary capital and resources of the members to the investee companies.

Proponents of syndication suggest several advantages of venture capitalists’ syndications. Stuart, Hong, & Hybels (1999) argue that syndicated networks share information among one another about markets, deals, and industry in the investment process. Thus, it helps improved deal

screening and selection (Manigart *et al.*, 2006; Casamatta and Haritchabalet, 2007) and mitigates investment risks (Cumming *et al.*, 2005; Gompers and Lerner, 2004). Similarly, Siddiqui *et al.* (2016) state that syndications help entrepreneurs to build a wide array of networks with distributors, lawyers, bankers, and professionals of different spheres which otherwise is not possible for a solo investor. Syndication may also help in accumulating and inject more capital into the ventures (Lerner, 1994; Ferrary, 2010; Andrieu and Groh, 2012). Through syndication, ventures capital firms make “window dressing” to succeed in future deals (Lerner, 1994). Moreover, syndication plays an instrumental role in the nurturing of the portfolio companies to obtain apposite skills to successfully exit in the future (Lerner 1994; Tian, 2011). More specifically, the syndication of different types of VC firms may help to alleviate the respective shortcomings of the other types of VC firms in the syndicated investment. For example, Cumming *et al.* (2017) and Zhang and Mayes (2018) show that mixed syndication of IVC and GVC firms may compensate for some weaknesses of GVC. On the other hand, few authors highlight some disadvantages of syndication. For instance, Bruining *et al.* (2005) and Dimov and Milanov (2010) argue that VC syndications may escalate the chances of confrontation among syndicated members and consequently, give rise to high associated costs due to the opportunistic tendencies of the syndicated members.

2 Heterogeneity of VC across countries and specificities of developing Asia

VC started in Silicon Valley, California US, and then prevailed in Europe and Asia (Ooghe *et al.*, 1991). Emerging countries undertook revolutionary structural reforms to make their regulatory environment more conducive for VC investments (Gompers and Lerner, 1998). Silicon Valley served as the inspiration for Asian VC. Nevertheless, VC activity appears to evolve differently around the world, and VC industry in developing Asia is still underdeveloped and rather immature when compared to the US (Cumming *et al.*, 2006; Kenney *et al.*, 2002; Bruton *et al.*, 2003, 2004, and 2005).

VC industry’s characteristics are strongly influenced by the institutions of a given country or by geographical area. Studies by Bruton *et al.* (2002, 2003, 2004, 2005, and 2009) that relied on institutional perspective provide comprehensive insights into VC differences across geographical areas and categorized institutional forces into three types: normative, regulatory, and cognitive. First, normative forces refer to those values, beliefs, and norms that are shared among firms in an

industry around the globe. The rudimentary worldwide VC industry norms and beliefs have been established according to the US VC industry and are equally strong in Europe, Asia, and the US.

Second, regulatory and cognitive forces drive different patterns for the VC industry according to the geographical area. Regulatory forces refer to legal philosophy, investor protection, legal enforcement, and the nature of stock market capital. For example, Black and Gilson (1998) and Armour and Cumming (2006) argue that a robust stock market is necessary for the development of the VC market because a vibrant stock exchange would provide venture capitalists a viable exit route for their investments. Asian countries are mainly bank-centered, with low developed stock markets compared to the Western economy (Bruton *et al.*, 2003 and 2004), which restrains the opportunities of exit via Initial Public Offering (IPO). Additionally, the role of the government in the economy is stronger than that in the US or Europe (Zhang and Mayes, 2018). More specifically, it controls the capital market by approving prevalent financial decisions, such as IPOs. Finally, even if laws are in place, their enforcement is prevalent for investor protection and the development of VC. Enforcement of laws is quite ineffectual in Asia when compared to Europe and the US (Bruton *et al.*, 2003).

Third, cultural and traditional forces give rise to cognitive institutions. Asian culture and traditions are different from those in the US and Europe. Several studies have demonstrated the role of social networks in VC success in the US (Hochberg *et al.*, 2007; Sorenson and Stuart, 2001), but it is far stronger in Asia, where the status of entrepreneurs is lower than in the US and Europe. A reliance on social ties, especially networks with governmental officials, will be an essential part of the VC process in this area.

The dynamics of VC in developing and developed countries are different (Dossani and Kenney, 2002; Kenney *et al.*, 2002). Kenney *et al.* (2002) define several other factors such as government incentives, investment prospects, exit opportunities, and sociocultural factors that lead to the differential development of the VC industry in Asia. Government policies and strategies strongly influence VC investment during downturns by setting a sound regulatory investment environment (Jeng and Wells, 2000). There are other subtle and pervasive differences in screening and selection, governance, and value addition of VC firms across countries¹. But developing Asian

¹ The history, evolution and differences in VC industry across countries and regions are discussed in detail in the Chapter 1

countries exhibit common characteristics regarding their VC industry. VC industry is still underdeveloped and very marked by the prevalence of Chinese commercial culture, as businesses practices are predominantly influenced by ethnic Chinese (Bruton *et al.*, 2009). Thus, the dynamics of the VC industry in developing Asia are quite different than those in Western economies. Therefore, this makes developing Asia an interesting and appealing region to study concerning VC activity.

3 Research questions and thesis structure

What types of VC firms perform better and efficiently nurture their portfolio companies? Whether IVC-backed or Captive VC-backed companies perform better? This question has sparked the interest of researchers, and hence, the performance of VC-backed companies has been a heated debate, among academia and practitioners, over recent years. Most of the previous studies have been conducted with respect to the US and European context. However, given the specificities of the VC in Asian developing countries, an analysis of the drivers of VC activity and a comparison of the performance of different types of VC could bear novel results in this geographical area.

The thesis is composed of four chapters to address this issue, among them three chapters are self-contained essays, with each one having its literature review, unique and original questions, references, and datasets. Tables, figures, equations, and appendices are all numbered starting at the beginning of each chapter. Throughout the thesis, page numbers, footnotes, titles, and subtitles are in chronological order. The structure of the thesis is as follows.

Chapter 1 provides comparative elements between the US, Europe, and developing Asia regarding the history and evolution of VC and its economic importance to highlight the specificities of the VC industry in the geographical area of the research. It also discusses the key driving factors of VC investment and outlines salient differences based on the institutional framework in terms of screening and selection of projects, value addition, and exit mechanism of the portfolio companies.

Chapter 2 presents our first essay. It focuses on the exit performance of GVC-backed companies in comparison with IVC-backed companies in developing Asia.

Measuring the performance of private equity and VC-backed companies is a challenging task. Because VC-backed entrepreneurial firms are projects, the Internal Rate of Return (IRR) appears to be the best measure of their performance. However, VC-backed companies are

exempted to file their returns. Due to the unavailability of IRR and other financial and accounting measures of performance, existing literature relies on proxies for performance. The conventional proxy for performance is the successful exit of the investee companies (Brander *et al.*, 2015; Cumming *et al.*, 2017; Zhang and Mayes, 2018).² A successful exit means that VC firms regain their capital through IPO, buybacks, mergers and acquisitions (M&A) of the portfolio company. Conversely, unsuccessful exits occur when entrepreneurial companies go out of business due to write-offs, becoming defunct, or bankruptcy.

A burgeoning literature has compared the performance of IVC-backed versus GV-backed companies (Bertoni and Tykvová, 2015; Grilli and Murtinu, 2014; Brander *et al.*, 2015; Cumming *et al.*, 2017; Zhang and Mayes, 2018). The extant literature is consensual, and convergent regarding the underperformance of GVC-backed firms in terms of a successful exit. For example, Brander *et al.* (2010) found that GVC-backed companies underperform, in Canada and found the same results on an international sample (Brander *et al.*, 2015). Similarly, Cumming *et al.* (2017) also found that GVC-backed companies are less likely to go successful in Europe. Previous studies were conducted in Western developed countries. By contrast, Zhang and Mayes (2018) studied a Chinese sample and explored that GVC-backed companies also had fewer chances of going successful. The existing literature highlights many pitfalls of GVCs, which are thought to be the cause of their underperformance when compared to IVC. First, managers suffer from weak experience in the VC industry deal selection and evaluation (Leleux and Surlemont, 2003, Armour and Cumming, 2006, Bertoni *et al.*, 2015), as governments officials are often “transformed” into venture capitalists. They also have lower incentives due to less efficient compensation mechanisms. In addition, they are less independent in decision-making under political pressure (Cumming *et al.*, 2017).

GVCs are highly heterogeneous in terms of design, and differences across geographical areas can surely affect their exit performance (Alperovych *et al.*, 2020). Focusing on an area – developing Asia – where governments exert considerable control over economic and financial development (Zhang and Mayes, 2018), in comparison with Europe or the US (Leleux and Surlemont, 2003), may bear novel results. As previously mentioned, developing Asia has different specificities and dynamics than Western countries. In developing Asia, there is a prevalent role of government, and

² Some studies rely on alternative proxies such as the innovative output (number of patents) of the investee companies (Bertoni and Tykvová, 2015), employees’ and sales’ growth of the investee companies (Grilli and Murtinu, 2014). But these variables do not capture performance such as successful exit.

IPO markets are controlled by the state. Furthermore, in developing Asia, the role of social ties among government officials may offset the previously cited shortcomings. First, in accessing projects, GVCs may enjoy privileged access to local resources and better access to policy supports, such as tax benefits or R&D subsidies (Zhang, 2018). Second, in screening projects, IVCs rely on links with peers through previous investments and syndications, but they suffer from coordination costs, especially in the aspect of due diligence due to a lack of transparency of financial reporting and weak corporate governance (Bruton *et al.*, 2003). In contrast, GVC may benefit from priorities during due diligence, and ties may also allow for privileged access to the IPO approval in this context of low developed capital markets. We first questioned the exit performance of GVC-backed companies in terms of a successful exit in comparison with IVC-backed companies in developing Asia. We also focused on the role of syndicated investments in Asia. Syndication has been a striking practice in VC activity. Classical financial theory as well as resource-based theory collectively point out that there are several perceived advantages to VC syndication (Cumming *et al.*, 2005; Lockett and Wright, 2001; De Clerq and Dimov, 2004). First, syndication helps better screening and evaluation in the early stage (Casamatta and Haritchabalet, 2007), providing more information to investors (Manigart *et al.*, 2006) because syndicated networks share information about markets, deals, and industries during the investment process. Consequently, it may enhance the performance of firms by adding value in the expansion stage and later stage (Cumming *et al.*, 2005; Gompers and Lerner, 2004). Second, it may help VC firms accumulate more funds and inject more capital (Ferrary, 2010; Andrieu and Groh, 2012).

This study contributes to the debate on the effectiveness of GVC and provides novel results by challenging the “exit underperformance hypothesis” associated with GVC-backed companies, which has been mostly confirmed in previous studies. We rely on the staged decomposition of VC funding: GVC and IVC play different roles and bear different risks when investing in the early-stage (financing seed or startups) or expansion and mature stages. Thus, factors driving successful exit for GVC-backed companies compared with IVC-backed companies differ according to the stage of investment. We highlight a double phenomenon of substitution and compensation effects between the two types of VCs that explains the overperformance of GVC on the whole cycle of VC life in developing Asia. Finally, we provide new insights into the role of syndication to check how it ameliorates the performance for both GVC and IVC syndicated-backed firms, as previous research exhibits contrasting results (see Cumming *et al.*, 2017; Zhang, 2018). We rely on

multinomial logit models and several econometric techniques are used to address the endogeneity concerns and confirm the robustness of the findings.

Chapter 3 presents our second essay. It investigates the characteristics of CVC and GVC firms, and the optimal exit route choice of GVC-backed entrepreneurial firms in comparison with CVC-backed companies in the Asian context. What types of entrepreneurial companies do GVC firms target in comparison with CVC firms? What is the exit performance of GVC-backed companies relative to CVC-backed ones, and what is the optimal exit route for each type of VC-backed firm?

High-technology-related entrepreneurial firms require excellent managerial skills and expertise, wide-range industry connections, sound marketing strategies. They also require specialized complementary assets in a timely and efficient manner to commercialize their new technologies. Young high-tech companies not only face severe challenges in developing them internally but also acquiring them from the open market due to prohibitive costs and time constraints. In this context, CVC firms are investing arms of established corporations. Their managers are industry specialists, and they have access to distinct and specialized assets like distribution networks, manufacturing resources, and technological expertise of the parent corporations. On the other hand, GVC firms have excess to public offices and resources. So, we conjecture that high-tech companies are more appealing to CVC firms given the technicalities associated with them. Secondly, we focused on the exit performance GVC versus CVC-backed companies. In the extant literature, researchers compared the exit performance and choice of exit route of IVC-backed with CVC-backed companies (Gompers and Lerner, 2000; Gompers, 2002; Chemmaur and Loutskina; 2008; Guo *et al.*, 2015), in different geographical regions and periods. However, there is a paucity of empirical and theoretical evidence on how captive VC-backed firms behave relative to each other in nurturing their portfolio companies. We more specifically focused on the exit route choice of CVC-backed companies in comparison with GVC-backed companies. IPO markets are strongly influenced by government institutions in Asia, and the role of government is prevalent in the financial and economic decisions.

Therefore, the second chapter fills the gap in the literature by studying the relative efficiency of CVC and GVC firms in nurturing their portfolio firms to successful exit and optimal exit choice. This study contributes to the heated debate of investment behaviors of different types of VC firms

and their relative efficiency in nurturing their portfolio companies. Our first result shows that CVC firms are more likely to invest in technology-related companies as compared with the GVC firms. Second, we fill the gap in the existing literature on the exit performance of GVC-backed companies, in comparison with CVC-backed companies, as the topic remains unexplored. Our second main result regarding exit route choice exhibits that GVC-backed companies are more likely to go public. We rely on the same kind of econometric tools as in Chapter 2.

Chapter 4 presents our third essay. It examines the determinants of VC activity in developing Asia. The factors that affect venture capital activity have been the focus of researchers for the last two decades. Tyebjee and Bruno (1984) are the first researchers who probed into the matter of venture capitalist's investment decisions, but they were more inclined towards the process of decision making rather than evaluating the determinants of VC activity. Afterward, researchers tried to explore the macroeconomic indicators, firm-level variables, entrepreneurial environmental factors, and institutional and legal determinants of VCI in developing and developed countries (Black and Gilson, 1998; Romain and La Potterie, 2004; Cherif and Gazdar, 2011; Félix *et al.*, 2013; Groh and Wallmeroth, 2016).

Macroeconomic indicators have a significant impact on VC activity. Literature is consensual that Gross Domestic Product (GDP)'s growth rate and interest rates significantly and positively influence VC investments in a country (Romain and La Potterie, 2004; Gompers and Lerner, 1999). On the other hand, taxes negatively impact VC investments (Gompers and Lerner, 1999). Besides macroeconomic indicators, environment specific variables like stock-market development (Black and Gilson, 1998), labor market rigidities (Jeng and well, 2000) also influence VC markets. However, the expedition in the field of VC determinants is still underway and needs much more exploration (Groh and Wallmeroth, 2016). In this regard, we question the impact of the cross-border investment by multinational companies³ – Foreign Direct Investment (FDI) – on venture capital activity. Literature studying the interaction between these two types of capital flows – international capital flows and domestic VC investment – remains rather underdeveloped. According to Hattari & Rajan (2011), FDIs are long-term and stable investments. Borensztein *et al.* (1998) define FDIs as the cross-border capital flows from a foreign country through acquiring

³ We alternatively used the terms multinational companies, transnational companies, foreign entrants, foreign firms for Foreign direct investment.

a host country's land, business, establishing a new business, financing, or taking over an existing company. We expect FDI may induce complementarity effect or substitution effect on the VC investments.

The contribution of the paper is threefold. First, we, for the first time, explore the impact of FDI on VC activity in developing Asia. Second, we rely on a unique sample of seven Asian developing countries, a geographical area where VC activity is expanding rapidly. Third, controlling for both FDI and macroeconomic determinants of VC investment, we address the methodological limitation of previous studies by using a panel model with a heterogeneous slope that is robust to cross-sectional dependency and potential endogeneity. We use the Autoregressive Distributed Lag (ARDL) model using the PMG estimator by Pesaran *et al.* (1999) and the MG estimator of Pesaran and Smith (1995) to capture both short term and long-run effects of FDI on VC domestic investment. We find that FDI has no effect on VC activity in the short run. By contrast, our results exhibit the significant and positive effect of FDI on domestic VC activity in the long run: it appears that, due to positive externalities and spillover effects, FDI complements domestic VC investments and helps in the creation of new VC-backed companies.

Chapter 5 concludes the thesis. We summarize the findings of the thesis and discussed the limitations, implications, and we suggest avenues for future research.

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Chapter 1

History, Evolution and Specificities of VC Industry in Developing Asia: A Comparison with the US and Europe

History, Evolution and Specificities of VC Industry in Developing Asia: A Comparison with the US and Europe

The first section of this chapter recalls the history and evolution of VC activity in the US to discuss its internationalization and spreading in developing Asia. The second section put the focus on the economic importance of VC activity in developing Asia over the 2000-2018 period and on its specific key drivers. Lastly, we rely on institutional theory to document salient differences between Western and Asian VC firms in terms of screening and selection of projects, governance, value addition, and exit mechanisms.

1 History of VC

1.1 Historical overview in the US

Prior to World War II (WW-II), the financing of enterprises was dependent upon state and state-sponsored institutions or informal investors such as angel investors (Kenney *et al.*, 2002 a). As a matter of fact, private banks were reluctant to invest in the nascent established firms given the lack of collateral and a high degree of risk associated with them, whereas angel investors mostly had some prior links and connections with the entrepreneurs (Dossani and Kenney, 2002). Therefore, fledgling firms were facing the challenges of severe capital market failures. However, after WW-II, a specialized group of financiers emerged in the United States of America who invested in fledgling firms that had the potential of growth. Subsequently, these investors surfaced as Venture Capitalists and institutionalized the VC industry in the US. Karl Compton – President of MIT – and General Georges F. Doriot – professor at the Harvard Business School – set forth the first American VC fund ‘American Research and Development (ARD)’ in 1946 (Gompers and Lerner, 2001).

In the US, the government played a prevalent role in the development of the VC industry, both direct and indirect. The direct intervention was straightforward investing in Governmental supported VC funds. The passing of the Small Business Investment Act (SBIA) from the Congress in 1958 led to the creation of Small Business Investment Corporations (SBICs) to fund small firms and promote innovation; per se, it was not purported to develop VC, but it paved the way for the

development of VC in the US (Dossani and Kenney, 2002). At that time, the government funds were mostly channeled toward military and electronic research. However, SBICs had encountered several bureaucratic hurdles and challenges since its very inception. Corruption was the main challenge; according to Bean (2001), approximately 90% of SBICs companies rendered irregularities and violated agency regulations, and a good chunk of companies perpetrated criminal acts. Nevertheless, the US federal government took stern actions against the culprits and streamlined the SBICs in 1965. Formally, the creation of the National Venture Capital Association (NCVA) in the 1970s institutionalized the concept of Private Equity (PE) and VC in the US (Yeoh, 2004).

Government's indirect support came from VC-friendly fiscal and monetary policies. For instance, the US government cut down capital gain taxes and allowed pension funds to be invested in the VC funds (Gompers, 1994). Furthermore, the government very efficiently regulated the NASDAQ stock exchange to provide the Venture Capitalists with a sound exit platform for their investments. The US government also invested heavily in university-based research programs: for example, prestigious educational institutions like Berkeley, MIT, and Stanford in the US played a key role in fostering innovation and developing human sources by breeding a new generation of promising engineers and scientists (Saxenian, 2001). Thus, the government implemented sound policies and practices that created a vibrant macroeconomic and financial environment for VC development, and that enhanced transparency and minimized risks for the investors (Kenney *et al.*, 2002 a). The institutionalization of VC in the US began in the mid-1980s when Venture capitalists and entrepreneurs manifested formalizing their agreements and contracts; since then, VC became a part and parcel of the national innovation system of the US as a distinct industry (Suchman, 2000). Therefore, a trial-and-error experimental method helped the VC industry to emerge as a robust institution in the US for the development of new firms and fostering of innovation.

The transference and internationalization of VC institutions attracted much interest in the mid-1980s. The bilateral and multilateral financial and development institutions such as the British Commonwealth Fund, Deutsche Entwicklungs Gesellschaft, and Asian Development Bank were the major advocates of the transference of VC across countries (Kenney *et al.*, 2002a). These organizations did not play a direct role in the creation of VC in other countries but an indirect one by encouraging cross-border investors to invest in several countries. Consequently, the modern

archetype of VC firms – that developed in Silicon Valley in the US – diffused to several geographic areas. For example, Israel impeccably imitated and adopted the US-style VC industry. Israeli Jewish diaspora in the US cultivated good relations between the US and Israel. These Israeli citizens were employed in US firms and played a significant role in the development of the Israeli VC market in the 1980s. There emerged good bilateral relations between Silicon Valley and the Israeli high-tech Industry; besides listing on the Tel Aviv stock exchange, Israeli firms availed the opportunities to get listed on the NASDAQ stock exchange in the 1980s. Eventually, in the 1990s, the Israeli government intervened and created the first government VC fund “YOZMA” – a Hebrew word meaning initiative. Thus, the development of the Israeli VC industry seems to be related to the US VC industry, and Israel emerged as a leader in the high-tech industry. Similarly, VC investment had seen a surge in Europe during the 1980s. European Venture Capital Association (EVCA) was created in 1983 and most of the European VC firms became its member. European VC funds along with corporations such as Philips, Volvo, Fiat, among others played a pertinent part in the development of the European VC market. European Venture Capitalists focused on the development of high-technology products and heavily invested in computer-based products and electronics. In Europe, the UK became a significant VC market along with the Netherlands and France. In short, this US-VC model diffused worldwide and became an international phenomenon, and there developed significant VC markets in continental Europe, the UK, France, and Germany.

However, VC activity appears to evolve differently around the world and, more specifically, in Asian developing countries. A detailed history and evolution of the Asian VC market is given in the following section.

1.2 The transference and internationalization of VC to Asia

The first wave of US-style VC internationalized in Asia during the 1970s but could not make its way into the market because of the unfamiliar concept of VC in Asia. VC firms were not appealing to the local entrepreneurs, and investors failed to attract the clients given the Asian business culture (Montagu-Pollock, 1988). Cultural barriers, along with the local accounting practices and legal systems, were the greatest hindrance for the foreign venture capitalists (Naqi and Hettihewa, 2007). However, the second wave of VC came in the 1980s in Asia. Japan was the first country that attracted VC but was remained in trouble due to some macroeconomic conditions. Besides Japan, there were only 50 VC firms in Asia, and VC could not make any headway progress in Asia.

The third wave of VC came in the 1990s. During the early 1990s, Asian countries shifted from labor-intensive agrarian and manufacturing environments to technology-based productions which boosted the overall economy, and hence, the need for VC materialized, and its investment experienced tremendous growth (Naqi and Hettihewa, 2007). They further indicate that profitable companies, particularly, in East Asia, began to invest in startups and the governments played a vital role in the development of VC in their respective countries. VC investments in Asia grew annually at the rate of 15% during the period 1990 to 2005; whereby the US and European VC market only grew at the rate of 4% and 6 % respectively over the same period (Naqi and Hettihewa, 2007).

Silicon Valley served as the inspiration for Asian VC as it did in other parts of the world. The influx of entrepreneurs from Silicon Valley to Asia for manufacturing functions, and the repatriation of the Asian students who were enrolled in US universities had conceived the idea of VC development in Asia during the 1960s (Saxenian, 2001). Asian students who worked in Silicon Valley learned its business structure, and afterward, they launched their businesses in Silicon Valley. At the same time, they retained their close ties with their acquaintances and family members in Asia, and they bootstrapped their start-ups with the help of their colleagues and family members back in Asia. When these students and managers returned to Asia, they began working with the Silicon Valley firms operating in Asia or franchised their businesses with Silicon Valley firms. Additionally, the Asian entrepreneurs – who domestically ran their own business in Asia – joined the Silicon Valley firms, and they learned the *modus operandi* of US-style VC firms, and later they incorporated and implemented those ideas in Asia. Henceforth, these channels served as the medium of transfer and internationalized of Silicon Valley-type of VC firms – in terms of structure and technical and managerial skills.

It is considered that like Israel, Taiwan adopted US-style VC in East Asia, and the Taiwanese government played a key role in the development of VC. But Taiwanese VC market significantly had a different evolutionary trajectory – given the fact that Taiwan is a developing country, and it did not have a good high-tech infrastructure and human capital as had Israel due to the links with the US. Nonetheless, there were Chinese and Taiwanese engineers and scientists working in the US who helped in the development of the Taiwanese VC industry (Saxenian, 2001). In Asia, Taiwan is the most vibrant country for entrepreneurial firms. The growth of Taiwanese VC is related to the connections with Silicon Valley just like Israel and a huge investment in electronic products. Moreover, the role of the government was very supportive of the development

of VC in Taiwan. The success of the Taiwanese VC market is linked with its success in electronic components and industry overall. Historically, foreign investors helped Taiwanese entrepreneurs to gain access to overseas markets and adopt new technologies. Many Taiwanese scientists and engineers were having key positions in the US technology firms and they were directing and advising the entrepreneurs in Taiwan and even some repatriated to Taiwan to establish their businesses (Saxenian, 2001). Though Taiwan being an active spot of business venturing yet until 1989 growth was slow and gained momentum after 1990.

Besides Taiwan, VC spread to the rest of East Asia and China. China is the fastest-growing country in the region. Chinese VC industry was established back in the 1980s and the Chinese government played a phenomenal role in the development of high-tech companies (Kenney *et al.*, 2002a). The trajectory of Chinese VC is no different from other Asian countries, as the basic rudimentary normative forces from the Silicon Valley US served as the foundation stone of the VC industry elsewhere. Chinese VC made a headway progressed and surpassed the European VC investments. Today China is the second-largest VC industry after the US VC industry in terms of the number of deals and dollar amount invested.

Similarly, VC spread to other Asian developing countries: India, Singapore, Malaysia, South Korea, Thailand, Indonesia. Discussing the history and evolution of VC of every country is beyond the limit of this section. In short, the respective governments played the most vital role in the development of the VC industry in the region and VC got momentum in Asia after 1990.

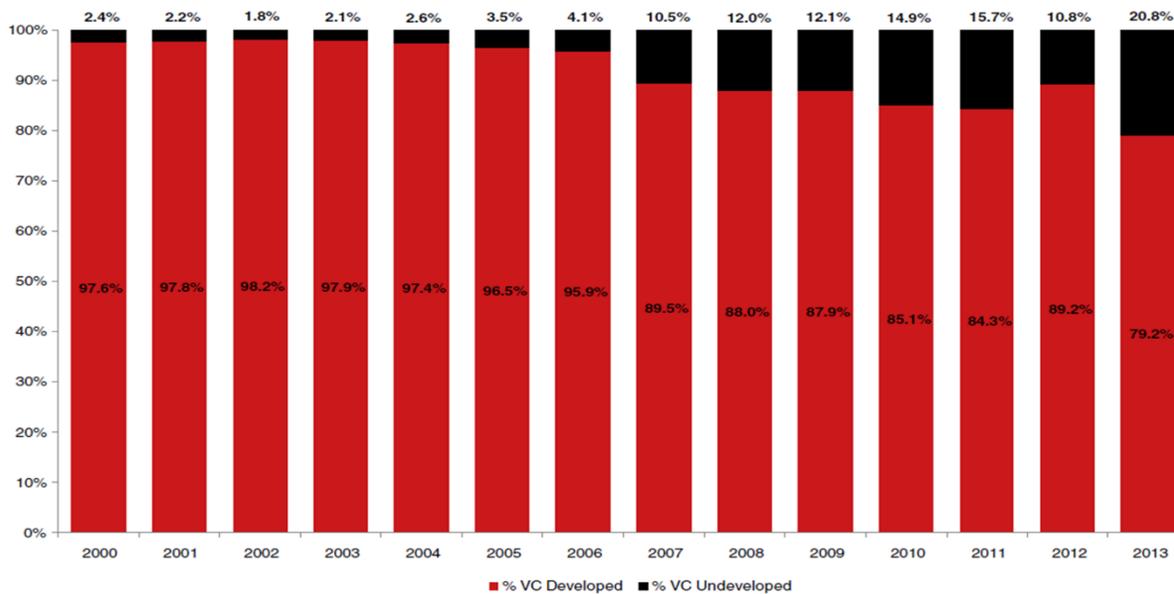
2 Economic Importance of VC Activity in Developing Asia: An Overview of the 2000 – 2018 Period

Despite VC investment is a small portion of the overall economy, yet VC has significantly contributed to the economies of the UK, the US, Europe, and Israel. VC has been an attractive means of financing in the US economy; versatile high-tech giants such as Microsoft, Compaq, Oracle, Sun, and Microsystems were originally backed by VC, and these firms proved their remarkable success within 2 decades and grossly contributed to the US economy (Jeng and wells, 2000). However, in the last century, Asia did not produce the ‘Champions’ like the ones which Western countries established (Kenney *et al.*, 2002).

Indeed, the VC activity has seen a phenomenal upsurge during the last three decades around the globe; the total amount invested remarkably grew from scant 610 million USD (1980) to more

than 30 billion USD (2010); but until 2000 most of the increase in investments were witnessed in developed countries. Interestingly, it has been noticed that developed countries experienced a decline in VC investments, and developing countries saw an upsurge in VC investments during the last two decades. The total amount of VC invested in developing countries raised from 3.25 billion to 9.8 billion USD over the period 2000 to 2013 (Groh and Wallmeroth, 2016). Further, they state that 3.23 billion USD is only 2.4% of the global VC investments and 9.8 billion USD is 20.8% of the total VC investments. Therefore, developing countries have seen a rise of 18.4% in VC investments over this period. Therefore, we decided to present an overview of VC investments in Asia during the last two decades. The following bar chart presents the share of overall global VC investments in developing and developed countries during the period 2000 – 2013.

Figure 1.1: VC investment shares in developed and developing countries over the period 2000 – 2013



Source: Groh and Wallmeroth (2016)

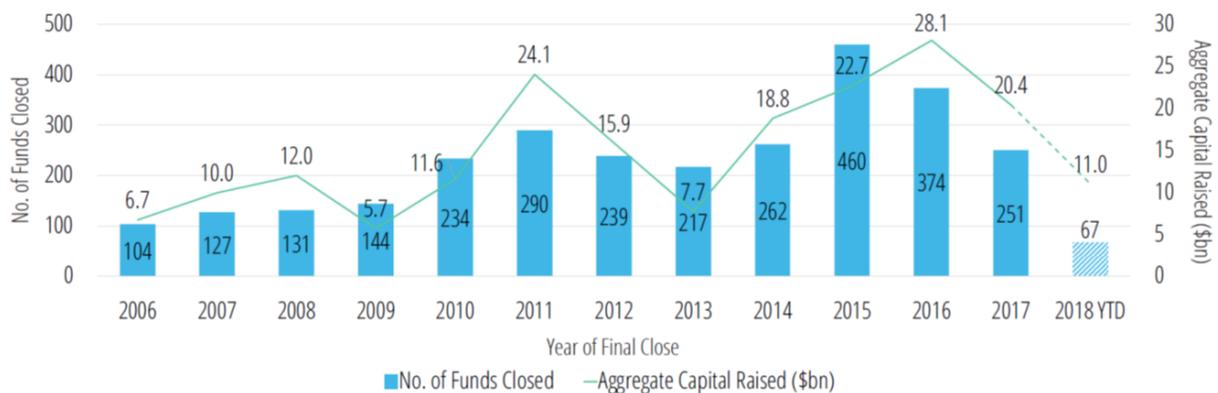
2.1 Annual Asian focused VC fundraising and asset under management

The Global Private Equity & Venture Capital Report provide interesting figures to characterize VC activity in Asia. The Preqin (Preqin Special Report: Asian Private Equity and Venture Capital, 2018) report states that VC fundraising substantially increased in terms of the number of funds and

aggregate capital raised over the last two decades. The number of VC funds in Asia grew from 104 to 251 from 2006 to 2017 and the aggregate capital raised during the same period soared from 6.7 billion USD to over 20 billion USD in Asia. However, 2016 witnessed the peak of fundraising worth 28.1 billion USD, and interestingly, in the previous year (2015), the number of funds increased to ever high 460 funds with aggregate capital raised worth 22.7 billion USD. In 2009, fundraising was at its lowest ebb (only 5.7 billion USD). This could be the effect of the Global Financial Crisis (GFC) of 2008, as every other industry during the GFC witnessed a downturn. Additionally, the VC fundraising in Asia dramatically plummeted from 24.1 billion USD in 2011 to 7.7 billion USD in 2013, nonetheless, it regained its momentum in the forthcoming years. Figure 2 depicts the annual Asia-focused VC fundraising over the years 2006 – 2017.

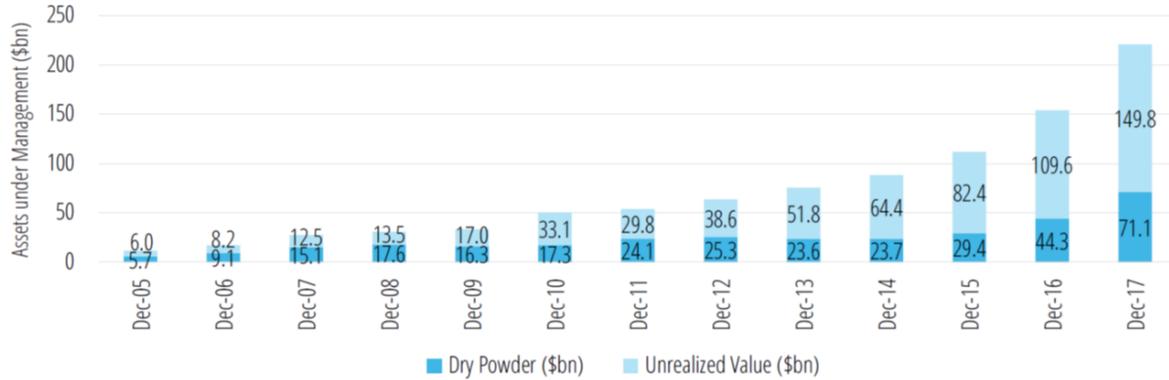
The 2018 Preqin report also shows that Asia-focused assets under management have seen a tremendous growth of 800% during the period 2009 – 2017. The growth in assets under management is caused by technological progress and innovation in Asia. The assets under management grew from a scant 11.7 (2005) billion USD to 121 (2017) billion USD. Figure 3 depicts the VC assets under management in Asia.

Figure 1. 2: Annual Asian VC fundraising in billion USD over the 2006-2017 period



Source: Preqin VC Report (2018)

Figure 1.3: Annual Asian VC assets under management in billion USD over the period 2005 – 2017



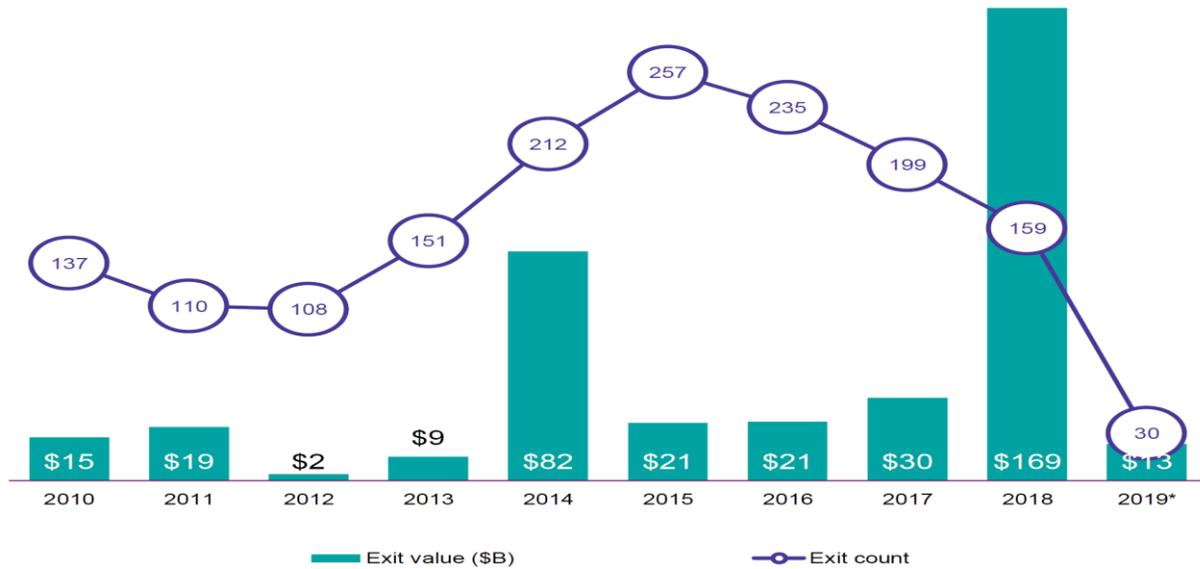
Source: Preqin VC Report (2018)

2.2 Exit routes of VC-backed firms in Asia

Venture Plus (2019) reports the number of exits and the dollar value of exits in Asia⁴. The report states that Asia witnesses 250 VC-backed exits of the worth dollar value of 21 billion. However, the highest exit in terms of dollar value is recorded during 2018. There took place 159 exits worth \$169. 2012 did not prove to be fruitful both in terms of number and volume of exits, as it only recorded 108 exits of only worth \$2 billion. The number of exits and their monetary values are depicted in Figure 4. However, Figure 5 shows that the greater number of exits happen via strategic acquisitions in Asia. IPOs, despite being lesser in number than strategic acquisitions, generate more money than strategic acquisitions in Asia, as shown in Figure 6.

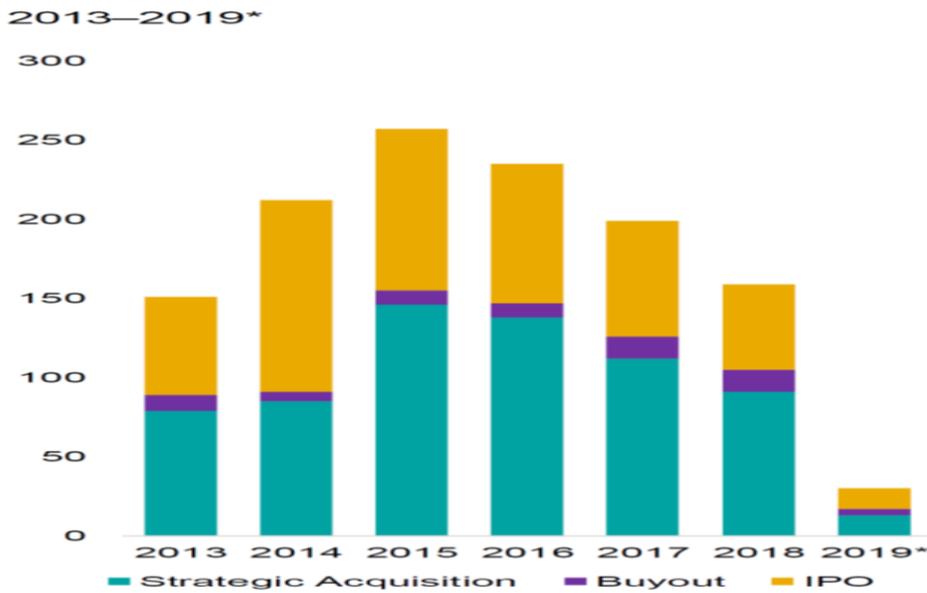
⁴ Venture Plus (2019), Global Analysis of Venture capital Funding, is an annual report published by KMPG corporation.

Figure 1.4: Exit of VC-backed firms in Asia in terms of number and volume in billion USD over the 2010-2018 period



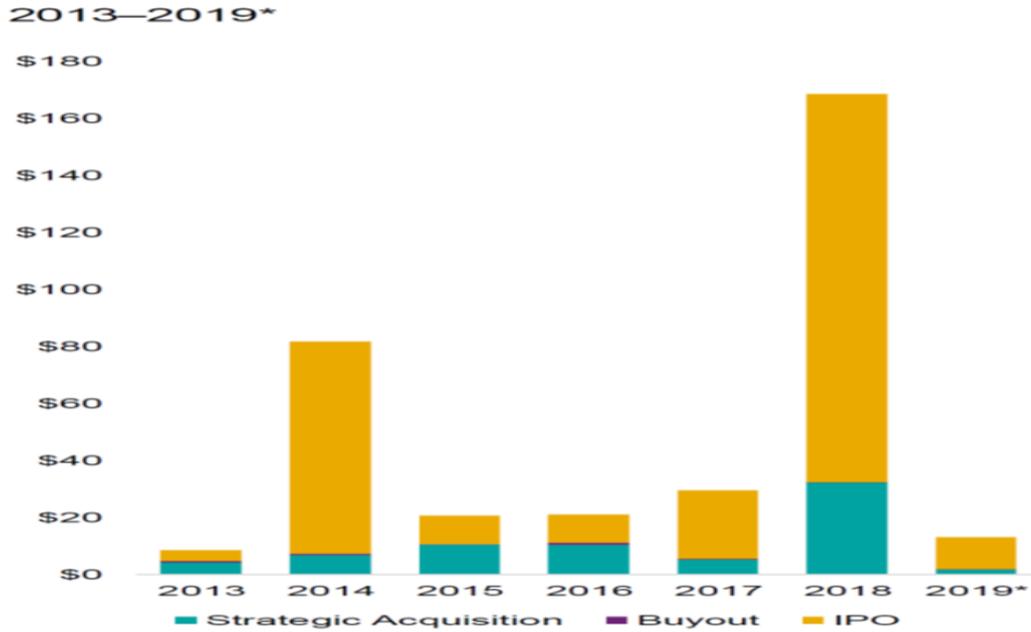
Source: Venture Plus (2019)

Figure 1. 5: Exit route type of VC-Backed firms in Asia over the 2013-2018 period (%)



Source: Venture Plus (2019)

Figure 1. 6: Exit route type of VC-Backed firms in Asia in billion USD over the 2013-2018 period



Source: Venture Plus (2019)

3 Key drivers of VC investment

A type of long-term investment in portfolio companies that has ascertained its role in developing and fostering the economy (Groh and Wallmeroth, 2016), VC activity’s driving factors have been the focus of researchers for the last two decades. Tyebjee and Bruno (1984) probed into the matter of venture capitalist’s investment decisions, but they were more inclined towards the process of decision making rather than evaluating the determinants of VC activity. Subsequently, researchers tried to explore the macroeconomic indicators, firm-level variables, entrepreneurial environmental factors, and institutional and legal determinants of VC investment in developing and developed countries (for example see: Black and Gilson, 1998; Gompers and Lerner, 1999; Jeng and Well, 2000; Marti and Balboa, 2001; Leleux and Surlemont, 2003; Romain and La Potterie, 2004; Cumming *et al.*, 2010; Cherif and Gazdar, 2011; Félix *et al.*, 2013; Groh and Wallmeroth, 2016). Their findings are summarized and presented in the following Table 1.1.

Macroeconomic indicators play a paramount role in the development of businesses in a country. Regarding macro-economic indicators, extant literature is mostly consensual that GDP (Gross Domestic Product) growth rate significantly and positively impacts VC investments (Gompers and Lerner, 1999; Romain and La Potterie, 2004; Cherif and Gazdar, 2011; Félix *et al.*, 2013). Regarding interest rates, results are more contrasted: Gompers and Lerner (1999) and Romain and La Potterie (2004) document that interest rates positively and significantly impact the VC activity, whereas Cherif and Gazdar (2011) found no impact of interest rate on VC development. Corporate and capital gain taxes also play a significant part in promoting or discouraging investments. Gompers and Lerner (1999) and Romain and La Potterie (2004) noticed that higher tax rates discourage VC investments; on the other hand, Jeng and Well (2000) and Groh and Wallmeroth (2016) documented no impact of tax rates on VC development. Likewise, the unemployment rate negatively impacts VC activity according to Félix *et al.*, 2013, and Cherif and Gazdar, 2011. Finally, Groh and Wallmeroth (2016) explored that corrupt countries are less likely to attract VC investments, whereas trade open countries – measured by export as a percentage of GDP – develop better VC industries.

Apart from macroeconomic indicators, investment-environment factors are also the key driving factors of VC investments. Black and Gilson (1998) found that stock-market-centered countries are characterized by vibrant VC industries than bank-centered countries. Later, Gompers and Lerner (1999) lend some supports to this finding, but Shertler (2003) contended that robust stock-market only affect early-stage ventures. However, in the subsequent studies, instead of stock-market development, researchers proxied it with the market capitalization and number of preceding year IPOs. Interestingly, Félix *et al.* (2013) found that IPOs have a positive impact on VC investments, and Jeng and Well (2000) explored that IPOs only affect later-stage investments but not early-stage investments. On the other hand, Gompers and Lerner (1999), Cherif and Gazdar (2011), and Marti and Balboa (2001) found no impact of IPOs on VC development. Similarly, Cherif and Gazdar (2011) found that market capitalization significantly impacts the VC activity, but Gompers and Lerner (1999) document that market capitalization has no impact. Moreover, pension funds have been a substantial contributor to VC investments, and Gompers and Lerner (1999) and Jeng and Well (2000) empirically endorsed that the countries with higher levels of pension funds develop sound VC industries. Another important factor that affects businesses is labor market rigidity. Romain and La Potterie (2004) found that a labor rigid market deters VC

investments; however, Jeng and Well (200) and Félix *et al.* (2013) endorsed this finding only for early-stage ventures and contended that it does not affect later stage ventures.

Furthermore, the legal and institutional variables also impact VC investments. For example, the legal system of a country also plays a significant role in the development of VC in a country: Common law countries are more likely to develop robust VC industries as compared to German and French Civil law countries (Leleux and Surlemont, 2003), and countries with strong legal rights and Intellectual Property (IP) rights also foster VC investments (Félix *et al.*, 2013; Groh and Wallmeroth, 2016). Similarly, VC flourishes and thrives in innovative countries i.e., the countries with higher innovative index and the greater number of patents are more likely to have vibrant VC industries (Félix *et al.*, 2013; Groh and Wallmeroth, 2016; Romain and La Potterie, 2004). The countries with the higher R&D expenditure also attract more VC investments (Gompers and Lerner, 1999; Schertler, 2003; Romain and La Potterie, 2004; Cherif and Gazdar, 2011). However, given the cyclic nature of VC investments, the number of trade sales and mergers and acquisitions (M&A) in a country also positively impacts the VC activity (Cherif and Gazdar, 2011; Groh and Wallmeroth, 2016).

The extant literature presents contrasting results regarding the determinants of VC investments. These studies are mostly based on European and related western perspectives over different periods. For a better understanding of the readers, we have tabulated the finding of the extant literature in the following Table 1.1.

Table 1. 1 The Determinants and Key Drivers of VC Activity.

| Study/year/sample/period/ dependent variable | Macroeconomic factors | Legal and institutional factors | Firms' specific variables | Environment variables |
|--|---|---|----------------------------------|--|
| Black and Gilson, (1998) US, Japan, and Germany [1991-1995] Dependent Variable Capital contribution | | | | Stock Market development (+) |
| Gompers and Lerner (1999) Unites states [1971-1994] Dependent variable VC investments, No of VC-backed companies, Total Fundraised | GDP Growth rate (+) Interest Rate (+) Capital Gain Tax Rate (-) | | R&D Expenditure (+) | IPO (=) Stock market (+) Pension funds (+) |
| Jeng and Well (2000) 21 countries [1986-1995] Dependent variables The ratio of VC investment to GDP, the ratio of early-stage to GDP, funds raised, | GDP growth (=) Corporate Tax rate (=) | Accounting standards (-) | | Pension funds level (+) Market capitalization (=) IPO (=) Early stage IPO (+) Later stage Labor Market Rigidity (=) later stage Labor Market Rigidity (-) Early-stage |
| Marti and Balboa (2001) European 16 countries [1991-1999] Dependent variables VC funds raised | GDP growth rate (=) | | Preceding year VC investment (+) | IPO (=) |
| Leleux and Surlemont (2003) European 15 countries [1990-1996] Dependent variable: VC funds raised VC funds invested | | Common law (+) German and French Civil Law (-) | | |

| | | | | |
|--|---|---|--|--|
| Schertler (2003) European 14 countries [1988-2000] Dependent Variable Early stage and expansion as a percentage of GDP or Gross Capital | | | R&D Expenditure (+) | Stock market (+) for early stages only Labor Market Rigidity (+) for early stages only |
| Romain and Van Pottelsberghe de la Potterie (2004) OECD 16 [1990-2000] VC investment share of GDP | GDP Growth rate (+) Corporate Tax (-) Interest rate (+) | | R&D expenditure (+) No of Patents (+) | Labor market rigidities (-) |
| Felix <i>et al.</i> (2007) European 23 countries [1992-2003] The ratio of VC investment to GDP New Funds raised to GDP High tech investment to GDP Early-stage to GDP | GDP growth rate (+) Unemployment rate (-) | Legal right index (+) | R&D Expenditure (=) Innovation index (+) | IPO (+) Trade sales (+) Labor Market Rigidity, later stage (=) Labor Market Rigidity Early stage (-) |
| Cherif and Gazdar (2011) Europe 21 countries [1997-2006] Dependent variable The ratio of early-stage VC investment to GDP, Funds raised to GDP | GDP growth rate (+) Unemployment rate (-) (Only early stage) interest rate (=) | | R&D Expenditure (+) | IPO (=) Trade sale (=) Write off (=) Market capitalization (+) |
| Groh and Wallmeroth (2016) 118 developed and developing countries [2000-2013] Dependent variable VC investment as a percentage of GDP | Bribery and Corruption (-) Corporate Tax (=) Unemployment (=) Export (+) | Legal Right (+) Intellectual Property protection (+) | Innovation (+) | M&A (+) |

(+) shows the positive impact, (-) shows the negative impact, and (=) shows the non-significant impact

4 Institutional Theory to Understand the Specificities of VC in Developing Asia: A Comparison with the US and Europe

Institutional theory is suitable for studying the difference in the VC industry across continents. This theory states that institutions and culture subtly but pervasively govern the behaviors of individuals and organizations and thereby underscore several potential managerial differences across countries. Studies by Bruton *et al.* (2002, 2003, 2005, and 2009) provide comprehensive insights into the institutional perspective on VC differences across continents. This theory classifies institutional forces into three categories: normative, regulatory, and cognitive forces.

Normative forces refer to those values, beliefs, and norms that are shared among firms in an industry around the globe. Bruton *et al.* (2005) state that followers imitate the pioneers' practices as an industry norm, although these practices might not be economically sound. VC started in the U.S. and then prevailed in Europe and Asia; thus, the rudimentary VC industry norms and beliefs worldwide have been established as per the U.S. VC industry and are equally strong in Europe, Asia, and the U.S.

By contrast, regulatory and cognitive forces drive different patterns for the VC industry according to the geographical area. Regulatory forces refer to legal philosophy, investor protection, legal enforcement, and the nature of stock market capital. As shown by several studies cited above, both the legal system and the structure of financial markets influences VC activity. La Porta (1997) and La Porta *et al.* (1998, and 2000) note that civil law systems provide less investor protection than common law systems. Regarding the structure of financial markets, Black and Gilson (1998) found that stock market-centered economies have robust VC industries than bank-centered economies. Moreover, governments intervene in the capital markets by developing and implementing industrial policy, managing exchanges rates, deploying reserves, and using state-owned assets. Specifically, in the VC industry, the government plays a significant role by devising the legal and financial framework in which investors operate and their protection is ensured, and it may patronize or impede VC funds by regulating financial institutions such as banks and insurance

companies. More generally, in Asian developing countries, the role of the government in the economy is stronger than it is in the US or Europe and a key driver of these regulatory forces.

Finally, cultural and traditional forces give rise to cognitive institutions. Culture has a substantial influence on the evolution and ecology of organizations. Investing trends, consumer behavior, risk-taking attitudes, and saving tendencies vary across cultures. Contracting and social networking are important for the course of business. All these cognitive behaviors are of paramount influence in organizations. Asian culture and tradition are different from those in the U.S. and Europe. Therefore, Bruton *et al.* (2005) document that the status of entrepreneurs in Asia is low, and reliance on social networks is stronger than in the US and Europe. If the VC industry is homogeneous in the US and Europe due to similarities in the Western culture (Sapienza *et al.* 1996), the Asian VC industry differs strongly from its western counterparts because of distinct business practices and activities due to organizational and institutional differences (Peng, 2000; Burton and Ahlstrom, 2003; Ahlstrom *et al.* 2007). In the same vein, Groh *et al.* (2010) argue that the VC industry is significantly different across countries because of the differences in the institutional environment, legal framework, and historical legacy. Hence, the ecology of organization, culture, laws, and statute of indigenous society molded this industry according to the environment in which it operates.

Several characteristics of the Asian entrepreneurial environment make Asian VC a unique and distinct industry. The diversity in the economic and political environment of Asian countries led to variations in the institutional setup, financing sources, tax incentives, transparency level, cost of capital, and idiosyncratic risk, and all these elements considerably influenced the VC development in Asia (Naqi and Hettihewa, 2007). More specifically, Asian specificities can be declined according to the staged process of VC investment, consisting of three very important phases: (i) Screening and selection (ii) Monitoring and Value addition (iii) Exit. The extant literature documents the following noteworthy differences in the VC activity between Asian and Western VC firms.

4.1 The differences in screening and selection

Selection and due diligence is the first and most meticulous and assiduous phase of venture capital activity. Portfolios' development stage, industry, geographic proximity, and future round investment are contingent upon the appropriate selection and due diligence. In western countries,

Venture capitalists decide their investment based on the financial statements provided by the entrepreneurial firms. Financial statements are the measuring yardsticks for the investment. Western venture capitalists review the proposal for funding by investigating the financial and accounting information reflected in the business plan provided by the entrepreneur (McGrath, 1997; Wright, Thompson, and Robbie 1992) and therefore they measure the level of risk associated with the project (Wright *et al.*, 1992). However, financial reporting in Asia is generally not transparent. The accounting and financial information reflected in the books of accounts are not reliable as compared to that in the West. Business legislations like the financial and commercial statute in Asia are underdeveloped as compared to those in Europe and the U.S, and if rules are present, yet these are not implemented in true letter and spirit (Backman, 2001; Khanna and Palepu, 1999). Hence, the selection and due diligence, and funding of portfolio companies in Asia are quite a time-consuming and difficult task because of the lack of well-developed regulatory institutions and lack of transparency of financial statements than that in the Western countries (Bruton *et al.*, 2004). Moreover, due to difficult access to reliable financial statements, Asian venture capitalists mostly prefer to invest in portfolio companies that have already well established at least three years of financials (Bruton *et al.*, 2004). Finally, unlike the West, Asian venture capitalists are more interested to invest in geographically proximate portfolio companies to avoid travel and communication barriers (Bruton *et al.*, 2002).

4.2 The differences in governance, monitoring, and value addition

VC is the investment of experts in the long-term, risky, and unlisted ventures, and venture capitalists play an active role in the management of the company. Venture capitalists' experience and connections differentiate VC funding from other types of traditional investors, and their value-adding activities lead the portfolio companies to success (Gompers, 1995). Asian countries do not have the same professional and expert venture capitalists and investment managers that western countries produced during the last century (Kenney *et al.*, 2002). Therefore, inexperienced investment managers, poor educational systems, low level of research grants are the factors that prevented Asia from creating iconic firms that exist in the West. There are subtle and pervasive differences in governance and monitoring mechanisms of venture capitalists in Asian and western countries.

Traditionally, Venture Capitalists reserve a board seat in the investee companies to have a say in the governance, monitoring, and decision making. The Board seat is the most formal mechanism through which VC firms exercise their control over the investee companies (Fried and Hisrich, 1994). In the US and Europe, portfolio companies have smaller boards as compared to those in Asia, and smaller boards help avoid conflicts and help in prompt and efficient decision-making (Bruton *et al.*, 2004). Further, they explain, on average, there are 6 board members and out of which 41% of board seats belong to venture capitalists in western countries. On the contrary, in Asia, businesses are mostly family-owned companies, and families are not willing to share their powers and authority over the business to the venture capitalists, so they are reluctant to give a board member position to venture capitalists (Naqi and Hettihewa, 2007). The directors in the board are mostly insiders, and it is difficult for Venture Capitalists to be the board members (Low, 2002). In case, Venture Capitalists manage to reserve a board seat, yet it would not be influential and even sometimes would not receive valid and reliable information (Peng, 2000; Bruton *et al.*, 2004).

As mentioned earlier, VC not only provides financial but also non-financial capital. Venture capitalists give non-financial capital through their active participation in the management and operational activities of the investee companies. They are the strategic advisor to the CEOs of the funded companies (Bruton *et al.*, 2009). One way through which the venture capitalists could add value to the portfolio companies is their direct interaction with the entrepreneurs - time devoted by venture capitalists to the management and operational activities of the portfolio companies (Naqi and Hettihewa, 2007; Bruton *et al.*, 2009). However (Naqi, 2002) found that Asian venture capitalists only devote 58 hours per month in direct contact with the entrepreneurs, whereas, in the US, venture Capitalists spend 153 hours per month with the managers of the investee companies. Therefore, they act as financiers rather than traditional venture capitalists whose role is active participation in the management of the company.

In Western countries, Venture capitalists are the former CEOs of established companies, and they are experts in portfolio investments. On the other hand, because of the comparatively shorter history of the VC industry in Asia, Venture Capitalists mostly have banking backgrounds, and their fundamental professional and value addition skills to the portfolio companies, as compared with their Western counterparts, are restricted (Naqi and Hettihewa, 2007). They further

add that Asian Venture Capitalists emphasize more for collaterals – stressing for collateral is not a feature of traditional VC investment.

Lastly, contracts and covenants are the lifelines of private equity: before investment, entrepreneurs and venture capitalists sign the term sheet – a formal document that denotes the terms and conditions of the investment. In the West, laws are well developed and fully imposed upon the entrepreneurs and VC firms alike. Hence, investor protection is well addressed and warranted. Contrary, in developing countries, since laws and statutes are not fully developed, and organizations must depend on informal and personal relations to fulfill the agreements (Ahlstrom, Young, and Nair, 2003). This dependency on informal and personal relations exacerbates the situation when Venture capitalists cannot direct the CEO to act in a certain way (Bruton *et al.*, 2009).

4.3 Exit differences

As stated earlier, VC is staged, and exiting from investments is the most important phase of VC activity. Venture capitalists are temporary investors, as they monetize their stake after 5 to 10 years (Sahlman, 1990; Gompers and Lerner, 1999). In Asia, the investment horizon is shorter, approximately 2 to 4 years (Naqi and Hettihewa, 2007). A successful exit means that venture capitalists regain their capital through initial public offerings, buybacks, mergers, and acquisitions or, sometimes, in the form of company stock. Conversely, unsuccessful exits occur when entrepreneurial companies go out of business due to write-offs, becoming defunct, or bankruptcy. However, IPO is the most preferred and fruitful type of exit.

The structure of financial markets plays a key role in the exit of VC investments. For example, some countries are bank-centered financial markets i.e., Japan and Germany while others are stock market-oriented like the U.S. and the UK. So, these variations have grave impacts on the VC industry across countries. Like, based on stock markets development, Black and Gilson (1998) underline noteworthy differences between the US VC industry and elsewhere in the world. They add that a vibrant stock market is inevitable for a healthy VC industry: like well-developed stock markets bolster IPO exits. In Asia exiting from business for the venture capitalist is a quite troublesome and complex task due to the less developed regulatory institutions (Bruton *et al.*, 2004). VC firms in western countries are managed as a limited partnership and their utmost objective is to divest through IPO. Asian private venture capitalists invest for a shorter period in

relatively more mature ventures, and their goal is to exit from investment through IPO or merger and acquisitions (Bruton *et al.*, 2004). Asian developing countries are characterized by bank-centered systems and relatively weak stock markets compared to western economies (Bruton *et al.*, 2005 and 2009). Due to the weak regulatory forces in Asia, stock markets are inefficient as compared to western economies (Bruton *et al.*, 2009), and due to less developed stock markets, it is very difficult for the young and early-stage ventures to get listed (Wang and Sim, 2001). As a result, venture capitalists must look for a strategic sale to exit, but unfortunately, it is very difficult to hook up with a sound buyer, and even sometimes the returns for venture capitalists are quite lower than expectations (Bruton *et al.*, 2004).

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Chapter 2

Performance of Government Venture Capital (GVC): An Asian Perspective

Performance of Government Venture Capital (GVC): An Asian Perspective

Abstract

This article investigates the exit performance of companies backed by government venture capital (GVC) compared with that of firms backed by independent venture capital (IVC) in Asia. Using a sample of 3,817 firms from 9 Asian developing countries over 26 years (1991-2017), we first show that GVC-backed firms are more likely to be financed in the early stage than IVC-backed firms. In doing so, GVC absorbs the higher probability of unsuccessful exit associated with firms financed in the early stage. In contrast, we find that in the expansion stage and later stage, GVC-backed firms perform better than IVC-backed ones. Overall, we show that GVC-backed firms outperform IVC-backed firms in terms of successful exits. We thus challenge the hypothesis of GVC underperformance tested in the existing literature on other geographical areas. Finally, we also provide evidence that mixed syndication (combination of GVC and IVC) improves the exit performance of ventures.

1 Introduction

Entrepreneurial companies are generally viewed as drivers of economic growth (Audrescht 1995); however, they remain financially constrained because they are risky, lack track records, and, cannot benefit from collateral to secure their debt, due to the intangibility of the assets (Denis, 2004; Berger and Udell, 2006). In this context, venture capital not only plays the role of bridging the financial gap for these companies (Gompers and Lerner, 2001; Denis, 2004), but it may also result in value-added activities, such as strategic, managerial, or administrative support (Sahlman, 1990).

Several types of venture capital firms (henceforth known as VC) exist. Independent VC firms (henceforth known as IVC) only pool the resources of private investors. Another type of VC firm is called captive VC because resources are provided by specific organizations, such as large corporations, banks, or government institutions. In this paper, we focus on captive venture capital known as government venture capital firms⁵ (henceforth known as GVC). GVC are VC firms set up by governments and operated by managers who are appointed by governments. They directly question the role of government as both promoting economic growth and being an investor. The literature highlights strong differences in terms of objectives: IVC strive for profit maximization, while GVC value regional development, economic activity, job creation, and links between institutions (Hellmann, 2002, Leleux and Surlemont, 2003; Bertoni and Tykvová, 2015). Many studies stress the positive economic consequences of VC in general for fostering economic growth, creating jobs, developing technology, and spurring innovation (Kortum and Lerner, 2001; Kanniainen and Keuschnig, 2004). However, when considering the specific impact of GVC, the results are mostly not positive: Bertoni and Tykvová (2015) conclude that government funding has no significant effect on entrepreneurial firms' innovation, whereas Grilli and Murtinu (2014) obtain similar negative findings in terms of employees' and sales' growth. Moreover, Alperovych *et al.* (2015) document that GVC funding negatively impacts the efficiency of the investee company. Another strand of the literature is dedicated to analyzing a possible crowding-out effect of GVC on IVC (Del Palacio *et al.*, 2012; Jeng and Wells, 2000, Leleux and Surlemont, 2003; Brander *et al.*, 2015; Guerini and Quas, 2016). These studies provide mixed evidence regarding the effectiveness of GVC financing on companies' additional PVC fundraising.

⁵ Researchers have used different terminologies for government venture capital: publicly sponsored venture capital (Buzzacchi *et al.*, 2013), government managed venture capital (Grilli and Murtinu, 2014), government-sponsored venture capital (Brander *et al.*, 2010, and 2015).

In this paper, we question the exit performance of GVC-backed firms compared with that of IVC-backed firms in developing Asian countries. The type of exit is usually used as a proxy for performance in the venture capital literature (Hochberg *et al.*, 2007; Nahata, 2008; Tian 2012; Brander *et al.*, 2015; Cumming *et al.*, 2017; Zhang and Mayes, 2018). More precisely, a successful exit means that venture capitalists regain their capital through initial public offerings (IPOs), mergers and acquisitions (M&As), or, sometimes, through buyouts when VC resell their stake to entrepreneurs. Conversely, unsuccessful exits occur when entrepreneurial companies go out of business due to write-offs or by becoming defunct or bankrupt.

GVC are highly heterogeneous in terms of design, and differences across geographical areas can surely affect their exit performance (Alperovych *et al.*, 2020). Focusing on an area – developing Asia – where governments exert considerable control over economic and financial development (Zhang and Mayes, 2018), in comparison with Europe or the US (Leleux and Surlemont, 2003), may bear novel results. Moreover, the economic importance of GVC is increasing in this area; specifically, according to an annual report published by Bain (“Asia Pacific private equity report”), government-linked investors have increased their momentum, representing more than a quarter of the deal value in 2018⁶. The comparison of GVC and IVC in terms of exit is a recent research issue (Luukkonen *et al.*, 2013): existing studies are mainly based on the US and European data and have demonstrated that GVC-backed companies underperform compared to IVC-backed companies (see Brander *et al.* (2010 and 2015), Cumming *et al.* (2017) and Zhang and Mayes (2018) from the Canadian, international, European, and Chinese perspectives).

Our paper contributes to the debate on the effectiveness of GVC and provides novel results by challenging the “exit underperformance hypothesis” that is associated with GVC-backed companies, which has been mostly confirmed in the existing empirical literature. Moreover, we rely on the staged decomposition of VC funding, with GVC and IVC playing different roles and bearing different risks when investing in the early stage (financing seeds or startups) or the mature and expansion stages. Thus, factors driving successful exits for GVC-backed companies (compared with IVC-backed companies) may differ according to the stage of investment. We highlight a

⁶ Examples of Asian GVC: Beijing High-Tech Venture Capital Co Ltd. in China, IFCI Venture Capital Funds Ltd. (IFCI Venture) in India, Malaysia Venture Capital Management Bhd in Malaysia, Tube Dasan Venture Fund in South Korea, EDB Investments (EDBI) economic development board investment in Singapore, Small Industry Finance Corporation in Thailand, National Development Fund Executive Yuan in Taiwan.

double phenomenon of substitution and compensation effects between the two types of VCs that explains the overperformance of GVC on the whole cycle of VC life in developing Asia. Finally, we provide new insights into the role of syndication regarding its impact on the performance for both GVC and IVC syndicated-backed firms, as previous research has demonstrated conflicting results (see Cumming *et al.*, 2017; Zhang, 2018).

By using a multinomial logistic regression, we analyze a sample of 3,817 venture capital-backed companies (4,682 observations) from nine Asian developing countries that received their first VC investment between 1991 and 2013. Our results show that, in our Asian sample, GVC invests more in the risky early-stage than IVC, thus absorbing a higher probability of achieving an unsuccessful exit. Additionally, we find that GVC-backed firms have a higher probability of success in the expansion stage and later stage than did IVC-backed firms, thus highlighting the positive role of Asian governments in these stages. Finally, we find that overall, in Asian developing countries, GVC-backed companies outperform IVC-backed companies in terms of successful exits: it appears that successful exits in the expansion stage and later stage outweigh risk-taking and failure in the early stage. When regarding syndication, our results agreed with findings from previous research, which showed that mixed syndication (a combination of GVC and IVC) generates more successful exits than standalone backed companies and pure IVC syndication, but for a different motive. Our results are reinforced by several robustness checks.

The remainder of this paper is structured as follows. Section 2 provides an overview of the theoretical framework and hypothesis development. Section 3 is dedicated to research design. Section 4 is devoted to the results and analysis, and section 5 concludes the paper.

2 Theoretical Framework and Development of Hypotheses

After highlighting the specificities of GVCs in developing Asia, we construct our hypotheses in relation to the exit performance of GVC-backed firms compared to IVC-backed firms by taking into account the different stages of investment.

2.1 GVC in developing Asia: Which specificities?

The VC industry is strongly influenced by the institutions of a given country or by geographical area. Studies by Bruton *et al.* (2002, 2003, 2004, 2005 and 2009) that relied on this institutional perspective provide comprehensive insights into VC differences across geographical areas and

categorized institutional forces into three types: normative, regulatory and cognitive. Normative forces refer to those values, beliefs and norms that are shared among firms in an industry around the globe. The rudimentary worldwide VC industry norms and beliefs have been established according to the US VC industry and are equally strong in Europe, Asia and the US.

In contrast, regulatory and cognitive forces drive different patterns for the VC industry according to geographical area. Regulatory forces refer to legal philosophy, investor protection, legal enforcement and the nature of stock market capital. Developing Asian countries exhibit mostly civil law systems that provide less investor protection than common law systems (La Porta *et al.*, 1997, 1998, and 2000)⁷. These countries are mainly bank-centered, with low developed stock markets compared to the Western economy (Bruton *et al.*, 2003 and 2004), which restrains the opportunities of exit via Initial Public Offering (IPO). In addition, the role of the government in the economy is stronger than that in the US or Europe (Zhang and Mayes, 2018); specifically, it controls the capital market by giving approval to prevalent financial decisions, such as IPOs.

Finally, cultural and traditional forces give rise to cognitive institutions. Asian culture and traditions are different from those in the US and Europe. Several studies have demonstrated the role of social networks in VC success in the US (Hochberg *et al.*, 2007; Sorenson and Stuart, 2001), but it is far stronger in Asia, where the status of entrepreneurs is low than in the US and Europe. A reliance on social ties, especially networks with governmental officials, will be an essential part of the VC process in this area. Previous specificities of our geographical area may lead to contextually adjusted hypotheses regarding the differences in performance between IVC and GVC.

2.2 Exit performance of GVCs in developing Asia according to the stage of investment

The existing literature highlights many pitfalls of GVCs, which are thought to be the cause of their underperformance when compared to IVC. First, managers suffer from weak experience in VC industry deal selection and evaluation (Leleux and Surlemont, 2003, Armour and Cumming, 2006, Bertoni *et al.*, 2015), as governments officials are often “transformed” into venture capitalists. They

⁷ 6 out of the 9 countries of our study exhibit civil law system.

also have lower incentives, due to less efficient compensation mechanisms. In addition, they are less independent in decision-making under political pressure (Cumming *et al.*, 2017).

However, in developing Asia, the role of social ties among government officials may offset the previously cited shortcomings. First, in accessing projects, GVCs may enjoy privileged access to local resources and better access to policy supports, such as tax benefits or R&D subsidies (Zhang, 2018). Second, in screening projects, IVCs rely on links with peers through previous investments and syndications, but they suffer from coordination costs, especially in the aspect of due diligence due to a lack of transparency of financial reporting and weak corporate governance (Bruton *et al.*, 2003). In contrast, GVC may benefit from priorities during due diligence, and ties may also allow for privileged access to the IPO approval in this context of low developed capital markets.

The weight of social ties may differ according to the stage of investment. In the early stage (seeds, start-ups and early investments, see Gompers, 2005), as is similar in other geographic areas, GVC will play the role of promoting the local economy. In the early stage, firms are riskier because they have a very short history of cash flows, earnings and tangible assets. Due to this severe information asymmetry, a higher probability of failure and insufficient collateral, the early stage is not attractive for IVC striking for profit. Like previous studies in other areas (see Lerner, 2002; Bertoni *et al.*, 2015, for results in Europe and in the US), we posit the existence of the substitution effect: GVC fill the financing vacuum that is left by other types of VC:

H1: GVCs are more likely than IVCs to invest in early-stage ventures in Asian developing countries.

In the expansion and later stage, we support the novel idea that, in developing Asia, GVCs will take advantage of social ties to access and select the better projects, as well as to favor their exit via IPO. The government may patronize state-owned ventures through tax subsidies, funds for R&D and innovation but also prompt access to financial institutions and information sharing, as seen in Chinese state-owned enterprise financing (Aharony *et al.*, 2000; Brandt and Li, 2003; Cull and Xu, 2003). Interestingly, Brander *et al.* (2015) argue that GVC could perform better in underdeveloped markets than in developed ones, but their empirical study provided nonsignificant results regarding Asian countries. We rely on the idea that GVC-backed ventures receive preferential responses and patronage from state institutions in the expansion stage and later stage

and overcome the structural weaknesses of financial markets experienced in the early stage. Therefore, we assume that:

H2: In developing Asia, GVC-backed companies receiving their first investment in their expansion stage or later stage have a higher probability of successful exit than IVC-backed firms.

Finally, GVC firms may sacrifice their expected returns for policy objectives in the early stage and attract the most promising ventures in the mature stage by funding them at below-market rates and “pick winners”, thereby leaving behind only the “lemons” for IVC investments (Leleux and Surlemont, 2003). We posit that the successful exit in the expansion stage and later stage outweighs risk-taking and failure in the early stage, thus leading GVC to perform better than IVC. The probability of a successful exit by entrepreneurial firms receiving investments in the expansion stage and later stage will then mitigate or offset the poor performance of GVC-backed companies receiving investments in the early stages. Therefore, we posit:

H3: In developing Asia, GVC-backed firms perform better than IVC-backed firms in terms of successful exits.

2.3 Performance of mixed syndication in developing Asia

According to both classical financial theory and resource-based theory (Cumming *et al.*, 2005; Lockett and Wright, 2001; De Clerq and Dimov, 2004), there are several perceived advantages to VC syndication. First, syndication helps better screening and evaluation in the early stage (Casamatta and Haritchabalet, 2007), providing more information to investors (Manigart *et al.*, 2006) because syndicated networks share information about markets, deals and industries during the investment process. Consequently, it may enhance the performance of firms by adding value in the expansion stage and later stage (Cumming *et al.*, 2005; Gompers and Lerner, 2004). It may also help VC firms accumulate more funds and inject more capital (Ferrary, 2010; Andrieu and Groh, 2012).

When regarding syndication that mixes GVC and IVC, several studies have enhanced its specific advantages. According to Cumming *et al.* (2017), mixed syndication may alleviate the pitfalls of GVCs. Lerner (2002) and Guerini and Quas (2016) also highlight a certification effect; that is, the idea that GCV firms can screen the market and act as “a stamp of approval”. On the

Chinese market, Zhang (2018) supports the idea of a higher performance for mixed syndication, as compared with standalone IVC- and GVC-backed firms, as IVC firms may also benefit from the advantages of public privileges of GVC firms, including faster regulatory approvals. However, she found no significant difference in the exit performance of companies that were backed by mixed syndication and pure IVC syndication. H4 supports the hypothesis that GVC could perform better than IVC; thus, we settle on the idea of a better exit for mixed syndication, but not for the same motive as was described in previous studies. According to our framework, the strong advantage of the social ties exhibited by GVC will reinforce the efficiency of IVC due to a better expertise and incentive, and will offset potential inconvenient effects, such as conflicts of coordination or discrepancies in screening methods.

H4: In developing Asia, mixed GVC perform better than other standalone backed firms and pure IVC syndication

3 Research Design

3.1 Sources and sample

We used the data and information from the *Thomson One Banker* dataset, formerly known as *Venturexpert*. This comprehensive database sources data from public news releases, surveys of private equity firms and government filings, and it offers good coverage of Asian countries. It records deals conducted around the globe in VC and private equity over the last three decades and has been used by several cited studies (Nahata, 2008; Nahata *et al.*, 2014; Brander *et al.*, 2015).

Our sample consists of portfolio companies that are headquartered in nine Asian developing countries—China, India, Indonesia, Malaysia, the Philippines, Singapore, South Korea, Taiwan⁸ and Thailand — and that received their first investment between 1991 and 2013 from four types of VC: GVC, IVC, mixed syndication (a combination of GVC and IVC) and pure syndication (composed of only IVC)⁹. Taking the first round of investment is convention in VC research and literature¹⁰, as it is of paramount impact on future financing rounds.

⁸ We treated China and Taiwan separately, given their different political and economic system. We do not include Hong Kong and Japan because they are classified as developed countries.

⁹ We dropped other captive venture capital-backed companies from the sample (bank-affiliated and corporate VC-affiliated firms, angel investors, university endowments and pension funds) and real estate, insurance firms and financial firms.

¹⁰ See Lerner, 1994; Sørensen, 2007; Cumming *et al.*, 2017; Zhang and Mayes, 2018

After dropping missing data, the resulting sample included 3,817 portfolio companies (4,682 observations) located in nine Asian developing countries that received their first VC investment during the 1991-2013 period. We then probed the life cycle of venture capital-backed firms until 2017, aiming to identify the type of exit. To do so, we relied on the database classification: successful exit is classified as an IPO in registration for an IPO, merger & acquisition, and pending acquisition, while an unsuccessful exit is identified as defunct or bankrupt companies (Bock & Watzinger, 2019). We also needed to address those companies for which no exit was registered in 2017. To do so, we followed the conventions of extant VC literature that give 4 years of tenure to allow portfolio firms to mature and obtain a conclusive situation (success or failure)¹¹: Therefore, we dropped from the sample those companies that received their first investment after 2013. We classified as “still active” portfolio firms that received their first investment before 2013 but registered no exit (successful or unsuccessful) in the database. This is a different treatment from that adopted by Zhang and Mayes (2018), who treated active firms as unsuccessful. In our data sample, approximately 62% of companies are still active, and treating them as unsuccessful may distort the findings.

3.2 Variables

All variables are defined in Table 2.1.

[Please insert Table 2.1 about here]

Dependent variable. The first primary variable used in the models is exit performance. We follow the existing literature in the field and use this variable to proxy for VC performance (Brander, *et al.*, 2002; Hochberg *et al.*, 2007; Sørensen, 2007; Nahata, 2008; Tian 2012; Brander *et al.*, 2015; Cumming *et al.*, 2017; Zhang and Mayes, 2018). Conceptually, the best measure of VC performance is the Internal Rate of Return (IRR). However, primary data such as IRR are rarely available in existing databases. As noted by Phalippou and Gottschalg (2009), successful exits are significantly related to returns, and other measures such as employment and innovation are positively related to the exit performance of VC firms. Conversely, write-offs, defunct firms and other negative exits are negatively correlated with returns. Thus, we use alternatively categorical

¹¹ See Nahata, 2008 ; Nahata et al, 2014 ; Hochberg et al, 2007 ; Brander *et al.*, 2015.

or binary dependent variables¹². Our first dependent variable (**Exit**) is a categorical variable that equals 0 if the company is still active, 1 if it exhibits a successful exit (IPO, merger, acquisition, trade sale) and 2 if the venture is unsuccessful (defunct, bankrupt, liquidated). **Successful** is a binary variable that equals 1 if the company exhibits a successful exit and 0 otherwise. **Unsuccessful** is a binary variable conversely defined (1 if failure, 0 otherwise). **Active** is a binary variable and is set equal to 1 if the company's status is active as of December 31st, 2017; otherwise, it is set to zero. Our second dependent variable is **Stage** and is a categorical variable that equals 1 if the company received its first investment in the early stage, equals 2 in the expansion stage and equals 3 in the later stage.

Explanatory variables. The second primary variable used in the models is the type of VC: **GVC** is a binary variable that equals 1 if a company received its first round of investment from a GVC and 0 otherwise. **IVC** is a binary variable that equals 1 if a company received its first round of investment from an IVC and 0 otherwise. **Mixed syndication** refers to a company that received its first round of investment from a syndication composed of both GVC and IVC firms. **Pure syndication** refers to a first-round investment provided by a syndication that is only composed of IVC firms. To isolate the complete role of IVC, we also built the binary variable **IVC2**, which equals 1 if the first round of investment is received by either a solo IVC or a syndicated IVC.

The third primary variable is the stage of investment. **Early stage** is a dummy variable that equals 1 if company receives its first round of funding in the early stage and 0 otherwise; **Expansion stage** is a dummy variable that equals 1 if a company receives its first round of funding in the expansion stage and 0 otherwise; **Later stage** is a dummy variable that equals 1 if company receives its first round of funding in the later stage and 0 otherwise.

Control variables. In conformity with the existing literature, we collected control variables that should impact the drivers of exit performance without being connected to previously defined hypotheses. Three subsets of control variables are used to capture VC-backed firm characteristics, VC characteristics and environmental characteristics.

¹² Categorical variable Exit is used while running multinomial logistic regression while binary variables Successful, Unsuccessful and Active are used in the robustness and endogeneity concerns where Heckman Treatment effect, Bivariate probit and IV probit do not take into account categorical nature of variables that are having more than two stages. So, we used binary variables. (Explained in Endogeneity section).

(1) VC-backed firm characteristics

The successful exit of companies depends upon the quality of the venture itself. The better the company is, the more chances it will stay in the portfolio list of VC firms. Following Giot and Schwienbacher (2007) and Tian (2012), we proxied connectedness with the total funding of the VC firm in the company. Nahata (2008) states that the higher the total funding is, the higher the chances of success and the higher the number of future rounds. Hence, we define the **connectedness** variable as $\log(1 + \text{amount of total funding})$. Following Nahata (2008), Giot and Schwienbacher (2007), Cumming *et al.* (2017) and Chahine *et al.* (2012), we controlled for **syndication size** using the number of VC firms investing in a company. We include time to exit, also termed **elapse time**, which is the time from the first investment, in months, until a successful or unsuccessful exit; if the firm is still active, we take 31 December 2017, the last point of our data, as the cutoff date (Giot and Schwienbacher, 2007). Following Giot and Schwienbacher (2007), Tian (2012), Zhang and Mayes (2018) and Cumming *et al.* (2017), we controlled for the industry of the portfolio company. **Industry dummies** are a set of six mutually exclusive dummy variables that switch from 1 to zero for every type of industry (see Table 2.1).

(2) VC firm characteristics

Several studies have documented that experienced firms have a greater probability of leading their ventures to a successful exit. Following Tian (2012), Nahata (2008) and Chahine *et al.* (2012), we proxied for VC **firm experience** with the age of the VC firm at the time of financing. In addition, VC **firm reputation** also attracts potential companies that have more probabilities of succeeding. Following Fleming (2004), we proxied for VC firm reputation using the number of funds raised by the VC firm. Finally, we control for firm deals: a firm with a higher number of deals at the time of first investment may have more experience with the market, products, and strategies. The variable is termed the **firm total number of deals**.

(3) Environmental factors

We control for the global financial crisis following Giot and Schwienbacher (2007), Chahine *et al.* (2012) and Cumming *et al.* (2017). **Bubble dummy** is a dummy variable that equals 1 if a company received its first investment in 1998, 1999 and 2000 and 0 otherwise. Following

Cumming *et al.* (2017), we also included **country dummies** in our regression. Country dummies are a set of nine mutually exclusive dummy variables that switch from 1 to zero for every country (shown in Table 2.1).

3.3 Descriptive statistics

Table 2.2 provides descriptive statistics for our final sample. On our sample of 4,682 observations over the 1991-2017 period, we see, using an unpaired t-test assuming equal variance, that exit performance appears to differ significantly according to the type of VC (when compared to the full sample) and to the stage of investment.

[Please insert Table 2.2 about here]

Panel A provides the breakdown according to the type of VC across countries. China appears to play a dominant role in the VC industry in developing Asia: there are 3,817 investee companies in our sample, of which 1,747 are Chinese (more than 50 percent). China is followed by South Korea and India, with 1,198 and 470, respectively. The Philippines has the fewest VC-backed firms. There are 2,930 IVC-backed companies, of which China has 45 percent, South Korea is second (32.32 percent), and India ranks third with 13.61 percent companies. Similarly, there are 273 GVC-backed companies in our sample, of which China holds 35 percent; we see a contrast here, in that China is followed by Singapore, which has 21 percent of the companies, and then India and South Korea, which each have 15 percent of companies. Interestingly, GVC-backed firms outnumbered IVC-backed firms in Malaysia, and in Indonesia and the Philippines, government spending is very meager. In terms of mixed syndication, China enjoys the lion's share, having 68 percent of the total 44 companies, followed by Singapore. Pure syndication shows a different scenario, as China is followed by Taiwan.

Panel B of Table 2.2 indicates that VC-backed companies in developing Asia prefer to invest in non-high-tech and computer-related industries irrespective of the VC firm type. Out of 3,817 companies, 1,535 are related to the non-high-tech industry, and 1,152 are in a computer-related industry, while semiconductors and media & communications rank third and fourth with 425 and 403 companies, respectively. Biotechnology is the industry attracting the least IVC and pure IVC syndicated investment. Overall, medical and health is not a fascinating industry for developing Asian venture capitalists, and even mixed syndications have not made a single investment in medical and health-related industries over our period.

Panel C shows the breakdown of companies with respect to the investment stage. Out of 3,817 portfolio companies, 1,349 are in the early stage, 1,547 are in the expansion stage, and 921 are in the later stage. Descriptive statistics show that GVC invests more in early stages, whereas IVC, mixed and pure syndicates prefer to invest in the expansion stage and later stage compared with the full sample.

Finally, Panel D shows the number and percentages of companies according to the type of exit. Out of 3,817 companies, 1,339 were successful, 93 unsuccessful and 2,385 remained active. Out of 1,339 successful companies, 92 companies were GVC-backed, 963 were IVC-backed, 24 were mixed syndication backed, and 260 were pure syndication backed. Similarly, 93 companies were unsuccessful, of which 7 were backed by GVC, 73 by IVC and 13 by pure syndication. Notably, not a single portfolio firm backed by mixed syndication was unsuccessful.

Table 2.3 reports the Pearson pairwise correlation matrix of the covariates. The correlation between the explanatory variables and the control variables are weak; hence, the issues of multicollinearity concerns in the model are mitigated.

[Please insert Table 2.3 about here]

3.4 The Models

We first use a multinomial logistic regression model to test our hypotheses, which is appropriate for a model in which the dependent variable (exit or development stage) is categorical and has more than two outcomes (polychotomous variables). The multinomial logit has N probability states or outcomes, $N=1, 2, 3, \dots, S$, that are mutually exclusive and exhaustive. In our case, the three outcome possibilities for exit are successful exit, unsuccessful exit and still active; the outcomes for stage are early, expansion and later.

Hypotheses are tested on our sample of developing Asian countries using the following models:

- H1: GVC-backed firms are more likely to invest in early-stage ventures than IVC-backed firms \Rightarrow Stage = f (VC type, control variables)

- H2: The probability of successful exit is higher for GVC-backed companies receiving their first investment in the expansion stage or later stage than for IVC-backed companies
 $\Rightarrow \text{Exit} = f(\text{VC type, control variables})$
- H3: Overall, GVC-backed firms perform better than IVC-backed firms in terms of successful exits
 $\Rightarrow \text{Exit} = f(\text{VC type, control variables})$
- H4: Mixed syndicate-backed ventures perform better than standalone backed companies and pure IVC syndication
 $\Rightarrow \text{Exit} = f(\text{VC type, control variables})$.

4 Empirical Findings

4.1 Main results

We hypothesize that, in Asia, GVC invests more than IVC in early-stage ventures, thus absorbing the higher probability of failure at this stage¹³. The results are estimated by multinomial logistic regression, and the coefficients are expressed as average marginal effects, as shown in Table 2.4. The dependent variable **Stage** has three categories: the early stage, the expansion stage, and the later stage. The independent variables are related to VC type (GVC, IVC, Mixed Syndication, Pure Syndication), and all the control variables are included in the model.

[Please insert Table 2.4 about here]

We find that, on average, GVC invests 8.5 percent more in the early stage than IVC. The industry analysis shows that computer-related companies are 22.3 percent more likely to receive funding in the early stage than non-high-tech industries; additionally, biotechnology-related firms are 19.3 percent more likely to receive funding in the early stage than non-high-tech industries. Our results endorse the hypothesis 1 and a substitution effect for GVC in the early stage.

Subsequently, we split the sample into the following two subsamples based on the portfolio company development stage: one subsample composed of early-stage ventures, and the other comprised of the expansion- and later (mature)-stage ventures. We regressed the sample that was only composed of the portfolio companies that received their first investment in the expansion and

¹³ As shown in Table 2.4, early-stage ventures are 25% less likely to go successful as compared with later stage ventures and 13% less likely to go successful as compared with expansion stage ventures.

later stages. We hypothesized that GVC investments in the expansion stage and later stage leads to a higher probability of a successful venture. Table 2.5 presents the results. The number of observations decreased to 3,108, because we dropped the companies that received their first investments in the early stage. Our results support our hypothesis, as we find that GVC investments in the expansion-stage and later-stage ventures have a greater chance of achieving a successful exit than IVC-backed firms investing in the expansion stage or later stage.

[Please insert Table 2.5 about here]

We then considered the exit performance of GVC-backed firms, regardless of the development stage¹⁴. The results shown in Table 2.6 are estimated by using a multinomial logit regression, and the average marginal effects are reported. The results show, regardless of the development stage, GVC-backed companies are 6.7 percent more likely to be successful than IVC-backed companies. Finally, according to hypothesis 4, mixed syndication-backed firms are 19.2 percent more likely to be successful than standalone IVC-backed companies (although this result is not statistically significant) and 13.5 percent (statistically significant) more likely to be successful than standalone GVC-backed companies (this result is statistically significant). Moreover, the mixed syndication-backed VC firms are 14.3 percent more likely to successful as compared with the pure IVC syndication-backed companies.

[Please insert Table 2.6 about here]

Regarding the control variables, firm experience, time to exit and firm reputation have a negligible impact on successful exit, but syndication size has a positive significant effect. Well-reputed firms are more likely to take their investee companies to a successful exit. It is interesting to note that the bubble dummy has a positive effect on the success of ventures. The companies that received their first investment during the bubble are 7 percent more likely to be successful and 8 percent less likely to stay active than the companies that did not receive their first investments during the bubble period. Finally, industry dummies show that companies related to health and medical sciences, as well as semiconductors and electronics, have a higher chance of success than non-high-tech industries.

¹⁴ Including all the companies that received their first investment in Early stage, Expansion stage and Later stage and the number of observations increased to 4682 observations

4.2 Robustness checks

Endogeneity concerns.

Our empirical estimates show that in developing Asia, GVC-backed companies perform better than IVC-backed companies. However, our results may be driven by potential endogeneity due to a selection bias, unobservable characteristic or omitted variables. To address this issue, we rely on the use of four techniques: three instrumental variable strategies (bivariate probit, Heckman treatment effect and IV probit) and a Propensity Score Matching (PSM) method.

The use of the instrumental variable is a classical remedy to correct for the problem of endogeneity. Following Brander *et al.* (2015) and Zhang and Mayes (2018), we constructed an instrumental variable (IV), **availability of GVC** based on local market conditions, which is defined as the availability of GVC funding in a given year, in a given industry and in a given country at the firm level¹⁵. This instrumental variable shows how likely it is that an enterprise will or will not receive government funding. The greater the level of **availability of GVC** is, the higher the chances that a firm will receive GVC funding. The **availability of GVC** is supposed to be exogenous because it has no impact on the exit performance of entrepreneurial firms. Suppose we have two different markets, one with plenty of GVC and the other with little GVC. An entrepreneurial firm being financed by GVC is endogenous, but the availability of GVC funding is exogenous: Once the entrepreneurial firm obtains funding, it becomes unrelated to that market. Therefore, the **availability of GVC** is an appropriate instrument for addressing selection bias. This sort of variable is widely used in the corporate finance literature¹⁶.

Bivariate probit model. It is an instrumental variable method that is appropriate when both the dependent and independent variables are binary. It is a standard maximum likelihood technique, wherein selection and outcome equations are estimated simultaneously. Our dependent and independent variables are binary; therefore, we first conducted a bivariate probit estimator to correct for the problems of unobservable variables. In the first stage, we identified the likelihood of being backed by GVC by inserting the instrumental variable as being an independent variable;

¹⁵ Brander *et al.*, 2015 defines a market: suppose the semiconductor & electronic portfolio company in Thailand that got its first funding in 1991 is considered one market. Consequently, there are 6 industries, 23 years, and 9 countries, and therefore, there would be 1242 local markets in total (23*6*9=1242)

¹⁶ See Brander *et al.* (2015), Bottazzi *et al.* (2008) and Zhang and Mayes (2018).

subsequently, we inserted the error terms obtained from the first step in the second stage as additional control variables.

$$y_1 = y_2\beta_1 + x\beta_1 + \mu_1 \quad (\text{Eq. 2.1})$$

$$y_2 = z\beta_3 + \mu_2 \quad (\text{Eq. 2.2})$$

where y_1 shows the dependent variable binary variables, y_2 shows the independent endogenous variable, x shows the vector of the control variables for the second stage and z denotes the independent, control, and instrumental variables that were inserted in the second stage.

IV Probit model. This two-step instrumental technique is also a maximum likelihood estimator. In the first stage, the propensity of being backed is estimated; afterward, the error terms obtained from the first step are inserted in the second stage.

Heckman treatment effect. There may be other potential unobservable characteristics of the investee companies, such as the riskiness of the project, the quality of the project, and the capabilities of the entrepreneurs, which may influence the probability of the company's decision being backed by GVC and may also influence the ability to successfully exit (Zhang and Mayes, 2018). Hence, the outcome variable may be correlated with the error terms. The specifications having both selection effects and an endogenous variable pose econometric challenges. Therefore, the Heckman selection model efficiently deals with such types of issues. The Heckman selection (Heckit) effect is also a two-step estimator, which is a limited likelihood approach that uses an instrumental variable to identify the selection equation. The Heckit estimates the inverse Mill ratio (λ) in the selection equation. Subsequently, λ is inserted in the second stage regression as an explanatory variable. The null hypothesis of 'no selection' for the coefficients of the λ can be tested via a t-test (see Woodridge, 2002: 568).

Overall, these three approaches give a comprehensive estimate of the effect of the type of VC-backing on the exit performance of entrepreneurial firms. They cannot be employed directly when the outcome variable is categorical and has more than two outcomes. In this situation, several binary models are estimated for every outcome¹⁷. Therefore, in this specification, we first treat the outcome variable Exit as binary by defining successful as one category and combining the other

¹⁷ See Zhang and Mayes (2018).

two categories; that is, unsuccessful and active as one category (Successful=1, Unsuccessful and Active=0). Similarly, we treat the outcome variable Exit as binary by defining unsuccessful as one category and combining the other two categories; that is, successful and active, as one category (Unsuccessful=1, successful and Active=0). We employed the F test to evaluate the evidence of a weak instrument. In the first stage, the F test shows no evidence of weak instruments.

First, we employed bivariate probit model. The estimates of the second stage of the bivariate probit are shown in Table 2.7. The sign and significance of the variables remain unaltered. The only difference we see is that the coefficient of mixed syndication becomes significant and lower than it was in Table 2.5. Furthermore, the early stages are 25 percent, and the expansion stages are 13 percent, which is less likely to be successful than the later stages. Overall, the results are qualitatively similar to those in Table 2.6.

[Please insert Table 2.7 about here]

Second, we employed the IV probit model. The results of the second stage are reported in Table 2.8. The signs and significance of the variables remain unchanged. GVC performs better than IVC, and syndications perform better than standalone IVC.

[Please insert Table 2.8 about here]

Third, we employed the Heckman treatment effect. The results are shown in Table 2.9. The signs of the coefficients remain the same, but GVC loses its significance. The estimates show that GVC-backed companies perform better than IVC-backed companies. Syndicate-backed companies perform better than standalone-backed companies. The results show that compared to IVC-backed companies, GVC-backed companies are 6 percent more likely to be successful, while mixed syndicate-backed companies and pure syndicate-backed companies are 16.4 percent and 8.6 percent more likely to be successful, respectively. Regarding the stage, the results are similar to those in Table 2.6.

All three of the above instrumental techniques endorsed the finding that GVC-backed companies perform better than IVC-backed companies and that early-stage ventures are less likely to go successful.

[Please insert Table 2.9 about here]

Propensity score matching. Our results show that GVC-backed companies have a higher chance of successful exit; it appears that GVC selects and screens the most promising ventures and consequently reaps the most favorable results. Hence, the overperformance of GVC may be due to the better screening and selection *ex-ante* investments, as well as the value addition *ex-post* investment. Moreover, GVC firms may target different types of portfolio companies based on industry, stage, and age, among other factors. Furthermore, our sample is composed of only 7 percent of GVC-backed companies, which means that IVC-backed companies are dominant in the sample. Therefore, we also employed another econometric technique based on propensity scores, to address the problems of endogeneity concern based on observable factors. The propensity score relies on matching techniques, wherein the GVC-backed companies (treated group) are matched with other types of VC-backed companies (control group), based on similarities in their estimated probabilities of being treated. It efficiently accounts for observable characteristics but does not control for correlation with omitted and unobservable biases. We matched the portfolio companies based on the following characteristics: firm experience, firm reputation, industry, country, stage, and year of investment. PSM ensures that GVC-backed companies are compared with similar IVC-backed companies in a specific country in a specific industry in a specific year. We used average treatment effects in the PSM score model and ran a one-to-one probit regression matching with the nearest neighbor method.

The results are shown in Table 2.10. After controlling for selection bias using PSM, the results show that GVC-backed companies have a 25 percent greater chance of being successful than IVC-backed companies. Therefore, the estimates suggest that the good performance of GVC-backed firms is not due to the selection effect but rather because of the treatment effect. Although PSM supports the treatment hypothesis, Zhang and Mayes (2018) contend that the possibility of a selection effect cannot be ruled out completely.

[Please insert Table 2.10 about here]

Additional robustness checks.

We conducted additional tests to ensure the robustness of the econometric results. First, according to Brander *et al.* (2015), the better exit performance of enterprises backed by mixed syndication compared to standalone-backed companies could be due to investment additionality.

This means that mixed syndicate-backed companies accumulate more investment than standalone VC-backed companies. Therefore, we control for the total amount of investment in a portfolio firm by a VC firm using the **connectedness** variable. In Table 2.11, we find that the results remain unaltered. Mixed syndication still has a high magnitude coefficient (but not statistically significantly different), and GVC-backed companies perform 6 percent better than IVC-backed companies. We see that total funding has no impact on the success of portfolio companies.

[Please insert Table 2.11 about here]

Second, the multinomial logit model frequently used when measuring the VC-backed exit performance of entrepreneurial firms is prone to some weaknesses because it entails the assumption of “independence of irrelevant alternatives”. To address this issue, we used the multinomial probit model to estimate the result, *ceteris paribus* (Cumming *et al.*, 2017). Table 2.11 (con’t) depicts the estimation results. The results show that successful exit GVC-backed companies have a greater positive coefficient than IVC-backed companies and are significant at the 1 percent level. Similarly, mixed syndicate-backed companies have a higher probability of successful exit than standalone GVC- and IVC-backed companies. Therefore, the results are shown to be robust by using multinomial probit estimation.

Third, half of our sample is composed of Chinese firms; thus, our sample is influenced by Chinese dominance. Therefore, we split our sample into two subsamples: China and the rest of East Asia (India, Indonesia, the Philippines, Thailand, Taiwan, Malaysia, Singapore, South Korea). With all else being equal to the original model specification, the results are depicted in Table 2.12 and confirm the overperformance of both GVC-backed companies and mixed-syndicated backed companies.

[Please insert Table 2.12 about here]

4.3 Comparison with previous studies

Cumming *et al.* (2017) and Brander *et al.* (2015) classified VC-backing into three types: GVC, IVC and mixed syndication. In this paper, we decomposed private into IVC standalone and pure IVC syndication, thus creating 4 types of VC. Following Cumming *et al.* (2017) and Brander *et al.* (2015), we merged the two types of IVC and **pure syndication** into one category and created the

variable **IVC2**. Then, we regressed the data with three types of VC-backing. The results (see Table 2.12) show that GVC-backed companies perform 6 percent better than IVC-backed companies and that mixed syndication performs 17 percent better than IVC-backed companies (but not significantly different). Thus, our estimates endorse our baseline model.

[Please insert Table 2.13 about here]

Zhang & Mayes (2018) only regressed standalone GVC- and IVC-backed companies and did not include syndicated investments. Therefore, our results might be influenced by the presence of syndicated investments. Consequently, we dropped all the syndicated investments and regressed a sample of standalone IVC and GVC investments (N=3213). The results (see Table 2.13; cont') show that GVC-backed companies are 5 percent more likely to be successful than IVC-backed companies.

5 Discussion and conclusion

This study attempts to explore the exit performance of GVC firms in developing Asia, an appealing but rather unexplored issue. Most previous studies compared the performance of GVC-backed companies relative to IVC-backed companies and syndicated-backed companies from US and European perspectives and endorsed the underperformance of GVC-backed companies given the different weaknesses and inconveniences of GVC firms. Our findings contribute to the existing stream of literature by providing a new understanding of GVC investment performance in developing Asia. The most important result of our paper is to highlight the overall exit performance of GVC in a sample of 3,817 VC-backed companies from nine Asian developing countries from 1991 to 2017, thus challenging this underperformance hypothesis. We first find that GVC firms are more prone than IVC firms to invest in the early stage in ventures that are more likely to fail. This result is consistent with the underperformance hypothesis of GVC and more precisely with the study by Zhang and Mayes (2018), which highlights the underperformance of GVC-backed firms in the early stage when compared with IVC-backed firms in China. However, in contrast to Zhang and Mayes (2018), who focused on the early stage, we also find that in the expansion and later stages, GVC outperform IVC in terms of a successful exit, and this overperformance outweighs risk-taking and failure in the early stage. Our results appear robust to additional tests dedicated to controlling for endogeneity concerns (we adopted three instrumental approaches and

the PSM technique to address the potential selection bias), to the potential bias created by the total amount of funding, and to the prevalence of Chinese VC firms in our sample.

These original results suggest that GVC behavior may not be driven by a problem of screening due to a lack of skills or incitation but by the choice to bear the risk in this early stage, thus assuming the economic role of stimulating local industry and filling a financing gap for entrepreneurial firms. In our sample, GVC firms seem to be skilled in identifying promising ventures and do so by investing in mature and later stages, thus exhibiting higher exit performance than IVC firms. Finally, when GVC and IVC firms are mixed in syndication, they perform better than standalone companies or pure IVC syndication. We attribute this overperformance of GVC to the prevalent role of social ties in developing Asia, as pointed out by Bruton *et al.* (2003, 2004).

This study is not exempt from limitations. A reliance on social networks in the mature stage of investment deserves further investigation to better understand how governments channel public financial resources. The use of data from surveys or interviews like Bruton *et al.* (2003) could be a fruitful research avenue. Our study is constrained to developing Asia, but countries in this area also exhibit GVC heterogeneity. Thus, the effectiveness of GVC programs according to the economic characteristic of the region (see Alperovych *et al.*, 2020) or according to local knowledge (see Zhang and Mayes, 2018) could also be investigated. Finally, our study solely focuses on performance, without consideration of the impact of GVC on the total amount of VC raised from a macroeconomic perspective. A global vision of the effectiveness of GVC should include both the ability to enhance fundraising and the exit success of such deals

Despite the previously stated limitations, the implication of our analysis is important for policy makers who are interested in better understanding GVC effectiveness in a geographic area where the role of governments is historically prevalent. The result of better performance for mixed syndication is also useful, suggesting that IVC firms should not stand alone and that government employees should meet with entrepreneurs to achieve VC success in this area. Our result contrasts with the study by Zhang (2018), which focused only on syndication in China, and highlighted that mixed syndication has lower performance than pure IVC syndication, attributing this result to higher coordination costs in mixed syndication.

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Appendix

Table 2. 1: Variables index

| Variable | Definition |
|-----------------------------|--|
| Exit | Categorical variable, set equal to 0 if the company is active, 1 if the company goes successful and 2 if the company goes unsuccessful |
| Successful | Binary variable, set equal to 1 if the company goes successful, and 0 otherwise |
| Unsuccessful | Binary variable, set equal to 1 if the company goes unsuccessful, and 0 otherwise |
| Active | Binary variable, set equal to 1 if the company is active, and 0 otherwise |
| GVC | Binary variable, set equal to 1 if the company receives first investment from a Government Venture Capital firm, and 0 otherwise |
| IVC | Binary variable, set equal to 1 if the company receives first investment from an Independent Venture Capital firm, and 0 otherwise |
| Mixed syndication | Binary variable, set equal to 1 if the company receives first investment from syndication of GVC and IVC firms, and 0 otherwise |
| Pure syndication | Binary variable, set equal to 1 if the company receives first investment from syndication of IVC firms, and 0 otherwise |
| IVC2 | Binary variable, set equal to 1 if the company receives investment either from IVC standalone or IVC Pure syndication, and 0 otherwise |
| Stage | Categorical variable, set equal to 1 if the company receives first investment in early-stage, 2 in expansion stage and 3 in the later stage. |
| Early-stage | Binary variable, set equal to 1 if the company receives first investment in early stage, and 0 otherwise |
| Expansion stage | Binary variable, set equal to 1 if the company receives first investment in the expansion stage, and 0 otherwise |
| Later (mature) stage | Binary variable, set equal to 1 if the company receives first investment in later stage, and 0 otherwise |
| Elapse time | It is the time taken from the first investment till a successful or unsuccessful exit. If the company is still active, 31 December 2017 is the cutoff date. |
| Firm Experience | Age of the VC firm at the time of the investment (in years) |
| Firm Reputation | Number of the funds raised and managed by the venture capital firm |
| Syndication size | Number of venture capital firms investing in a company |
| Firms total number of deals | Total number of deals made by the VC firm at the time of the investment |
| Bubble dummy | Binary variable, set equal to 1 if the company receives first investment during the years 1998, 1999, and 2000, and 0 otherwise |
| Connectedness | Log (1+ total funding) |
| Countries dummies | For every country, we introduced a dummy variable. There are 9 countries and 9 dummies. |
| Industry dummies | For every industry, we introduced a dummy variable. There are 6 industries and six dummies (biotechnology, communication, and media, computer-related, health medical and life science, semiconductors electronics, non-high tech) |

Table 2. 2: Descriptive statistics

| Variables | Full sample | IVC | GVC | Mixed syndication | IVC Pure syndication |
|------------------------|--------------------|--------------|------------|--------------------------|-----------------------------|
| Successful | 0.377 | 0.329*** | 0.346 | 0.559*** | 0.473*** |
| Unsuccessful | 0.023 | 0.025 | 0.025 | 0.000 | 0.020 |
| Active | 0.600 | 0.646*** | 0.629 | 0.441*** | 0.507*** |
| GVC | 0.060 | 0.000 | 1.000 | 0.000 | 0.000 |
| IVC | 0.626 | 1.000 | 0.000 | 0.000 | 0.000 |
| Mixed syndication | 0.024 | 0.000 | 0.000 | 1.000 | 0.000 |
| Pure syndication | 0.290 | 0.000 | 0.000 | 0.000 | 1.000 |
| IVC2 | 0.916 | 1.000 | 0.000 | 0.000 | 1.000 |
| Early stage | 0.336 | 0.357*** | 0.470*** | 0.198**** | 0.275*** |
| Expansion stage | 0.402 | 0.415** | 0.311*** | 0.459 | 0.390 |
| Later stage | 0.262 | 0.229*** | 0.219* | 0.342** | 0.335*** |
| Elapse time | 125.183 | 126.015 | 132.636* | 120.359 | 122.229* |
| Firm Experience | 62.839 | 64.284* | 37.876*** | 46.405*** | 66.268** |
| Firm Total No of deals | 142.442 | 144.319 | 61.445*** | 61.883*** | 161.856*** |
| Firm reputation | 16.054 | 15.709** | 5.329*** | 8.414*** | 19.658*** |
| Syndication size | 2.557 | 2.181*** | 2.067*** | 5.198*** | 3.253*** |
| Bubble dummy | 0.202 | 0.201 | 0.191 | 0.036*** | 0.221** |
| Connectedness | 1.960 | 1.838*** | 1.599*** | 3.071*** | 2.175*** |
| Observations | 4 682 | 2 930 | 283 | 111 | 1 358 |

The sample consists of 4,682 observations – related to 3,817 portfolio companies – that received their first investment during the 1991-2013 period in 9 Asian developing countries. Table 2.2 reports the means for the full sample and for each type of VC (IVC, GVC, mixed syndicated-backed and pure IVC syndicated-backed companies) and tests of differences in means (unpaired t tests assuming equal variance) between the full sample and each type of VC. ***, **, * indicate that the difference in mean for characteristics of full sample versus each type of VC is significant at 1 percent, 5 percent, or ten percent, respectively. All the variables are defined in Table 2.1.

Table 2.2:
Descriptive statistics (con't)

| | | IVC | | GVC | | Mixed syndication | | Pure syndication | | |
|----------------|-------------------------------|--------------|------------|-------------|------------|-------------------|------------|------------------|--------------|--------------|
| Country | | Nb | % | Nb | % | Nb | % | Nb | % | Total |
| PANEL A | China | 1 334 | 45.529 | 96 | 35.165 | 30 | 68.182 | 287 | 50.351 | 1 747 |
| | India | 399 | 13.618 | 42 | 15.385 | 1 | 2.273 | 28 | 4.912 | 470 |
| | Indonesia | 11 | 0.375 | 1 | 0.366 | 0 | 0 | 0 | 0 | 12 |
| | Malaysia | 26 | 0.887 | 28 | 10.256 | 2 | 4.545 | 1 | 0.175 | 57 |
| | Philippine | 8 | 0.273 | 1 | 0.366 | 0 | 0 | 0 | 0 | 9 |
| | Singapore | 52 | 1.775 | 58 | 21.245 | 7 | 15.909 | 3 | 0.526 | 120 |
| | South Korea | 947 | 32.321 | 43 | 15.751 | 4 | 9.091 | 204 | 35.789 | 1 198 |
| | Taiwan | 142 | 4.846 | 1 | 0.366 | 0 | 0 | 47 | 8.246 | 190 |
| | Thailand | 11 | 0.375 | 3 | 1.099 | 0 | 0 | 0 | 0 | 14 |
| | Total | 2 930 | 100 | 273 | 100 | 44 | 100 | 570 | 100 | 3 817 |
| PANEL B | Industry | Nb | % | Nb | % | Nb | % | Nb | % | Total |
| | Biotechnology | 74 | 2.526 | 18 | 6.593 | 4 | 9.091 | 17 | 2.982 | 113 |
| | Communication and Media | 305 | 10.410 | 33 | 12.088 | 5 | 11.364 | 60 | 10.526 | 403 |
| | Computer related | 906 | 30.922 | 79 | 28.938 | 7 | 15.909 | 160 | 28.070 | 1 152 |
| | Medical/Health/Life sciences | 149 | 5.085 | 13 | 4.762 | 0 | 0.000 | 27 | 4.737 | 189 |
| | Non-high tech | 1 187 | 40.512 | 113 | 41.392 | 22 | 50.000 | 213 | 37.368 | 1 535 |
| | Semiconductor and electronics | 309 | 10.546 | 17 | 6.227 | 6 | 13.636 | 93 | 16.316 | 425 |
| Total | 2 930 | 100% | 273 | 100% | 44 | 100% | 570 | 100% | 3 817 | |
| PANEL C | Stages | Nb | % | Nb | % | Nb | % | Nb | % | Total |
| | Early | 1 045 | 35.7% | 130 | 47.6% | 10 | 22.7% | 164 | 28.7% | 1 349 |
| | Expansion | 1 215 | 41.5% | 84 | 30.7% | 22 | 50% | 226 | 36.7% | 1 547 |
| | Later | 670 | 22.8% | 59 | 21.7% | 12 | 27.3% | 180 | 34.6% | 921 |
| Total | 2 930 | 100% | 273 | 100% | 44 | 100% | 570 | 100% | 3 817 | |
| PANEL D | STATUS | Nb | % | Nb | % | Nb | % | Nb | % | Total |
| | Successful Exit | 963 | 32.8% | 92 | 33.7% | 24 | 55% | 260 | 45.6% | 1 339 |
| | Unsuccessful Exit | 73 | 2.50% | 7 | 2.5% | 0 | 0% | 13 | 2.3% | 93 |
| | Active | 1 894 | 64.7% | 174 | 63.8% | 20 | 45% | 297 | 52.1% | 2,385 |
| Total | 2 930 | 100% | 273 | 100% | 44 | 100% | 570 | 100% | 3 817 | |

Table 2.2 (cont') shows the breakup of the 3,817 portfolio companies for the full sample and each type of VC (IVC, GVC, mixed syndicated and pure syndicated) according to the country (panel A), industry (Panel B), stage of investment (panel C) and exit performance (panel D).

Table 2. 3: The Pearson correlations matrix

| | [1] | [2] | [3] | [4] | [5] | [6] | [7] | [8] | [9] | [10] | [11] | [12] | [13] | [14] |
|----------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|------|
| [1] GVC | 1.00 | | | | | | | | | | | | | |
| [2] IVC | -0.32a | 1.00 | | | | | | | | | | | | |
| [3] Mixed syndication | -0.04a | -0.20a | 1.00 | | | | | | | | | | | |
| [4] Pure syndication | -0.16a | -0.82a | -0.10a | 1.00 | | | | | | | | | | |
| [5] Firm experience | -0.09a | 0.02c | -0.03a | 0.03b | 1.00 | | | | | | | | | |
| [6] Elapse time | 0.02c | 0.01 | -0.01 | -0.02c | -0.05a | 1.00 | | | | | | | | |
| [7] Syndication size | -0.05a | -0.21a | 0.18a | 0.19a | -0.07a | -0.15a | 1.00 | | | | | | | |
| [8] Firm reputation | -0.17a | -0.02b | -0.07a | 0.15a | 0.49a | 0.09a | -0.15a | 1.00 | | | | | | |
| [9] Firm total no of deals | -0.13a | 0.01 | -0.07a | 0.07a | 0.44a | 0.08a | -0.08a | 0.74a | 1.00 | | | | | |
| [10] Bubble dummy | -0.00 | -0.00 | -0.06a | 0.03a | -0.14a | 0.33a | -0.09a | 0.03a | 0.01 | 1.00 | | | | |
| [11] Early stage | 0.07a | 0.05a | -0.04a | -0.08a | -0.01 | 0.08a | 0.11a | -0.04a | 0.03b | 0.12a | 1.00 | | | |
| [12] Expansion stage | -0.04a | 0.03b | 0.01 | -0.01 | 0.020 | 0.10a | -0.13a | 0.04a | 0.07a | 0.05a | -0.58a | 1.00 | | |
| [13] Connectedness | -0.06a | -0.10b | 0.13a | 0.09a | 0.03b | -0.25a | 0.60a | -0.14a | -0.00 | -0.32a | -0.04a | -0.11a | 1.00 | |
| [14] Availability of GVC | 0.59a | -0.17a | 0.01 | -0.14a | -0.09a | 0.05a | -0.00 | -0.13a | -0.08a | -0.01 | 0.07a | -0.03a | 0.07 | 1.00 |

This table reports the Pearson pairwise correlation matrix of the covariates.

a, b, and c indicate the correlation coefficient is significant at the 1%, 5%, or 10% level, respectively.

Table 2. 4: GVC firms invest more than IVC firms in early-stage ventures (Hypothesis 1)

| | Early stage | | Expansion Stage | | Later Stage | |
|----------------------------|----------------|---------|-----------------|---------|----------------|---------|
| GVC | 0.085*** | (0.028) | -0.091*** | (0.033) | 0.006 | (0.028) |
| Mixed syndication | -0.216*** | (0.052) | 0.173*** | (0.049) | 0.043 | (0.037) |
| Pure syndication | -0.084*** | (0.016) | 0.001 | (0.017) | 0.083*** | (0.014) |
| Firm Experience | 0.000*** | (0.000) | -0.000* | (0.000) | -0.000 | (0.000) |
| Elapse time | 0.000*** | (0.000) | 0.000*** | (0.000) | -0.001*** | (0.000) |
| Syndication size | 0.030*** | (0.003) | -0.025*** | (0.004) | -0.005 | (0.003) |
| Firm reputation | -0.004*** | (0.001) | -0.002** | (0.001) | 0.006*** | (0.001) |
| Firm Total Number of Deals | 0.000*** | (0.000) | 0.000*** | (0.000) | -0.001*** | (0.000) |
| Bubble dummy | 0.083*** | (0.018) | 0.030 | (0.021) | -0.113*** | (0.021) |
| Biotechnology | 0.193*** | (0.036) | -0.136*** | (0.043) | -0.057* | (0.034) |
| Communication Media | 0.155*** | (0.022) | -0.036 | (0.025) | -0.120*** | (0.024) |
| Computer Related | 0.223*** | (0.015) | -0.056*** | (0.017) | -0.167*** | (0.015) |
| Health Medical | 0.038 | (0.033) | -0.054 | (0.035) | 0.016 | (0.025) |
| Semiconductors Electronics | 0.154*** | (0.022) | -0.076*** | (0.024) | -0.078*** | (0.020) |
| Countries dummies | Yes | | Yes | | Yes | |
| Observations | 4 682 | | 4 682 | | 4 682 | |
| Pseudo R Square | 0.110 | | 0.110 | | 0.110 | |
| Log-Likelihood | -4512.9 | | -4512.9 | | -4512.9 | |

Table 2.4 reports the results of multinomial logit regressions. The dependent variable is a categorical variable that equals 1 if the company received investment in the early stage, 2 in the expansion stage, and 3 in the later stage. The independent variables are two types of VC: GVC, a dummy variable that equals 1 if the first investment is received from GVC and 0 otherwise; IVC is a dummy variable that equals 1 if the first investment is received from an IVC and 0 otherwise (reference category). All the variables are defined in Table 2.1. Industry and country dummies have been included (the reference category for the industry is non-high-tech, and the reference category for the country is China). Coefficients of all the variables are reported as average marginal effects. Standard errors in parentheses * p < .10; ** p < .05; *** p < .01 indicate significance at the 10%, 5% and 1% levels, respectively.

Table 2. 5: GVC-backed firms receiving their first investment in expansion and later stages have higher chances of success than IVC-backed firms (Hypothesis 2)

| | Active | | Successful | | Unsuccessful | |
|----------------------------|----------------|---------|----------------|---------|----------------|---------|
| GVC | -0.098** | (0.043) | 0.132*** | (0.044) | -0.034** | (0.017) |
| IVC | -0.089*** | (0.025) | 0.116*** | (0.025) | -0.027*** | (0.007) |
| Mixed syndication | -0.135 | (3.924) | 0.317 | (5.621) | -0.182 | (9.544) |
| Pure syndication | -0.148*** | (0.030) | 0.177*** | (0.030) | -0.029*** | (0.008) |
| Firm Experience | 0.001*** | (0.000) | -0.000*** | (0.000) | -0.000** | (0.000) |
| Elapse time | 0.002*** | (0.000) | -0.002*** | (0.000) | -0.000*** | (0.000) |
| Syndication size | -0.043*** | (0.005) | 0.048*** | (0.005) | -0.005** | (0.002) |
| Firm reputation | -0.004*** | (0.001) | 0.004*** | (0.001) | -0.000 | (0.000) |
| Firm Total Number of Deals | 0.000*** | (0.000) | -0.000*** | (0.000) | 0.000** | (0.000) |
| Bubble dummy | -0.037 | (0.027) | 0.027 | (0.027) | 0.010** | (0.005) |
| Biotechnology | 0.082 | (0.051) | -0.091* | (0.052) | 0.009 | (0.011) |
| Communication Media | 0.003 | (0.030) | -0.002 | (0.031) | -0.001 | (0.006) |
| Computer Related | 0.032 | (0.021) | -0.037* | (0.021) | 0.006 | (0.005) |
| Health Medical | -0.088** | (0.035) | 0.096*** | (0.036) | -0.008 | (0.013) |
| Semiconductors Electronics | -0.088*** | (0.028) | 0.096*** | (0.028) | -0.008 | (0.007) |
| Countries Dummies | Yes | | Yes | | Yes | |
| Observations | 3108 | | 3108 | | 3108 | |
| Pseudo R Square | 0.172 | | 0.172 | | 0.172 | |
| Log likelihood | -1946.3 | | -1946.3 | | -1946.3 | |

Table 2.5 reports the results of multinomial logit regressions. The dependent variable is a categorical variable that equals 1 if a company exhibits successful exit, 2 if it is unsuccessful and 3 if it is still active. The independent variables are the four types of VC: GVC, IVC, mixed syndication, and pure syndication. All the variables are defined in Table 2.1. Industry and country dummies have been included (the reference category for the industry is non-high-tech, and the reference category for the country is China). Coefficients of all the variables are reported as average marginal effects. Standard errors are in parentheses. * p < .10; ** p < .05; *** p < .01 indicate significance at the 10%, 5% and 1% levels, respectively.

Table 2. 6: GVC perform better than IVC (Hypothesis 3) Mixed syndicated backed firms performs better than standalone VC-backed firms (Hypothesis 4)

| | Active | | Successful | | Unsuccessful | |
|----------------------------|----------------|---------|----------------|---------|----------------|---------|
| GVC | -0.204*** | (0.034) | 0.265*** | (0.033) | -0.061*** | (0.014) |
| IVC | -0.143*** | (0.022) | 0.198*** | (0.021) | -0.055*** | (0.011) |
| Mixed syndication | -0.143 | (4.878) | 0.390 | (4.423) | -0.247 | (9.301) |
| Pure syndication | -0.193*** | (0.025) | 0.247*** | (0.024) | -0.054*** | (0.012) |
| Early stage | 0.202*** | (0.018) | -0.252*** | (0.017) | 0.051*** | (0.010) |
| Expansion stage | 0.101*** | (0.016) | -0.136*** | (0.016) | 0.035*** | (0.010) |
| Firm Experience | 0.000*** | (0.000) | -0.000*** | (0.000) | -0.000*** | (0.000) |
| Elapse time | 0.002*** | (0.000) | -0.002*** | (0.000) | -0.000*** | (0.000) |
| Syndication size | -0.024*** | (0.003) | 0.034*** | (0.003) | -0.010*** | (0.002) |
| Firm reputation | -0.003*** | (0.001) | 0.003*** | (0.001) | 0.000 | (0.000) |
| Firm Total Number of Deals | 0.000*** | (0.000) | -0.000*** | (0.000) | 0.000 | (0.000) |
| Bubble dummy | -0.087*** | (0.020) | 0.069*** | (0.020) | 0.018*** | (0.004) |
| Biotechnology | 0.103*** | (0.040) | -0.100** | (0.040) | -0.003 | (0.012) |
| Communication Media | 0.009 | (0.024) | -0.002 | (0.024) | -0.007 | (0.006) |
| Computer Related | 0.038** | (0.016) | -0.037** | (0.016) | -0.000 | (0.005) |
| Health Medical | -0.065** | (0.029) | 0.077*** | (0.029) | -0.012 | (0.012) |
| Semiconductors Electronics | -0.072*** | (0.022) | 0.084*** | (0.022) | -0.012* | (0.006) |
| Countries Dummies | Yes | | Yes | | Yes | |
| Observations | 4 682 | | 4 682 | | 4 682 | |
| Pseudo R2 | 0.212 | | 0.212 | | 0.212 | |
| Loglikelihood | -2812.2 | | -2812.2 | | -2812.2 | |

Table 2.6 reports the results of multinomial logit regressions. The dependent variable is a categorical variable that equals 1 if a company exhibits successful exit, 2 if it is unsuccessful and 3 if it is still active. The independent variables are the 4 types of VC: GVC, IVC, mixed syndication and pure syndication; and the stage of investment (early or expansion, later stage is the reference category). All the variables are defined in Table 2.1. Industry and country dummies have been included (reference category for industry is non-high-tech and reference category for country is China). Coefficients of all the variables are reported as average marginal effects. Standard errors in parentheses * p < .10; ** p < .05; *** p < .01 indicate significance at the 10%, 5% and 1% levels, respectively.

Table 2. 7: Endogeneity issues: Bivariate Probit

| | Active | | Successful | | Unsuccessful | |
|----------------------------|-----------------------|---------|-----------------------|---------|-----------------------|----------|
| GVC | -0.277 ^{***} | (0.056) | 0.219 ^{***} | (0.053) | 0.024 | (0.017) |
| Mixed syndication | -0.126 ^{***} | (0.042) | 0.109 ^{***} | (0.042) | -0.168 | (29.126) |
| Pure syndication | -0.063 ^{***} | (0.015) | 0.059 ^{***} | (0.015) | -0.001 | (0.005) |
| Firm Experience | 0.000 ^{***} | (0.000) | -0.000 ^{**} | (0.000) | -0.000 ^{**} | (0.000) |
| Elapse time | 0.002 ^{***} | (0.000) | -0.002 ^{***} | (0.000) | -0.000 ^{***} | (0.000) |
| Syndication_size | -0.029 ^{***} | (0.003) | 0.033 ^{***} | (0.003) | -0.007 ^{***} | (0.002) |
| Firm reputation | -0.003 ^{***} | (0.001) | 0.003 ^{***} | (0.001) | 0.000 | (0.000) |
| FirmTotalNumberofDeals | 0.000 ^{***} | (0.000) | -0.000 ^{***} | (0.000) | 0.000 | (0.000) |
| Bubble dummy | -0.089 ^{***} | (0.019) | 0.041 ^{**} | (0.019) | 0.021 ^{***} | (0.005) |
| Early stage | 0.218 ^{***} | (0.017) | -0.251 ^{***} | (0.017) | 0.054 ^{***} | (0.010) |
| Expansion stage | 0.118 ^{***} | (0.016) | -0.134 ^{***} | (0.016) | 0.040 ^{***} | (0.010) |
| Biotechnology | 0.114 ^{***} | (0.039) | -0.107 ^{***} | (0.040) | -0.007 | (0.013) |
| Communication Media | 0.011 | (0.024) | -0.001 | (0.024) | -0.008 | (0.007) |
| Computer Related | 0.033 ^{**} | (0.016) | -0.030 [*] | (0.016) | 0.002 | (0.005) |
| Health Medical | -0.069 ^{**} | (0.029) | 0.078 ^{***} | (0.029) | -0.014 | (0.012) |
| Semiconductors Electronics | -0.074 ^{***} | (0.022) | 0.087 ^{***} | (0.022) | -0.015 ^{**} | (0.007) |
| Countries Dummies | Yes | | Yes | | Yes | |
| Observations | 4 682 | | 4 682 | | 4 682 | |
| Loglikelihood | -3157.4 | | -3156.3 | | -682.4 | |
| F value | 1519 | | 1519 | | 1519 | |

Table 2.7 reports the results of bivariate probit regressions. The dependent variable is a categorical variable that equals 1 if a company exhibits successful exit, 2 if it is unsuccessful and 3 if it is still active. The independent variables are the 4 types of VC: GVC, IVC, mixed syndication and pure syndication; and the stage of investment (early or expansion, later stage is the reference category). All the variables are defined in Table 2.1. Industry and country dummies have been included (reference category for industry is non-high-tech and reference category for country is China). Coefficients of all the variables are reported as average marginal effects. Standard errors in parentheses. * p < .10; ** p < .05; *** p < .01 indicate significance at the 10%, 5% and 1% levels, respectively.

Table 2. 8: Endogeneity issues: IV Probit

| | Active | | Successful | | Unsuccessful | |
|----------------------------|-----------------------------|----------------|-----------------------------|----------------|-----------------------------|----------------|
| GVC | -0.893 ^{***} | (0.186) | 0.766 ^{***} | (0.186) | 0.810 | (0.516) |
| Mixed syndication | -0.410 ^{***} | (0.133) | 0.359 ^{***} | (0.133) | 0.000 | (.) |
| Pure syndication | -0.204 ^{***} | (0.048) | 0.193 ^{***} | (0.048) | 0.014 | (0.132) |
| Firm Experience | 0.001 ^{***} | (0.000) | -0.001 ^{**} | (0.000) | -0.003 ^{**} | (0.001) |
| Elapse time | 0.007 ^{***} | (0.000) | -0.006 ^{***} | (0.000) | -0.011 ^{***} | (0.001) |
| Syndication size | -0.091 ^{***} | (0.010) | 0.105 ^{***} | (0.010) | -0.198 ^{***} | (0.044) |
| Firm reputation | -0.011 ^{***} | (0.002) | 0.009 ^{***} | (0.002) | 0.007 | (0.007) |
| Firm Total Number of Deals | 0.001 ^{***} | (0.000) | -0.001 ^{***} | (0.000) | 0.001 | (0.001) |
| Bubble dummy | -0.277 ^{***} | (0.062) | 0.127 ^{**} | (0.061) | 0.587 ^{***} | (0.126) |
| Early stage | 0.694 ^{***} | (0.057) | -0.803 ^{***} | (0.057) | 1.496 ^{***} | (0.267) |
| Expansion stage | 0.375 ^{***} | (0.051) | -0.426 ^{***} | (0.051) | 1.131 ^{***} | (0.260) |
| Countries Dummies | Yes | | Yes | | Yes | |
| Athrho_cons | 0.175^{***} | (0.041) | -0.143^{***} | (0.041) | -0.232^{**} | (0.115) |
| Insigma_cons | -1.667^{***} | (0.010) | -1.667^{***} | (0.010) | -1.656^{***} | (0.010) |
| N | 4 682 | | 4 682 | | 4 536 | |
| Log likelihood | -1431.7 | | -1430 | | 776 | |

Table 2.8 reports the results of the second stage of IV probit regressions. The dependent variable is a categorical variable that equals 1 if a company exhibits successful exit, 2 if it is unsuccessful and 3 if it is still active. The independent variables are the 4 types of VC: GVC, IVC, mixed syndication and pure syndication; and the stage of investment (early or expansion, later stage is the reference category). All the variables are defined in Table 2.1. Industry and country dummies have been included (reference category for industry is non-high-tech and reference category for country is China). Coefficients of all the variables are reported as average marginal effects. Standard errors are in parentheses. * $p < .10$; ** $p < .05$; *** $p < .01$ indicate significance at the 10%, 5% and 1% levels, respectively.

Table 2. 9: Endogeneity issues: Heckman Treatment Effect

| | Active | | Successful | | Unsuccessful | |
|-------------------------------------|---------------|----------------|-------------------|----------------|---------------------|----------------|
| GVC | -0.070 | (0.051) | 0.064 | (0.050) | 0.006 | (0.016) |
| Mixed syndication | -0.182*** | (0.052) | 0.164*** | (0.052) | 0.018 | (0.017) |
| Pure syndication | -0.095*** | (0.020) | 0.086*** | (0.020) | 0.009 | (0.007) |
| Firm Experience | 0.000 | (0.000) | -0.000 | (0.000) | -0.000 | (0.000) |
| Elapse Time | 0.002*** | (0.000) | -0.002*** | (0.000) | -0.001*** | (0.000) |
| Syndication size | -0.031*** | (0.004) | 0.035*** | (0.004) | -0.004*** | (0.001) |
| Firm reputation | -0.001 | (0.001) | 0.001 | (0.001) | 0.000 | (0.000) |
| Firm Total Number of Deals | 0.000** | (0.000) | -0.000* | (0.000) | -0.000 | (0.000) |
| Bubble dummy | -0.114*** | (0.036) | 0.051 | (0.036) | 0.063*** | (0.012) |
| Early stage | 0.256*** | (0.023) | -0.287*** | (0.023) | 0.031*** | (0.007) |
| Expansion stage | 0.145*** | (0.022) | -0.158*** | (0.022) | 0.013* | (0.007) |
| Biotechnology | 0.077 | (0.069) | -0.077 | (0.069) | -0.000 | (0.022) |
| Communication Media | -0.000 | (0.040) | 0.010 | (0.040) | -0.009 | (0.013) |
| Computer Related | 0.020 | (0.023) | -0.032 | (0.023) | 0.012 | (0.007) |
| Health Medical | -0.073 | (0.049) | 0.078 | (0.048) | -0.005 | (0.015) |
| Semiconductors Electronics | -0.073* | (0.039) | 0.087** | (0.039) | -0.014 | (0.013) |
| Countries dummies | Yes | | Yes | | Yes | |
| Inverse Mills Ratio (lambda) | 0.000 | (0.060) | -0.014 | (0.060) | 0.014 | (0.019) |
| Observations | 4 682 | | 4 682 | | 4 682 | |

Table 2.9 reports the results of the Heckman treatment effect. The dependent variable is a categorical variable that equals 1 if a company exhibits successful exit, 2 if it is unsuccessful and 3 if it is still active. The independent variables are the 4 types of VC: GVC, IVC, mixed syndication and pure syndication, and the stage of investment (early or expansion, later stage is the reference category). All the variables are defined in Table 2.1. Industry and country dummies have been included (reference category for industry is non-high-tech and reference category for country is China). Coefficients of all the variables are reported as average marginal effects. Standard errors are in parentheses. * p < .10; ** p < .05; *** p < .01 indicate significance at the 10%, 5% and 1% levels, respectively. Pb citer Heckman et le Mills Lambda.

Table 2. 10: Endogeneity issues: Propensity Score Matching

| | Active | Successful | Unsuccessful |
|------------|----------------------|---------------------|-------------------|
| ATE | | | |
| GVC (1vs0) | -0.115*** (0.023) | 0.250*** (0.048) | -0.010 (0.010) |
| N | 4682 | 4682 | 4682 |

Table 2.10 reports one-to-one propensity scores of GVC-backed companies are estimated using the nearest neighbor method and compared with those of IVC-backed companies based on the following characteristics: firm experience, firm reputation, industry, country, stage and year of investment. Standard errors are in parentheses. * p < .1, ** p < .05, *** p < .01 indicate significance at the 10%, 5% and 1% levels, respectively

Table 2. 11: Additional robustness check 1: Augmented model with total funding (logit)

| | Active | | Successful | | Unsuccessful | |
|----------------------------|--------------|---------|--------------|---------|--------------|---------|
| GVC | -0.233** | (0.041) | 0.298** | (0.041) | -0.065** | (0.019) |
| IVC | -0.195** | (0.029) | 0.240** | (0.029) | -0.046** | (0.016) |
| Mixed syndication | -0.199 | (3.608) | 0.422 | (3.774) | -0.222 | (7.381) |
| Pure syndication | -0.243** | (0.031) | 0.278** | (0.031) | -0.035** | (0.016) |
| Early stage | 0.226** | (0.021) | -0.279** | (0.021) | 0.053** | (0.015) |
| Expansion stage | 0.097** | (0.020) | -0.134** | (0.020) | 0.037** | (0.015) |
| Firm Experience | 0.001** | (0.000) | -0.001** | (0.000) | -0.000 | (0.000) |
| Elapse time | 0.002** | (0.000) | -0.002** | (0.000) | -0.000** | (0.000) |
| Syndication size | -0.017** | (0.004) | 0.025** | (0.004) | -0.007** | (0.002) |
| Firm reputation | -0.005** | (0.001) | 0.005** | (0.001) | 0.000 | (0.000) |
| Firm Total Number of Deals | 0.000** | (0.000) | -0.000** | (0.000) | -0.000 | (0.000) |
| Bubble dummy | -0.088** | (0.023) | 0.067** | (0.023) | 0.020** | (0.005) |
| Biotechnology | 0.082* | (0.046) | -0.092** | (0.046) | 0.010 | (0.011) |
| Communication Media | 0.026 | (0.028) | -0.026 | (0.028) | -0.000 | (0.007) |
| Computer Related | 0.060** | (0.019) | -0.061** | (0.019) | 0.001 | (0.005) |
| Health Medical | -0.047 | (0.035) | 0.048 | (0.035) | -0.001 | (0.012) |
| Semiconductors Electronics | -0.060** | (0.027) | 0.063** | (0.026) | -0.003 | (0.007) |
| Connectedness | -0.004 | (0.008) | 0.010 | (0.008) | -0.006* | (0.003) |
| Countries dummies | Yes | | Yes | | Yes | |
| Observations | 3 393 | | 3 393 | | 3 393 | |
| Pseudo R 2 | 0.221 | | 0.221 | | 0.221 | |
| Log likelihood | -2047 | | -2047 | | -2047 | |

Table 2.11 reports the results of multinomial regressions. The dependent variable is a categorical variable that equals 1 if a company exhibits successful exit, 2 if it is unsuccessful and 3 if it is still active. The independent variables are the four types of VC: GVC, IVC, mixed syndication and pure syndication; and the stage of investment (early or expansion, later stage is the reference category). Connectedness is included as an additional control variable. All the variables are defined in Table 2.1. Industry and country dummies have been included (reference category for industry is non-high-tech and reference category for country is China). Coefficients of all the variables are reported as average marginal effects. Standard errors are in parentheses. * p < .10; ** p < .05; *** p < .01 indicate significance at the 10%, 5% and 1% levels, respectively.

Table 2.11 (cont’):
Additional robustness checks 1: Augmented model with total funding (Probit)

| | Active | | Successful | | Unsuccessful | |
|----------------------------|--------------|-----------|--------------|-----------|--------------|-----------|
| GVC | -0.209*** | (0.032) | 0.264*** | (0.032) | -0.054*** | (0.012) |
| IVC | -0.158*** | (0.021) | 0.214*** | (0.021) | -0.056*** | (0.010) |
| Mixed syndication | -0.092 | (2.1e+06) | 0.428 | (1.9e+06) | -0.335 | (4.0e+06) |
| Pure syndication | -0.219*** | (0.024) | 0.275*** | (0.024) | -0.057*** | (0.010) |
| Firm Experience | 0.000** | (0.000) | -0.000 | (0.000) | -0.000*** | (0.000) |
| Elapse time | 0.002*** | (0.000) | -0.002*** | (0.000) | -0.000*** | (0.000) |
| Syndication size | -0.023*** | (0.003) | 0.032*** | (0.003) | -0.009*** | (0.002) |
| Firm reputation | -0.002*** | (0.001) | 0.002** | (0.001) | 0.001*** | (0.000) |
| Firm Total Number of Deals | 0.000*** | (0.000) | -0.000*** | (0.000) | 0.000 | (0.000) |
| Bubble dummy | -0.107*** | (0.019) | 0.075*** | (0.018) | 0.032*** | (0.005) |
| Early stage | 0.205*** | (0.018) | -0.260*** | (0.017) | 0.055*** | (0.010) |
| Expansion stage | 0.098*** | (0.016) | -0.139*** | (0.016) | 0.041*** | (0.010) |
| Biotechnology | 0.100** | (0.040) | -0.094** | (0.040) | -0.006 | (0.013) |
| Communication Media | 0.003 | (0.024) | -0.000 | (0.024) | -0.003 | (0.007) |
| Computer Related | 0.031* | (0.016) | -0.032* | (0.016) | 0.001 | (0.005) |
| Health Medical | -0.065** | (0.030) | 0.075** | (0.030) | -0.010 | (0.012) |
| Semiconductors Electronics | -0.111*** | (0.021) | 0.119*** | (0.021) | -0.008 | (0.007) |
| Observations | 4 682 | | 4 682 | | 4 682 | |
| Log likelihood | -2865 | | -2865 | | -2865 | |

Table 2.11 (cont’) reports the results of probit regressions. The dependent variable is a categorical variable that equals 1 if a company exhibits successful exit, 2 if it is unsuccessful and 3 if it is still active. The independent variables are the 4 types of VC: GVC, IVC, mixed syndication and pure syndication; and the stage of investment (early or expansion, later stage is the reference category). All the variables are defined in Table 2.1. Industry and country dummies have been included (reference category for industry is non-high-tech and reference category for country is China). Coefficients of all the variables are reported as average marginal effects. Standard errors are in parentheses. * p < .10; ** p < .05; *** p < .01 indicate significance at the 10%, 5% and 1% levels, respectively.

Table 2. 12: Additional robustness checks 2: subsample of Chinese companies (Logit)

| | Active | | Successful | | Unsuccessful | |
|----------------------------|----------------|---------|----------------|---------|----------------|----------|
| GVC | -0.051 | (4.112) | 0.145 | (2.632) | -0.094 | (6.743) |
| IVC | -0.042 | (0.030) | 0.065** | (0.030) | -0.023*** | (0.007) |
| Mixed syndication | -0.118 | (5.323) | 0.199 | (3.408) | -0.081 | (8.729) |
| Pure syndication | -0.165*** | (0.034) | 0.183*** | (0.033) | -0.018*** | (0.007) |
| Firm Experience | 0.001*** | (0.000) | -0.001*** | (0.000) | 0.000* | (0.000) |
| Elapse time | 0.001*** | (0.000) | -0.001*** | (0.000) | -0.000*** | (0.000) |
| Syndication size | -0.035*** | (0.004) | 0.035*** | (0.004) | -0.001 | (0.001) |
| Firm reputation | -0.001 | (0.001) | 0.002** | (0.001) | -0.001 | (0.000) |
| Firm Total Number of Deals | 0.000 | (0.000) | -0.000* | (0.000) | 0.000 | (0.000) |
| Bubble dummy | -0.073 | (0.048) | 0.058 | (0.048) | 0.015*** | (0.005) |
| Early stage | 0.299*** | (0.025) | -0.306*** | (0.025) | 0.007 | (0.006) |
| Expansion stage | 0.136*** | (0.022) | -0.145*** | (0.022) | 0.009 | (0.006) |
| Biotechnology | 0.082 | (7.361) | -0.025 | (4.712) | -0.057 | (12.073) |
| Communication Media | 0.002 | (0.043) | -0.010 | (0.043) | 0.009 | (0.006) |
| Computer Related | 0.033 | (0.025) | -0.039 | (0.025) | 0.006 | (0.004) |
| Health Medical | -0.102** | (0.042) | 0.092** | (0.042) | 0.010 | (0.006) |
| Semiconductors Electronics | -0.019 | (3.879) | 0.079 | (2.483) | -0.060 | (6.361) |
| N | 2 201 | | 2 201 | | 2 201 | |
| Pseudo R Square | 0.1438 | | 0.1438 | | 0.1438 | |
| Log Likelihood | -1345.3 | | -1345.3 | | -1345.3 | |

Table 2.12 reports the results of multinomial regressions on the subsample of Chinese entrepreneurial firms, which comprises 2,201 observations. The dependent variable is a categorical variable that equals 1 if a company exhibits successful exit, 2 if it is unsuccessful and 3 if it is still active. The independent variables are the 4 types of VC: GVC, IVC, mixed syndication and pure syndication, and the stage of investment (early or expansion, later stage is the reference category). All the variables are defined in Table 2.1. Industry and country dummies have been included (reference category for industry is non-high tech and the reference category for country is China). Coefficients of all the variables are reported as average marginal effects. Standard errors are in parentheses. * p <.10; ** p <.05; *** p <.01 indicate significance at the 10%, 5% and 1% levels, respectively.

Table 2.12 (cont’):

Additional robustness checks 2: Subsample excluding Chinese companies (Logit)

| | Active | | Successful | | Unsuccessful | |
|----------------------------|--------------|---------|--------------|---------|--------------|---------|
| GVC | -0.330*** | (0.041) | 0.366*** | (0.042) | -0.037* | (0.022) |
| IVC | -0.273*** | (0.031) | 0.315*** | (0.031) | -0.043** | (0.019) |
| Mixed syndication | -0.173 | (3.098) | 0.458 | (4.860) | -0.285 | (7.956) |
| Pure syndication | -0.266*** | (0.037) | 0.310*** | (0.038) | -0.044** | (0.021) |
| Firm Experience | 0.000* | (0.000) | 0.000 | (0.000) | -0.000*** | (0.000) |
| Elapse time | 0.003*** | (0.000) | -0.003*** | (0.000) | -0.001*** | (0.000) |
| Syndication size | -0.007 | (0.005) | 0.030*** | (0.005) | -0.023*** | (0.004) |
| Firm reputation | -0.003*** | (0.001) | 0.001 | (0.001) | 0.001*** | (0.000) |
| Firm Total Number of Deals | 0.000 | (0.000) | -0.000 | (0.000) | -0.000 | (0.000) |
| Bubble dummy | -0.137*** | (0.020) | 0.106*** | (0.020) | 0.031*** | (0.007) |
| Early stage | 0.114*** | (0.024) | -0.204*** | (0.024) | 0.090*** | (0.018) |
| Expansion stage | 0.052** | (0.023) | -0.113*** | (0.023) | 0.061*** | (0.018) |
| Biotechnology | 0.076 | (0.048) | -0.069 | (0.050) | -0.007 | (0.022) |
| Communication Media | -0.000 | (0.027) | 0.012 | (0.027) | -0.011 | (0.010) |
| Computer Related | 0.022 | (0.021) | -0.016 | (0.022) | -0.006 | (0.008) |
| Health Medical | 0.003 | (0.039) | 0.025 | (0.041) | -0.028 | (0.026) |
| Semiconductors Electronics | -0.120*** | (0.024) | 0.138*** | (0.024) | -0.018* | (0.010) |
| Observations | 2 481 | | 2 481 | | 2 481 | |
| Pseudo R Square | 0.289 | | 0.289 | | 0.289 | |
| Log Likelihood | -1370 | | -1370 | | -1370 | |

Table 2.12 (con’t) reports the results of multinomial regressions excluding Chinese entrepreneurial firms, which comprises 2,481 observations. The dependent variable is a categorical variable that equals 1 if a company exhibits successful exit, 2 if it is unsuccessful and 3 if it is still active. The independent variables are the 4 types of VC: GVC, IVC, mixed syndication and pure syndication, and the stage of investment (early or expansion, later stage is the reference category). All the variables are defined in Table 2.1. Industry and country dummies have been included (reference category for industry is non-high-tech and reference category for country is China). Coefficients of all the variables are reported as average marginal effects. Standard errors are in parentheses. * p <.10; ** p <.05; *** p <.01 indicate significance at the 10%, 5% and 1% levels, respectively.

Table 2. 13: Comparison with existing literature - Logit

| | Active | | Successful | | Unsuccessful | |
|----------------------------|---------------|---------|---------------|---------|---------------|---------|
| GVC | -0.203*** | (0.034) | 0.264*** | (0.033) | -0.061*** | (0.014) |
| IVC2 | -0.152*** | (0.022) | 0.207*** | (0.021) | -0.055*** | (0.011) |
| Mixed syndication | -0.132 | (4.906) | 0.380 | (4.431) | -0.248 | (9.336) |
| Firm Experience | 0.000*** | (0.000) | -0.000*** | (0.000) | -0.000*** | (0.000) |
| EIapse time | 0.002*** | (0.000) | -0.002*** | (0.000) | -0.000*** | (0.000) |
| Syndication size | -0.027*** | (0.003) | 0.037*** | (0.003) | -0.010*** | (0.002) |
| Firm reputation | -0.003*** | (0.001) | 0.003*** | (0.001) | 0.000 | (0.000) |
| Firm Total Number of Deals | 0.000*** | (0.000) | -0.000*** | (0.000) | 0.000 | (0.000) |
| Bubble dummy | -0.090*** | (0.020) | 0.072*** | (0.020) | 0.018*** | (0.004) |
| Early stage | 0.209*** | (0.018) | -0.260*** | (0.017) | 0.051*** | (0.010) |
| Expansion stage | 0.104*** | (0.016) | -0.139*** | (0.016) | 0.035*** | (0.010) |
| Biotechnology | 0.103*** | (0.040) | -0.100** | (0.040) | -0.003 | (0.012) |
| Communication Media | 0.008 | (0.024) | -0.001 | (0.024) | -0.007 | (0.006) |
| Computer Related | 0.038** | (0.016) | -0.038** | (0.016) | -0.000 | (0.005) |
| Health Medical | -0.066** | (0.030) | 0.078*** | (0.029) | -0.012 | (0.012) |
| Semiconductors Electronics | -0.075*** | (0.022) | 0.086*** | (0.022) | -0.012* | (0.006) |
| Countries dummies | Yes | | Yes | | Yes | |
| Observations | 4682 | | 4682 | | 4682 | |
| Pseudo R Square | 0.2886 | | 0.2886 | | 0.2886 | |
| Log Likelihood | -2818 | | -2818 | | -2818 | |

Table 2.13 reports the results of multinomial regressions where the dependent variable is a categorical variable that equals 1 if a company exhibits successful exit, 2 if it is unsuccessful and 3 if it is still active. The independent variables are GVC or IVC2. All the variables are defined in Table 2.1. Industry and country dummies have been included (reference category for industry is non-high-tech and reference category for country is China). Coefficients of all the variables are reported as average marginal effects. Standard errors are in parentheses. * p < .10; ** p < .05; *** p < .01 indicate significance at the 10%, 5% and 1% levels, respectively.

Table 2.13:
Comparison with existing literature – Logit (cont')

| | Active | | Successful | | Unsuccessful | |
|----------------------------|-----------------------|---------|-----------------------|---------|-----------------------|---------|
| GVC | -0.174 ^{***} | (0.036) | 0.241 ^{**} | (0.035) | -0.067 ^{***} | (0.016) |
| IVC | -0.127 ^{***} | (0.026) | 0.190 ^{***} | (0.025) | -0.063 ^{***} | (0.013) |
| Firm Experience | 0.001 ^{***} | (0.000) | -0.000 ^{**} | (0.000) | -0.000 ^{***} | (0.000) |
| Elapse time | 0.002 ^{***} | (0.000) | -0.002 ^{***} | (0.000) | -0.000 ^{***} | (0.000) |
| Syndication_size | -0.028 ^{***} | (0.004) | 0.039 ^{***} | (0.004) | -0.010 ^{***} | (0.003) |
| Firm reputation | -0.002 ^{**} | (0.001) | 0.002 ^{**} | (0.001) | 0.000 | (0.000) |
| Firm Total Number of Deals | 0.000 | (0.000) | -0.000 ^{**} | (0.000) | 0.000 [*] | (0.000) |
| Bubble dummy | -0.106 ^{***} | (0.023) | 0.089 ^{***} | (0.023) | 0.017 ^{***} | (0.005) |
| Early stage | 0.179 ^{**} | (0.021) | -0.228 ^{***} | (0.020) | 0.049 ^{**} | (0.011) |
| Expansion stage | 0.098 ^{***} | (0.019) | -0.127 ^{***} | (0.019) | 0.029 ^{***} | (0.011) |
| Biotechnology | 0.154 ^{***} | (0.052) | -0.153 ^{***} | (0.052) | -0.001 | (0.014) |
| Communication Media | 0.033 | (0.028) | -0.019 | (0.028) | -0.013 [*] | (0.008) |
| Computer Related | 0.068 ^{***} | (0.019) | -0.064 ^{***} | (0.019) | -0.004 | (0.006) |
| Health Medical | -0.062 [*] | (0.033) | 0.074 ^{**} | (0.033) | -0.012 | (0.014) |
| Semiconductors Electronics | -0.043 | (0.027) | 0.064 ^{**} | (0.026) | -0.021 ^{**} | (0.009) |
| Countries Dummies | Yes | | Yes | | Yes | |
| Observations | 3 213 | | 3 213 | | 3 213 | |
| Pseudo R Square | 0.2088 | | 0.2088 | | 0.2088 | |
| Log Likelihood | -1883 | | -1883 | | -1883 | |

Table 2.13 (cont') reports the results of multinomial regressions where the dependent variable is a categorical variable that equals 1 if a company exhibits successful exit, 2 if it is unsuccessful and 3 if it is still active. The sample excludes all syndicated investments and thus comprises 3 213 observations. Estimates are derived from multinomial logit regressions, whereas the coefficients of all of the variables are reported as average marginal effects (N=3213).

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Chapter 3

Investment Behavior and Optimal Exit route Choice of Corporate and Government Venture Capital-backed Portfolio Companies in Asia

Investment Behavior and Optimal Exit route Choice of Corporate and Government Venture Capital-backed Portfolio Companies in Asia

Abstract

This paper investigates the investment behavior, exit performance and optimal exit route choice of Corporate Venture Capital (CVC) backed entrepreneurial companies in comparison with Government Venture Capital-backed (GVC) entrepreneurial firms in developing Asia. We studied a sample of 1198 companies that received their first investment either from a CVC firm or from a GVC firm, during the period 1999 to 2013, in five Asian countries. We first showed that CVC firms are more likely to invest in High-tech companies as compared with GVC firms. We further showed that GVC-backed firms are more likely to go successful and that GVC-backed firms are more likely to exit through Initial Public Offerings (IPO), as compared with CVC-backed companies, in developing Asia. We addressed the problems of endogeneity concerns and selection bias of observable and unobservable characteristics by employing the Bivariate Probit Model, Heckman two-step estimator, and Propensity Score Matching (PSM) techniques. Our results are robust to several checks.

1 Introduction

Venture Capital (VC) is a vibrant form of financing for young and innovative entrepreneurial firms that lack traditional financing such as debt and bond financing (Cumming *et al.*, 2017; Zhang and Mayes, 2018). Not only do Venture Capitalists provide financial capital, but also non-financial capital (management and human resources skills, strategy consulting...) to the investee companies, and they help entrepreneurs build contact with other potential market players like investors and acquirers (Sørensen, 2007; Sahlman, 1990). Thus, policymakers have acknowledged the pivotal role of VC (Pierrakis & Saridakis, 2017) in spurring innovation and fostering the economy.

There are different types of VC firms, e.g. Independent venture capital (IVC) firms and non-Independent Venture Capital firms. IVC firms pool funds and resources from private investors – like pension funds, hedge funds, and wealthy individuals. In contrast, different types of non-IVC firms emerged with the time such as Government Venture Capital (GVC) and Corporate Venture Capital (CVC) firms. GVC firms are government-backed entities — financed and managed by the governments — that provide equity or equity-like investments in young innovative companies. CVC firms are investment vehicles of corporations and non-financial companies, and CVC investments are the direct financial and strategic stakes of established corporations to young innovative companies. Non-IVC firms are referred to as Captive VC firms since they are backed by other financial or non-financial organizations known as the parent organization— Governments in case of GVC and corporations in the case of CVC. Funds and resources of Captive VC firms are provided by their parent organization.

However, Captive VC firms are heterogeneous and different from each other in several dimensions such as organizational structure, ownership, governance mechanism, objectives, and investment targets (Gompers *et al.*, 2009; Bertoni *et al.*, 2013; Bertoni *et al.*, 2015). The objectives of VC firms translate into the overall strategy and investment behaviors of the parent organizations and exit strategies of the portfolio companies. For example, governments and policymakers, around the world, keep in view certain objectives while launching public programs. The motives behind establishing GVC schemes are to spur innovation, develop economically lagging areas, generate employment, clout private investment, and bolster the economy by injecting financial capital into the start-ups, which face financial constraints (see Mason and Harrison, 1999; Lerner, 2002; Leleux and Surelémont, 2003; Bertoni and Tykvova, 2015; Criscuolo *et al.*, 2014). On the

other hand, objectives of CVC firms are both financial and non-financial gains: CVC firms want to gain a window to new technologies for the parent corporations through corporate venturing and external R&D. Based on the heterogeneity in the Captive VC firms and the characteristics of the portfolio companies¹⁸, this paper focuses on a comparison between two types of captive VC, namely Government Venture Capital (GVC) and Corporate Venture Capital (CVC). This comparison has a twofold purpose: identifying the characteristic of the target portfolio company in terms of the business sector and the drivers of exit performance. Thus, it is rudimentary that the investment behaviors of CVC and GVC firms would be different in terms of focusing on the business sector of the target investee companies, and additionally, the type of VC also impacts the exit performance and exit route choice of VC firms.

First, we explored the relationship between the business sector (industry) of the portfolio company and the type of Captive VC firm. High-tech companies require excellent managerial technicities, sound industry connections, and marketing strategies, and they also require specialized complementary assets in a timely and efficient manner to commercialize their new technologies¹⁹ (Stern *et al.*, 2000). But they face severe challenges in internally developing these assets due to prohibitive costs and time constraints (Aghion and Tirole, 1994) and acquiring them from the open market as well (Park and Steensma, 2012). Established corporations often control these specialized complementary assets (Park and Steensma, 2012). CVC firms are run and managed by corporate employees who possess a sound knowledge of the parent firms' resources like production facilities, distributional channels, and R&D (Dushnitsky and Lenox, 2006). Thus, CVC firms may not only provide financial but also non-financial capital in the form of specialized assets, and thus high-tech companies outsource complimentary assets externally in an arm's length transaction. These complementary non-financial resources refer to expertise and infrastructure for product development and refer to industry-, marketing-, supplier-, consumer-, and innovative-knowledge. (Dushnitsky and Lenox, 2005).

¹⁸ The characteristics of portfolio company include age, industry, stage and geographical location of the portfolio company.

¹⁹ Provision of product development expertise and manufacturing infrastructure, legal assistance, sales and distribution networks, customer services etc. are some examples of specialized and complementary assets. For example, Qualcomm, a CVC firm, invested in a wireless hardware and software developer entrepreneurial firm Airvana during the period 2001-05. Qualcomm provided CDMA technology license and product development expertise and manufacturing infrastructure to Airvana which finally exit through IPO in 2007: as quoted in Park and Steensma (2012).

On the other hand, GVCs firms are public entities that have strong ties with public institutions and incumbents and therefore enjoy easy access to government resources. They have greater access to key regional innovative actors like governmental research institutions and incubators, university laboratories, and science parks (Pierrakis & Saridakis, 2017). But GVC firm's managers are bureaucrats who lack the management skills and technicalities and incentive to coach and monitor technology-based companies (Leleux and Surlemont 2003), and GVC firms also lack industrial connections and marketing strategies which are very important in supporting technology-based companies (Grilli and Murtinu 2014; Leleux and Surlemont 2003). Therefore, we expect high-tech-related portfolio companies are more appealing to CVC firms than GVC firms.

Secondly, exiting or divesting from an investment is as important as an investment decision in the VC cycle. Generally, VC firms invest for a period of 7 to 10 years²⁰ and afterward divest and monetize their stake simply through exiting from portfolio companies. Exits are classified into two types: successful exit or unsuccessful exit. Exiting from investment through Initial Public Offering (IPO) or secondary sale (such as trade sale, merger, and acquisition) is called successful exit. On the other hand, if a portfolio company goes bankrupt, defunct, or is liquidated is termed as an unsuccessful exit. However, optimal exit choice depends upon multiple factors such as duration of the investment, characteristics of the portfolio company, market conditions, and most importantly the type of VC firm backing the entrepreneurial company (Guo *et al.*, 2015). In this article, we focus on the type of VC firm and exit performance and exit route choice of captive VC-backed companies.

In this regard, researchers mostly compared the exit performance of IVC-backed companies compared with GVC-backed companies (Brander *et al.*, 2010; Brander *et al.*, 2015; Cumming *et al.*, 2017; Zhang and Mayes, 2018) and IVC with CVC-backed companies (Gompers and Lerner, 2000; Gompers, 2002; Chemmaur and Loutskina, 2008; Guo *et al.*, 2015). However, there is a paucity of empirical and theoretical evidence on how captive VC-backed firms behave relative to each other in nurturing their portfolio companies. There is no study comparing the exit performance and exit route choice of captive VC-backed capital firms, to the best of our knowledge.

²⁰ In Asian countries, the horizon of investment is generally shorter, approximately 3 years.

To study the relative efficiency of captive VC firms in nurturing their portfolio companies to successful exit, we relied on the strengths and weaknesses of the VC firms. As mentioned previously, both these types of investors have their advantages and disadvantages over each other. Therefore, it is difficult to have an *a priori* expectation about the exit performance of CVC-backed firms in comparison with GVC-backed companies, and it is an empirical question in the long run if GVCs outweigh CVCs in nurturing their portfolio companies to successful exit or vice versa.

Furthermore, the aims and objectives, and connections of CVC and GVC firms translate into different exit strategies – exiting via IPO or secondary sale. Going for an IPO is a bureaucratic process and requires lengthy governmental sanctions. For example, companies are subject to seek approval from the state and from the China Securities Regulatory Commission to raise financing through the domestic IPO in China. Additionally, there are often quotas for companies to get listed on the stock market. GVC-backed companies have the benefit of governmental and political connection and therefore, may get preferential treatment while going for an IPO. Hence, we conjecture that GVC-backed companies are more likely to go public in comparison with CVC-backed companies in Asia.

This paper offers several contributions. First, we compare the characteristic of CVC and GVC firms in the specific context of emerging Asia. CB Insight report (2018)²¹ states CVCs investment experienced a sharp acceleration during the last two decades: dollar amount invested increased by 47% and the number of deals increased by 32% from 2017 to 2018 around the globe. This report adds that CVC accounts for 23% of all the VC deals in 2018, which is 7% more than in 2013. Further, this report adds that CVC investment declined in North America and Europe, but Asia attracted all-time high CVC investment: 38% of total VC investments in 2018, and therefore Asia emerged as the ‘power station’ of CVC investment. Similarly, according to the Asia Pacific Private Equity report, GVC-backed investments in Asia soared to 25% of the deal values in 2018. These statistics show that captive VC investments gained huge momentum in Asia in the past two decades.

The striking feature of these Asian developing countries is that their VC industry is underdeveloped, and immature especially compared to the US (Kenney *et al.*, 2002; Bruton *et al.*,

²¹ CB Insights is a tech market intelligence platform that analyzes millions of data points on venture capital, startups, patents, partnerships.

2005). The VC industry is strongly influenced by the institutions of a given country or by geographical area. Studies by Bruton *et al.* (2002, 2003, 2004, 2005, and 2009) that relied on this institutional perspective provide comprehensive insights into VC differences across geographical areas and categorized institutional forces into three types: normative, regulatory, and cognitive.

Normative forces refer to those values, beliefs, and norms that are shared among firms in an industry around the globe and are equally strong in Europe, Asia, and the US. Whereas regulatory forces refer to legal philosophy, investor protection, legal enforcement, and the nature of the stock market, and these forces are weak in Asia as compared to the Western countries. Finally, cultural and traditional forces trigger cognitive forces. Asian cultures are strikingly different than western ones. Businesses practices are predominantly influenced by ethnic Chinese in developing Asia (Bruton *et al.*, 2009). Thus, the dynamics of the VC industry in developing Asia are quite different from those in western economies. Therefore, this makes developing Asia an interesting and appealing region to study concerning VC activity.

This study adds to the literature in the context of the investment behavior of captive VC firms in terms of the business sector of the target company. This study also contributes to the heated debate about which type of VC firms efficiently nurture their portfolio companies. It fills the gap in the existing literature on the exit performance of GVC-backed companies, in comparison with CVC-backed companies as the topic remains unexplored. Furthermore, this study stresses the optimal exit route choice of entrepreneurial firms backed by different times of captive VC firms.

For our quantitative analysis, we retrieved the data from the Thomson One (T1) Banker database. It is a private database that collects and compiles data from different sources like government filings, news press releases, and surveys of venture capital and private equity companies. This database is widely cited by researchers and academics in VC literature. Using logistic regression, we studied a sample of 1198 VC-backed companies from five Asian countries that received their first investment from GVC or CVC firms during the period 1999 to 2013. Regarding the industry of investment, we found that CVC firms invest 61% more in high-Tech companies, as compared with GVC firms in Asia. Further, we explored that GVC-backed companies show a higher success rate (but statistically insignificant) than CVC-backed companies in Asia, so they show no difference in nurturing their portfolio companies. We also raised the

question of exit route choice, so our results indicate that GVC-backed companies are more likely to go public as compared with CVC-backed companies in Asia.

However, the entrepreneurial firms receiving CVC funding are not randomly matched. There are quite the possibilities of selection and unobserved variable bias. Hence, our explanatory CVC variable could be potentially endogenous. Therefore, we resort to instrumental variable techniques like the Bivariate Probit model and Heckman Two-step model to correct for endogeneity problems of selection and unobservable variables. Further, CVC and GVC firms might invest in different types of investee companies having different observable characteristics. We employed Propensity Score Matching (PSM) to resolve this problem. Overall, our results are in line with our naïve estimates and robust to several checks.

The rest of the paper is structured as follows: Section 2 presents the theoretical framework and hypothesis development, section 3 describes the research design, section 4 reports results and analysis, section 5 presents the robustness checks and endogeneity concerns, and section 6 concludes the paper.

2 Theoretical Framework and Hypotheses Development

Existing literature did not compare Captive VC between them but mostly with IVC, given the fact that the provision of non-financial capital matters a lot for this type of VC and is supposed to make a difference, both in terms of backed firms' characteristics and in terms of exit performance. In this literature review, we try to highlight the non-financial specificities of GVC and CVC to build this comparison between them and subsequent hypotheses.

2.1 Differences between GVC and CVC

Government Venture Capital

GVC is a government-backed entity — financed and managed by the government — that provides equity or equity-like investments in young companies. Governments around the world, directly or indirectly intervene in the capital market imperfections. GVC funds, government-sponsored, and government-managed VC funds are examples of direct government intervention in the VC activity (Brander *et al.*, 2015). These programs are designed to support innovation and economic growth and to fill the financing gap left behind by other investors, especially for young and innovative firms (Sunley *et al.*, 2005). Government intercession in the capital markets makes sense since governments tend to alleviate the market imperfections caused by moral hazards and information

asymmetries between the investors and entrepreneurial companies (Cumming, 2007). Not necessarily, the government injects only financial capital but may also intervene indirectly by providing rebates such as tax exemptions, subsidies, debts, or a mixture of all (Alperovych *et al.*, 2020).

Governments and policymakers, around the world, keep in view certain objectives while launching public programs. The motives behind establishing Government-backed VC schemes are to spur innovation, encourage indigenous entrepreneurship, develop economically lagging areas, generate employment, clout private investment, bolster the economy and spawn R&D externalities and spillovers by injecting financial capital to the start-ups, which face financial constraints (Mason and Harrison, 1999; Lerner, 2002; Leleux and Surelemont, 2003; Bertoni and Tykvova, 2015; Criscuolo *et al.*, 2014).

However, GVC firms have certain strengths. For example, GVCs firms are public entities that have strong ties with public institutions and incumbents and, therefore, enjoy easy access to government resources. GVCs have greater access to key regional innovative actors like governmental research institutions and incubators, university laboratories, and science parks (Pierrakis & Saridakis, 2017). Further, these state-backed ventures may receive preferential treatment from public institutions like tax subsidies, funds for R&D and innovation, information sharing, and access to financial organizations. In contrast to strengths, GVC firms also have weaknesses: Government programs are run by bureaucrats with several mandates on behalf of the public (Pahnke *et al.*, 2015). Civil servants lack skills in selecting and screening *ex-ante* investment and value addition *ex-post* investment (Munari and Toschi, 2015; Leleux and Surlemont, 2003). Further, they lack the technicalities and incentive to coach and monitor technology-based companies (Leleux and Surlemont, 2003). Moreover, their decision-making powers are curtailed and covenants between government venture capitalists, and entrepreneurs are not well addressed (Cumming *et al.*, 2017). Most importantly, GVC firms lack industrial connections and marketing strategies which are very important in supporting technology-based companies (Grilli and Murtinu, 2014; Leleux and Surlemont, 2003).

Corporate Venture Capital

The stronger product market competition and the shorter product life not only made the R&D an expensive but also unprofitable activity. Consequently, corporations began to look outside

their frontiers for innovation. Hence, another typology of VC, Corporate venture capital (CVC), emerged back in the 1960s in the US (Gompers, 2000; Chemmaur and Loutskina, 2008). CVC firms are investment vehicles of non-financial and established corporations (Dushnitsky and Lenox, 2006), and these are defined as the direct financial and strategic stakes from a non-financial organization like established corporations to risky, high growth potential privately owned investee companies (Wadhwa *et al.*, 2016; Yang *et al.*, 2014).

These are designed to meet the external R&D development requirement of the established firms and to gain a window to new technology for the parent companies. Dushnitsky and Lenox, (2005) consider CVCs as a breeding ground for external R&D that enhances parent firms' innovation and organizational learning; while Wadhwa *et al.* (2016) contend that it helps incorporate growth. Similarly, Keil (2004) writes that these are designed to explore and exploit knowledge and to monitor the development of new technologies. In the same vein, Yang *et al.* (2009) consider it as the external corporate venturing by utilizing internal and external resources through a bundle of organizational systems to flourish and thrive in existing or novel industries, fields, and markets.

Capitalizing on distinctive and specialized assets of the parent company, corporate investors augment both financial and complementary resources to high-growth innovative entrepreneurial firms that lack funds to commence their operations (Dushnitsky and Shapira, 2010). For example, CVC firms provide manufacturing resources, technological expertise, marketing strategies, distribution networks, and access to potential customers and suppliers networks of the parent organization to the portfolio companies (Colombo and Murtinu, 2017; Dushnitsky and Lenox, 2005; Bertoni *et al.*, 2013). While in return, CVCs expect to get both financial and strategic benefits from entrepreneurial firms like on the window to new technology and explore new markets to further their innovative tendencies (Dushnitsky and Lenox, 2005; Benson and Ziedonis, 2009; Keil, 2004; Dushnitsky and Shapira, 2010). It is not only the corporation that benefits from this investment relation but the entrepreneurial firms as well. To spur and accelerate innovation, entrepreneurial firms also need resources beyond their boundaries, and these entrepreneurial firms, therefore, forge alliances with the fund provider to gain the desired resources (Pahnke *et al.*, 2015).

Hence, GVC and CVC drastically differ in the dimensions of ownership, structure, governance mechanism, objectives, and complementary assets for portfolio companies. GVC and CVC have in common not to pursue only financial gains (compared with IVC) but they exhibit huge differences: CVC firms strive for strategic benefits like gaining a window to new technologies and competence building while GVC firms strive for promoting the local economy and job creation. They have access to different sets of networks: GVCs have access to state institutions and public servants, while CVCs have good industrial connections.

2.2 Hypotheses development

2.2.1 Investment Behavior: Targeting the Business Sector

High-tech companies require excellent managerial technicities, sound industry connections, and marketing strategies, and they also require specialized complementary assets in a timely and efficient manner to commercialize their new technologies²² (Stern *et al.*, 2000). But they face severe challenges in internally developing these assets due to prohibitive costs and time constraints (Aghion and Tirole, 1994) and in acquiring them from the open market as well (Park and Steensma, 2012).

GVC firm's managers are bureaucrats who lack the technicities and incentive to coach and monitor technology-based companies (Leleux and Surlemont, 2003). Moreover, GVC firms lack industrial connections and marketing strategies which are very important in supporting technology-based companies (Grilli and Murtinu 2014; Leleux and Surlemont, 2003). Established corporations often control these specialized complementary assets (Park and Steensma, 2012), and CVCs are the investing arms of established corporations. Whereas CVC firms are run and managed by corporate employees who possess a sound knowledge of the parent firms' resources like production facilities, distributional channels, and R&D (Dushnitsky and Lenox, 2006). However, CVC firms may not only provide financial but also non-financial capital in the form of specialized assets, and therefore high-tech companies outsource complimentary assets externally in an arm's length transaction. These complementary non-financial resources refer to expertise and infrastructure for

²² Provision of product development expertise and manufacturing infrastructure, legal assistance, sales and distribution networks, customer services etc. are some examples of specialized and complementary assets. For example, Qualcomm, a CVC firm, invested in a wireless hardware and software developer entrepreneurial firm Airvana during the period 2001-05. Qualcomm provided CDMA technology license and product development expertise and manufacturing infrastructure to Airvana which finally exit through IPO in 2007: as quoted in Park and Steensma (2012).

product development and also refer to industry-, marketing-, supplier-, consumer-, and innovative knowledge. (Dushnitsky and Lenox, 2005).

CVC firms pursue strategic benefits by investing in high-tech companies since R&D is getting more expensive and less profitable. Therefore, corporate investors tend to invest in portfolio companies with entrepreneurial technologies to gain strategic dividends to fill the technological gap (Kann, 2001). Additionally, CVC funding for high-tech companies engenders synergetic outcomes both for the investor and the investee companies. Entrepreneurial firms, leveraging on the complementary assets and resources of CVC firms' parent corporations and pooling of their knowledge, may develop new technologies, which will serve as a window to new technology for the CVC firms' parent corporations. Hence, given the shortcomings of the industrial connections and managerial expertise of GVC firms and their inability to deal with information asymmetries, we believe that high-tech companies are not appealing to public investors. Thus, we conjecture high-tech ventures are not the concern of public servants. Therefore, they are less likely to finance high-tech companies. Hence, we posit the following propositions:

H1: It is more likely that CVC firms invest in high-tech-related portfolio companies, as compared with GVC firms, in Asia.

2.2.2 Exit Performance: Comparison of Exit Routes

Different goals and strategies of GVC firms and CVC firms translate into different exit strategies of the portfolio companies. However, the extant literature is not convergent upon the exit route choice of CVC-backed firms, in comparison with IVC-backed companies. One strand of the literature suggests that CVC-backed companies choose to go more Public (see Gompers and Lerner, 2000; Gompers, 2002), while another strand documents that CVC-backed companies are more acquired (see Guo *et al.*, 2015).

Going IPO is a bureaucratic process and requires lengthy governmental sanctions. For example, companies are subject to seek approval from the state and from the China Securities Regulatory Commission to raise financing through the domestic IPO in China. GVC-backed companies have a governmental and political connection with state institutions. Hocherberg *et al.* (2007) and Bottazzi *et al.* (2008) stressed that connections have a phenomenal role in the VC activity. There is often a quotas system for companies to get listed on the stock market. Therefore,

the companies having institutional connections may get preferential treatment while going for an IPO.

Further, CVC firms pursue strategic goals and objectives and may invest in a promising venture to acquire it in the future. CVCs contemplate strategic goals, even sometimes sacrifice their financial gains to develop new technologies that are compatible with the core business of the corporation (Dushnitsky and Lenox, 2005). Sometimes CVC lets potential financial gains forgo to identify acquisition targets in the future (Benson and Ziedonis, 2009). We have sound reasons to believe that GVC-backed companies go more IPO exit as compared to CVC-backed companies, in Asia.

H2: The ventures backed by GVC are more likely to choose IPO exit routes and CVC-backed ventures are more likely to go secondary sale exits.

2.2.3 Overall Exit Performance of GVC and CVC

The extant literature is consensual and convergent regarding the underperformance of GVC-backed companies (Brander *et al.*, 2010; Brander *et al.*, 2015, Cumming *et al.*, 2017; Zhang and Mayes, 2018) and overperformance of CVC-backed companies (Gompers and Lerner, 2000; Gompers, 2002; Chemmaur and Loutschina, 2008; Guo *et al.*, 2015) in comparison with IVC-backed companies, in terms of a successful exit with respect to European and the US context.

GVC and CVC have access to distinct channels of contacts, possess different sets of abilities and skills, so they differently nurture their investee companies. GVCs have some strengths and edges over CVCs and vice versa.

Connections and networks play a very important role in successful exits. GVCs firms are public entities that have strong ties with public institutions and incumbents and, therefore, enjoy easy access to government resources. GVCs have greater access to key regional innovative actors like governmental research institutions and incubators, university laboratories, and science parks (Pierrakis & Saridakis, 2017) which CVC firms lack. Further, these state-backed ventures may receive preferential treatment from public institutions like tax subsidies, funds for R&D and innovation, information sharing, and access to financial organizations. On the other hand, CVC firms, capitalizing on distinctive and specialized assets of the parent company, provide manufacturing resources, technological expertise, marketing strategies, and distribution networks to the portfolio companies (Bertoni *et al.*, 2013) which GVC firms lack. Therefore, CVC firms

influence portfolio companies not only by injecting financial resources but also other complementary non-financial resources such as industry-, marketing-, supplier-, consumer-, and innovative knowledge.

Secondly, the role of management is very pertinent in the success of VC-backed companies. Experience managers lead their portfolios to success. Government programs are run by bureaucrats with several mandates on behalf of the public (Pahnke *et al.*, 2015). Moreover, civil servants lack skills in selecting and screening *ex-ante* investment and value addition *ex-post* investment (Munari and Toschi, 2015; Leleux and Surlemont, 2003) Moreover, their decision-making powers are curtailed (Cumming *et al.*, 2017). Whereas CVC firms are run and managed by corporate employees who possess a sound knowledge of the parent firms' resources like production facilities, distributional channels, and R&D (Dushnitsky and Lenox, 2006). However, CVCs' whole resources are centralized to the parent company and managers are in a long chain of command. This hierarchal structure may impede the timely and accurate decision-making process and allocation of resources. Hence, CVC managers must cooperate and comply with the corporate hierarchal structure, which limits their power and authority and may diminish their performance (Pahnke *et al.*, 2015). Consequently, the administrative abilities of CVC firms may not be as vibrant as the experienced IVC firms have (Drover *et al.*, 2017).

Whereas the compensation of the CVCs managers are corporate salaries and sometimes bonuses and perk and privileges that depend upon the financial performance of the parent company and the compensation of civil servants are government salaries. Therefore, the managers of captive VC firms are not as efficient as the managers of IVC firms.

Because of the above arguments, both GVCs and CVCs have their shortcomings and advantages compared to each other. So, it is very difficult to have an *a priori* expectation either GVC or CVC firms nurture their portfolio better in terms of a successful exit. Hence it is an empirical question, and we, therefore, conjecture the following null hypothesis:

H3: CVC-backed venture and GVC-backed venture do not exhibit differences in terms of a successful exit in Asia.

3 Research Design

3.1 Sources and sample

For our quantitative analysis, we retrieved the data from the Thomson One (T1) Banker database. It is a private database that collects and compiles data from different sources like government filings, news press releases, and surveys of venture capital and private equity companies. This database is widely cited by researchers and academics in VC literature. Thomson One database provides information about the characteristics of VC firms and portfolio companies such as firm type, firm age, no of funds managed by the firm, investment amount, and similarly portfolio company stage, industry, age, and exit route. Therefore, we obtained the data for the investee companies that are located in 5 Asian developing countries– China, India, Malaysia, Singapore, and South Korea. The peculiar feature of this sample is that these countries have similar VC industries. The VC industry in Asia is immature and not developed as compared to that in western countries.

We selected portfolio companies that received their first investment from GVC or CVC firms during the period 2000 to 2013²³. The first investment made by any VC firm later impacts the future rounds in the portfolio company, and it is conventionally used in VC literature and research²⁴. We dropped the portfolio companies with missing information, and we ended up with a sample of 1198 companies that received their first investment during the period 2000 to 2013. Then we traced the life cycle of these companies till 2017 to identify their exit route. In the extant literature, it is the convention to give the companies approximately 4 years to reach a conclusive situation – to go successful or unsuccessful²⁵. The companies that went public, or are in the registration process to an IPO, merged and acquired, or pending for acquisition is considered as successful and companies that went bankrupted or defunct are classified as unsuccessful exit (Bock and Watzinger, 2017)²⁶.

²³ We dropped portfolio companies that received investment from insurance companies, financial firms, real estate. We also dropped companies that received their first investment from IVC or other captive VC firms like bank VC firms.

²⁴ See Zhang and Mayes, 2018; Cumming *et al.*, 2017; Sorensen, 2007.

²⁵ Suppose a company received first investment in 2013 (the last year of our data), so following extant literature we trace life cycle for 4 years to identify exit route. Similar treatment could be seen in Nahata, 2008; Hochberg *et al.*, 2007; Cumming *et al.*, 2017 and Brander *et al.*, 2015.

²⁶ Following Guo *et al.* (2015), we dropped the companies that went Management Buy Out.

3.2 Variables

Dependent and Independent Variable

The main independent variable is the type of VC investor whether a company receives funding from a CVC firm or a GVC firm. Therefore, our independent variable *CVC* is a dummy variable equal to 1 if the startup is financed by a corporate VC firm and is equal to zero if the startup is backed by a GVC firm²⁷.

We have three dependent variables: *High-tech* is an indicator variable defined according to the nature of the entrepreneurial firms' business descriptions, and it is based on the industrial classification of the Thomson Banker One database. Following Wang and Sim (2001), we grouped computer-related, semiconductor and electronics, media-related, medical-related, and biotechnology as high technology firms. Thus, high-tech is a dummy variable equal to 1 if the portfolio company's industry is a high technology and otherwise zero. *IPO* is a dummy variable equal to 1 if the company goes IPO or is in the process of going IPO and zero otherwise. *Successful* is a dummy variable if the company goes successful (exit via IPO, M&A) otherwise zero is unsuccessful (bankrupt, write off, defunct, or still active). Following the extant literature, we controlled for a set of variables that may explain investment behavior, optimal exit route choice, and overall successful exit.

Firm characteristics may impact investment behavior and exit performance. Experienced VC firms have rich resources and may likely invest higher amounts and their portfolio companies are more likely to go successful (Hochberg *et al.*, 2007; Nahata, 2008). Similarly, the VC firms that have good reputation lead their portfolio companies to success; therefore, we proxied the *Firm reputation* with the number of funds managed by the firm. we also controlled *firms Number of deals* and is defined as the firm's total number of deals.

²⁷ Following Guo *et al.* (2015), If a company is being financed by both CVC and GVC, we defined as CVC-backed or GVC-backed whichever made the first investment. If the investment date was same, then we defined CVC or GVC based on higher investment amount. For instance, on 12/22/2011 Deqin Group co Ltd received an investment of 4.73 million USD from GVC firm Chengdu Yinki venture capital and 11.04 million USD from CVC firm Beijing Bray Shengde Venture Investment co Ltd, So we defined Deqin as CVC-backed. On the other hand, DuZhe Publishing Co Ltd received first investment on 2/8/2011 from both GVC and CVC; GVC investment amount is 51.96 million USD and CVC investment amount is 9.36 Million USD, hence we define DuZhe as GVC-backed given higher amount of investment.

We also controlled the portfolio firm-specific variables. In conformity to the extant literature and following Giot and Schwienbacher (2007), Tian (2011), and Nahata (2008) we controlled for the *Investment Amount* received by the company in all the rounds²⁸. Following prior literature, we also included *syndication size* and is defined as the number of VC firms investing in the startup. Following Giot and Schwienbacher (2007), we controlled *Elapse Time* and is defined as the log natural of the number of days taken by the portfolio company from the first investment till the exit date; in case the portfolio company is still active we take the cut-off date 31st December 2017, the last point of our data. *The expansion stage* is a dummy variable equal to 1 if the portfolio company is in the expansion stage at the time of first investment otherwise zero. *The later stage* is a dummy variable equal to 1 if the portfolio company is in a later stage at the time of first investment otherwise zero. *Industry dummies*, Thomson one classifies the portfolio companies into six categories based on industry classification, industry dummies are mutually exclusive indicator varies which switch from zero to 1 for every industry. *Country dummies* are mutually exclusive indicators that vary which switch from zero to 1 for every country. we controlled the environment-specific variable, *GFC is* a dummy variable equal to 1 if the investee company received its first investment during the global financial crisis of 2007-08.

Table 3.1 exhibits the variables and their definition.

[Please insert Table 3.1 about here]

3.3 Descriptive statistics

Table 3.2 depicts the summary statistics of the sample. Our final sample is a cross-sectional dataset of 1198 VC-backed entrepreneurial firms that received their first investment from CVC or GVC firms during the period 1999 to 2013. Out of which 302 (25%) are GVC-backed and 896 (75%) are CVC-backed. Table 3.2 shows the country-wise distribution of portfolio companies. Overall, 54% of companies are from South Korea and followed by China with 27% of the firms. Interestingly, GVC-backed companies are more prevalent in China and Singapore, and CVC-backed firms are more prevalent in South Korea. Therefore, the number of South Korean CVC-backed companies surpass CVC-backed Chinese companies. Table 3.2 also shows the industry-wise distribution of companies, there are 35% non-high-tech companies and 27% computer-related

²⁸ Thomson One Banker shows the total funds received by the portfolio company and is defined as the log of 1+total funding.

entrepreneurial firms²⁹. Regarding the stage of investment, summary statistics show that 41% of the companies received their first investment in their Early-stage while 41% in Expansion and 17% in Later stages³⁰. Further, statistics show that 45% of GVC-backed companies are in the early stage while 40% of CVC-backed companies are in Early-stage.

Table 3.2 represents the descriptive statistics of the variables. In our sample, 75% of the entrepreneurial companies are CVC-backed while the rest are GVC-backed. Further, 24% of the companies have an IPO exit, 7% of the companies have secondary exits such as trade sales, acquisition, or mergers. Therefore, overall, 31% of the companies have a successful exit. The mean number of funds managed by a firm is approximately 11 and the mean age of the portfolio company when received its first investment is 74.7 months. The average total funding a portfolio company received is 17.8 million USD and the mean of the syndication size is 2.3 and approximately 13% of the companies received their first investment during the Global Financial Crisis of 2007-08

[Please insert Table 3.2 about here]

Whereas Table 3.3 reports the Pearson pairwise correlation matrix. The correlation between CVC and Early Stage is -0.04 and between CVC and IPO is -0.003 and between high-tech and CVC is 0.08. The correlation between dependents and independent variables is weak and also the correlations among the independent and control variables are weak which mitigates the problems of multicollinearity concerns in the models.

[Please insert Table 3.3 about here]

4 Results and Analysis

4.1 Univariate analysis

Table 3.4 provides the univariate comparison of the variables of the two groups i.e., portfolio companies backed by GVC and CVC firms. Variables in these two groups are significantly different from each other. For example, CVC firms manage a greater number of the fund than GVC

²⁹ Thomson One banker classifies the investee companies into 6 industries: (i) Biotechnology (ii) Communication and media (iii) Computer related (iv) Medical/Health/Life Sciences (v) Non high technology (vi) Semiconductors and other. Therefore, we relied on this classification of companies.

³⁰ Thomson one banker classifies the companies into seed/startup stage, Early stage, Expansion stage, and Later and other. We defined a company as an Early stage if it receives first investment in seed stage, startup stage or Early stage.

firms. The average number of managed by CVC funds is 12.7 while the number of funds managed by GVC firms is 5.2. Therefore, the difference between these two subsamples is 7.5 and is significant at the 1% level. Similarly, CVC firms have 43.5% more deals as compared to GVC firms and the difference is significant at a 1% level. On the other hand, GVC-backed portfolio companies on average receive 25.5 million USD total funding, whereas CVC-backed portfolio firms receive 15.5 million USD. Therefore, the difference is 10 million USD and is significant at a 10% level. The difference in Age at financing is significant at 5% level. The difference in high tech is approximately 10% and is significant at a 1% level. However, the difference in early-stage, IPO, and success is not significant. Table 3.4 represents the detail of all the variables of the two groups.

[Please insert Table 3.4 about here]

4.2 Multivariate results and analysis

4.2.1 VC type and Industry of portfolio company

We hypothesized that CVC firms invest more in high-tech companies as compared to GVC firms in Asian countries (H 1). In the following specification, my dependent variable is a dummy variable equal to 1 if the industry of investee company is high-tech otherwise zero, and independent variable CVC is an indicator variable equal to 1 if the investor is a corporate-backed firm otherwise zero.

$$Hightech = \beta_0 + \beta_1 CVC + \sum_{j=1} \beta_j Z_{ji} + \varepsilon_i \quad (Eq. 3.1)$$

We estimated the results using logit regression analysis. Table 3.5 reports the results. The coefficient of CVC is positive and significant. Model 1 estimates that it is 61% more likely that CVC invests more in high-tech industries as compared to GVC in Asia. The results are highly significant at a 1% level. We controlled for several variables as in models 2, 3, and 4. The results remain unchanged.

[Please insert Table 3.5 about here]

4.2.2 VC type and choice of Exit route

In hypothesis 2, We conjectured that CVC-backed companies like to go for secondary sales exit routes and GVC-backed companies are more likely to go IPO in Asia.

$$IPO = \beta_0 + \beta_1 CVC + \sum_{j=1} \beta_j Z_{ji} + \varepsilon_i \quad (Eq. 3.2)$$

In the above specification, our dependent variable is an indicator variable if the portfolio company exit via initial public offering (IPO) otherwise zero, and the explanatory variable CVC is an indicator variable equal to 1 if the investor is a CVC firm otherwise zero. We use a binary logistic model to estimate the results. Table 3.6 reports the results. In model 1, the CVC-backed companies are 28.8% less likely to exit through IPO as compared with GVC-backed companies in Asia (though not statistically significant). We controlled for portfolio firm experience, investment amount, and elapsed time. The coefficient of CVC further decreased and became significant, and pseudo-R square enhanced but no of observations fell due to missing values. The coefficient of the investment amount is positive and significant suggesting that the higher the investment, the higher the likelihood of exiting via IPO. It is interesting to know that stage of investment has no impact on exiting via IPO. The portfolio firm experience has a negative and significant coefficient which means that the companies which take a longer time to acquire their first VC investment since their creation have fewer chances of going public. Also, the companies which take a longer time to exit after the first VC investment have fewer chances of going public.

[Please insert Table 3.6 about here]

4.2.3 VC type and Successful Exit.

Given the advantages and disadvantages, conveniences and inconveniences, benefits and shortcomings of both the GVC and the CVC, it is difficult to have an *a priori* expectation that GVC or CVC-backed companies perform better in terms of a successful exit in Asia. Therefore, it is an open question and we resorted to an empirical expedition to dig down further. In the following specification, our dependent variable is a binary variable assuming 1 if the company exits via IPO or Trade sale (successful), otherwise, zero, and predictor variable CVC is a dummy variable taking value 1 if the portfolio company is backed by CVC firm and zero if backed by a GVC firm.

$$Successful = \beta_0 + \beta_1 CVC + \sum_{j=1} \beta_j Z_{ji} + \varepsilon_i \quad (Eq. 3.3)$$

Results are estimated by employing a logit regression model and are depicted in Table 3.7. The coefficient of CVC is negative and significant at a 10% level. The results show that CVC-backed companies are less likely to go successful as compared to GVC-backed companies in Asia. Further, the control variables show that the greater the syndication size, the greater the chances of successful exit of the portfolio firms, and the greater the elapsed time, the less likely the companies will exit successfully. Therefore, the results depict that overall GVC-backed companies perform better than CVC companies in Asia.

[Please insert Table 3.7 about here]

5 Endogeneity Concerns and Robustness Checks

In our sample, 1198 entrepreneurial firms received CVC or GVC investments. Our results show that CVC firms are more likely to invest in high-tech-related entrepreneurial companies, and CVC-backed companies are less likely to go public and successful in comparison with GVC-backed companies. The dyed pair of investments is not a random process. Since entrepreneurial firms have fewer chances of choosing a VC firm and hence endogeneity due to self-selection is not likely to happen in this case (Park and Steensma, 2012). However, we cannot overlook or rule out the possibility of selection bias i.e., GVC firms pick the most promising entrepreneurial firms that have higher chances of leading to a successful exit. Hence, CVC firms are only left with unpromising companies to invest in which have lower probabilities of achieving success. Secondly, there could be endogeneity in the models due to omitted variable bias. Hence, our estimates of H1, H2, and H3 as shown in Tables (3.6,3.7, and 3.8 respectively) might be influenced by selection bias since entrepreneurial firms are not randomly assigned; also, the estimates might be inconsistent and driven by endogenous VC type. To address and tackle the problems of endogeneity concerns, we resorted to propensity score matching techniques (PSM) and instrumental variable (IV) techniques (bivariate probit, Heckman Treatment effect).

5.1 Instrumental variable

Omitted variable bias may be leading to inconsistent and spurious results, such that VC-type CVC is endogenous in the model. The classical remedy to selection bias is the use of an instrumental

variable that is correlated to the endogenous variable (VC type: CVC) and is exogenous to the outcome variable (Hightech, Successful, and IPO).

Therefore, we need an instrumental variable to remove the endogeneity in the regression. We suppose our treatment variable CVC is endogenous, then it might be correlated with the error term. Therefore, our naive specifications could produce inconsistent coefficients. To solve this issue, we must resort to an exogenous instrumental variable that is correlated with the endogenous CVC variable and not correlated with the error term. Put simply, IV indirectly affects the dependent variable in the specification, through its correlation with the predictor variable. In our case, there is one endogenous variable CVC, and one instrumental variable (Z). The IV must qualify two assumptions to be considered as a valid instrument:

1. Exclusion restriction, means it must be exogenous $cov(Z, u) = 0$ and
2. Relevance: it must be correlated with the endogenous variable CVC.

Following Brander *et al.* (2015), Zhang and Mayes (2018), and Park and Steensma (2012) we constructed an Instrumental Variable (IV) *availability of CVC* given the domestic market situation of every country³¹. It is measured as to how much amount of CVC funding is available at the firm level in a given industry, in a given country each year. It is logical that the higher the availability of CVC funding in the local market, the higher are the chances that entrepreneurial firms would receive CVC funding. Our IV '*availability of CVC*' would be exogenous as it does not influence a VC-backed venture to go public and/or be successful. Since IV meets the basic assumption i.e., as it is highly (0.70) correlated with the endogenous variable CVC and weakly correlated with dependent variables High-tech (0.11) *successful* (0.04) and *IPO* (0.01).

5.1.1 Results of Bivariate Probit for H1, H2, and H3.

Bivariate probit is an instrumental variable method that is appropriate when both the dependent and independent variables are binary. It is a standard maximum likelihood technique where selection and outcome equations are estimated simultaneously. Our dependent and independent variables are binary, therefore we first run a bivariate probit estimator to correct for the problems

³¹ Brander *et al.* (2015) describes market as: assume that a Biotechnology company in china receives first investment in 2000 is one market at firm level. Thomson one Reuters classifies the entrepreneurial companies into 6 categories hence there are 6 industries, five countries and our data set covers the period 1999 to 2013 ie 15 years (during which companies received first investment). Therefore there are 450 markets (15*5*6=450) in total.

of unobservable variables. In the first stage, we find the likelihood of being backed by CVC by inserting instrumental variable as an independent variable, and then we inserted the errors terms obtained from the first step in the second stage as additional control variables.

$$y_1 = y_2\beta_1 + x\beta_1 + \mu_1 \quad (Eq. 3.4)$$

$$y_2 = z\beta_3 + \mu_2 \quad (Eq. 3.5)$$

where y_1 shows the dependent variable binary variables (High-tech, Successful, and IPO), y_2 shows the independent endogenous variable, x shows the vector of control variables for the second stage while z denotes the independent, control, and instrumental variables inserted in the second stage.

Table 3.8 reports the results of the bivariate probit model for our H1; column 1 presents the estimates of the first stage (selection equation) where CVC is regressed on control variables and the instrumental variable to find the likelihood of being backed by a CVC firm. The coefficient of the IV variable is positive and significant at a 1% level. Therefore, after estimating the possibility of being backed by CVC, we used the residuals from the first stage as additional explanatory variables in the second stage. Table 3.8 Columns 2 shows the estimates of the second stage. The results are consistent with our naïve model as shown in Table 3.5. The coefficients of CVC are positive and significant showing that CVC is more likely to invest in high-tech companies. Hence, the results highly confirm that CVC firms are more likely to invest in high-tech companies.

Table 3.9 presents the result of the bivariate probit model of our H2. Column 1 presents the results of the first stage equation of the likelihood of being backed by CVC. The coefficient of IV is positive and significant at a 1% level. The error terms obtained from the first stage were inserted in the second stage. Column 2 of Table 3.9 reports the results of the second stage. The results are in line with Table 3.6 of our previous naïve estimates. The results show that CVC-backed companies are less likely to go IPO as compared with GVC-backed companies in Asia. Therefore, the results of the bivariate model Table 3.9 confirm the naïve results of our hypothesis three as presented in Table 3.6.

Table 3.10 reports the estimates of the bivariate probit model of H3. Column 1 of Table 3.10 presents the results of the first stage equation of propensity of being backed by CVC. The coefficient of the instrumental variable is positive and significant at a 1% level. The error terms

obtained from the first stage were inserted in the second stage. Column 2 of Table 3.10 reports the results of the second stage. The results are in line with Table 3.10 of our previous naïve estimates. The results show that CVC-backed companies are less likely to go successful as compared with GVC-backed companies in Asia.

[Please insert Table 3.8 about here]

[Please insert Table 3.9 about here]

[Please insert Table 3.10 about here]

5.1.2 Heckman Two-Step Model for H1, H2, and H3.

There could be other potential unobservable characteristics of the investee companies like the riskiness of the project, quality of the project, and the capabilities of the entrepreneurs which may influence the probability of the company's decision being backed by CVC or GVC and may also influence the ability to exit via an IPO or trade sale (Zhang and Mayes, 2018). Hence the outcome variable might be correlated with the error terms. The specifications having both selection effects and endogenous variable poses econometric challenges. Therefore, the Heckman selection model deals with such types of issues efficiently. Heckman selection (Heckit) effect is also a two-step estimator which is a limited likelihood approach that uses an instrumental variable to identify the selection equation. Heckit estimates the inverse Mill ratio (λ) in the selection equation. Then λ is inserted in the second stage regression as an explanatory variable. The null hypothesis of 'no selection' for the coefficients of the λ can be tested by t-test (see Woodridge, 2002: 568).

Table 3.8 (columns 3 and 4) reports the estimates of the Heckit model for our H1. Column 3 shows the results of first stage estimations of the probability of being backed by a CVC firm, while column 4 exhibits the results of the second stage. The insertion of inverse Mills ratio from selection effects does not alter the relationship between CVC and Hightech as shown in Table 3.5. Inverse Mills ratio is significant at 1% level. The estimates of Heckit are qualitatively like our baseline naïve model. The results confirm that our baseline model estimates efficient coefficients i.e., CVC firms are more likely to invest in high-tech companies.

Table 3.9 (columns 3 and 4) reports the estimates of the Heckit model for our H2. Column 3 shows the results of first stage estimations of the probability of being backed by a CVC firm, while column 4 exhibits the results of the second stage. The insertion of the inverse Mills ratio

from selection effects does not change the relationship between CVC and IPO as shown in Table 3.6. Inverse Mills ratio is significant at 1% level. The estimates of Heckit are qualitatively like our baseline naïve model. The coefficient of CVC is negative and significant at a 1% level. Hence, our Heckit model results confirm that CVC-backed companies are less likely to go IPO exit.

Table 3.10 reports the estimates of the Heckman treatment effect of H3. Column 1 presents the results of the first stage equation of propensity of being backed by CVC. The coefficient of the instrumental variable is positive and significant at a 1% level. The inverse Mills ratio obtained from the selection equation was inserted in the second stage. Column 2 of Table 3.10 reports the results of the second stage of the Heckit model. The results are in line with Table 3.7 of our previous naïve estimates. The coefficient of CVC is negative and significant at a 1% level. The results show that CVC-backed companies are less likely to go successful as compared with GVC-backed companies in Asia.

5.2 Propensity Score Matching (PSM):

Our estimates show that CVC firms invest more in high-tech companies and that CVC-backed firms underperform in comparison with GVC-backed companies in terms of going IPO and Successful; this could be due to the better screening and selection *ex-ante* investment and value addition *ex-post* investment. CVC firms might target different types of portfolio companies based on industry, stage, and age, etc. Therefore, we also employed another econometric technique based on propensity scores and is an important econometric tool to deal with the problems of endogeneity concern based on observable factors. This approach is widely used in the VC literature (see Zhang and Mayes, 2018; Zhang, 2018; Guo *et al.*, 2015). Propensity score relies on matching techniques where the CVC-backed companies (treated group) are matched with GVC-backed companies (control group) based on similarities in their estimated probabilities of being treated. It efficiently accounts for observable characteristics but does control for correlation with omitted and unobservable bias.

We first run a probit regression with the dependent variable CVC and independent covariates to capture the propensity of being backed by CVC. Then, we matched CVC investments with GVC investments with the closest propensity weight score without replacement in the same stage, industry, country, and VC firm and portfolio firm characteristics.

Table 3.11 panel A shows the results of PSM for our H1, where we first run a Probit regression with the dependent variable CVC and independent covariates to capture the propensity of being backed by CVC. Then, we matched CVC investments with GVC investments with the closest propensity weight score without replacement in the same stage, country, and VC firm and portfolio firm characteristics. We employed average treatment effects on the treated in the PSM score model and ran a one-to-one Probit regression matching with the nearest neighboring method. Figure 1 depicts the common support graph of PSM for H1. Therefore, after accounting for selection using score matching, the estimates in Table 3.11 Panel (A) show that CVC firms are more likely to invest in high-tech companies in Asia.

We replicated the same procedure for our successful exit hypothesis and exit route choice where the dependent variables are *Successful and IPO respectively*. The common support graph for H2 and H3 is shown in Figure 2. Table 3.11 Panel (B) reports the estimates of PSM for our H3; the results indicate that CVC-backed firms are less likely to go successful as compared with GVC-backed companies in Asia. Similarly, we ran PSM for our H2, where the dependent variable is an indicator variable assuming the value of 1 if the portfolio company exit through IPO, otherwise zero. Table 3.11 panel (C) reports the results for our H2. The results are in line with our baseline model: CVC-backed companies are less likely to exit via IPO as compared to GVC-backed companies in Asia. After controlling for observable and measurable characteristics, PSM supports our hypothesis and confirms that our results are not driven by a selection effect but rather a treatment effect. Yet, we cannot completely rule out and overlook the possibility of the selection effect.

[Please insert Table 3.11 about here]

Figure 2.1: Common Support Graph of PSM for H1 (High-tech).

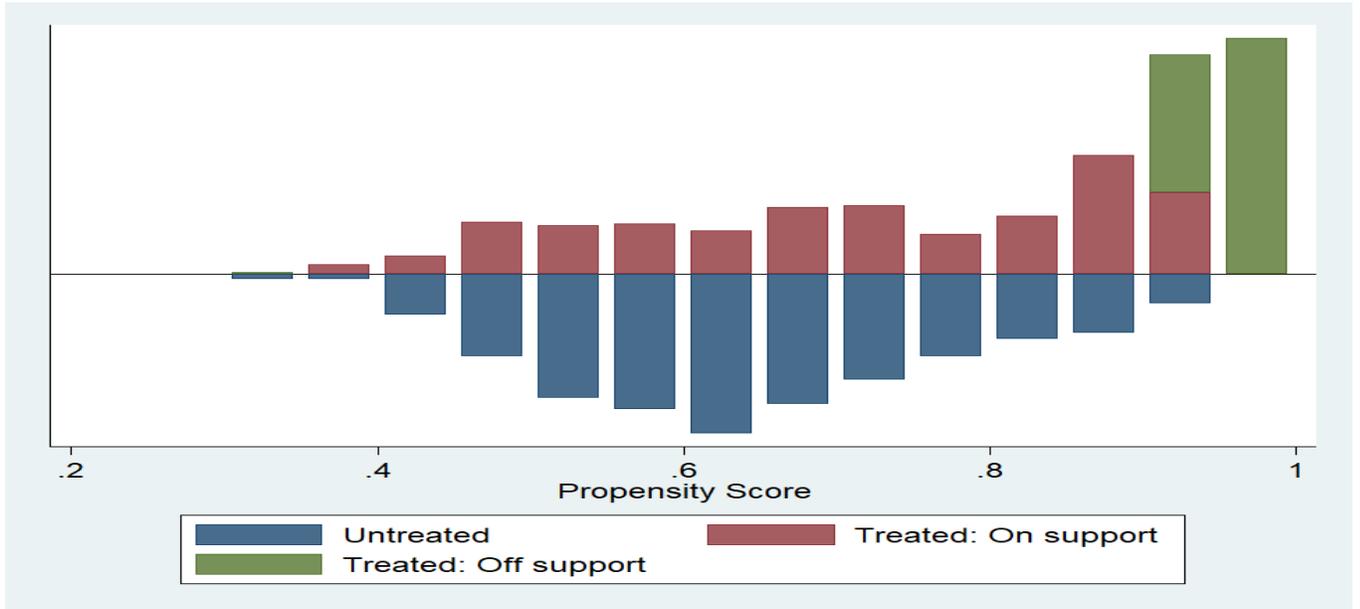
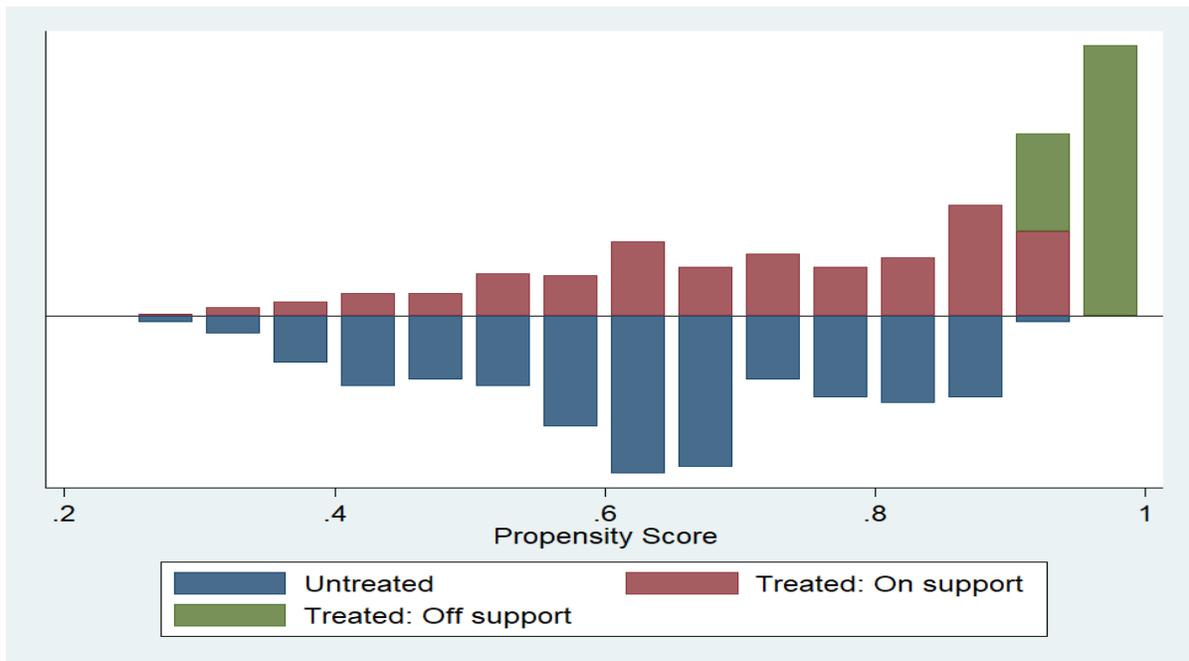


Figure 2.2: Common Support Graph of PSM for H2 & H3 (Successful and IPO Exit).



5.3 Robustness checks

5.3.1 Alternative econometric model

The logistic regression model is a non-linear maximum likelihood estimator. Therefore, as a robustness check, we used the Linear Probability Model (LPM). It is a particular case of binary regression where the dependent variable is dichotomous. We ran an LPM Using the same specifications as in Equations 1, 2, and 3. Therefore, Table 3.12 reports the baseline estimates of all three hypotheses. The results are in line with our initial findings. For our H1 coefficient of CVC is positive and significant suggesting that CVC firms are more likely to invest in high-tech companies as previously presented in Table 3.5 using the logistic regression model. The coefficients of CVC for our H2 and H3 are negative and significant suggesting that CVC-backed companies are less likely to go Successful and are less likely to exit through IPO. Therefore, our estimates in Table 3.12 are consistent with our previous estimates.

[Please insert Table 3.12 about here]

5.3.2 Cross country analysis

Our sample is composed of 1198 VC-backed entrepreneurial firms; out of which, 54% of the companies are from South Korea. Therefore, one may question that our results are influenced by South Korean dominance. We split the CVC-backing into two groups: South Korea (SK) and the Rest of Asia by introducing CVC interaction terms³². Using the specifications parallel to those in Table 3.5 (High-tech), Table 3.7 (Successful), and Table 3.6 (IPO), the results in Table 3.13 show the estimates for South Korea and the Rest of Asia.

For our H1, Table 3.13 shows that the coefficient of the rest of *Asia* is positive and significant for the rest of Asia and positive and non-significant for South Korea; this suggests that CVC firms are more likely to invest in High-tech companies as compared with GVC firms. Similarly, for our H3 of a successful exit, the coefficients of CVC for the rest of Asia are negative and significant and the coefficient of CVC for South Korea is negative and non-significant. Results for H2 are also similar, the coefficient for the rest of Asia is significant and negative, and negative

³² A similar treatment could be seen in Brander *et al.* (2015) s' study where they did a cross country comparison by introducing the interaction terms for the US, Europe and Asia.

and insignificant for South Korea. Overall, the estimates are qualitatively in line with our initial findings and similar across the region.

[Please insert Table 3.13 about here]

5.3.3 An alternative measure of explanatory variable CVC

Following Guo *et al.* (2015), we defined an alternative measure of being backed by CVC. This is a continuous variable (CVC percentage), and it is defined as the percentage of CVC funding received by a firm scaled by the company's total investment amount³³. As the continuous nature of the variable does not make any sense of affecting the industry of operation of the portfolio firm. Therefore, we only regressed our second hypothesis and the third hypothesis using the CVC_per explanatory variable. Table 3.14 reports the results. The coefficients of CVC_per for both the hypotheses ie successful exit and IPO are negative and significant. This suggests that the higher the amount of CVC funding a portfolio company receives, the fewer the chances of a successful exit and fewer the chances of going public as compared with GVC-backed companies in Asia. The economic significance of the variable is low but significantly negative. So, our findings are consistent with our baseline naïve model specifications. CVC-backed companies are less likely to go successful and less likely to go public in Asia.

[Please insert Table 3.14 about here]

6 Conclusions and Discussion

Over the recent years, the investment behaviors of VC firms and the performance of VC-backed companies have widely attracted the attention of academia and practitioners. Extant literature has compared the exit performance of CVC-backed with IVC-backed companies and has compared the exit performance of GVC-backed companies with IVC-backed companies. But there is a lack of systematic study of how captive VC firms nurture their portfolio companies relative to one another. In this paper, we explored the VC characteristics and choice of industry of entrepreneurial firm, exit performance, and optimal exit route choice of CVC-backed companies versus GVC-backed companies.

³³ Suppose a portfolio company receives a total investment of 100 million USD, and CVC funding is 25 million USD. Then CVC_percentage share is 25% or 0.25.

We retrieved the data from Thomson Banker One for five Asian countries on firm-level during the period 1999 – 2013 and track their lifecycle till the end of 2017. Since High-tech companies require managerial technicities and industry-specific assets, we empirically show that CVC firms are more likely to invest in high-tech companies as compared with GVC firms. Additionally, CVC firms and GVC own different sets of capabilities and assets leading to distinct strengths and weaknesses; therefore, we posed an open question about the performance of CVC and GVC-backed companies i.e., whether CVC or GVC nurture efficiently their portfolio companies to a successful exit. The estimates show that CVC-backed companies are less likely to go successful in comparison with GVC-backed companies in Asia. Further, we were interested to investigate the optimal exit route choice of CVC versus GVC-backed companies. For Asia, the IPO market is strongly influenced by Government and there is always a quote system for the companies to get listed on the stock market. Therefore, we believe that government-backed companies might get preferential treatment from the government institutions and might have higher chances of going for an IPO. Therefore, our findings supported our hypothesis and we econometrically showed that GVC-backed companies are more likely to go for IPO as compared with CVC-backed companies.

Since portfolio firms were not randomly matched with VC type; secondly, the VC firms might invest in different types of entrepreneurial firms having different observable characteristics like stage, industry, and age, etc. So, our results might be influenced by selection and unobservable and omitted. Therefore, to mitigate the problem of endogeneity, we employed two instrumentals variable techniques: The bivariate probit model and the Heckman treatment model for unobservable and selection bias. For the selection bias of observable characteristics, we employed Propensity score Matching (PSM) to deal with the issue. After addressing the endogeneity concerns, our results were in line with our baseline naïve model specifications.

This study contributes to an emerging literature on captive VC. First, it contributes to the literature on how CVC prioritize their investment keeping in view the industry of operation of portfolio firms. Secondly, it shows which type of VC efficiently nurtures their portfolio companies to a successful exit in Asia. Third, it exhibits the preferential treatment of state institutions towards their stake in helping investee companies to get listed on the stock exchange – exiting through IPOs.

This study is not free of limitations, especially regarding proxy for exit performance. The internal rate of return remains the best measure of performance for portfolio projects. But private and VC-backed firms are exempted to file their returns, and we faced the limitations of publicly available data on VC investments. Hence data limitation is a genuine problem in measuring the performance of VC-backed companies. Secondly, we cannot completely rule out the possibility of selection bias. Secondly, we have used different econometric techniques and matching principles to account for the selection bias. Yet we can't completely rule out the possibilities of the selection effect. There are quite the possibilities that GVC firms do '*cherry picking*' and select the most promising ventures and leaving behind only unprofitable for the CVC firms to invest in.

We suggest some future avenues of the research. This study has been conducted with respect to Asian developing countries. However, institutional settings subtly but pervasively govern the VC industry. Therefore, the result of this study could not be generalized to other geographical regions. This study might bear novel results for the US and European settings. Secondly, we proxy performance with the successful exit of the portfolio company; however, the study could be extended with other proxy measures such as overall economic growth, sales growth, employee growth of the investee company. Furthermore, innovation measures such as the number of patents applied by the investee company after receiving CVC or GVC funding could also be an interesting proxy.

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Appendix

Table 3. 1: Variables Index

| Variables | Definitions |
|-------------------------------|--|
| Successful | Binary variable, set equal to 1 if the company goes successful, and 0 otherwise. |
| High tech | Binary variable, set equal to 1 if the industry of portfolio company is High-tech, and 0 otherwise. |
| IPO | Binary variable set equal to 1 if company exit via initial public offering, and 0 otherwise. |
| CVC | Binary variable, set equal to 1 if the company receives first investment from a corporate venture capital firm, and 0 if the company receives from a GVC firm. |
| Early-stage | Binary variable, set equal to 1 if the company receives first investment in early stage, and 0 otherwise. |
| Expansion stage | Binary variable, set equal to 1 if the company receives first investment in the expansion stage, and 0 otherwise. |
| Later (mature) stage | Binary variable, set equal to 1 if the company receives first investment in later stage, and 0 otherwise. |
| Elapse time years | It is the time taken in years from first investment till successful or unsuccessful exit. If the company is still active, 31 December 2017 is the cutoff date of our data. |
| Firm Reputation | The number of the funds raised and managed by the firm. |
| Syndication size | The number of VC firms investing in a company. |
| Firms total number of deals | The total number of deals made by the VC firm at the time of the investment. |
| GFC dummy | Binary variable, set equal to 1 if the company receives first investment during the years 2007, and 2008, and 0 otherwise ie during Global Financial Crisis. |
| Investment Amount (M USD) | It is the total amount received by a company in million USD. We used Log (1+ Investment Amount) in the regressions. |
| Countries dummies | For every country, we introduced a dummy variable. There are 5 countries and 5 dummies. |
| Industry dummies | For every industry, we introduced a dummy variable. There are 6 industries and six dummies (biotechnology, communication, and media, computer-related, health medical and life science, semiconductors electronics, non-high tech) |
| Portfolio Experience (Months) | It is the age of the portfolio company in months at the time of the first VC investment. We used the log of (1+Portfolio Experience) in the regressions. |

Table 3.1 shows the definition of all the variables. The data are retrieved from Thomson 1 Banker. The sample is composed of 1198 portfolio companies that received their first investment during the period 1999 to 2013 either from a GVC or a CVC firm in Asia.

Table 3. 2: Descriptive statistics

| | GVC | | CVC | | Total | |
|-------------------------------|--------------------|----------|--------------------|----------|--------------------|----------|
| Country-wise breakup | No of Firms | % | No of Firms | % | No of Firms | % |
| China | 124 | 41.06 | 208 | 23.21 | 332 | 27.71 |
| India | 42 | 13.91 | 57 | 6.36 | 99 | 8.26 |
| Malaysia | 29 | 9.60 | 9 | 1.00 | 38 | 3.17 |
| Singapore | 60 | 19.87 | 18 | 2.01 | 78 | 6.51 |
| South Korea | 47 | 15.56 | 604 | 67.41 | 651 | 54.34 |
| Industry-wise break up | No of Firms | % | No of Firms | % | No of Firms | % |
| Biotechnology | 21 | 6.95 | 63 | 7.03 | 84 | 7.01 |
| Communications and Me | 35 | 11.59 | 132 | 14.73 | 167 | 13.94 |
| Computer Related | 84 | 27.81 | 247 | 27.57 | 331 | 27.63 |
| Medical/Health/Life S | 13 | 4.30 | 34 | 3.79 | 47 | 3.92 |
| NonHigh Technology | 127 | 42.05 | 294 | 32.81 | 421 | 35.14 |
| Semiconductors/Other | 22 | 7.28 | 126 | 14.06 | 148 | 12.35 |
| Stage wise break up | No of Firms | % | No of Firms | % | No of Firms | % |
| Early Stage | 136 | 45.03 | 361 | 40.29 | 497 | 41.49 |
| Expansion Stage | 101 | 33.44 | 388 | 43.30 | 489 | 40.82 |
| Later Stage | 65 | 21.52 | 147 | 16.41 | 212 | 17.70 |

Table 3.2 shows the breakdown of the 1198 VC-backed companies. There are 302 GVC-backed while 896 CVC-backed companies. This Table reports the country-wise, industry-wise, and stage-wise distribution of the portfolio companies.

Table 3.2 (Continued): Descriptive Statistics

| | N | Std. Dev. | Median | Mean | min | max |
|-------------------------------|----------|------------------|---------------|-------------|------------|------------|
| IPO | 1198 | .427 | 0 | .24 | 0 | 1 |
| Trade sale | 1198 | .251 | 0 | .068 | 0 | 1 |
| Successful | 1198 | .462 | 0 | .307 | 0 | 1 |
| High tech | 1198 | .478 | 1 | .649 | 0 | 1 |
| Early stage | 1198 | .493 | 0 | .415 | 0 | 1 |
| CVC | 1198 | .434 | 1 | .748 | 0 | 1 |
| Elapse Time years | 1113 | 5.842 | 10.297 | 10.513 | .003 | 18.847 |
| Investment Amount (M USD) | 929 | 71.258 | 1.64 | 17.859 | 0 | 975 |
| ln Investment Amount | 929 | 2.062 | .495 | .665 | -8.517 | 6.882 |
| Syndication size | 1198 | 1.925 | 2 | 2.347 | 1 | 17 |
| Firm reputation | 1198 | 8.68 | 9 | 10.856 | 1 | 48 |
| Portfolio Experience (Months) | 995 | 109.075 | 42 | 74.799 | 0 | 1223 |
| ln Portfolio Experience | 995 | 1.358 | 3.761 | 3.587 | 0 | 7.11 |
| Firm Total Number of Deals | 1198 | 89.74 | 52 | 93.727 | 1 | 616 |
| GFC | 1198 | .336 | 0 | .129 | 0 | 1 |
| Expansion stage | 1198 | .492 | 0 | .408 | 0 | 1 |
| Later stage | 1198 | .382 | 0 | .177 | 0 | 1 |

The sample is composed of 1198 entrepreneurial firms which received their first investment over the period 1999 to 2013 in 5 Asian developing countries. This Table shows the mean, standard deviations, minimum, maximum, and number of observations of the variables. The definitions of all variables are given in Table 3.1.

Table 3.3: The Pearson pairwise correlation matrix of the covariates

| Variables | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
|----------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------|
| (1) CVC | 1.000 | | | | | | | | | |
| (2) Investment Amount | -0.060 | 1.000 | | | | | | | | |
| (3) Syndication size | 0.014 | 0.420 | 1.000 | | | | | | | |
| (4) Firm reputation | 0.374 | -0.090 | -0.096 | 1.000 | | | | | | |
| (5) ln Portfolio Exp | -0.035 | 0.029 | -0.044 | 0.059 | 1.000 | | | | | |
| (6) Firm Total No of deals | 0.211 | 0.101 | 0.005 | 0.635 | 0.055 | 1.000 | | | | |
| (7) High tech | 0.084 | -0.080 | 0.074 | -0.035 | -0.295 | -0.042 | 1.000 | | | |
| (8) Early stage | -0.042 | -0.027 | 0.073 | -0.088 | -0.613 | -0.062 | 0.268 | 1.000 | | |
| (9) Elapse Time (years) | 0.025 | -0.181 | -0.257 | -0.027 | -0.341 | -0.066 | 0.145 | 0.251 | 1.000 | |
| (10) GFC | 0.058 | 0.042 | -0.026 | 0.131 | 0.149 | 0.087 | -0.169 | -0.148 | -0.163 | 1.000 |

This Table reports the pairwise correlation of the covariates. All the variables are defined in Table 3.1.

Table 3.4: Comparison between GVC- and CVC- backed companies (Univariate Analysis)

| Variables | Mean CVC | Mean GVC | difference | t statistics |
|-------------------------------|----------|----------|------------|--------------|
| Successful | 0.299 | 0.331 | -0.032 | 1.0427 |
| IPO | 0.239 | 0.242 | -0.003 | 0.1014 |
| Early stage | 0.403 | 0.45 | -0.047 | 1.4468 |
| High tech | 0.672 | 0.579 | 0.093 | -2.9168*** |
| Firm reputation | 12.742 | 5.262 | 7.48 | -13.9623*** |
| Syndication size | 2.363 | 2.301 | 0.062 | -0.4792 |
| Portfolio Experience (Months) | 68.995 | 92.096 | -23.101 | 2.908** |
| ln Portfolio Experience | 3.56 | 3.669 | -0.109 | 1.1018 |
| Investment Amount (M USD) | 15.498 | 25.511 | -10.013 | 1.82* |
| ln Investment Amount | 0.543 | 1.06 | -0.517 | 3.2593*** |
| Firm Total Number of Deals | 104.693 | 61.192 | 43.501 | -7.4492*** |
| Expansion stage | 0.433 | 0.334 | 0.099 | -3.0239*** |
| Later stage | 0.164 | 0.215 | -0.051 | 2.0168** |
| GFC | 0.141 | 0.096 | 0.045 | -1.9988** |
| Elapse Time (years) | 10.595 | 10.262 | 0.334 | -0.8227 |

*The sample consists of 1198 portfolio companies - that received their first investment during the period 1999-2013, in 5 Asian developing countries. Table 3.4 reports the mean for CVC and GVC-backed portfolio companies and tests of differences in means (unpaired t-tests assuming equal variance) between the two groups in their characteristics. ***, **, * indicates that the difference in mean for characteristics of CVC versus GVC is significant at 1 percent, 5 percent, or ten percent, respectively. All the variables are defined in Table 3.1.*

Table 3.5: VC Type and business sector of the portfolio company (Hypothesis1)

| Dependent variable High tech | Model 1 | Model 2 | Model 3 | Model 4 |
|------------------------------|----------------------|---------------------|----------------------|----------------------|
| CVC | 0.613*** (0.180) | 0.680*** (0.205) | 0.657*** (0.221) | 0.687*** (0.229) |
| Syndication size | 0.118*** (0.039) | 0.168*** (0.052) | 0.151*** (0.055) | 0.131** (0.057) |
| Firm reputation | -0.014 (0.012) | 0.010 (0.015) | 0.018 (0.016) | 0.024 (0.017) |
| Firm Total Number of Deals | -0.000 (0.001) | -0.001 (0.001) | -0.001 (0.001) | -0.002 (0.001) |
| GFC | -0.730*** (0.191) | -0.617** (0.247) | -0.546** (0.274) | -0.545* (0.281) |
| Early stage | 1.654*** (0.187) | 1.803*** (0.232) | 1.141*** (0.299) | 1.121*** (0.312) |
| Expansion stage | 0.751*** (0.176) | 0.778*** (0.216) | 0.513** (0.234) | 0.539** (0.245) |
| Ln Investment Amount | | -0.088 (0.054) | -0.099 (0.061) | -0.081 (0.064) |
| Ln Portfolio Experience | | | -0.266*** (0.090) | -0.293*** (0.095) |
| Elapse Time (years) | | | | -0.005 (0.017) |
| Constant | -0.600* (0.322) | -0.918** (0.400) | 0.563 (0.598) | 0.800 (0.671) |
| Industry Dummies | Yes | Yes | Yes | Yes |
| Country Dummies | Yes | Yes | Yes | Yes |
| <i>N</i> | 1198 | 929 | 797 | 746 |
| pseudo <i>R</i> ² | 0.107 | 0.142 | 0.164 | 0.163 |

*This Table reports the results of the logistic regression analysis. The sample consists of 1198 portfolio companies that received their first investment during the period 1999-2013, in 5 Asian developing countries. The dependent variable High-tech is a dummy variable equal to 1 if the portfolio company is a high-tech company otherwise zero, and the independent variable is an indicator variable equal to 1 if the portfolio company is backed by a CVC firm and zero if backed by a GVC firm. All the variables are defined in Table 3.1. Standard errors in parentheses * $p < .1$, ** $p < .05$, *** $p < .01$*

Table 3. 6: VC type and exit strategy (Hypothesis 2)

| Dependent variable IPO | Model 1 | Model 2 | Model 3 | Model 4 |
|-------------------------------|----------------------|----------------------|----------------------|----------------------|
| CVC | -0.288 (0.206) | -0.396* (0.229) | -0.698* (0.401) | -0.860** (0.436) |
| Syndication size | 0.273*** (0.039) | 0.169*** (0.048) | 0.039 (0.086) | 0.075 (0.094) |
| Firm reputation | -0.003 (0.013) | 0.032** (0.015) | -0.009 (0.026) | -0.027 (0.029) |
| Firm Total Number of Deals | 0.001 (0.001) | -0.001 (0.001) | 0.001 (0.002) | 0.003 (0.002) |
| GFC | -0.214 (0.225) | -0.178 (0.261) | 0.298 (0.433) | 0.717 (0.456) |
| Early stage | -1.792*** (0.219) | -1.836*** (0.256) | -0.316 (0.443) | -0.782 (0.588) |
| Expansion stage | -0.723*** (0.190) | -0.800*** (0.225) | -0.002 (0.412) | -0.125 (0.449) |
| Ln Investment Amount | | 0.183*** (0.060) | 0.151 (0.107) | 0.168 (0.114) |
| EIapse Time (years) | | | -0.732*** (0.062) | -0.762*** (0.067) |
| Ln Portfolio Experience | | | | -0.366* (0.194) |
| Constant | -1.726*** (0.585) | -1.485** (0.673) | 1.870 (1.181) | 3.675** (1.709) |
| Industry Dummies | Yes | Yes | Yes | Yes |
| Country Dummies | Yes | Yes | Yes | Yes |
| <i>N</i> | 1198 | 929 | 867 | 746 |
| pseudo <i>R</i> ² | 0.137 | 0.158 | 0.703 | 0.713 |

*This Table reports the results of the logistic regression analysis. The sample consists of 1198 portfolio companies that received their first investment during the period 1999-2013, in 5 Asian developing countries. The dependent variable IPO is a dummy variable equal to 1 if the portfolio company exits through IPO otherwise zero, and the independent variable is an indicator variable equal to 1 if the portfolio company is backed by a CVC firm and zero if backed by a GVC firm. All the variables are defined in Table 3.1. Standard errors in parentheses * $p < .1$, ** $p < .05$, *** $p < .01$*

Table 3.7: Success rate of CVC and GVC-backed firms (H3)

| Dependent variable Successful | Model 1 | Model 2 | Model 3 | Model 4 |
|--------------------------------------|----------------------|----------------------|----------------------|----------------------|
| CVC | -0.173 (0.187) | -0.212 (0.210) | -0.561 (0.414) | -0.843* (0.444) |
| Syndication size | 0.285*** (0.038) | 0.209*** (0.048) | 0.184** (0.090) | 0.260*** (0.098) |
| Firm reputation | 0.002 (0.012) | 0.034** (0.014) | -0.004 (0.030) | -0.024 (0.032) |
| Firm Total Number of Deals | 0.000 (0.001) | -0.002 (0.001) | -0.001 (0.002) | 0.001 (0.002) |
| GVC | -0.419* (0.214) | -0.439* (0.256) | -0.303 (0.450) | -0.068 (0.466) |
| Early stage | -1.490*** (0.201) | -1.537*** (0.241) | -0.261 (0.480) | -0.879 (0.612) |
| Expansion stage | -0.710*** (0.184) | -0.764*** (0.222) | 0.270 (0.452) | 0.130 (0.490) |
| Ln Investment Amount | | 0.133** (0.055) | -0.202* (0.112) | -0.189 (0.120) |
| Elapse Time (years) | | | -0.823*** (0.072) | -0.838*** (0.077) |
| Ln Portfolio Experience | | | | -0.484** (0.199) |
| Constants | -0.413 (0.480) | -0.488 (0.584) | 4.446*** (1.262) | 6.561*** (1.807) |
| Industry Dummies | Yes | Yes | Yes | Yes |
| Country Dummies | Yes | Yes | Yes | Yes |
| <i>N</i> | 1198 | 929 | 867 | 746 |
| pseudo <i>R</i> ² | 0.122 | 0.137 | 0.744 | 0.752 |

*This Table reports the results of the logistic regression analysis. The sample consists of 1198 portfolio companies that received their first investment during the period 1999-2013, in 5 Asian developing countries. The dependent variable Successful is a dummy variable equal to 1 if the portfolio company exits successfully i.e. through IPO, Trade sale, secondary sale, M&A, and otherwise zero, and independent variable is an indicator variable equal to 1 if the portfolio company is backed by a CVC firm and zero if backed by a GVC firm. All the variables are defined in Table 3.1. Standard errors in parentheses * $p < .1$, ** $p < .05$, *** $p < .01$*

Table 3.8: Bivariate Probit and Heckit model (Hypothesis 1)

| Dependent Variable =High-tech | Bivariate Probit Model | | Heckit Model | |
|-----------------------------------|--|----------------------|--|----------------------|
| | The propensity of being backed by CVC (First Step) | | The propensity of being backed by CVC (First Step) | |
| | Column 1 | Column 2 | Column 3 | column 4 |
| CVC | | 0.855*** (0.229) | | 0.274*** (0.074) |
| Instrument | 4.225*** (0.4) | | 4.202*** (0.407) | |
| Elapse Time years | 0.022 (0.014) | -0.003 (0.01) | 0.023 (0.014) | -0.001 (0.003) |
| Ln Investment Amount | -0.003 (0.049) | -0.053 (0.037) | 0.017 (0.049) | -0.018 (0.011) |
| Syndication size | 0.033 (0.04) | 0.075** (0.033) | 0.041 (0.04) | 0.021** (0.009) |
| Firm reputation | 0.058*** (0.013) | 0.003 (0.008) | 0.064*** (0.013) | 0.001 (0.002) |
| Ln Portfolio Experience | -0.021 (0.071) | -0.151*** (0.053) | -0.012 (0.071) | -0.046*** (0.016) |
| GFC | -0.192 (0.218) | -0.357** (0.164) | -0.197 (0.22) | -0.122** (0.053) |
| Inverse Mills Ratio (λ) | | | | -0.120** (0.049) |
| constant | -2.683*** (0.545) | 0.26 (0.387) | -2.814*** (0.548) | 0.579*** (0.118) |
| Industry Dummies | Yes | Yes | Yes | Yes |
| Country Dummies | Yes | Yes | Yes | Yes |
| P | -0.393 | | -0.286 | |
| N/ Wald chi2 | 746/381.321*** | | 746/214.708*** | |

*This Table reports the results of the Bivariate Probit model and Heckman Treatment effect. The sample consists of 1198 portfolio companies that received their first investment during the period 1999-2013, in 5 Asian developing countries. The dependent variable High-tech is a dummy variable equal to 1 if the portfolio company is a high-tech company otherwise zero, and the independent variable is an indicator variable equal to 1 if the portfolio company is backed by a CVC firm and zero if backed by a GVC firm. Column 1 reports the results of the first stage of the propensity of being backed by CVC and availability of CVC is used as an instrumental variable, and Column 2 shows the results of the second stage of the Bivariate Probit Model. Column 3 presents the estimates of the selection equation of the likelihood of being backed by CVC and column 4 depicts the coefficients of the treatment effect of the Heckit Model. All the variables are defined in Table 3.1. Standard errors in parentheses * p < .1, ** p < .05, *** p < .01*

Table 3.9: Bivariate Probit and Heckit model (Hypothesis 2)

| Dependent variable=IPO | Bivariate Probit Model | | Heckit Model | |
|-----------------------------------|--|----------------------|--|----------------------|
| | The propensity of being backed by CVC (First Step) | IPO | The propensity of being backed by CVC (First Step) | IPO |
| | Column 1 | Column 2 | Column 3 | column 4 |
| CVC | | -1.169*** (0.368) | | -0.158*** (0.05) |
| Instrument | 4.175*** (0.425) | | 4.173*** (0.42) | |
| Elapse Time years | 0.025* (0.014) | -0.374*** (0.033) | 0.023 (0.015) | -0.063*** (0.002) |
| Ln Investment Amount | 0.037 (0.049) | 0.087 (0.059) | 0.025 (0.05) | -0.002 (0.007) |
| Syndication size | 0.046 (0.041) | 0.047 (0.046) | 0.038 (0.04) | 0.012* (0.006) |
| Firm reputation | 0.063*** (0.013) | 0.006 (0.012) | 0.066*** (0.013) | 0 (0.002) |
| Ln Portfolio Experience | 0.014 (0.071) | -0.174* (0.093) | 0.001 (0.071) | -0.037*** (0.01) |
| GFC | -0.27 (0.224) | 0.368 (0.237) | -0.166 (0.227) | -0.003 (0.036) |
| Inverse Mills Ratio (λ) | | | | 0.082** (0.031) |
| Constant | -2.985*** (0.645) | 1.900** (0.887) | -2.890*** (0.65) | 1.125*** (0.094) |
| Stage dummies | Yes | Yes | Yes | Yes |
| Industry dummies | Yes | Yes | Yes | Yes |
| Country dummies | Yes | Yes | Yes | Yes |
| P | 0.6129 | | 0.294 | |
| N/ chi2 | 746/397.889 | | 746/1359.315 | |

*This Table reports the results of the Bivariate Probit model and Heckman Treatment effect. The sample consists of 1198 portfolio companies that received their first investment during the period 1999-2013, in 5 Asian developing countries. The dependent variable IPO is a dummy variable equal to 1 if the portfolio company exits through IPO otherwise zero, and the independent variable is an indicator variable equal to 1 if the portfolio company is backed by a CVC firm and zero if backed by a GVC firm. Column 1 reports the results of the first stage of the propensity of being backed by CVC and availability of CVC is used as an instrumental variable, and Column 2 shows the results of the second stage of the Bivariate Probit Model. Column 3 presents the estimates of the selection equation of the likelihood of being backed by CVC and column 4 depicts the coefficients of the treatment effect of the Heckit Model. All the variables are defined in Table 3.1. Standard errors in parentheses * $p < .1$, ** $p < .05$, *** $p < .01$.*

Table 3.10: Bivariate Probit and Heckit Model (Hypothesis 3)

| Dependent Variable=Successful | Bivariate Probit Model | | Heckit Model | |
|-----------------------------------|--|----------------------|--|----------------------|
| | The propensity of being backed by CVC (First Step) | Successful | The propensity of being backed by CVC (First Step) | Successful |
| | Column 1 | Column 2 | Column 3 | Column 4 |
| CVC | | -1.579*** (0.17) | | -0.161*** (0.047) |
| Instrument | 3.921*** (0.372) | | 4.173*** (0.42) | |
| Elapse Time (years) | 0.025* (0.014) | -0.379*** (0.032) | 0.023 (0.015) | -0.070*** (0.002) |
| Ln Investment Amount | 0.047 (0.046) | -0.105* (0.06) | 0.025 (0.05) | -0.018*** (0.007) |
| Syndication size | 0.035 (0.04) | 0.143*** (0.052) | 0.038 (0.04) | 0.023*** (0.006) |
| Firm reputation | 0.054*** (0.012) | 0.009 (0.013) | 0.066*** (0.013) | 0 (0.001) |
| ln Portfolio Experience | 0.014 (0.068) | -0.190** (0.093) | 0.001 (0.071) | -0.035*** (0.01) |
| GFC | -0.318 (0.21) | -0.034 (0.238) | -0.166 (0.227) | -0.072** (0.034) |
| Inverse Mills Ratio (λ) | | | | 0.092*** (0.031) |
| Constant | -2.955*** (0.63) | 3.270*** (0.913) | -2.890*** (0.65) | 1.239*** (0.089) |
| Stage dummies | Yes | Yes | Yes | Yes |
| Industry dummies | Yes | Yes | Yes | Yes |
| Country dummies | Yes | Yes | Yes | Yes |
| P | | 1 | | 0.353 |
| N/ chi2 | | 746/447.873 | | 746/1811.609 |

*This Table reports the results of the Bivariate Probit model and Heckman Treatment effect. The sample consists of 1198 portfolio companies that received their first investment during the period 1999-2013, in 5 Asian developing countries. The dependent variable Successful is a dummy variable equal to 1 if the portfolio company go successful i.e., exit through IPO or Trade sale otherwise zero, and the independent variable is an indicator variable equal to 1 if the portfolio company is backed by a CVC firm and zero if backed by a GVC firm. Column 1 reports the results of the first stage of the propensity of being backed by CVC and availability of CVC is used as an instrumental variable, and Column 2 shows the results of the second stage of the Bivariate Probit Model. Column 3 presents the estimates of the selection equation of the likelihood of being backed by CVC and column 4 depicts the coefficients of the treatment effect of the Heckit Model. All the variables are defined in Table 3.1. Standard errors in parentheses * $p < .1$, ** $p < .05$, *** $p < .01$.*

Table 3.11: Propensity Score Matching.

| | Variable | Sample | Treated | Controls | Difference | S.E. | T-stat |
|----------------|-----------------|---------------|----------------|-----------------|-------------------|-------------|---------------|
| Panel A | High-tech | Unmatched | 0.727273 | 0.54023 | 0.187043 | 0.039729 | 4.71 |
| | | ATT | 0.667752 | 0.560261 | 0.107492 | 0.070682 | 1.52 |
| | Variable | Sample | Treated | Controls | Difference | S.E. | T-stat |
| Panel B | Successful | Unmatched | 0.342657 | 0.385057 | -0.0424 | 0.041389 | -1.02 |
| | | ATT | 0.318182 | 0.361111 | -0.04293 | 0.125683 | -0.34 |
| | Variable | Sample | Treated | Controls | Difference | S.E. | T-stat |
| Panel C | IPO | Unmatched | 0.298951 | 0.316092 | -0.01714 | 0.039833 | -0.43 |
| | | ATT | 0.265152 | 0.318182 | -0.05303 | 0.122026 | -0.43 |

*One-to-one Propensity scores of CVC-backed companies are estimated using the nearest neighboring method and compared with GVC- backed companies without replacement on the firm and firm characteristics. In panel A the dependent variable is High-tech, in the Panel B the dependent variable is Successful and in panel C the dependent variable is IPO. Standard errors in parentheses * $p < .1$, ** $p < .05$, *** $p < .01$.*

Table 3.12: Linear probability model for Hypotheses 1, 2 and 3

| Dependent Variables | High-tech (H1) | Successful (H3) | IPO (H2) |
|----------------------------|----------------------|----------------------|----------------------|
| CVC | 0.129*** (0.042) | -0.044* (0.026) | -0.057** (0.028) |
| Elapse Time years | -0.001 (0.003) | -0.070*** (0.002) | -0.063*** (0.002) |
| Ln Investment Amount | -0.015 (0.011) | -0.018*** (0.007) | -0.003 (0.007) |
| Syndication size | 0.022** (0.009) | 0.021*** (0.006) | 0.011* (0.006) |
| Firm reputation | 0.004 (0.003) | -0.000 (0.002) | -0.001 (0.002) |
| Ln Portfolio Experience | -0.047*** (0.016) | -0.035*** (0.010) | -0.037*** (0.010) |
| Firm Total Number of Deals | -0.000 (0.000) | -0.000 (0.000) | 0.000 (0.000) |
| GFC | -0.113** (0.053) | -0.084** (0.033) | -0.012 (0.036) |
| Early stage | 0.235*** (0.057) | -0.050 (0.036) | -0.099*** (0.038) |
| Expansion stage | 0.134*** (0.047) | 0.010 (0.030) | -0.018 (0.032) |
| Constant | 0.581*** (0.106) | 1.287*** (0.082) | 1.263*** (0.087) |
| Industry Dummies | No | Yes | Yes |
| Country Dummies | Yes | Yes | Yes |
| <i>N</i> | 746 | 746 | 746 |
| <i>R</i> ² | 0.193 | 0.709 | 0.642 |

*This Table reports the results of the Linear Probability Model (LPM) regression analysis. The sample consists of 1198 portfolio companies that received their first investment during the period 1999-2013, in 5 Asian developing countries. In column 1 (H1) the dependent variable is High-tech, in column 2 (H2) the dependent variable is Successful, and in column 3 (H3) the dependent variable is IPO. The independent variable is an indicator variable equal to 1 if the portfolio company is backed by a CVC firm and zero if backed by a GVC firm. All the variables are defined in Table 3.1. Standard errors in parentheses * $p < .1$, ** $p < .05$, *** $p < .01$*

Table 3.13: Cross country analysis for hypotheses 1, 2 and 3

| | High-tech (H1) | Successful(H3) | IPO (H2) |
|------------------------------|----------------------|----------------------|----------------------|
| CVC Asia | 0.690** (0.272) | -0.835* (0.461) | -0.814* (0.466) |
| CVC SK | 0.679 (0.436) | -0.939 (1.612) | -1.181 (1.223) |
| Elapse Time years | -0.005 (0.017) | -0.838*** (0.077) | -0.763*** (0.067) |
| Ln Investment Amount | -0.081 (0.064) | -0.190 (0.120) | 0.166 (0.114) |
| Syndication size | 0.131** (0.057) | 0.260*** (0.098) | 0.075 (0.095) |
| Firm reputation | 0.024 (0.017) | -0.024 (0.032) | -0.026 (0.029) |
| Ln Portfolio Experience | -0.293*** (0.095) | -0.484** (0.200) | -0.368* (0.195) |
| Firm Total Number of Deals | -0.002 (0.001) | 0.001 (0.002) | 0.003 (0.002) |
| GFC | -0.546* (0.281) | -0.066 (0.466) | 0.726 (0.458) |
| Early stage | 1.121*** (0.312) | -0.880 (0.613) | -0.782 (0.588) |
| Expansion stage | 0.540** (0.246) | 0.133 (0.492) | -0.109 (0.453) |
| Constant | 0.800 (0.672) | 6.555*** (1.811) | 3.649** (1.719) |
| Industry Dummies | No | Yes | Yes |
| Country Dummies | Yes | Yes | Yes |
| <i>N</i> | 746 | 746 | 746 |
| pseudo <i>R</i> ² | 0.163 | 0.752 | 0.713 |

*This Table reports the results of the Logistic regression analysis. The sample consists of 1198 portfolio companies that received their first investment during the period 1999-2013, in 5 Asian developing countries. In column 1 (H1) the dependent variable is High-tech, in column 2 (H2) the dependent variable is Successful, and in column 3 (H3) the dependent variable is IPO. The explanatory variable CVC_SK is an indicator variable if the portfolio company is backed by CVC and is located in South Korea, and CVC_Asia is an explanatory variable if the portfolio company is backed by CVC and located in the rest of Asia. All the variables are defined in Table 3.1. Standard errors in parentheses * $p < .1$, ** $p < .05$, *** $p < .01$*

Table 3.14: Alternative measure of the explanatory variable

| | Successful | IPO |
|----------------------------|----------------------------------|----------------------------------|
| CVC_per | -0.001 ^{***} (0.000) | -0.001 ^{**} (0.000) |
| Elapse Time years | -0.069 ^{***} (0.002) | -0.063 ^{***} (0.002) |
| Ln Investment Amount | -0.025 ^{***} (0.008) | -0.010 (0.009) |
| Syndication size | 0.017 [*] (0.009) | 0.001 (0.010) |
| Firm reputation | 0.001 (0.002) | -0.000 (0.002) |
| Ln Portfolio Experience | -0.018 [*] (0.010) | -0.025 ^{**} (0.011) |
| Firm Total Number of Deals | -0.000 (0.000) | -0.000 (0.000) |
| GFC | -0.084 ^{**} (0.037) | -0.017 (0.042) |
| Early stage | 0.039 (0.038) | -0.047 (0.043) |
| Expansion stage | 0.034 (0.030) | -0.009 (0.034) |
| Constant | 1.273 ^{***} (0.090) | 1.269 ^{***} (0.103) |
| Industry Dummies | Yes | Yes |
| Country Dummies | Yes | Yes |
| <i>N</i> | 588 | 588 |
| <i>R</i> ² | 0.769 | 0.678 |

*This Table reports the results of the Linear Probability Model (LPM) regression analysis. The sample consists of 1198 portfolio companies that received their first investment during the period 1999-2013, in 5 Asian developing countries. In column 1 the dependent variable is Successful and in column 2 the dependent variable is IPO. The independent variable is continuous and is defined as the percentage of CVC funding received by an entrepreneurial firm scaled by overall investment amount. Standard errors in parentheses * $p < .1$, ** $p < .05$, *** $p < .01$*

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Chapter 4

Impact of Foreign Direct Investment on Domestic Venture Capital Investments: An Asian Perspective.

Impact of Foreign Direct Investment on Domestic Venture Capital Investments: An Asian Perspective.

Abstract

This study investigates the impact of Foreign Direct Investments (FDI) on the hosts country's domestic venture capital industry. We studied a sample of 7 Asian developing countries over the period 2000 to 2018. Employing Autoregressive Distributed Lags (ARDL) model – Mean Group (MG) and Pooled Mean Group (PMG) estimators – we find that the FDIs has no effect, in the short run, but significant and positive effect on domestic VC activity due to the positive externalities and spillover effects, in the long run. FDI crowds in domestic venture capital investment and helps in the creation of new VC-backed companies.

1 Introduction

Venture Capital (VC) is a vibrant mode of financing for entrepreneurial firms that cannot rely on traditional resources (like banking or bond debt). VC mainly targets young and innovative high-tech firms, with high growth potential. VC not only plays the role of bridging the financial gap of these companies (Gompers and Lerner, 2001; Denis, 2004), but may also bring value-added activities, such as strategic, managerial, or administrative support (Sahlman, 1990).

As one type of long-term investment in portfolio companies that has ascertained its role in developing and fostering the economy (Groh and Wallmeroth, 2016), VC activity's driving factors have been the focus of researchers for the last two decades. Tyebjee and Bruno (1984) are the first researchers who probed into the matter of venture capitalist's investment decisions, but they were more inclined towards the process of decision making rather than evaluating the determinants of VC activity. Afterward, researchers tried to explore the macroeconomic indicators, firm-level variables, entrepreneurial environmental factors, and institutional and legal determinants of VC in developing and developed countries (for example see: Black and Gilson, 1998; Gompers and Lerner, 1999; Jeng and Well, 2000; Marti and Balboa, 2001; Leleux and Surlemont, 2003; Romain and La Potterie, 2004; Cumming *et al.*, 2010; Cherif and Gazdar, 2011; Félix *et al.*, (2013); Groh and Wallmeroth, 2016).

However, the expedition in the field of VC determinants is still underway and needs much more exploration (Groh and Wallmeroth, 2016). In this paper, we specifically focus on the impact of the cross-border investment by multinational companies (MNCs)³⁴, namely Foreign Direct Investment (FDI), on venture capital activity in developing Asian countries. Literature studying the interaction between these two types of capital flows – international capital flows and domestic VC investment – remains rather underdeveloped. Gocer *et al.*, (2014) plausibly define FDI as a long-term investment relationship in which MNCs set up factories, merge or acquire a domestic firm, pursue joint ventures, grant licensing authorities, and invest in real estate fixed assets in the host country³⁵.

³⁴ We alternatively used the terms multinational companies, transnational companies, foreign entrants, foreign firms for Foreign direct investment.

³⁵ Borensztein *et al.* (1998) define FDI as the cross-border capital flows from a foreign country through acquiring a host country's land, business, establishing a new business, financing, or taking over an existing company. Likewise,

Developing Asia is an interesting area to analyze this issue since VC investment and the flow of inward FDIs have gained tremendous momentum for the last few decades. According to Preqin's (2017) report, VC investment soared up to \$182 Billion in 2017, and the total number of VC deals increased from 13 019 in 2015 to 11 144 in 2017 (% here) whereas deals total monetary value increased by 26% from 2016 to 2017. Developing countries observed an increase in VC whereas the developed countries experienced a decline. Groh and Wallmeroha (2016) explained that aggregate VC investments increased by 18.4% from 2000 to 2013 in developing economies and decreased by the same magnitude (18.4%) in developed economies. Regarding Asia, in 2017, Greater China's deal values account for \$65 Billion (36% of the total VC amount invested) and 24% of the total number of the deals; similarly in India deal value amounted to \$10 billion (6% of the total amount invested) and 7% of the total number of deals (Preqin, 2017).

FDI and VC exhibit similarities. Both are long-term investments, that take the form of equity with an active role in the management and control of the investee firm. Venture Capitalists control the investee company through active participation in the management of the company by securing board member seats. Similarly, Foreign investors should at least get 10% of the voting rights to be qualified as FDI to gain control of the investee company. But the two types of investment are also different in several characteristics. First, VC firms pool their funds and resources from well-off individuals, university endowment funds, pension funds whereas FDIs come from Multinational companies. Second, venture capitalists rely on exit from the business after several years whereas FDIs do not have a predetermined exit plan. Finally, venture capitalists are risk-takers and target young, risky, high tech, high growth potential, and innovative firms whereas FDI mostly invests in established cross-border businesses via merger and acquisition or establish a new business. Due to these similarities and discrepancies, questioning the interaction between these two types of capital flows remains a promising issue. More precisely, in this paper, we aim at analyzing the impact of FDI on venture capital activity that remained unexplored to the best of our knowledge.

A strand of the literature had studied the economic impact of the FDI in the host country concerning domestic business investment and entrepreneurship. On one hand, some studies endorse a “crowding-in/complementarity effect”, of FDI on domestic investment and entrepreneurship by highlighting positive externalities and spillover effects (see Göçer *et al.*, 2014; Hechet, 2004; Gorg and Strobl, 2002). On the other hand, some studies document a negative impact

i.e., “crowding-out/substitution effect” due to as market stealing effect and unfair competition (see Jude, 2019; Wang, 2010; Eregha, 2012; Mayanja,2012; De Backer and Sleuwaegen, 2003; Danakol *et al.*, 2017). In this paper, we question the impact of FDIs on domestic VC activity. More precisely, given the specificities of VC in terms of governance, value addition effect, and absorptive capacity, we explore the complementarity (crowding-in) effect of FDI on domestic venture capital activity. We believe that FDI may crowd in and complement domestic VC investments and entrepreneurship.

The contribution of the paper is threefold. First, it contributes to the literature by analyzing a new driving factor of VC investment, namely FDI. Second, we rely on a unique sample of seven Asian developing countries, a geographical area where VC activity is expanding rapidly, for an extended period. Third, controlling for both FDI and macroeconomic determinants of VC investment, we address the methodological limitation of previous studies by using a panel model with a heterogeneous slope that is robust to cross-sectional dependency and endogeneity. We rely on the Autoregressive Distributive distributed Lag (ARDL) model using the PMG estimator by Pesaran *et al.* (1999) and the MG estimator of Pesaran and Smith (1995) to capture both short term and long-run effects of FDI on VC domestic investment. Our study has implications for policymakers, investors, and venture capitalists.

In our sample of seven Asian countries over the period 2000 – 2018, we find that, in the short run, FDIs do not have any significant impact. However, in the long run, FDIs positively affect the VC investment in terms of dollar amount invested and of the number of VC-backed firm entries. Thus, our results show that, in the long run, FDIs tend to crowd in the VC investment.

The rest of the paper is structured as follows: section two outlines the existing literature, section three presents the theoretical framework and hypothesis development, section four describes sample and data, section five outlays estimation methodology, section six presents Econometric Findings, section seven concludes the paper.

2 Literature Review

We did a two-fold literature review: Firstly, what are the factors that affect venture capital Activity at the country-level i.e., the macroeconomic determinants of Venture capital investment; Secondly, how FDI impacts domestic entrepreneurship and domestic investments.

2.1 Determinants of VC investment

In the extant literature, we came across a handful of papers dealing with macroeconomic determinants of venture capital investment. Previous studies performed on different periods and geographical areas highlight three main driving factors of VC activity: (1) Macroeconomic factors such as GDP, corruption, unemployment, interest rate, tax rate are the significant determinants of VC activity (Gompers and Lerner, 1999; Jeng and Well, 2000; Felix *et al.*, 2007 and among others). (2) legal and institutional factors like common law countries develop a robust VC industry (Leleux and Surlemont, 2003), IP protection, and legal rights positively impact VC activity (Groh and Wallmeroth, 2016). (3) Investment Environment and firms' specific variables like stock market development, innovation, and labor market rigidities also impact VC activity (Black and Gilson, 1998; Felix *et al.*, 2007). These studies were mostly conducted with respect to the US and European context. Whereas Studies of Jeng and Well (2000) and Groh and Wallmeroth (2016) are conducted in the global context. The findings of extant literature are summarized below in Table A.

Table A: Determinants of VC Activity

| Study/year/ sample/period/ dependent variable | Macroeconomic factors | Legal and institutional factors | Firm's specific variables | Environment variables |
|--|---|---------------------------------------|------------------------------|--|
| Black and Gilson, (1998) US, Japan, and Germany [1991-1995] Dependent Variable Capital contribution | | | | Stock Market development (+) |
| Gompers and Lerner (1999) Unites states [1971-1994] Dependent variable VC investments, No of VC-backed companies, Total Fundraised | GDP Growth rate (+) Interest Rate (+) Capital Gain Tax Rate (-) | | R&D Expenditure (+) | IPO (=) Stock market (+) Pension funds (+) |

| | | | | |
|--|--|---|---|--|
| <p>Jeng and Well (2000) 21 countries [1986-1995] Dependent variables The ratio of VC investment to GDP, the ratio of early stage to GDP, funds raised,</p> | <p>GDP growth (=) Corporate Tax rate (=)</p> | <p>Accounting standards (-)</p> | | <p>Pension funds level (+) Market capitalization (=) IPO (=) Early stage IPO (+) Later stage Labor Market Rigidity later stage (=) Labor Market Rigidity Early-stage (-)</p> |
| <p>Marti and Balboa (2001) European 16 countries [1991-1999] Dependent variables VC funds raised</p> | <p>GDP growth rate (=)</p> | | <p>Preceding year VC investment (+)</p> | <p>IPO (=)</p> |
| <p>Leleux and Surlemont (2003) European 15 countries [1990-1996] Dependent variable: VC funds raised VC funds invested</p> | | <p>Common law (+) German and French Civil Law (-)</p> | | |
| <p>Schertler (2003) European 14 countries [1988-2000] Dependent Variable Early stage and expansion as a percentage of GDP or Gross Capital</p> | | | <p>R&D Expenditure (+)</p> | <p>Stock market (+) for early stages only Labor Market Rigidity (+) for early stages only</p> |
| <p>Romain and Van Pottelsberghe de la potterie (2004) OECD 16 [1990-2000] VC investment share of GDP</p> | <p>GDP Growth rate (+) Corporate Tax (-) Interest rate (+)</p> | | <p>R&D expenditure (+) No of Patents (+)</p> | <p>Labor market rigidities (-)</p> |
| <p>Felix <i>et al.</i> (2007) European 23 countries [1992-2003] The ratio of VC investment to GDP New Funds raised to GDP High tech investment to GDP Early-stage to GDP</p> | <p>GDP growth rate (+) Unemployment rate (-)</p> | <p>Legal right index (+)</p> | <p>R&D Expenditure (=) Innovation index (+)</p> | <p>IPO (+) Trade sales (+) Labor Market Rigidity later stage (=) Labor Market Rigidity Early stage (-)</p> |

| | | | | |
|--|---|---|------------------------|---|
| Cherif and Gazdar (2011) Europe 21 countries [1997-2006] Dependent variable The ratio of early-stage VC investment to GDP, Funds raised to GDP | GDP growth rate (+) Unemployment rate (-) (Only early stage) interest rate (=) | | R&D Expenditure (+) | IPO (=) Trade sale (=) Write off (=) Market capitalization (+) |
| Groh and Wallmeroth (2016) 118 developed and developing countries [2000-2013] Dependent variable VC investment as a percentage of GDP | Bribery and Corruption (-)) Corporate Tax (=) Unemployment (=) Export (+) | Legal Right (+) Intellectual Property protection (+) | Innovation (+) | M&A (+) |

(+) shows the positive impact, (-) shows the negative impact, and (=) shows the non-significant impact

2.2 Impact of foreign direct investment on domestic investment and entrepreneurship

We conducted a relevant literature review of the impacts of inward FDI on the host country’s domestic investment (Total Gross Capital Formation) and entrepreneurship.

The impact of FDI on domestic investment and entrepreneurship is rather non-consensual. One strand of existing literature argues that there are both direct and indirect benefits of FDI in the host country’s entrepreneurial milieu, due to the interaction among MNCs and domestic companies. Therefore, this strand validated the complementarity effect hypothesis by using different periods, geographical areas, and different econometric strategies (Agarwal, 2000; Göçer *et al.*, 2014; Gorg and Strobl 2002). While the other strand of literature counts the crowding-out effect/substitution effect due to negative externalities and negative spill-over effects of foreign direct investments on domestic investments and entrepreneurship (Jude, 2019; Wang, 2010; Danakol *et al.*, 2019). Table B summarizes the impact of FDI on domestic investment and entrepreneurship.

The complementarity effect highlight three channels through which FDI benefits domestic investment and entrepreneurship: demonstration effect, labor mobility, and network and linkage effects. The complementarity effect takes place when foreign entrants reinforce and crowd in domestic investments and entrepreneurship. It is a sobering assumption that ‘the impetus of change is always an external agent’. Innovation and technological revolution take place in developed countries while the least developed countries import these inventions (Jude, 2012). Therefore, for

developing countries, consider FDI is an inexpensive (Blomstrom and Kokko, 1998) and efficient (Campos and Kinoshita, 2002) tool of technology diffusion. Therefore, MNCs are the viable source of diffusing business norms and practices rather than only fiscal exchange across borders (Dunning, 1970). Consequently, the governments offer special inducements to attract foreign capital like tax holidays, subsidies, incentives, duty exemptions, etc (Jude, 2012). Governments expect that FDI may bring modern technology and help in knowledge and know-how diffusion to domestic entrepreneurial talent and finally cause a multiplier effect in the incumbent host country (Jude, 2012). Therefore, extant literature points out the following channels through which foreign firms may positively impact domestic investments and entrepreneurship:

Firstly, the demonstration effect is the foremost channel of technology diffusion. The demonstration effect – also called contagion-imitation effect or reverse engineering – is the channel through which technology and knowledge diffusion take place between foreign entrants and domestic firms (Blomstrom and Kokko, 1998; Spencer, 2008; Zhang *et al.*, 2010, Danakol *et al.*, 2017). The demonstration effect means learning by imitating and replicating the business practices from foreign entrants. Görg and Strobl (2001) state that by demonstration effect, domestic firms may learn from copying and replicating foreign firms' technology and operating procedures. It is well documented that MNCs from developed countries owe superior technology, skilled management teams, modern tools and techniques of business practices (Zhang *et al.*, 2010) which give them an extra edge over local entrepreneurs. These firm-specific ownership advantages possessed by foreign firms make them transcend in the local settings³⁶. Therefore, local companies tend to imitate their foreign counterparts, introduce new technologies, and launch new products to survive and compete in the local setting (Caves 1996; Blomstrom and Kokko, 1998; Spencer, 2008; Danakol *et al.*, 2017). Sometimes, Foreign firms may deliberately and voluntarily transfer technologies and a set of competencies to the downstream host country's domestic firms which provide inputs and intermediate goods to foreign firms. However, technology transfer is not only the transfer of physical technology, but it encompasses a broad spectrum of knowledge, productivity, and spillover effects. Since complex goods require specialized and skilled human capital and are relatively difficult to copy; therefore, the extent to which a local firm may absorb the spillover effect depends upon the sophistication of the exogenous technology brought by

³⁶ Firm specific ownership advantages include copyrights, intellectual rights, brand recognition, and other intangible assets.

foreign firms. Technology diffusion enhances productivity, adds value, and helps in profit maximization. These are generally termed as positive spillover effects due to the foreign entrants and increase the productivity of the domestic firms (Spencer, 2008).

Secondly, labor mobility is another mechanism through which knowledge diffusion may take place (Görg and Strobl, 2005). Training and development of employees is a tedious task and requires time and financial resources. MNC bring new technologies that need a competent and skilled labor force. Therefore, MNCs may train and develop a domestic labor force about firm-specific assets such as strategic management, operation, and process management. Foreign firms exuberantly and exorbitantly spend on the training and development of their employees to complete the domestic firms. In the future, this skilled labor force polished and nurtured by foreign entrants may work with local entrepreneurs or may embark on an entrepreneurial journey of their own³⁷. However, these former employees of foreign firms, harnessed with the modern concept of business activities, may end up working in the domestic firms and bring novel techniques in the domestic settings (Danakol *et al.*, 2017). The extant literature considers two aspects of labor mobility spill-over effects. Firstly, these trained employees may switch to domestic firms for better working conditions; therefore, to retain these employees, the foreign firms must pay more handsome packages to stop the diffusion of knowledge and know-how to domestic competitors (Fosfuri *et al.*, 2001). Secondly, foreign firms may relocate to another destination to inhibit technology diffusion to domestic firms creates a space for local entrepreneurship (Glass and Saggi, 2002).

Thirdly, Markusen and Venables (1999) think that linkage effects may come about due to the foreign firms in the incumbent host country. According to Danakol *et al.* (2017), there are two kinds of linkages that may sprout out due to the entrance of foreign firms. Horizontal linkage, also known as intra-industry linkages, means when the foreign and domestic firms belong to the same sector and produce similar goods that substitute each other and have the same target customers. Whereas, vertical linkage, also called inter-industry linkages, means when foreign firms become a supplier of or buyer of domestic firms. In inter-industry linkages exchange intermediate inputs amongst themselves. Therefore, vertical or inter-industry linkages could be further classified into

³⁷ In 1979, South Korean Daewoo corporation trained 130 Bangladeshi employees in textile industry; eventually, 115 employees left Daewoo and started their own textile industry in Bangladesh and very successful in their venture (Klein, 2003).

two types: the backward vertical linkages and forward vertical linkages. In backward linkages, foreign firms serve as a supplier of input to domestic firms whereas in forward-linkages foreign firms play the consumer of domestic firms. Markusen and Venables, (1999) argue that FDI enhances local investment due to forward or reverse linkages in the domestic market e.g., maybe the outputs of domestic firms serve as inputs for MNCs and vice versa, thus creating a complementary effect. Therefore, due to the entrants of foreign firms, the aggregate demand for inputs may increase domestic firms may benefit from economies of scale and lower costs of production. consequently, this creates a virtuous cycle in which foreign firms and domestic firms serve as suppliers and consumers in upward and downward linkages. In the same vein, Kose *et al.* (2006) term this ‘Collateral benefits’ that may enhance local investment e.g. Maybe Multinational companies depend on the local goods for the production: hence increasing demand and supply mechanism.

On the other hand, the substitution effect occurs when foreign firms displace or crowd out domestic investment and entrepreneurship. FDI may crowd out domestic investment and entrepreneurship due to the competition effect. Aitken and Harrison (1999) call this ‘market stealing effect’ of MNCs due to the competition effect. This extant literature highlights several causes of the crowding-out effect due to increased competition: decreasing price effect, increasing cost of production effect (wages, supplies), and technological advantages among others. Foreign firms possessing sophisticated technology have the advantage of producing at lower costs. Agosin and Machado (2005) argue that possessing superior technology and owing a competitive advantage over indigenous manufacturing may lead to unfair competition. Therefore, foreign firms may penetrate and capture the existing local market by decreasing prices. Domestic firms must make fewer units and in return, fixed costs may be distributed over fewer numbers of units. In the same vein, MNCs may foster competition and lower the prices of finished goods and resultantly drive out domestic companies (Mahmood and Chaudhary, 2012). Additionally, Foreign firms may increase the prices of locally supplies goods and wages which may also lead to a crowding-out effect (Apergis *et al.*, 2006). Access to financing is very crucial for the survival and development of the enterprises, and if foreign firms borrow heavily from local financial institutions, then they may tend to pose a menace to local borrowers (Harrison *et al.*, 2004). Moreover, in developing countries, skilled labor is worth more than capital. Foreign entrants may select and recruit a skilled labor force and local entrepreneurs may end up in a squeezing situation. Therefore, Rodrik (1999)

encompasses the whole discussion in a single sentence “today's policy literature is filled with extravagant claims about positive spill-overs from FDI, but the hard evidence is sobering”. Therefore, the consequences of negative spillover effects and externalities could not be ruled out and there are quite the possibilities that negative externalities may lead to the ‘substitution effect’.

All these studies have been conducted in respect of total gross capital formation and new firm entry in general and their findings are summarized in Table B. There is no study dealing with venture capital investment. This void has not been discussed before and we try to fill that lacuna in the literature.

Table B: Impact of FDI on domestic investment and entrepreneurship

| Impact of FDI | The crowd-in effect (+) | The Crowd-out effect (-) | Non-Significant U shape | Causes of Crowd in | Causes of Crowd out |
|---------------------|---|--|--|---|---|
| Domestic investment | Agosin and Machado (2005) 30 countries [1970-1996]. (+) in Asia | Agosin and Machado (2005) 30 countries [1970-1996]. (-) Latin America | Agosin and Machado (2005) 30 countries [1970-1996]. (=) in Africa. | The demonstration effect is the channel through which technology and knowledge diffusion take place between foreign entrants and domestic firms. Labor Mobility is another channel of positive Technology Transfer Foreign firms may deliberately transfer technology to domestic firms | Competition effect Market stealing effect, Technological advantage, Increased prices of inputs and wages, shortage of skilled labor. lower selling prices of finished goods |
| | Agarwal (2000) South Asian countries [1965-1996] (+) effect | Titarenko (2005) sample Latvia [1995-2004] (-) effect | | | |
| | Apergis <i>et al.</i> (2006) 30 countries [1992-2002]. Bivariate endorse crowding in effect (+) | Apergis <i>et al.</i> (2006) 30 countries during [1992 to 2002]. Multivariate shows crowding out effect (-). | | | |
| | Hechet <i>et al.</i> (2004) 64 countries [1976-1997] (+) effect | Eregha (2012) ECOWAS countries [1970-2008] Crowd out (-) | | | |
| | Sunny and Sawant (2012) sample China and India | Sunny and Sawant (2012) sample China and India [1980-2010] | | | |

| | | | | | |
|---|--|--|--|---|--|
| | [1980-2010 crowding in effect in India. (+) | and found that there is a crowding-out effect in China. (-) | | Linkage effect Domestic firms may be the supplier or consumers of foreign entrants | |
| | Göçer <i>et al.</i> (2014) sample of 35 developing countries period [1992-2010] Crowd in (+) | Mayanja (2012) 30 Sub-Saharan African countries 1990-2008 crowding-out effect (-) | | | |
| | Mahmood and Chaudhary (2012) Pakistan Corwd (+) | Jude (2019) 10 Central and East European countries (1990-2010) crowd out effect | | | |
| | | Wang (2010) 50 countries [1970-2004] crowd out (-) | | | |
| Domestic Entrepreneurship (Proxied with the entry of new firms) | Gorg and Strobl (2002). They found that MNCs crowd in the Irish manufacturing firms. (+) | De Backer and Sleuwaegen (2003) Belgian sample [1990 to 1995] crowd out (-) Danakol <i>et al.</i> (2017) sample of 70 countries 2000-2009 Crowd out | Barrios <i>et al.</i> (2005) Irish sample 1972-2000 initially FDI tends to crowd out and then crowd in domestic firms. | | |

3 Theoretical Framework and Hypotheses Development

We stressed the complementarity (crowding-in) effect of FDI on domestic VC activity. We have reasons to believe that FDI may positively affect the VC industry. First, the salient venture capitalists’ features “governance and value-adding effect for investee companies” distinguish it from other investors (Gompers and Lerner, 2004). Second, venture capital-backed companies have greater absorptive capacities than non-VC-backed companies. Third, the brownfield FDI (M&A) provides an “Exit Market” to venture capital investments.

First, Venture capitalists are investments experts, and they possess experience, sound knowledge, and know-how of the industry. Venture capitalists have very strict due diligence, screening, and selection criteria to invest in portfolio companies and they only invest in high growth potential and promising entrepreneurial firms (Manigart *et al.*, 2002; Gompers and Lerner,

2004). Further, venture capitalists take part in active monitoring and apply control mechanisms to deal with business risk and minimize agency problems (Sahlman, 1990; Gompers and Lerner, 2004) and overcome moral hazards (Lerner 1995). Venture capitalists add value to the investee company by cultivating a close relationship with the portfolio company's managers (Sapienza and Gupta, 1994); they provide access to their networks (Sapienza *et al.*, 1996) and help portfolio company in recruiting managerial staff and formulating strategic management (Hellman and Puri, 2002). Admati and Pfleiderer (1994, p.371) summarize the entire discussion in a single sentence, "an investor who not only provides capital but also works closely with the firm, monitors it frequently, and is generally very well informed about the firm's prospects and investment opportunities". In the extant literature, it is well established VC-backed companies are more efficient than non-VC-backed companies. Danakol *et al.* (2017) and Jude (2019) argue that the foreign entrants may mobilize the efficient domestic firms towards better technology and learn to use their in-hand resources more efficiently and effectively. Therefore, we believe that venture capital-backed firms benefit more from the positive spill-over effects (discussed above in detail) caused by the entry of foreign firms.

Second, benefitting from the foreign firm's positive spill-over effects depends upon the absorptive capacity of the domestic firms (Kokko *et al.*, 1996; Jude, 2019) and sophistication of the exogenous technology brought by foreign firms (Görg and Strobl, 2001; 2019). Absorptive capacity means how a local firm receives, imitates, assimilate, utilizes, and transforms the knowledge and know-how gained from the foreign entrants (Kokko *et al.*, 1996). Therefore, MNCs may crowd out the domestic firms having that limited absorptive capacity (Jude, 2019). On the contrary, Venture capital firms select those companies which have great growth potential, already well-developed innovation strategies (Bottazzi and Da Rin, 2002). According to Da Rin and Penas (2007), VC-backed companies are more absorptive than non-VC-backed companies and are thus more innovative. In this regard, Kortum and Lerner (2001) empirically found that VC-backed companies are more innovative than non-VC-backed companies. Therefore, it is reasonable to believe that domestic VC-backed companies assimilate positive spillover effects such as technology infusion from foreign entrants.

Third, Venture capitalists expect capital gains from the exit opportunities after 7 to 12 years³⁸. Proceed of exits determine the success or failure of VC investments (Bertoni and Groh, 2014), and therefore it is an important phase of the VC cycle (Gompers and Lerner, 1999). According to Cumming and Johan (2008), Venture capitalists pre-plan their exit strategy before closing the first round of investment. Consequently, the choice of exit route determines the viability and attractiveness of the investment (Bertoni and Groh, 2014). The two most appealing forms of successful exit are Initial Public offering (IPO) and Merger and Acquisition (M&A), and the second one is gaining tremendous importance (Amor and Kooli, 2019). In the same vein, it is documented that IPO is not the only attractive mode of exit for VC-backed entrepreneurial firms, but trade sales have gained equal significance over the past decades as well (Bayar and Chemmanur, 2011; Bayar and Chemmanur, 2012). The increase in the M&A mode of exit of private companies in the recent past is because of the increase of the high costs associated with going public (Bayar and Chemmanur, 2011). Going public is generally considered the most fruitful exit strategy for VC-backed companies, but M&A exits can be more gainful during the weak markets and effectively closed IPO markets (Masulid and Nahata, 2011). In terms of fund financial performance, trade sales are equally profitable as IPO exits are (Smith *et al.*, 2011).

However, Jeng and Well (2000) consider the illiquid capital markets as the greatest hurdles for a vibrant VC activity because exiting (divesting) will be a difficult task in these illiquid markets. Therefore, cross-border investors increase the scope of exit opportunities for VC investors (Bertoni & Groh, 2014). Brownfield FDIs, commonly known as merger and acquire (M&A), provide viable exit paths for domestic venture capital firms. The liquidity of initial public offering and merger and acquisition markets determines the chances of successful or unsuccessful VC divestment (Bertoni & Groh, 2014). Interestingly, Dai *et al.* (2012) note that M&A not only facilitates promising ventures to exit but also provides exit routes for unsuccessful companies. Black and Gilson (1998) the countries with developed stock markets develop robust VC industries. However, Asian countries are characterized by immature and underdeveloped stock markets (Bruton *et al.*, 2005). Hence brownfield FDIs may provide the domestic venture capitalists exit opportunities through M&A in Asia, where exiting through IPO is difficult.

³⁸ Asian Venture capitalist's investment horizons are relatively shorter approximately 3 years.

Hence, on account of the above discussion, we conjecture that FDI may positively impact the domestic venture capital activity by sprouting positive externalities and spill-over effects like technology diffusion, labor mobility, positive competition effects, horizontal and vertical linkage effects. Inward FDIs may complement VC activity in the host country by (1) establishing links with existing and new markets both abroad and indigenous settings; (2) creating linkage effects like vertical and horizontal integrations – the finished goods of local firms may serve as the input of foreign firms and vice versa; (3) introducing new and sophisticated technology which may bring about the cheap method of production; (4) employing a skilled labor force and labor mobility; (5) and most importantly by providing an exit plate to the venture capitalists via M&A. Therefore, the complementarity effect creates a symbiotic relationship between domestic VC activity and foreign firms.

Because of the foregoing, we assume that the higher the level of foreign direct investments in a certain country in a certain year, the higher the level of domestic venture capital investments. It means a country receiving more inward FDI, the more robust VC activity be in that country and consequently more amount of VC will be available to domestic firms. We call this “market-level additionality hypothesis”. Thus, we hypothesize:

H1: The net effect of inward Foreign direct investments on the domestic venture capital investments is likely to be comprised of complementarity effect being offset against substitution effect, and likely to cause market-level additionality in Asian developing countries.

Our first hypothesis leads to our second hypothesis. The higher the amount of venture capital financing available in a certain country in a certain year, the higher the number of portfolio companies receiving VC financing. Therefore, we call this “enterprise-level additionality hypothesis”.

H2: The net effect of inward Foreign direct investments on the domestic venture capital investments is likely to be comprised of complementarity effect being offset against substitution effect, and likely to cause enterprise-level additionality in Asian developing countries.

4 Research Design

4.1 Sample and sources

The influence of FDI on local investment varies due to national policies, types of FDI flows, and the role of the indigenous entrepreneurs (Agosin and Machado, 2005). In the same vein, Eregha, (2012) state that the impact of FDI on indigenous investment show a discrepancy due to variation in the policies of the respective countries. Therefore, our sample is composed of seven Asian developing countries – China, India, South Korea, Malaysia, Singapore, Taiwan, and Thailand – over the period 2000 – 2018. We retrieved the data from different sources: Thomson Banker One (T1), World Bank Development Indicators (WDI), World Bank Governance Indicators (WGI), United Nation Conference on Trade and Development (UNCTAD, 2019), The Global Economy (TGE), Statistical Yearbook of Taiwan (2019), National statistics Republic of China (Taiwan), Intellectual Property Office Ministry of Economic Affairs Republic of Taiwan. There are two reasons to study this sample of seven developing Asian countries and the period (2000-2018): First, this sample is already tested and studied, with respect to venture capital exit, by Cumming *et al.* (2006). The peculiar feature of these countries is that their VC industry is underdeveloped especially compared to the US (Cumming *et al.*, 2006), and additionally, the key feature of this region (excluding India, but India is a mega stakeholder in Asia with respect to VC industry) is that Chinese commercial culture prevails in this region and businesses practices are predominantly influenced by ethnic Chinese (Bruton *et al.*, 2009). Given the broad spectrum of the countries, the heterogeneity in the data provides a beneficial insight regarding the statistical selection effect of VC investments (Cumming *et al.*, 2006). Second, in the last few decades, we have seen a huge growth in foreign investments across Asian countries. Asia absorbs approximately 40% of the global inward FDI flow; particularly, developing Asia – China, Malaysia, Singapore, Indonesia, and other ASEAN countries - have been the largest recipients of FDI and their total investment soared up to 512 billion USD in 2018 (UNCTAD, 2019)³⁹. This relative increasing trend of VC investments in Asia and hosting 40% of global inward FDIs make Asia a lucrative field of study. Aylward (1998) note that, in the developing world, VC funding soared up dramatically during the 1990s and in the same vein according to Aitken & Harrison (1999) FDI has been the most lucrative

³⁹ UNCTAD stands for United nation Conference on Trade and Development

source of cross-border finance for developing countries since the late 1990s. Therefore, our final panel data set is composed of 7 countries over the period 2000 to 2018.

4.2 Variable's definitions

Variables sources and definitions are provided in Table 4.1.

Dependent variables

Venture capital investment (VCI) is the dependent variable. It is the aggregate venture capital invested in portfolio companies in a certain country in a certain year. Investments in China are far greater than in other countries; therefore, to deal with such sort of outliers we normalized the domestic venture capital investment by taking the natural log of the VC investment. We retrieved the data from Thomson one Banker database.

Our second dependent variable is **Entry**. It is the entry of new VC-backed companies which is measured by the aggregate number of portfolio companies receiving their first round of VC investment in a certain country in a certain year. The companies that receive their second or higher round rounds are excluded from the data since we are intended to see the rate of entry of VC-backed new firms (new firm creation funded by VC firms). We take the log+1 value of the number of new companies. The data are sourced from Thomson bankers One from nine Asian countries.

Independent Variable:

Net Inward FDI flow (hereafter *FDI*) is the independent variable: it is defined as the natural logarithm of the net inward FDI flow in a certain country in a certain year. We sourced the data from the United Nations Conference on Trade and Development 2019 (UNCTAD, 2019). The data for FDI from UNCTAD is in millions of current USD. Therefore, we converted it into unit USD and took the natural logarithm.

Control Variables

Winnowing through the extant literature, we controlled for the variables related to the investment environment and macroeconomic determinants of the country. Therefore, we controlled for the following variables:

Following extant literature (see Gompers and Lerner, 1999; Jeng and Well, 2000; Marti and Balboa 2001; Romain and La Potterie, 2004; Cherif and Gazdar;2011 and Félix *et al.*, 2013),

we controlled for the market size of the country. We proxied with the ***Economic Growth*** (*hereafter Growth*) and is defined as the *Real GDP Growth rate* of the country per annum. It is believed that the higher the growth rate the higher the VC investment in a country. In line with the extant literature, we controlled for ***Inflation*** and is defined as the change in consumer price index (CPI). Due to inflation, the firms' real returns are expected to be lower and hence we expect inflation harms the VC investments. Following Wang (2010) we controlled for the ***Exchange rate*** and is defined as the currency rate of the host country per unit USD. The depreciation of the host country's currency leads to the increase of foreign debt of the incumbent host country's firms and thus may harm the VC investments. We controlled for the ***Trade Freedom*** proxied by the Trade freedom index (TFI). It is a composite measure of the absence of trade hurdles like tariffs and quotas which hinder trade (imports and exports) across countries. The index ranges from 0 to 100 where the countries with 0 have the least trade freedom while 100 shows the highest freedom. We expect the higher the trade freedom the higher the VC investments. Following Engel and Keilbach (2007), Bonini, S., & Alkan, S. (2014), and Pierrakis & Saridakis (2017), we take a proxy variable ***Patent application*** to measure absorptive capacity, research and development, technological opportunities, and innovation. It is defined as the total number of patent applications registered by the residents and non-residents each year in each country. We believe that innovative countries attract more VC investment. All the variables, their definitions, and sources are given in Table 4.1.

[Please insert Table 4.1 about here]

4.3 Estimation Methodology

Because our sample comprises 7 Asian countries over a time series of 19 years, we use dynamic panel data regression. In this study, we tend to investigate the impact of the foreign capital flows particularly FDI on the domestic venture capital investments for selected seven Asian developing countries during the period 2000 to 2018. Therefore, we specified the following two equations:

$$(VCI)_{it} = f(FDI, Inflation, GDP Growth, Trade freedom, Exchange Rate, Patents) \quad (Eq. 4.1)$$

$$(Entry)_{it} = f(FDI, Inflation, GDP growth, Trade freedom, Exchange Rate, Patents) \quad (Eq. 4.2)$$

In equation 1, VCI shows the dollar value of venture capital invested in a country in a year and we took the natural logarithm in the regression. In equation 2, Entry is the entry of new VC-backed companies in a country in a year. We took the log+1 value in the regression analysis.

Inflation and GDP growth rate are in percentages, Trade freedom is an index, the Exchange rate is the rate of currency per unit USD and patents is the number of patents applied by residents and non-residents. We took the log of patents in the regression.

More precisely, to estimate results, we employed a Panel Autoregressive Distributed Lag (ARDL) model using Mean Group proposed by Pesaran (1995) and Mean Group estimators propounded by Pesaran *et al.* (1999). This model is frequently used in FDI and macroeconomic literature (for example see: Samargandi *et al.*, 2015; Kaulihowa and Adjasi, 2018; Jalil *et al.*, 2016; Ibrahim and Raji, 2018; Khadaroo and Seetanah, 2010). We first discuss the general econometric framework and strategy of Panel ARDL and compare it with other models in terms of efficiency and consistency.

The traditional static panel data analysis model such as Fixed Effect (FE), Random Effects (RE), and Pooled Ordinary Least Square (OLS) have some grave limitations. For example, given the highly restrictive nature of pooled OLS, this model does not regard the individual heterogeneity and presumes common slopes and intercepts for the groups. FE model imposes the common variance and slope but group-specific intercepts. Baltagi (2008) suggests that cross-sectional and time effects may be observed with the help of year and country dummies but the model loses degrees of freedom. Moreover, Campos and Kinoshita (2008) write that FE produces biased parameters if explanatory variables are endogenous and are correlated with the error terms. On the other hand, RE imposes a common intercept but is rather a time-invariant, which indicates that the error at any moment is not correlated with past, present, and future – called the strict exogeneity principal (Arellano, 2003). Static panels do not capture the long-run and short-run relation of the panel data Loayza and Ranciere(2006) The standard traditional model gives biased parameters by assuming homogeneous coefficients of lagged response variable whereas the dynamics are heterogeneous across the groups (Holly and Raissi, 2009).

The dynamic panel models like Generalized Method of Moment (GMM) difference developed by Arellano Bond (1991), GMM system by Arellano and Boyer (1995), and Blundell and Bond (1998) are reliable when the number of cross-sections is greater than the number of time series ($N > T$). The GMM estimators produce spurious coefficients if the time period is greater than the number of cross-sections ($T > N$). Firstly, with the larger time period the number of instruments will increase which violates the validity of the Sargan test of over-identification and reject the

hypothesis of exogeneity of instruments; the basic assumption of GMM is that the number of instruments must be less than the number of groups. Further, GMM does not capture the long-run coefficients and ignores the stationarity of the variables given the short times series. GMM estimator imposes homogeneous slope coefficients of lagged dependent variables which could produce spurious results.

Hence, there are quite the possibilities that these above-discussed models produce inconsistent and biased results (Pesaran and Smith, 1995; Pesaran, 1997; Pesaran and Shin, 1999). Therefore, we resorted to the ARDL error correction model using the Mean Group (MG) estimator proposed by Pesaran and Smith (1995) and Pooled Mean Group (PMG) estimator proposed by Pesaran *et al.* (1999). These estimators are computed by maximum likelihood and consider the long-run equilibrium and heterogeneity adjustment process. According to Asteriou and Hall (2011), most of the macroeconomic data have the problem of the existence of unit roots or sometimes certain trends due to which these data produce spurious results if simple linear regressions are employed. These estimators could be used for variables of integration order $I(0)$ and $I(1)$, produce both short-run and long-run coefficients simultaneously and produce consistent coefficients despite the possibility of endogenous variables exits (Pesaran *et al.*, 1999).

4.3.1 Panel Unit root tests

Macroeconomic time series are most of the time non-stationary. Using the unit root test, we check the stationarity of the variables at the level and first difference with and without trend. Panel Unit root test determines the order of integration of the variables and defines the stationarity of the annual data of the variables. It is regarded as a powerful test and provides limited normal distribution as compared to individual unit root tests with the complicated limited distributions and reduces the type II error. If the variables are non-stationary at integration order $I(0)$ and $I(1)$, then the estimates obtain from such regression could give spurious results (Asteriou and Hall, 2011). There are several unit root tests such as Breitung (2000), Levin, Lin, and Chu (2002) (hereafter LLC, 2002), Im, Pesaran and Shin (2003) (hereafter IPS, 2003). Each test has its pros and cons, therefore we applied IPS (2003) unit root test. IPS is more convenient to find the stationarity of the variables. This test estimates individual unit root statistics and then finds the average of the statistics. IPS test is more powerful and restrictive than the LLC test. Therefore, it overcomes the

problem of autocorrelation embedded in the LLC test since it considers heterogeneity between the groups in the panel. The following equation specifies the IPS test:

$$\Delta z_{i,t} = \theta_i + \alpha_i z_{i,t-1} + \sum_{j=1}^k \rho_{ij} \Delta z_{i,t-j} + e_{i,t}; \quad i = 1, 2, \dots, N; t = 1, 2, \dots, T \quad (\text{Eq. 4.1})$$

In the above equation, Z_{it} shows each variable in the model, α_i measures the uncorrelated residuals over the time t and θ_i gives the individual fixed effect. The IPS test is based on the Augmented Dickey-Fuller (ADF) statistics which performs average calculations across groups. The null hypothesis for IPS is that $H_0: \alpha_i=0$ i.e., there exists a unit root for the variable under consideration. The alternative hypothesis is $H_1: \alpha_i < 0$ i.e. the slope coefficients are less than zero which shows the absence of unit-roots. The IPS equation is specified below:

$$\bar{t} = \frac{1}{N} \sum_{i=1}^N t_i T \quad (\text{Eq. 4.4})$$

In the given equation, based on the country-specific ADF regressions, t_{iT} gives the ADF tests statistics for each group. Test statistics tend to be normally distributed under the null hypothesis.

4.3.2 Optimal Lag length Selection

Following the unit root test, we check for the collinearity of the regressors. There was no issue of multicollinearity among the explanatory variables in the specifications. Therefore, the next step is to find the optimal lag selection for MG and PMG estimators. We chose Akaike Information Criterion (AIC) for optimal lags. Given the limited number of observations of the data set, we imposed a maximum of 1 lag in the model. Since there are two hypotheses and two specifications with different dependent variables i.e., ‘market-level additionality’ and ‘enterprise-level additionality’. Therefore, we get two ARDL using AIC with a maximum lag length of 1.

4.3.3 Mean Group AND pooled Mean Group Estimation Methodology

Following the test of unit root, we employed the heterogeneous dynamic panel analysis techniques recently developed by Pesaran *et al.* (1999). To deal with the heterogeneity biased caused by the heterogeneous panel, they propose two types of different estimators: mean group (MG) and pooled mean group (PMG) estimators.

Mean Group

MG estimators being less restrictive assumes slope and intercepts vary across the groups and take into consideration the heterogeneity across the groups ie no cross-country restriction is imposed. This estimator provides the parameters with the opportunity to be autonomous across the countries and neglects the possible homogeneity among the countries. Using the ARDL model, The MG estimator estimates separate long-run and short-run parameters for the individual group and then averages the coefficients and provides consistent long-run results. Therefore, it estimates an ARDL as follows for $i=1, 2, \dots, N$ and $t=1, 2, \dots, T$

$$a_i(L)y_{it} = b_i(L)x_{it} + d_i z_{it} + e_{it} \quad (\text{Eq. 4.5})$$

For individual country $i=1, 2, \dots, N$, the following equation gives the long-run parameters

$$\theta_i = \frac{b_i(I)}{b_i(I)} \quad (\text{Eq. 4.6})$$

For the whole panel, the following specification exhibit the parameters

$$\theta = \frac{1}{N} \sum_{i=1}^N \hat{\theta}_i \quad (\text{Eq. 4.7})$$

Therefore, in the MG estimator, Pesaran *et al.* (1999) contend that the higher lag order variables provide a high level of consistent parameters even though if the variables are of order $I(1)$. Therefore, these assumptions being enough robust need that country-specific parameters are independent of the explanatory variables that are highly exogenous.

Pooled Mean Group

PMG estimator propounded by Pesaran *et al.* (1999) considers the group-specific differences in the short run while this estimator assumes the long-run homogeneity of the intercepts and slopes across the groups (in our case countries). Therefore, it underscores group-specific short-term adjustments and speed of convergence, while considering the group-specific homogeneity in the long run. Hence, this estimator provides the long-run and short-run dynamic relationships among the dependent and independent variables. Therefore it estimates an ARDL model for $i=1, 2, \dots, N$ and $t=1, 2, \dots, T$ as below:

$$y_{it} = \sum_{j=1}^m \lambda_{ij} y_{i,t-j} + \sum_{j=0}^n \delta'_{ij} x_{i,t-j} + \mu_i + \varepsilon_{it} \quad (Eq. 4.8)$$

Where Y_{it} is the dependent variable and x_{it} is the $(n*1)$ vector of regressor for the country i , and u shows the fixed effects. The given equation could be rewritten in the vector error correction model as follows:

$$y_{it} = \theta_i(y_{i,t-1} - \beta'_i x_{i,t-1}) \sum_{j=1}^m \gamma_{ij} \Delta y_{i,t-j} + \sum_{j=0}^n \gamma'_{ij} x_{i,t-j} + \mu_i + \varepsilon_{it} \quad (Eq. 4.9)$$

In the above equation, β and θ_i shows the long-run parameters and error correction parameters respectively. The PMG model assumes that β is equivalent across the countries. In this estimator, the short-run parameters vary across the groups whereas the long-run parameters are set homogenous. The maximum likelihood approach is utilized to estimate the models. Using the Akaike Information criteria (AIC), the appropriate optimal lag lengths are chosen for both MG and PMG estimators. The matter of consistency and efficiency of MG and PMG is gauged by Hausman (1978) test. the test shows the long-run homogeneity across the countries. the null hypothesis state that there is no difference in the parameters in the long run of the countries. However, PMG estimates more efficient and consistent coefficients if parameters are homogenous in the long run.

5 Findings

5.1 Descriptive statistics

We use Autoregressive Distributive distributed Lag (ARDL) model to estimate our results on seven Asian countries overs the 2000-2018 period with a total number of observations of 133 $(7*19=133)^{40}$. Table 4.2 reports the summary statistics of the panel data. **VCI** variable shows the amount of Venture capital invested. The mean value of VC investment is 3.12 billion USD while the median is 0.66 billion dollars. There is quite a huge gap in the investments of giant countries like China and India and small economies like Thailand. The minimum value of VC investment is only 0.368 million while the maximum value is up to 76 billion in China. Therefore, to deal with such variations we took the log natural of the VC investment which normalized the variable. Therefore, after taking the log mean and median of the variable became 19, and the minimum and

⁴⁰ But in the regressions, due to missing values our number of observations are 121 and 122.

maximum values become 12 and 25 respectively. For the same reasons, we adopted the same treatment for the second dependent variable *Entry* (the entry of new VC-backed companies) by taking the log natural (Number of companies+1) in the regression, which normalized the data. The mean and median values of the variable *Entry* are 3.7 and 3.4 respectively and the standard deviation is 1.69. Similarly, we took the log of Net inward FDI flows, the median and mean value for log natural of FDI are 23, and minimum and maximum are 18 and 26. Inflation, measured by the change in the consumer price index, is expressed in percentage. The median and mean are 2 and 2.5 and the standard deviation is 2.38. The minimum and maximum values for inflation are -0.9 and 11.989 respectively. The mean and median values for the *Exchange rate* are 179 and 31 while the standard deviation is 389. Trade freedom is an index that oscillates from 0 to 100. The standard deviation for Trade freedom is approximately 15 and the mean and median are 75 and 72. The minimum value for Trade Freedom is 20 and the maximum is 90. The variables patents have a very high standard deviation of 259000 and median and mean values of 361812 and 123000. The smallest value is 1937 and the largest is 1542002. Therefore, we took the log value in the regression. The log transformation normalized the data with a mean and median of 10 and a standard deviation of 1.6. Table 4.2 provides a complete insight into the descriptive statistics of the data.

[Please insert Table 4.2 about here]

5.2 Pairwise correlations

Table 4.3 reports the correlation matrix of the variables. The correlation matrix provides a first crude insight of the variables and their association among one another. The dependent variable VCI is positively correlated to FDI at a 5% level, as theoretically expected. Inflation, Growth, and Patents are positively and significantly correlated to VC investment while Trade Freedom is significantly correlated to VC investment as theoretically expected. Similarly, *Entry* is also significantly positively correlated to FDI at a 5% percent level. The control variables Growth, inflation, Exchange rate, and patents are significantly correlated to the number of companies at 5% level while Trade Freedom shows a negative significant relationship. Among the control variables, Trade Freedom shows a negative correlation with all the variables. Details are shown in Table 4.3.

[Please insert Table 4.3 about here]

5.3 Panel Unit Root Test

Table 4.4 shows the results of the unit root IPS test for stationarity of the variables. This table shows that VCI, Growth, FDI, and inflation are stationary at levels with and without trends, whereas Entry, Exchange rate, Patents, and Trade Freedom are non-stationary at level, but they are highly stationary at the first difference at 1%. No variable is of integration order I(2) or higher, which confirms the existence of the Unit root of the variables. The mix order of I(0) and I(1) confirms that we can use the ARDL model. Table 4.4 presents the details of the results.

[Please insert Table 4.4 about here]

5.4 PMG and MG Estimations for Market level Additionality

To estimate the impact of FDI on VC investment ie for market-level additionality specification, AIC suggested the ARDL (1 0 1 1 1 0 1). The MG and PMG estimations are shown in Table 4.5. This Table reports both long run and short parameters. By Following Pesaran *et al.* (1999), We used the lags suggested by ARDL. Hausman's (1978) test is used to choose between MG and PMG estimator. The null hypothesis states that there is no significant difference in the long-run parameters obtained by MG and PMG estimators. Then we run a Hausman test to select the efficient and consistent estimator. Therefore, the null hypothesis of no homogeneity, in the long run, is not rejected at a 5 percent significance level. Hence PMG estimator provides more efficient, consistent, and reliable results as compared to the MG estimator to estimates the impact of FDI inflow in developing Asian countries. The error correction term (ECT), also known as the convergence parameter, measures the speed of convergence of the model. The prime condition of the efficiency and consist of the model is the value of the error correction term which shows the long-run association among the variables of the interest. It is therefore pertinent that the value of ECT should not be less than -2; Otherwise, the results are inconsistent and ineffective. The ECT is negative (-0.707) and highly significant. It shows that the long-run coefficients are homogenous across the countries and the short-run parameter adjusts to the long run at a speed of 70 percent per annum. Therefore, coefficients of the variables show a significant association in the long run.

First, we discuss short-run coefficients. We discuss both the estimator but stress more on PMG since the Hausman test shows that PMG is more efficient than MG mode. Both the PMG and MG estimators report a negative and statistically insignificant coefficient for FDI. It means

that in the short run, FDI tends to crowd out VC investment ie FDI displaces venture capital investment. Moreover, the impact of growth is positive at a significance level of 1 percent. It means the countries with higher growth rates have higher VC investments in the short run. Similarly, inflation and patents show a positive but insignificant coefficient. Exchange rate and Trade freedom have positive but insignificant coefficients.

Long-run coefficients are our main interest parameters. In the long run, FDI Growth, trade freedom, inflation have significant effects on VC investment. Whereas patents and Exchange rates don't have any effect. Both the estimators i.e., PMG & MG show statistically significant coefficients for FDI in the long run. The PMG estimator depicts a coefficient of 0.619 at a significance level of 1 percent. This states that when the inward flow of FDI increases by 10%, the domestic venture capital increases by 6.19%. therefore, our results market-level additionality hypothesis: the foreign capital brings positive externalities associated with it in the long run. Inflation significantly and negatively impacts venture capital investment. A 10% increase in inflation would lead to a 1.07% decrease in the VC investment. Interestingly, it has been noted that economic growth negatively impacts VC investments in the long run. Exchange rate and patents have positive coefficients but are statistically insignificant. Trade freedom significantly and positively impacts the VC investment. Countries open to trade tend to have more VC investment. Our estimates represent the notion of creative destruction. The contemporaneous FDI crowds out domestic VC investment, but in the long run, complements the VC investment. In the short run foreign entrants tend to crowd domestic VC out due to the competition effect, but in the long run linkage effects and demonstration effect overrun the substitution effect and lead to a complementarity effect.

[Please insert Table 4.5 about here]

5.5 PMG and MG Estimations for Enterprise level Additionality

To estimate the impact of FDI on the VC-backed entrepreneurial firm creation, first, we found the optimal lag level using the AIC criterion, therefore ARDL suggested a lag of (1 0 0 1 0 0 0) of the variables in the model. We estimated the results from MG and PMG estimators and run a Hausman test to select the efficient estimator. Therefore, the Hausman test gives a chi-square value of 3.9 with a p-value of 0.682. Therefore, we cannot reject the null hypothesis of no homogeneity in the run parameters. Hence PMG gives the consistent coefficients than MG estimators. The results are

reported in Table 4.6. The error correction term has a negative value of 0.304 and is significant at a 1 % level. Therefore, the model's short-term parameters adjust to long-term parameters yearly at the rate of 30%.

In the short run, both the estimators report the negative effect of FDI on new firms' entry. But the coefficients are not significant. The negative sign of FDI in the short run marks that the contemporaneous FDI displaces substitutes the VC-backed entrepreneurial companies. Interestingly, all the variables Growth, Inflation, and patent have insignificantly negative coefficients. Exchange rate and trade freedom have positive coefficients yet are statistically insignificant.

Results of the long run are of prime importance in MG and PMG estimators. In the long run, FDI positively impacts the Entry (new VC-backed firm creation). The coefficient for FDI in PMG estimator is 0.66 and is significant at a 1% level. This means when the log of FDI increases by 1 % the chances of entry of new VC-backed companies rise by 0.66%. The economic growth, inflation, trade freedom, exchange rate all have unexpected negative coefficients but are statistically insignificant. The results of Patents are amazing. The coefficient for patents is 0.543 and is significant at a 1% level. Patents state that innovative countries have more VC-backed companies. If the log value of patents increases by 1% then the VC-backed countries increase by 0.543%. This suggests the concept of reverse engineering, that local companies learn from the foreign entrants in the long run.

[Please insert Table 4.6 about here]

6 Conclusion and Discussion

In VC literature, a few studies discussed the macroeconomic determinants of VC investment in the European and US context. Therefore, the extant literature is convergent that GDP, interest rates, and inflation rates impact the VC investment (Jeng and Well, 2000; Groh et al., 2016). The extant literature also documents that firm specific variables and investment environment specific variables also impact the VC activity. For example, countries characterized by well-developed stock markets tend to develop robust VC markets (Black and Gilson, 1998).

Nevertheless, the extant literature is silent regarding the impact of cross-border capital flows i.e., foreign direct investment on venture capital activity. This study tried to explore the impact of

foreign direct investment on venture capital investment. FDI not only bring capital but also a bundle of non-financial assets among themselves like technology, skilled labor and modern tools and techniques of doing businesses. Therefore, by employing PMG and MG estimators, we studied a panel of 7 Asian Developing countries during the period 2000 to 2018. We concluded that in the short run, FDI negatively but not significantly affects venture capital investment whereas in the long run FDI positively impact the VC investment in terms of dollar amount investment. Our results state that a 10 % increase in FDI leads to a 6.19% increase in VC investment. Secondly, we investigated the impact of FDI on new firm entry. The log of FDI increases by 1 % the log of new entry of VC-backed companies rises by 0.66% in the long run. The other finding interesting find is that innovative countries tend to develop more robust VC activity. The countries with a higher number of patents have higher VC investments; the possible reason could be that VC capitalists generally invest in high-tech and innovative entrepreneurial firms. It is interesting to note that the economic growth rate negatively impacts venture capital investment in the long run. The contemporaneous growth rate positively impacts the VC investment.

Therefore, the results indicate the concept of creative destruction. The concept of creative destruction was alluded to by Joseph Schumpeter in 1942. This oxymoron phrase ‘creative destruction’ suggests that innovative firms and products replace the non-innovative firms and products and hence leading to destruction. Subsequently, the positive spillovers from innovative firms create an environment where both existing and new firms need to do more investments and engender more sources of spillovers. This phenomenon gives birth to a virtuous cycle. In this regard, our results suggest that, initially, FDI casts negative impacts and substitutes domestic industry. Over time, complementarity effects develop between the domestic VC industry and foreign entrants. Therefore, our results indicate that in the short run FDI displaces VC investment due to the competition effect and market stealing effect. In the long run, positive externalities and spillover effects overcome negative spillover effects; and local VC investment tends to crowd in due to reverse engineering and contagion effect. Our results second that in the long run it gives rise to a complementarity effect due to linkage effect and employ mobility.

This article contributes to the literature by analyzing a new driving factor of VC investment, namely FDI. Second, we rely on a unique sample of seven Asian developing countries, a geographical area where VC activity is expanding rapidly. Third, controlling for both FDI and

macroeconomic determinants of VC investment, we address the methodological limitation of previous studies by using a panel model with a heterogeneous slope that is robust to cross-sectional dependency and potential endogeneity. We rely on the Autoregressive Distributive distributed Lag (ARDL) model using the PMG estimator by Pesaran *et al.* (1999) and the MG estimator of Pesaran and Smith (1995) to capture both short term and long-run effects of FDI on VC domestic investment.

This study has policy implications. Policymakers should create a business-friendly environment in the host country to attract foreign direct investments. It has dual advantages: on the one hand, FDI contributes to the domestic economy by creating jobs and employment for the local populace, and on the other hand, FDI crowds in domestic entrepreneurship and investments. This complementarity effect engenders a virtuous cycle, particularly for the developing economies which are capital hungry.

This study is not free from limitations. FDIs can be classified into two components i.e., Greenfield FDIs and Brownfield FDIs. In Greenfield FDIs, foreign entrants start a business from the scratch and in Brownfield FDI, foreign entrants merge or acquire an already existing business. These two types of capital flows have different dynamics. Hence, We faced data limitations so we relied on the aggregate inward FDIs. Similarly, venture capital investments could be split into early-stage investments and mature stage investments like expansion, later, and buy-out stages. Early stages have different sensitivities as compared to later stages. In the same vein, the typology of VC firms also impacts the VC investments like Government Venture Capital (GVC) backed companies have different sensitivities as compared to independent and private backed companies (Jeng and Well, 2000). Albeit Thomson Banker One neither provide a breakup of aggregate investments stagewise and nor the aggregate investments according to the typology of the firms. Therefore, we relied on the aggregate investments of all the stages and from all the types of VC firms.

We suggest some future directions for the research. This research could further dig deep with enriched and nuanced data like the VICO database which provides venture capital investments for Europe⁴¹. The impact of foreign capital flows could be checked separately for early stages and

⁴¹ “VICO is a research project, funded by the 7th Framework Programme of the European Commission (theme SSH-2007-1.2.3 – Grant Agreement 217485) aiming to assess the impact of VC investments on the economic performance

mature stages. Similarly, the impact of foreign capital flows could be checked on public and private venture capital investments. M&A (Brownfields) and Greenfield FDI have different dynamics and they could impact the VC industry differently.

of entrepreneurial firms in Europe as reflected by their innovation rates, employment creation, growth, investments and efficiency, and the role which VC investors play in helping these firms bridge their resource and competence gaps. The project involved 9 research centers from 7 European countries: Armines – Ecole des Mines de Paris (France), Politecnico di Milano (Italy), Università Carlo Cattaneo (Italy), Research Institute of the Finnish Economy (Finland), Centre for European Economic Research (Germany), Universidad Complutense de Madrid (Spain), University College London (United Kingdom), Vlerick Leuven Management School (Belgium), Ghent University (Belgium)” as quoted in Bertoni and Martí (2011).

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Appendix

Table 4.1: Variables index

| Variables | Description | Sources |
|----------------------|---|---|
| VC Investment | The aggregate value of Venture Capital Investment in current USD. We take the log natural of the variable in the regression | Thomson One Banker |
| Entry | The aggregate number of new portfolio companies receiving their first investment from VC firms. We used the log value in regression. | Thomson One Banker |
| FDI | it is defined as the net inward FDI flow in a certain country in a certain year. We take the log value in the regression. | World development indicators and UNCTAD (2019) |
| Economic Growth rate | The economic Growth rate is defined as the Real GDP Growth rate of the country per annum | World development indicators and Statistical Yearbook of Taiwan (2019) |
| Inflation | It is defined as a percentage change in the consumer price index (CPI). | World development indicators and Statistical Yearbook of Taiwan (2019) |
| Exchange rate | It is defined as the currency rate of the host country per unit USD. | World development indicators and Statistical Yearbook of Taiwan (2019) |
| Patent application | It is defined as the total number of patent applications registered by the residents and non-residents in a given year in a given country. We take the log value in the regression. | World development indicators and Intellectual Property Office Ministry of Economic Affairs Republic of China Taiwan |
| Trade Freedom | It is proxied by the Trade freedom index (TFI). It is a composite measure of the absence of trade hurdles like tariffs and quotas which hinder trade (imports and exports) across countries. The index ranges from 0 to 100 where the country with 0 has the least trade freedom while 100 shows the highest freedom. | The Global Economy |

Table 4.2: Descriptive statistics

| | N | St Dev | Median | Mean | Min | Max |
|-------------------------------|----------|---------------|---------------|-------------|------------|------------|
| VC Investment (Million USD) | 131 | 9830 | 266 | 3120 | 368000 | 76200 |
| ln VC Investment | 131 | 2.516 | 19.4 | 19.386 | 12.816 | 25.057 |
| Entry (No of Companies) | 132 | 296.306 | 31.5 | 160.758 | 1 | 1819 |
| ln Entry (ln No of Companies) | 132 | 1.69 | 3.481 | 3.774 | .693 | 7.507 |
| ln FDI | 132 | 1.415 | 23.098 | 23.358 | 18.558 | 26.396 |
| GDP Growth (%) | 133 | 3.057 | 5.391 | 5.409 | -1.6 | 14.526 |
| Inflation (%) | 133 | 2.38 | 2.027 | 2.577 | -.9 | 11.989 |
| Exchange Rate | 133 | 389.088 | 31.23 | 179.444 | 1.25 | 1290.995 |
| Trade Freedom | 133 | 14.964 | 75 | 72.414 | 20 | 90 |
| Patents | 133 | 259000 | 36812 | 123000 | 1937 | 1542002 |
| Patents log | 133 | 1.613 | 10.514 | 10.404 | 7.569 | 14.249 |

Table 4.2 reports the descriptive statistics. All the variables are defined in Table 4.1.

Table 4.3: Pearson correlation matrix of the variables

| Variables | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
|-----------------------------|------------|------------|------------|------------|------------|------------|------------|------------|
| (1) ln VC Investment | 1.000 | | | | | | | |
| (2) Entry | 0.904* | 1.000 | | | | | | |
| (3) ln FDI | 0.656* | 0.626* | 1.000 | | | | | |
| (4) Growth | 0.361* | 0.420* | 0.505* | 1.000 | | | | |
| (5) Inflation | 0.209* | 0.311* | 0.215* | 0.226* | 1.000 | | | |
| (6) Exchange Rate | 0.138 | 0.239* | -0.120 | -0.188* | 0.013 | 1.000 | | |
| (7) Trade Freedom | -0.262* | -0.373* | -0.011 | -0.279* | -0.362* | -0.044 | 1.000 | |
| (8) ln Patents | 0.660* | 0.697* | 0.416* | 0.179* | 0.027 | 0.404* | -0.086 | 1.000 |

* Shows significance at the .05 level. All the variables are defined in Table 4.1

Table 4.4: IPS (2003) unit root test results

| Variables | At Level | | At First Difference | |
|------------------|------------------------|------------------------|------------------------|------------------------|
| | Without Trend | With Trend | Without Trend | With Trend |
| Ln VC Investment | -2.0366** (0.0208) | -2.9340*** (0.0017) | -8.3863*** (0.0000) | -7.0483*** (0.0000) |
| Entry | 0.2154 (0.5853) | -0.7255 (0.2341) | -5.5382*** (0.0000) | -4.4577*** (0.0000) |
| Ln FDI | -2.2969** (0.0108) | -2.3678*** (0.0089) | -7.3407*** (0.0000) | -5.8613*** (0.0000) |
| GDP Growth | -3.6638*** (0.0001) | -3.6874*** (0.0001) | -8.3703*** (0.0000) | -6.7337*** (0.0000) |
| Inflation | 2.4086** (0.0080) | -0.7549 0.2252 | -8.9175*** (0.0000) | -7.6568*** (0.0000) |
| Exchange Rate | -0.8920 (0.1862) | 0.2626 (0.6036) | -3.3266*** (0.0004) | -2.3692*** (0.0089) |
| Trade Freedom | 1.1965 (0.8842) | 1.4684 (0.9290) | -4.4225*** (0.0000) | -3.4747*** (0.0003) |
| Patents log | -1.1774 (0.1195) | -1.5260* (0.0635) | -5.2117*** (0.0000) | -4.5046*** (0.0000) |

*, **, *** show significance at the 0.01, .05 and 0.10 level respectively. The values in parenthesis show the p values. All the variables are defined in Table 4.1.

Table 4. 5: MG and PMG estimators for market-level additionality

| | PMG Estimator | | MG Estimator | |
|-------------------------------|----------------------------------|---------|--------------|---------|
| Long Run Coefficients | | | | |
| Ln FDI | 0.619*** | (2.67) | 1.853* | (1.93) |
| Growth | -0.213*** | (-3.17) | -0.549 | (-1.45) |
| Inflation | -0.107*** | (-3.77) | -0.682 | (-1.59) |
| Exchange Rate | 0.00194 | (0.66) | 0.242 | (0.29) |
| Trade Freedom | 0.0367*** | (2.73) | -0.0759 | (-0.88) |
| Ln Patents | 0.407 | (1.39) | 0.780 | (0.65) |
| Short Run coefficients | | | | |
| ECT | -0.707*** | (-3.52) | -1.315*** | (-7.01) |
| Ln FDI | -0.0883 | (-0.39) | -0.478 | (-1.28) |
| Growth | 0.0643*** | (2.62) | 0.183 | (1.08) |
| Inflation | 0.0251 | (0.54) | -0.294* | (-1.83) |
| Exchange Rate | -0.707 | (-1.15) | -1.339 | (-0.78) |
| Trade Freedom | -0.0342 | (-0.51) | 0.00520 | (0.06) |
| Ln Patents | 1.908 | (1.59) | 4.380** | (1.96) |
| Cons | -0.612 | (-0.93) | -30.66 | (-1.52) |
| Log Likelihood | -113.4438 | | | |
| No of Observations | 121 | | | |
| Hausman Test | Chi-square=2.342 P-value (0.886) | | | |

Results are estimated using Pooled Mean Group and Mean Group estimators. Table 4.5 depicts both long-run and short-run parameters. The dependent variable is the log natural of domestic Venture capital investment. The Independent variable is the log inward FDI. Growth is the real GDP growth rate. Inflation is the change in the consumer price index. The exchange rate is the rate of change of local currency per USD. Trade freedom is the freedom index. The patent is the log of the number of Patents. An ARDL of (1 0 1 1 1 0 1) is used by the AIC criterion. Hausman's test shows PMG is the efficient estimator. T stats are shown in parenthesis; *, **, and *** indicate significance at 10 %, 5 % and at 1% respectively.

Table 4. 6: MG and PMG estimators of enterprise-level additionality

| | PMG Estimator | | MG Estimator | |
|-------------------------------|--|---------|--------------|---------|
| Long Run Coefficients | | | | |
| In_FDI | 0.660*** | (3.08) | 3.022 | (1.62) |
| Growth | -0.00255 | (-0.05) | -0.621 | (-1.06) |
| Inflation | -0.00188 | (-0.05) | -0.785 | (-1.24) |
| Exchange_Rate | -0.00855 | (-0.82) | 0.492 | (0.57) |
| Trade_Freedom | -0.000728 | (-0.05) | -0.199** | (-2.01) |
| Patents_log | 0.543** | (2.19) | 0.0509 | (0.02) |
| Short Run coefficients | | | | |
| ECT | -0.304*** | (-4.86) | -0.655*** | (-2.94) |
| In_FDI | -0.0735 | (-1.10) | -0.0224 | (-0.10) |
| Growth | -0.00974 | (-0.43) | -0.107 | (-1.43) |
| Inflation | -0.0230 | (-0.65) | -0.0345 | (-0.35) |
| Exchange_Rate | 0.249 | (1.11) | 0.514 | (1.49) |
| Trade_Freedom | 0.000115 | (0.02) | -0.00164 | (-0.05) |
| Patents_log | -0.0101 | (-0.03) | -0.281 | (-0.29) |
| Constant | -5.013*** | (-4.65) | -1.086 | (-0.07) |
| Log-Likelihood | -6.08123 | | | |
| Hausam test | Chi-square test value= 3.962 p-value (0.682) | | | |
| N | 122 | | | |

Results are estimated using Pooled mean group, mean group estimators. Table 4.6 depicts both long-run and short-run parameters. The dependent variable Entry is the log entry of new VC-backed entrepreneurial firms. The Independent variable is the log inward FDI. Growth is the real GDP growth rate. Inflation is the change in the consumer price index. The exchange rate is the rate of change of local currency per USD. Trade freedom is the freedom index. The patent is the log of the number of Patents. An ARDL of (1 0 0 1 0 0 0) is used by AIC criterion. Hausman's test shows PMG is the efficient estimator. T stats are shown in parenthesis; *, **, and *** indicate significance at 10 %, 5 % and at 1% respectively.

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General Conclusion

General Conclusion

Venture capital (VC) is a well-suited and appealing form of financing for young and innovative companies in modern-day knowledge-based economies. However, VC firms are heterogeneous in several dimensions like structure, governance, value addition, and objectives. The most prevalent form of VC firm is Independent Venture Capital (IVC) and their primary motive is the profit maximization of the investors. On the other hand, captive VC firms emerged in the recent past. They are backed by parent organizations that provide them with financial, administrative, and technical support. For example, Government Venture Capital (GVC) firms are established by governments to sustain the economy, create employment, and foster regional development among other stately mandates. Similarly, Corporate Venture Capital (CVC) firms are the investing arms of established corporations and strive for strategic dividends by gaining on a window to new technology. Therefore, it is well established in the extant literature that VC types significantly determine their investment behavior and patterns, and subsequently, impact the performance of their portfolio companies. Consequently, the performance of VC-backed companies has been a heated debate among academia and practitioners, and chapter 2 and 3 of the thesis aimed at contributing to the issue in the specific context of developing Asia. Moreover, key drivers of VC activity is another rich strand of existing literature: many papers well documented that macro-economic indicators, firms' variables and environment specific variables greatly impact VC activity. Chapter 4 of the thesis attempted to focus on a novel key driver of VC domestic activity, namely Foreign Direct Investment (FDI).

Our first essay (chapter 2) challenged the underperformance hypothesis of GVC – by comparison with IVC firms - mostly confirmed in previous studies. These original results suggest that GVC behavior may not be driven by a problem of screening due to a lack of skills or incitation, but by the choice to bear the risk in this early stage, thus assuming the economic role of stimulating local industry and filling a financing gap for entrepreneurial firms. In our sample, GVC firms seem to be skilled in identifying promising ventures and do so by investing in mature and later stages, thus exhibiting higher exit performance than IVC firms. Finally, when GVC and IVC firms are mixed in syndication, they perform better than standalone companies or pure IVC syndication. We attribute this overperformance of GVC to the prevalent role of social ties in developing Asia, as

pointed out by Bruton et al. (2003, 2004): more specifically, we relied on the idea that GVC-backed ventures receive preferential responses and patronage from state institutions in the expansion stage and later stage and overcome the structural weaknesses of financial markets experienced in the early stage.

Our second essay (chapter 3) provides a comparison between two types of captive VC firms, namely GVC and CVC, regarding investment behavior, exit choice, and exit performance in developing Asia. Previous literature mainly focused on a comparison of the exit performance of CVC-backed with IVC-backed companies. Both types of captive VC firms possess its advantages and drawbacks: GVCs firms enjoy strong connections with state institutions and public servants, while CVC firms enjoy the distinctive and specialized assets and connections of the parent corporations. Managers of GVC firms are government servants who lack the knowledge of deal selection and industry expertise. In contrast, managers of CVC firms are corporate executives who possess a sound knowledge of the parent corporations' resources. Therefore, it was difficult to have an *a priori* expectation about the exit performance of CVC-backed firms in comparison with GVC-backed companies, and it remained an empirical question if GVC firms outweigh CVC firms in nurturing their portfolio companies to successful exit or vice versa. We first showed that CVC firms are more likely to invest in high-tech companies as compared with GVC firms. We further showed that GVC-backed firms are more likely to exit through Initial Public Offerings (IPO), as compared with CVC-backed companies, in developing Asia. These results provide support to the idea developed in Chapter 2 that, due to strong social ties, government-backed companies might get preferential treatment from the government institutions and might have higher chances of going for an IPO. Overperformance of GVC is not confirmed in this paper, but deserves more investigation in the future. If CVC firms bear the high-tech risk and, in addition, face more constraints to exit via IPO than GVC firms, it raises the question of the evolution of this type of "captive" in developing Asia.

Our third essay (chapter 4) deals with the determinants and key drivers of the VC activity. Extant literature well documented that macro-economic indicators, firms' variables and environment variables greatly impact VC development in several countries and geographical areas. Robust VC industries are characterized by well-developed institutions, such as developed stock markets, thus trade-open countries are more likely to develop VC markets. Nevertheless, the extant

literature is silent regarding the impact of cross-border capital flows like foreign direct investment on the VC activity. We explored the impact of FDI on domestic venture capital investment. We exhibited two interesting results. First, in the short run, FDI displaces VC investment due to the competition effect and market stealing effect. Second, in the long run, positive externalities and spillover effects overcome negative spillover effects, and local VC investment tends to crowd in due to reverse engineering and contagion effects. Our results suggest that, in the long run, it gives rise to a complementarity effect due to the linkage effect and employ mobility. This result brings grasp to the mill of the concept of creative destruction initially defined by Schumpeter (1942).

This thesis is not exempted from limitations. The first series of limitations is related to data and econometric design. Data limitations is the first and foremost challenge that we faced in this research. Accounting measures reflect the true and quantifiable performance of the companies. VC-backed portfolio companies are projects and IRR is the best measure of performance. Nonetheless, private equity and VC-backed firms are exempted to file their returns. Therefore, there is no publicly available data on accounting measures like IRR, Tobin's Q, Return on Assets, Return of Equity of the VC-backed companies. As data limitation is a genuine problem in measuring the actual performance of VC-backed companies, in conformity with existing literature, we proxied performance with the exit outcomes (such as IPO or secondary sales) to overcome this issue. Second, GVC firms are heterogeneous in terms of designs across countries, and the different design potentially affects their performance (Alperovych et al., 2020). However, measuring this heterogeneity in GVCs across countries needs a comprehensive qualitative study. Therefore, measuring the diversity of GVC in terms of design and subsequently incorporating it as a variable is beyond the scope of this thesis. This remains a potential limitation of our study. Third, connections and networks play an integral part in businesses. Co-investing and syndicating are key features of VC networking. Selecting promising ventures and nurturing the ventures are the two key drivers of VC performance, and syndications are likely to impact both. However, some VC firms are more privileged over other VC firms in the networks and enjoy greater access to information. Unfortunately, due to the unavailability of proxies to capture this dimension, we could not control for networking variables in the econometric design. Fourth, despite we have controlled for observable and unobservable characteristics of the portfolio companies and VC firms by employing different econometric tools and techniques, we cannot completely rule out the possibility of selection bias. It could not be said with certainty that different types of VC firms

invest in similar types of firms. The selection effect could lead to biased estimators. Maybe governments pick up the most promising ventures and leave behind only unpromising ventures for the private investors. Thus, the result of the overperformance of GVC-backed companies in Asia may not be due to the value addition effect but to the selection effect.

Despite the previously stated limitations, the implications of our research are important both for policymakers and venture capitalists to better understand what is at stake in VC activity in developing Asia. It seems that GVC firms have a prevalent role and are difficult to circumvent. On our samples and periods, they outperform IVC and CVC in terms of a successful exit in this area. Connections and information sharing with the officials may also allow them to pick up promising investments in spite of more limited expertise, skills and incitations of VC managers in these firms. Second important result is the importance of cooperation between these heterogeneous types of VC: our first essay clearly exhibits better exit performance for mixed syndication by comparison with pure syndication or standalone VC firms. It suggests that IVC firms should not stand alone and that government employees should meet with entrepreneurs to achieve VC success in this area. It also suggests the idea of possible fruitful cooperation between GVC and CVC firms to mitigate respective drawbacks. Lastly, our research also put the focus on the importance of a long term attitude of policymakers regarding VC. For instance, in the first essay (chapter 2), GVC firms sacrifice performance in early stage to better select projects in expansion and mature stage, thus overperforming IVC firms in the whole process. In the third essay (chapter 4), positive long-term effects of FDI on VC activity suggest that policymakers should create a business-friendly environment in the host country to attract foreign direct investments. It has dual benefits: on the one hand, FDI contributes to the domestic economy by creating jobs and employment for the local population; on the other hand, FDI crowds in domestic entrepreneurship and investments. This complementarity effect engenders a virtuous cycle, particularly for the developing economies which are capital hungry.

This thesis has also implications for IVC managers and entrepreneurs. Mix syndication is fruitful for them as well. IVC must syndicate with GVC to gain certification effects, easy access to public offices and resources. This allegiance gives rise to a synergetic effect and results in a 'win-win' situation for both the public and private investors. Regarding entrepreneurs, high-tech investee companies must get funds from CVC to gain an access to special and complementarity

assets and to exit through secondary sales (like M&A), given the likelihood that CVC parent corporation may merge or acquire them. By contrast, entrepreneurial firms that intend to go public must look for GVC funding, as Asian IPO markets are strongly influenced by state institutions and the findings suggest that GVC-backed companies have higher chances of going public. In this way, the entrepreneurs could still hold a grip of the company after going public.

Several research questions remained unexplored, leading to some suggestions for future research. First, as noted earlier in the limitations of the study, GVC firms are heterogeneous in terms of design. Therefore, in future, heterogeneity of GVC firms across countries could be explored in a greater range and depth. This deserves a qualitative study focusing particularly on the differences in design, structure, and governance of GVC firms across countries. Understanding this heterogeneity in GVC firms would help better gauge their performance and dynamics. Second, as mentioned previously, networking plays a phenomenal role in VC success. Hence, network centrality analysis would be an interesting idea to dig further into the matter. How social networks impact the performance of VC firms? A reliance on social networks in the mature stage of investment deserves further investigation to better understand how governments channel public financial resources. The use of data from surveys or interviews like Bruton *et al.* (2003) could be a fruitful research avenue. Our study is constrained to developing Asia, but countries in this area also exhibit GVC heterogeneity. Thus, the effectiveness of GVC programs according to the economic characteristic of the region (see Alperovych *et al.*, 2020) or according to local knowledge (see Zhang and Mayes, 2018) could also be investigated. Finally, our study solely focuses on performance, without consideration of the impact of GVC on the total amount of VC raised from a macroeconomic perspective. A global vision of the effectiveness of GVC should include both the ability to enhance fundraising and the exit success of such deals.