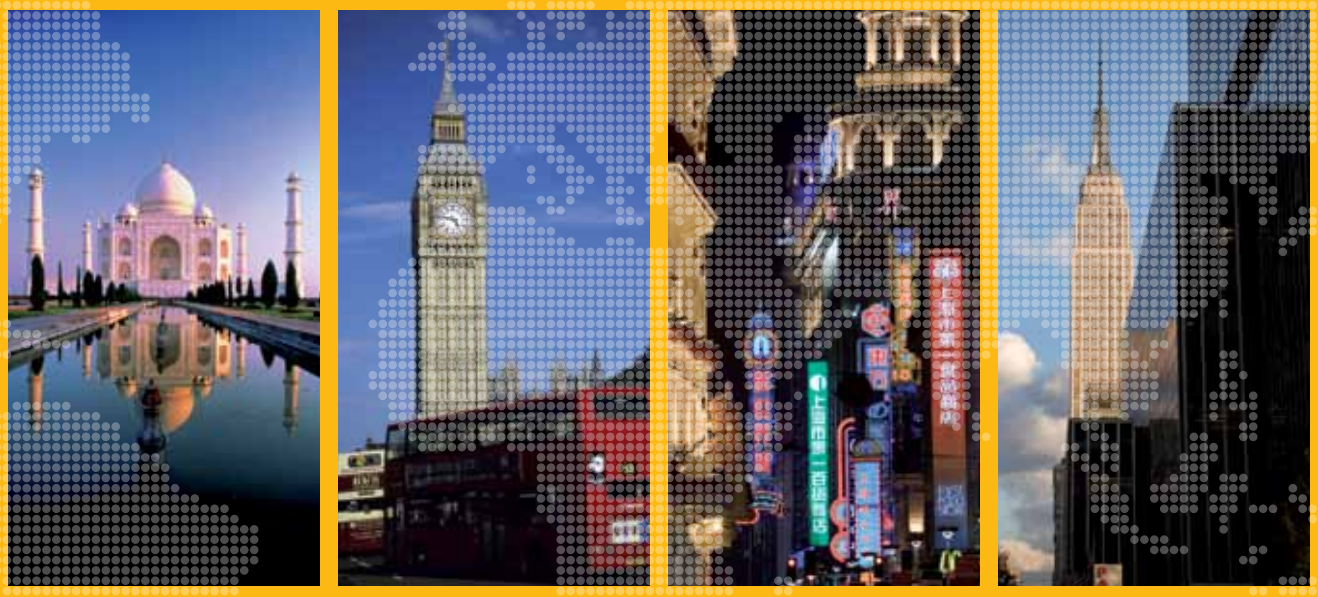
WORLD ECONOMIC FORUM

COMMITTED TO IMPROVING THE STATE OF THE WORLD

Globalization of Alternative Investments

Working Papers Volume 3

The Global Economic Impact of Private Equity Report 2010



The *Globalization of Alternative Investments Working Papers Volume 3: The Global Economic Impact of Private Equity Report 2010* is published by the World Economic Forum. It is the result of collaboration with researchers and faculty at various institutions.

The Working Papers in this volume are the work of the authors and do not represent the views of the World Economic Forum.

World Economic Forum
91-93 route de la Capite
CH-1223 Cologny/Geneva
Switzerland
Tel.: +41 (0)22 869 1212
Fax: +41 (0)22 786 2744
E-mail: contact@weforum.org
www.weforum.org

REF: 151209

World Economic Forum USA Inc.
3 East 54th Street
18th Floor
New York, NY 10022
Tel.: +1 212 703 2300
Fax: +1 212 703 2399
E-mail: forumusa@weforum.org
www.weforum.org/usa

World Economic Forum
Geneva, Switzerland

World Economic Forum USA Inc.
New York, USA

December 2009

Globalization of Alternative Investments

Working Papers Volume 3

The Global Economic Impact of Private Equity Report 2010

Contributors

CO-EDITORS

Anuradha Gurung
Associate Director, Investors Industries, World Economic Forum USA

Josh Lerner
Jacob H. Schiff Professor of Investment Banking at Harvard Business School

RESEARCH TEAM

Lead Academic:

Josh Lerner
Jacob H. Schiff Professor of Investment Banking at Harvard Business School

Research team members:

Shai Bernstein
Doctoral Candidate, Harvard University

James Brander
Asia-Pacific Professor of International Trade and Faculty of Commerce, Sauder School of Business, University of British Columbia

Qianqian Du
Assistant Professor, Shanghai Advanced Institute of Finance (SAIF), Shanghai Jiao Tong University

Thomas Hellmann
B.I. Ghert Family Foundation Professor of Finance and Policy and Director of the W. Maurice Young Entrepreneurship and Venture Capital Research Centre, Sauder School of Business, University of British Columbia

Morten Sørensen
Daniel W. Stanton Associate Professor of Business, Columbia Business School

Per Strömberg
Associate Professor of Finance, Stockholm School of Economics and Director, Swedish Institute for Financial Research

FROM THE WORLD ECONOMIC FORUM

Max von Bismarck
Head of Investors Industries, World Economic Forum USA

Anuradha Gurung
Associate Director, Investors Industries, World Economic Forum USA

Kevin Steinberg
Chief Operating Officer and Head of the Centre for Global Industries (New York), World Economic Forum USA

ADVISORY BOARD

Chair:

Joseph L. Rice, III
Chairman of Clayton, Dubilier & Rice, Inc.

Board Members:

Wim Borgdorff
Managing Partner, AlpInvest Partners

James W. Breyer
Managing Partner, Accel Partners

Hareb Al Darmaki
Executive Director, Head of Private Equity, Abu Dhabi Investment Authority

Nick Ferguson
Chief Executive, SVG Capital and Chairman, SVG Advisers

Emil W. Henry, Jr
Managing Partner, Tiger Infrastructure Partners and Former Assistant Secretary of the United States Treasury for Financial Institutions

Huh Yong-Hak
Head, Direct Investment Division, Reserves Management Department, Hong Kong Monetary Authority

Philip Jennings
General Secretary, UNI Global Union

Michael Klein
Former Chairman and Co-Chief Executive Officer Markets and Banking, Citi Inc.

Joel Kurtzman
Chairman, Kurtzman Group, Senior Fellow, Milken Institute and Senior Fellow, SEI Center for Advanced Studies in Management, Wharton School, University of Pennsylvania

Joncarlo Mark
Senior Portfolio Manager, CalPERS and Chairman, Institutional Limited Partners Association

Dominique Senequier
Chief Executive Officer, AXA Private Equity

Kevin Steinberg
Chief Operating Officer and Head of the Centre for Global Industries (New York), World Economic Forum USA

David Swensen
Chief Investment Officer, Yale University

Mark Wiseman
Senior Vice President, Private Investments, CPP Investment Board

John Zhao
Chief Executive Officer, Hony Capital

Contents

Preface

KEVIN STEINBERG
Chief Operating Officer
World Economic Forum USA

MAX VON BISMARCK
Director, Head of Investors Industries
World Economic Forum USA

The World Economic Forum is proud to release this third volume of Working Papers from our Globalization of Alternative Investments project. Building on the prior two volumes, we hope that these Working Papers will provide further insight into the global economic impact of alternative asset classes such as private equity and venture capital.

In the first volume of Working Papers in this series, we noted that through recent years alternative investment asset classes have become increasingly important pools of capital in the global financial system. The total value of firms (both equity and debt) acquired in leveraged buyouts, for example, is estimated to be US$ 3.6 trillion from 1970 through 2007, of which US$ 2.7 trillion-worth of transactions occurred between 2001 and 2007. Private equity has also grown tremendously in global reach, such that a majority of transactions now take place outside the United States. The first volume of Working Papers focused on the evolution of the private equity industry since the 1980s, covering the demography of private equity investments and their impact on innovation, employment and corporate governance. The work was complemented by six case studies. The second volume examined management practices adopted by private equity firms at portfolio companies, the impact of private equity on labour productivity, the impact of private equity investment on employment in France and the demography of private equity in emerging markets.

Over the past year we have witnessed the most serious global financial and economic crisis since the 1930s. While significant progress has been made by governments to stabilize markets, important challenges remain. Governments find themselves transitioning from a focus on crisis containment to a focus on reviving economic growth and ensuring systemic risk is substantially reduced going forward. Given global concerns about systemic risk, job creation and government investments, the research undertaken in this third volume of Working Papers is being released at a very opportune time.

The first paper focuses on the question of whether private equity investments in an industry affect aggregate growth and cyclicality. The second paper examines the record of government support for venture capital in terms of value creation, employment and innovation.

As was the case for prior volumes, this report is the culmination of a year-long partnership between leading international scholars, industry practitioners, other distinguished experts and stakeholders, and our organization. The core research team, led by Josh Lerner, Jacob H. Schiff Professor of Investment Banking at Harvard Business School, included:

- Shai Bernstein, Harvard University
- James Brander, Sauder School of Business, University of British Columbia
- Qianqian Du, Shanghai Advanced Institute of Finance (SAIF), Shanghai Jiao Tong University
- Thomas Hellmann, Sauder School of Business, University of British Columbia
- Morten Sørensen, Columbia Business School
- Per Strömberg, Stockholm School of Economics and Swedish Institute for Financial Research (SIFR)

In a matter of only 10 months, this group oversaw the two analytic studies.

On behalf of the World Economic Forum the project was expertly led by Anuradha Gurung, who oversaw the prior years' efforts. She served as both the project manager as well as the co-editor of this volume together with Josh Lerner. Her efforts continue to be a key driver of the project's success.

Intellectual stewardship and guidance was provided by an actively involved Advisory Board, chaired by Joe Rice, Chairman of Clayton, Dubilier & Rice, Inc. An illustrious group of experts completed the Advisory Board, including:

- Wim Borgdorff, AlpInvest Partners
- James W. Breyer, Accel Partners
- Hareb Al Darmaki, Abu Dhabi Investment Authority
- Nick Ferguson, SVG Capital plc
- Emil W. Henry, Jr, Tiger Infrastructure Partners and Former Assistant Secretary of the United States Treasury for Financial Institutions
- Huh Yong-Hak, Hong Kong Monetary Authority
- Philip Jennings, UNI Global Union
- Michael Klein, former Chairman and Co-Chief Executive Officer Markets and Banking, Citi Inc.
- Joel Kurtzman, Kurtzman Group, Milken Institute and SEI Center for Advanced Studies in Management, Wharton School

- Joncarlo Mark, CalPERS and Chairman, Institutional Limited Partners Association
- Dominique Senequier, AXA Private Equity
- Kevin Steinberg, World Economic Forum USA
- David Swensen, Yale University
- Mark Wiseman, CPP Investment Board

While not necessarily endorsing any of the specific conclusions reflected in the analyses, the Board provided detailed feedback, and helped ensure the integrity of the work by acting as a sounding board for the independent academics. The opinions herewith are solely the views of the authors and do not reflect the opinions of the Advisory Board or the World Economic Forum.

The research was undertaken as part of the Globalization of Alternative Investments project, which was mandated by the World Economic Forum's Investors Industry Partnership. The Investors Industry Partners are leading global companies that are actively involved in the World Economic Forum's mission and include top companies from private equity, hedge funds, venture capital, institutional investors and sovereign wealth funds. Their contributions and intellectual input to the research as well as to related discussions throughout the past year has been much appreciated.

This third volume of Working Papers is being launched in conjunction with our Annual Meeting in Davos-Klosters 2010, where two key tracks of the meeting will focus on how to strengthen economic and social welfare and how to mitigate global risks and address systemic failures. In this context, the Forum will release several reports on related issues – from rethinking risk management in financial services to restoring trust and confidence in financial institutions.

On behalf of the World Economic Forum, we thank all involved in creating this third volume of Working Papers. We appreciate their tremendous contributions to this valuable work, and relay our earnest hope they will continue their involvement in our future efforts. We also hope that this research will not only advance the academic understanding of the economic impact of alternative investments, but serve as a catalyst for further public discourse.

Letter on behalf of the Advisory Board

JOSEPH L. RICE, III
Chairman, Clayton, Dubilier & Rice, Inc.
Chair of the Advisory Board for the World Economic Forum
Globalization of Alternative Investments Project

Private capital is now front and centre in the ongoing examination of the global financial system. In this context, the World Economic Forum-sponsored research initiative that focuses on measuring the economic impact of private capital could not be more timely. Now in its third year, the research undertaken by some of the world's leading business and finance scholars provides government policy-makers with an authoritative analytical foundation that will permit informed policy decisions.

This year's effort examines two very different topics: the impact of private equity on industry performance and cyclicality, and the record of governments as venture capital investors. The first paper will inform the debate on systemic risk while the latter provides guidance to governments seeking to promote entrepreneurship. Taken in conjunction with the work of the previous two years, a very different picture emerges than might be painted by those strongly supporting private equity or those strongly opposed to it. In fact, the results are mixed. The challenge for the legislative bodies is to adopt policies that promote its beneficial aspects and not its harmful ones. We believe the effort in its entirety will help them do that.

As with the first two volumes of the Forum's Working Papers, the members of the Advisory Board, who include distinguished international experts representing labour, industry, finance and pensioners, do not necessarily endorse all of the conclusions reflected in the write-ups. Indeed, certain of the conclusions do not accord with the practical experience of certain members of the Advisory Board. Nevertheless, the breadth of the subject matter and sheer scale of the data analysed make this research effort among the most comprehensive ever undertaken on private equity and venture capital. The academic team, once again led by Josh Lerner of Harvard Business School, was diligent and open-minded in soliciting the counsel of the Advisory Board about avenues for additional research and analysis, but the final work product appropriately represents the independent findings and conclusions of the academics.

On behalf of the Advisory Board, I would like to thank the academic team for their important contributions.

Executive Summary

ANURADHA GURUNG
World Economic Forum, USA

JOSH LERNER
Harvard Business School

INTRODUCTION

The recent financial crisis has resulted in a heightened interest on the part of policy-makers to understand the impact of both traditional financial institutions, such as banks and insurance companies, and alternative investment asset classes, such as private equity and venture capital, on the global economy.

Policy-makers are understandably concerned about systemic risk and the role that governments can play to ensure both stable economic development and growth. As governments worldwide rethink their approach to regulating financial institutions, understanding the significance and impact of alternative investment asset classes, such as private equity and venture capital, is integral.

Private equity and venture capital have both become far more important around the world in recent years, yet our understanding of both these asset classes remains relatively limited.

RESEARCH PROJECT OVERVIEW

This volume is part of a series of Working Papers that commenced in 2007 under the auspices of the World Economic Forum's project on the Globalization of Alternative Investments to provide a fact-based look at the global economic impact of private equity (with this volume, the focus is expanded to include venture capital as well). The project brought together a team of international scholars to conduct in-depth analysis of the impact of the private equity industry and its transactions. Prior to the launch of the research effort, existing literature on private equity had primarily focused on a relatively small number of transactions in the US and the UK conducted in the 1980s.

For the purposes of the research project, private equity is defined as investments by professionally managed partnerships that involve leveraged buyouts (LBOs) or other equity investments with a substantial amount of associated indebtedness. Venture capital, on the other hand, is dominated by equity investments in start-ups or growing firms.

The first volume of the Working Papers (Globalization of Alternative Investments, Working Papers Volume 1: The Global Economic Impact of Private Equity Report 2008), published in January of 2008, studied the evolution of the private equity industry since the 1980s by including large-sample studies that covered the following broad topics: a) the demography of private equity investments, b) the willingness of private equity-backed firms to make long-term investments, c) the impact of private equity activity on employment and d) the post-acquisition governance practices utilized by private equity firms. The research team complemented these studies with a variety of case studies, which examined these issues and others across a variety of geographies, with a particular emphasis on Germany, the UK and emerging private equity markets such as China and India.

These Working Papers found that:

- The substantial periods that firms remain under private equity control, the robust long-run investments in innovation as measured by patents and the flexible governance structures (with small boards dominated by managers and investors) appear consistent with the view that the LBO organizational form is a long-run governance structure for many firms.
- The employment study had mixed results. The evidence supports neither the apocalyptic claims of extensive job destruction nor arguments that private equity funds create large amounts of domestic employment. The study suggested that employment falls more rapidly at target establishments post-transaction. At the same time, private equity targets engage in more greenfield job creation than controls. Private equity also accelerates the pace of acquisitions and divestitures. These results regarding private equity's impact on employment – as well as those in the innovation study – fit the view that private equity groups act as catalysts for change in the economy.
- Although LBO transactions outside of North America and Western Europe only accounted for approximately 13% of global LBO transactions in number and 7% in value over the period from 2001 to 2007, private equity activity in emerging economies was expanding and maturing, particularly for minority and growth capital investments. As illustrated by the case studies, there were different sets of dynamics in place for domestic and global private equity players in China and India.

In January 2009, the second volume of Working Papers (Globalization of Alternative Investments, Working Papers Volume 2: The Global Economic Impact of Private Equity Report 2009) complemented the first by examining: a) management practices adopted by private equity firms at portfolio companies, b) the impact of private equity activity on labour productivity, c) the impact of private equity

investment on employment and productivity in France and d) the demography of private equity in emerging markets.

These Working Papers found that:

- Private equity-owned firms are on average the best-managed ownership group, are mostly well-managed and have strong operational management practices.
- In the first two years after private equity transactions, productivity grows on average by about two percentage points more at target firms than at controls and productivity gains at both targets and controls are shared with workers in the form of higher wages.
- In France, private equity funds act as an engine of jobs, productivity and asset growth for small and medium-sized firms.
- Although emerging markets only account for a small share of private equity activity, the share is increasing. While financial and governance engineering matter for private equity activity, operational engineering seems to matter the most as private equity activity is more apparent in countries that have less corruption and better financial markets infrastructures.

This volume of Working Papers expands on the previous two volumes by focusing on:

- The relationship between the presence of private equity investments in an industry and the growth rates of productivity, employment and capital formation.
- The record of government support for venture capital in terms of value creation, employment and innovation.

A key choice made at the outset of the project, given the tight one-year time frame for the research, was to draw on already existing databases about the private equity and venture capital industries (such as Asian Venture Capital Journal database, SDC Platinum, Capital IQ, Dealogic and VentureXpert), as well as information from complementary databases compiling information on such activities as industry and firm performance, rather than developing new material from the original records of the groups.

1. Key findings: Private equity, industry performance and cyclicality study

This paper looks at the macroeconomic impact of private equity by focusing on its impact on industry performance and cyclicality. This study examines the impact of private equity investments across 20 industries in 26 major OECD nations between 1991 and 2007.

The main goal of the study is to determine whether private equity investments in an industry affect aggregate growth and cyclicality. In particular, the researchers look at the relationship between the presence of private equity investments and the growth rates of productivity, employment and capital formation.

Among the key findings are the following:

- Industries where private equity funds have been active in the past five years grow more rapidly than other sectors, whether measured using total production, value added or employment. In industries with private equity investments, there are few significant differences between industries with a low and high level of private equity activity.
- Activity in industries with private equity backing appears to be no more volatile in the face of industry cycles than in other industries, and sometimes less so. The reduced volatility is particularly apparent in employment.
- The aforementioned patterns continue to hold in continental Europe, where concerns about these investments have been most often expressed.
- It is unlikely that these results are driven by reverse causality, i.e. private equity funds selecting to invest in industries that are growing faster and/or are less volatile. The results are essentially unchanged if we only consider the impact on industry performance of private equity investments made between five and two years earlier.

2. Key findings: Governments as venture capitalists: Striking the right balance study

Governments from London to New Delhi are increasingly active in adopting policies to promote venture capital. This paper assesses the record of government support for venture capital through three different channels:

1) the direct provision of venture capital through government-owned venture capital funds (which the authors term full GVC);
2) government investment in independently managed venture capital funds (partial GVC); and
3) the provision of subsidies or tax concessions to venture capitalists (indirect GVC).

The researchers analysed over 28,800 enterprises (based in 126 different countries) that received venture capital funding in the 2000-2008 period. The enterprises cover a wide range of industries but are dominated by high-technology firms. The performance of enterprises financed by some form of government venture capital was compared with those supported by private venture capitalists in order to determine the impact of public involvement on performance.

The key findings illustrate that:

- Enterprises with moderate government venture capital (GVC) support outperform enterprises with only private venture capital (PVC) support and those with extensive GVC support, both in terms of value creation and patent creation.
- GVC performance appears to differ markedly, with GVCs associated with national governments and international organizations having stronger performance than those associated with sub-national (e.g., state and provincial) government.
- Partial GVCs and indirect GVCs exhibit stronger performance than full (i.e. government-owned) GVCs.

Putting it all together

Private equity and venture capital funds are attracting increased interest from policy-makers, albeit for different reasons. These two papers provide insight to policy-makers on the impact of private equity and venture capital respectively around the world. The findings illustrate that:

- Industries with private equity activity experience growth more rapidly (as measured by total production, value added and employment) and are no more volatile in the face of industry cycles than other industries. In some cases, industries with private equity activity are less volatile (as evidenced in terms of employment).
- Modest levels of direct government venture capital support and indirect encouragement (e.g., through subsidies and tax concessions), in conjunction with private financing, could potentially augment the performance of young enterprises. Public support seems most effective when provided at a national or international organization level.

The Working Papers presented in this volume, together with the previous two years' research, are intended to build a better understanding of private equity and venture capital, which can serve as a foundation for the implementation of sound public policy measures with respect to this asset class.

Part 1

Private equity, industry performance and cyclicality

Private equity, industry performance and cyclicality*

SHAI BERNSTEIN
Harvard University

JOSH LERNER
Harvard University and National Bureau of Economic Research (NBER)

MORTEN SØRENSEN,
Columbia Business School, NBER and Swedish Institute for Financial Research (SIFR)

PER STRÖMBERG
Stockholm School of Economics, SIFR, NBER and Centre for Economic Policy Research (CEPR).

1. INTRODUCTION

In response to the global financial crisis that began in 2007, governments worldwide are rethinking their approach to regulating financial institutions. Among the financial institutions that have fallen under the gaze of regulators have been private equity (PE) funds (see, for instance, European Commission (2009)). There are many open questions regarding the economic impact of PE funds, many of which cannot be definitively answered until the aftermath of the buyout boom of the mid-2000s can be fully assessed.

This paper addresses one of these open questions, by examining the impact of PE investments across 20 industries in 26 major nations between 1991 and 2007. We focus on whether PE investments in an industry affect aggregate growth and cyclicality. In particular, we look at the relationship between the presence of PE investments and the growth rates of productivity, employment and capital formation. For our productivity and employment measures, we find that PE investments are associated with faster growth. One natural concern is that this growth may have come at the expense of greater cyclicality in the industry, which would translate into greater risks for investors and stakeholders. Thus, we also examine whether economic fluctuations are exacerbated by the presence of PE investments, but we find little evidence that this is the case.

Throughout our analysis we measure the growth rate in a particular industry relative to the average growth rate across countries in the same year. In addition, we use country and industry fixed effects, so that the impact of PE activity is measured relative to the average performance in a given country, industry, and year. For instance, if the Swedish steel industry has more PE investment than the Finnish one, we examine whether the steel industry in these two countries performs better or worse over time relative to the average performance of the steel industry across all countries in our sample, and whether the variations in performance over the industry cycles are more or less dramatic.

Overall, we are unable to find evidence supporting the detrimental effects of PE investments on industries:

- Industries where PE funds have been active in the past five years grow more rapidly than other sectors, whether measured using total production, value added, or employment. In industries with PE investments, there are few significant differences between industries with a low and high level of PE activity.
- Activity in industries with PE backing appears to be no more volatile in the face of industry cycles than in other industries, and sometimes less so. The reduced volatility is particularly apparent in employment.
- These patterns continue to hold when we focus on the impact of private equity in continental Europe, where concerns about these investments have been most often expressed.
- We believe it is unlikely that these results are driven by reverse causality, i.e. PE funds selecting to invest in industries that are growing faster and/or are less volatile. The results are essentially unchanged if we only consider the impact of PE investments made between five and two years earlier on industry performance.

It is important to note that there are a number of limitations to this analysis. First, the question of economic growth and volatility is only one of many questions that regulators must grapple with when assessing the impact of PE investment. Second, we hope to deal more fully with the question of reverse causality in subsequent versions of the study. Finally, it is still too early to assess the consequences of the economic conditions in 2008 and 2009, a period where the decrease of investment and absolute volume of distressed private equity-backed assets was far greater than in earlier cycles.

The plan of this study is as follows: In the second section, we develop the hypotheses to be tested. The third section describes the construction of the dataset and the results are presented in Section 4. The final section concludes.

* We thank the World Economic Forum and Harvard Business School's Division of Research for financial support and members of the Globalization of Alternative Investments project's advisory board for helpful comments. All errors and omissions are our own.

2. INDUSTRY PERFORMANCE AND PRIVATE EQUITY

There are several alternative perspectives that can be offered as to how PE investments can affect the prospects of an industry. In this section, we begin by reviewing the suggestions about changes regarding overall performance; we then turn to hypotheses regarding the interaction between economic cycles and PE investments.

2.A: The impact of PE investments on industry performance

Our initial examination focuses on the performance of industries where PE funds have been active relative to industries where these investors have not been active.

A central hypothesis since Jensen (1989) has been that private equity has the ability to improve the operations of firms. By closely monitoring managers, restricting free cash flow through the use of leverage and incentivizing managers with equity, it is argued, private equity-backed firms are able to improve operations in the firms they back. In this article, Jensen suggested that these leveraged buyouts (LBOs) may not only affect the bought-out firm itself but may also increase competitive pressure and force competitors to improve their own operations. John et al. (1992) present supporting empirical evidence that the threat of takeover serves as a spur for firms to voluntarily undertake restructurings.

The claim that private equity-backed firms have improved operations has been supported by a number of empirical studies, which focus on the effects on the individual private equity-backed companies. Kaplan (1989) examines changes in accounting performance for 76 large management buyouts of public companies between 1980 and 1986. He shows that in the three years after the transaction operating income, cash flow and market value all increase. He argues that these increases reflect the impact of improved incentives rather than layoffs. (Looking at more recent US public-to-private transactions, however, Guo et al. (2009) find only weak evidence that gains in operating performance of bought-out firms exceed those of their peers.) Muscarella and Vetsuypens (1990) examine 72 "reverse LBOs" (RLBOs), that is, companies taken private which went public once again. These firms experienced a dramatic increase in profitability, which they argue is a reflection of cost reductions.

More recent studies have used large samples and a variety of performance measures to more directly assess whether private equity makes a difference in the management of the firms in which they invest. Bloom et al. (2009) survey over 4,000 firms in Asia, Europe and the US to assess their management practices. They show that private equity-backed firms are on average the best-managed ownership group in the sample, though they cannot rule out the possibility these firms were better managed before the PE transaction. Davis et al. (2009) compare all US-based manufacturing establishments that received PE investments between 1980 and 2005 with similar establishments that did not receive PE investments.[1] They show that private equity-backed firms experienced a substantial productivity growth advantage (about two percentage points) in the two years following the transaction. About two-thirds of this differential is due to improved productivity among continuing establishments of the firms. Cao and Lerner (2009) examine the three- and five-year stock performance of 496 RLBOs between 1980 and 2002. RLBOs appear to consistently outperform other IPOs and the stock market as a whole. Large RLBOs that are backed by PE firms with more capital under management perform better, while quick flips – when PE firms sell off an investment soon after acquisition – underperform.

These findings might suggest that we would see superior performance for PE firms, regardless of the economic conditions. Moreover, if PE firms represent a significant fraction of the activity in certain industries (and tabulations in several countries, including the US and UK, suggest that this is the case), there may also be a positive effect at the industry level. Investigating the industry level also allows us to capture the 'contagion' effects arising if improvements in bought-out firms spur their competitors to improve. This effect is not captured by studies focusing on the individual portfolio companies.

While there has been little systematic evidence regarding the deleterious effects of private equity on firms and industries, critics have pointed to case studies that illustrate negative consequences of transactions. For instance, Rasmussen (2008) points to the buyout of Britain's Automobile Association, which led to large-scale layoffs and service disruptions while generating substantial profits for the transaction's sponsor, Permira. The Service Employees International Union has prepared a series of studies (for example, 2007, 2008) showing the deleterious effect that excessive leverage, cost-cutting and poor managerial decisions by PE groups can have on firms and industries through case studies such as Hawaiian Telecom, Intelsat, KB Toys and TDC. These cases suggest that the impact of private equity on industries may be more negative than suggested by the previous studies.

[1] Establishments are specific factories, offices, retail outlets and other distinct physical locations where business takes place.

2.B: The impact of economic cycles

Numerous practitioner accounts over the years have suggested that the PE industry is highly cyclical, with periods of easy financing availability (often in response to the successes of earlier transactions) leading to an acceleration of deal volume, greater use of leverage, higher valuations, and ultimately more troubled investments (akin to the well-known 'corn-hog cycle' in agricultural economics).

This pattern is corroborated in several academic studies. Axelson et al. (2009) document the cyclical use of leverage in buyouts. Using a sample of 1,157 transactions completed by major groups worldwide between 1985 and 2008, they show that the level of leverage is driven by the cost of debt, rather than the more industry- and firm-specific factors that affect leverage in publicly traded firms. The availability of leverage is also strongly associated with higher valuation levels. Kaplan and Stein (1993) documented that the 1980s buyout boom saw an increase in valuations, reliance on public debt and incentive problems (for example, parties cashing out at the time of transaction). Moreover, in the transactions done at the market peak, the outcomes were disappointing: of the 66 largest buyouts completed between 1986 and 1988, 38% experienced financial distress, which they define as default or an actual or attempted restructuring of debt obligations due to difficulties in making payments. 27% actually did default on debt repayments, often in conjunction with a Chapter 11 filing. Kaplan and Schoar (2005) and other papers provide indirect supporting evidence, showing that the performance of funds is negatively correlated with inflows into these funds. Private equity funds raised during periods of high capital inflows – which are typically associated with market peaks – perform far worse than their peers.

These findings corroborate the suggestions that availability of financing impacts booms and busts in the PE market. If firms completing buyouts at market peaks employ leverage excessively, we may expect industries with heavy buyout activity to experience more intense subsequent downturns. Moreover, the effects of this overinvestment would be exacerbated if PE investments drive rivals, not backed by private equity, to aggressively invest and leverage themselves. Chevalier (1995) shows that in regions with supermarkets receiving PE investments, rivals responded by adding and expanding stores.

An alternative perspective is suggested by some recent events in the PE industry, even though it has not been articulated by economic theorists or explored empirically. This suggestion is that private equity-backed firms may do better during downturns because their investors constitute a concentrated shareholder base, which can continue to provide equity financing in a way that might be difficult to arrange for other companies during downturns. To cite two recent examples of 'equity cures,' Terra Firma made a number of investments in EMI, while Kraton Polymers' equity investors (Ripplewood and CCMP) did likewise during the recent recession.[2] This perspective would imply that private equity-backed companies may actually outperform their peers during downturns, as they have access to equity financing that other firms did not have. The presence of liquid PE funds as shareholders may lead to fewer failures in difficult economic conditions.

A related argument, originally proposed by Jensen (1989), is that the high levels of debt in PE transactions force firms to respond earlier and more forcefully to negative shocks to their business. As a result, private equity-backed firms may be forced to adjust their operations more rapidly at the beginning of an industry downturn, enabling them to better weather a recession. Even if some private equity-backed firms eventually end up in financial distress, their underlying operations may thus be in better shape than their peers. This facilitates an efficient restructuring of their capital structure and lowers the deadweight costs on the economy. Consistent with this argument, Andrade and Kaplan (1998) study 31 distressed leveraged buyouts from the 1980s that subsequently became financially distressed, and found that the value of the firms post-distress was slightly higher than the value before the buyout, suggesting that even the leveraged buyouts that were hit most severely by adverse shocks added some economic value.

Finally, the structural differences between PE funds and other financial institutions may make them less susceptible to industry shocks. A major source of concern for financial institutions is the so-called 'run on the bank' phenomenon. Runs occur when holders of short-term liabilities, for example, depositors or repo counterparties, simultaneously refuse to provide additional financing and demand their money back. Other versions of this phenomenon arise when companies simultaneously draw down lines of credit, hedge fund investors simultaneously ask for redemptions of their investments, or a freeze in the market for commercial paper prevents structured investment vehicles (SIVs) from rolling over short-term commercial paper. It is unlikely that PE investments create dangers through this mechanism. Private equity funds are typically prevented from borrowing themselves, and the funds' only claimants are their limited partners (LPs), which are typically bound by 10-year lock-up agreements. Hence, the funds have no short-term creditors that can run. By way of contrast, extensive loans are provided to the individual portfolio companies. However, these loans are typically made by a concentrated set of lenders, and are without recourse to other portfolio companies or the fund generally. Hence, an individual creditor's ability to be repaid is largely unaffected by the actions of other creditors, mitigating the incentive to run.

[2] See Sabbagh (2009) and http://www.sec.gov/Archives/edgar/data/1321730/000119312509171893/d10q.htm (accessed 27 August 2009).

3. DATA SOURCES AND SAMPLE CONSTRUCTION

To analyze how PE investments affect industries, we combine two datasets, one containing information about PE investments compiled by Capital IQ, and another with industry activity and performance across the Organisation for Economic Cooperation and Development (OECD) member countries included in the OECD's Structural Analysis Database (STAN).

PE investment sample: We use the Capital IQ database to construct a base sample of PE transactions. The base sample contains all private placements and M&A transactions in Capital IQ where the list of acquirers includes (at least) one investment firm that has a reported investment interest in one of the following stages: Seed/startup, Early venture, Emerging growth, Growth capital, Bridge, Turnaround, Middle market, Mature, Buyout, Mid-venture, Late venture, Industry consolidation, Mezzanine/subdebt, Incubation, Recapitalization, or PIPES.

From the base sample, we select all M&A transactions classified as 'leveraged buyout,' 'management buyout,' or 'going private' that were announced between January 1986 and December 2007 and where the target company is located in an OECD country included in the STAN database. We exclude transactions that were announced but not yet completed as well as transactions that did not involve a financial investor (for example, a buyout led and executed by the management team itself was excluded).

This results in a sample of about 14,300 transactions, involving 13,100 distinct firms. Since we only have information about the deal size for 50% of our transactions (though more of the larger transactions), we impute missing deal sizes by constructing fitted values from a regression of deal size on fixed effects for country, investment year and target industry. Using the imputed transaction sizes, we generate aggregate country-year-industry measures of PE volume in the form of summed deal sizes.

Industry data: The STAN database provides industry data across OECD countries compiled from national statistics offices. It contains economic information at the country, year and industry level. Thus, a typical observation would be the German transport equipment industry in 1999. STAN includes measures of productivity, employment and capital formation, as described in Table 1. Throughout this paper, we focus on the following measures of industry activity:

- Production (gross output), the value of goods and/or services produced in a year, whether sold or stocked, in current prices.
- Value added represents the industry's contribution to national GDP, i.e. output net of materials purchased. While the methodology for constructing this measure differs across nations, our focus here is on differences across time, which should reduce the effect of national differences in the measure.
- Labor costs, which comprise wages and salaries of employees paid by producers as well as supplements such as contributions to social security, private pensions, health insurance, life insurance and similar schemes.
- Number of employees, which is the traditional measure of employment, excluding self-employed and unpaid family members working in the business.
- Gross capital formation is acquisitions, less disposals, of new tangible assets, as well as such intangible assets as mineral exploration and computer software. This variable is the closest aggregate to capital expenditures. The two capital stock measures are indicators of the value of all capital equipment held. The gross stock measure does not factor in depreciation, while the net stock does reflect write-downs.
- Consumption of fixed capital measures the reduction in the value of fixed assets used in production resulting from physical deterioration or normal obsolescence.

Mapping Capital IQ and STAN industries: Industries in the STAN database are classified by the International Standard Industrial Classification (ISIC) code. To link these data to the industry-aggregated PE activity, we matched the ISIC codes with Capital IQ's industry classifications. We used the existing mapping from Capital IQ industry classification into SIC codes, and then used the existing matching between SIC and ISIC industries. The mapping of Capital IQ industry classifications to SIC codes includes only matches for the most detailed levels of the Capital IQ classifications. This poses a problem for more aggregated industries for which Capital IQ does not provide a match to a SIC and ultimately to ISIC. When the Capital IQ target industry is at a more aggregated industry level, we mapped all four-digit SIC codes that belong to the sub-categories of the industry classification of Capital IQ. In these cases, we had multiple four-digit SIC codes for a single Capital IQ industry. In some of the transactions all of the four-digit SICs corresponded to the same ISIC industry classification, creating a one-to-one mapping. In cases where the four-digit SIC codes corresponded to different industries in the ISIC scheme, we considered the particular deals and selected the most suitable industry. In 390 transactions, we were not able to determine with certainty the appropriate match in ISIC, and those transactions were dropped, leaving us with 13,910 PE transactions with ISIC classifications. Finally, we grouped ISIC sub-industries to balance PE activity across industries. Table 2 presents the distribution of deals across industries.

This results in a sample of 11,135 country-industry-year observations during the years 1986 to 2007. For each country, industry and year, we measure PE activity as the volume of PE deals occurring in this country and industry during the previous five years. In particular, an observation is a PE industry if it had at least one PE investment in one of those five years. (This definition was motivated by holding periods reported by Strömberg (2008)). With this definition, we can only compare activity during 1991 to 2007, leaving us with 8,596 country-industry-year observations.

Tables 2, 3 and 4 present the distribution of deals across industries, years and countries. In each table, we first present the number of observations (an observation is a country-industry-year pair) and the number of those that were *PE industries*, as defined above. We then present the number of deals, transaction volume and the transaction volume including the imputed sizes of deals with missing information.

Several patterns are visible from Tables 2 through 4:

- The heavy representation of buyouts as a share of economic activity in traditional industries, such as 'Textiles, textile products, leather,' 'Machinery and equipment,' 'Pulp, paper, paper products, printing,' 'Electrical and optical equipment,' and 'Chemical, rubber, plastics and fuel products'.
- The acceleration in buyout activity, first modestly during the late 1980s and then especially in the mid-2000s.
- The greater level of activity in a handful of traditional hubs for PE funds, including the United States, the Netherlands, Sweden, and the United Kingdom.[3]

In Table 5, we compare the changes in the industry measures over time for PE and non-PE industries. The PE industries grow more quickly in terms of output and value added, as well in terms of employment. But for gross fixed capital formation, the PE industries have a slower growth rate.

4. ANALYSIS

4.A: Industry performance

We begin by examining the relationship between various industry characteristics and the role of private equity in the industry. In each case, we use the industry-country-year as an observation, and the explanatory variable is the relative growth rate along a given dimension (for example, employment). This adjusted rate is computed by subtracting the growth rate experienced in that industry, country and year from the average growth rate across countries in that same industry and year. Demeaning the growth rate in this way is largely equivalent to including year-industry fixed effects, but it allows for an easier interpretation of the estimated parameters.

We employ several specifications. First, we look at specifications that include controls for each year, industry and country. For the exogenous variable, we include an indicator which denotes whether the industry is a PE industry or not, using the definition above. This definition does not use the imputed deal values, since it only depends on the presence of PE deals. Second, we use two indicators to capture whether an industry is a low or high PE industry. A low PE industry *(PE Low)* is a PE industry where the fraction of total imputed PE investments divided by total production (both normalized to 2008 USD) is smaller than the median (conditional on having a non-zero level of PE investment). Empirically, this median is 0.61%. Correspondingly, a high PE industry *(PE High)* is one where the fraction is greater than 0.61%. We also perform the analysis dividing PE activity into quartiles to better measure the differential effects of different activity levels. Third, we include dummies that are interactions between countries and industries *(Co-Ind FE)*. These controls allow us to more precisely capture national differences in the industry dynamics: if there is any effect from a PE investment, it is because the growth rate is fast during that specific period.

The results in Table 6 indicate that industries with PE deals have significantly higher growth rates of production and value added. For instance, in the first regression, the coefficient of 0.906 implies that the total production of an average PE industry grows at an annual rate that is 0.906% higher than a non-PE industry. (Table 5 reports that the mean growth rate is 5.9%.) We report the significance of a statistical test for differences between high and low PE industries and differences between the four quartiles of PE activity (all reported as $PE_L = PE_H$). We find few differences in total production between high and low PE industries, although the specification using quartiles suggests that the positive effect may be particularly strong for industries with an intermediate level of PE activity. Value added for an industry appears to be increasing in the amount of PE activity, with the differences between high and low PE industries being statistically and economically significant.

One concern is the direction of causality. It is possible that PE investors pick industries that are about to start growing and our results may reflect this industry choice rather than the causal effect of the investments on the industry. To mitigate this concern, we change our definition of the PE industry measure to only include investments during the period from two to five years prior to the observation, called the twice-lagged measure (the original PE measure included all five years prior to the observation). The results are reported in Table 7. We find that the results are very similar, indicating that the effect that we find is unlikely to be driven by PE investors entering countries and industries where they expect stronger immediate growth.

Table 8 considers measures of employment. PE industries appear to grow significantly faster in terms of labor costs and the number of employees. The annual growth rate of total labor cost is 0.5 to 1.4 percentage points greater for PE industries, and the number of employees grows at an annual rate that is 0.4 to 1.0 percentage points greater. These findings are particularly surprising, since a common concern is that PE investors act aggressively to reduce costs with little concern for employees. This concern is not necessarily inconsistent with our results. Despite initial employment reductions at private equity-backed firms, the greater subsequent growth in total production, observed in Table 6, may lead to subsequent employment growth in the industry overall. Considering the specifications with PE activity quartiles, industries with more PE activity appear to have more rapid growth of total labor costs, but the growth rate of the number of employees is fastest in industries with more moderate levels of PE activity. Regardless of the level of PE activity, however, the PE industries' growth rates of labor costs and employment always exceed the rates for non-PE industries.

[3] The level of transactions is extremely high in Luxembourg, due to the tendency of many firms to domicile there for tax reasons, even though the bulk of their operations are elsewhere. As a result, we omit Luxembourg from the analyses below.

As above, we are concerned about the direction of causality, and Table 9 repeats the analysis using the twice-lagged PE measure. The magnitudes in Tables 8 and 9 are largely similar, suggesting that the effect we find is not mainly driven by PE investors picking industries with expectations of immediate employment growth.

Finally, in Table 10 we examine measures of fixed capital formation and consumption of fixed capital. These measures appear much more volatile than the production and employment measures, making it difficult to discern any relationship between PE investments and capital formation.

4.B: Cyclical patterns

We next turn to analyzing how private equity relates to industry cycles. For each industry and year, we calculate the average growth by averaging the growth rate of the productivity and employment measures across countries. This measures the annual aggregate shock in these variables (for example, production output in the steel industry fell by 2% on average in 2002 across the nations in our sample). We then investigate whether PE industries are more or less exposed to this shock by including the PE measure interacted with this average growth measure in the regressions. If PE industries are more sensitive to economic conditions, the coefficient on the interaction term is positive: during upturns, these industries grow faster and during downturns they decline faster. A negative coefficient indicates a lower exposure to the aggregate shock than industries without PE investments. Once again, we use country and industry fixed effects, as well as country-industry fixed effect interactions.

In Tables 11 and 12, we examine the impact on production and employment. In the first table, the interaction terms are negative, which implies that PE industries are less sensitive to industry shocks. To interpret the coefficients, using the estimates in the first regression in Table 12, if an industry on average experiences a 5% increase in total labor costs in a given year (the aggregate shock), a PE industry will experience, on average, a 5.576% increase (5% + 1.591% + 5% x –0.203 = 5.576%). Conversely, following a 5% decrease in the wage bill, a PE industry will only experience, on average, a 2.394% decline (–5% + 1.591% + (–5%) x –0.203 = –2.394%). Hence, an aggregate swing from +5% to –5% (10% total difference) in aggregate growth rates translates into a swing from 5.6% to –2.4% (8% total difference) in the growth rates for PE industries. Both for the productivity and employment analyses, the coefficients are significantly negative in the simple specification and most of the coefficients in the employment analysis remain statistically significant when high and low PE industries are included separately. Overall, it appears that some PE activity translates into an industry whose employment changes less than average, but industries with a larger amount of PE activity may follow a growth pattern that is closer to that of the industry as a whole.

4.C: Geographic patterns

One concern is that the impact of private equity is different in continental Europe than in the United States and United Kingdom. Not only is the level of PE activity higher in the US and UK than in most other nations, but the industry is more established, having begun in these two nations. We thus repeat the analysis, looking at US and UK versus Continental Europe (investments in Japan and South Korea are excluded from these analyses).

We report the results in Tables 13 and 14, which repeat the base specifications reported in Tables 6 and 8. All the main effects remain largely unchanged for the Continental Europe sample. The coefficients in the US and UK sample are generally not statistically significant but they are not statistically different from the coefficients for the Continental Europe sample either. This probably reflects the small size of the US and UK sample and the resulting large standard errors: for productivity, value added and labor costs the coefficients are smaller than in Continental Europe; for total employment the coefficient is larger.

4.D: Addressing causality concerns

One natural concern relates to the interpretation of these results. While it appears that private equity is associated with more rapid growth at an industry level in our analyses, it is natural to wonder which way the causation runs. Does the presence of private equity lead to better performance, or do PE investors invest where they (correctly) anticipate industries will grow?

We respond to this question in several ways. First, we look at PE investments during the five years before the measured growth. Second, as discussed above, we have also narrowed our measure to only include deals in the second through fifth year prior to the investment. If our effects are due to PE investors anticipating growth, they would have to be quite prescient.

In subsequent versions of this paper, we will also attempt to address this concern using an instrumental variables technique. To identify exogenous variation, we may use the size of the private pension pool in the nation and year, expressed as a percentage of GDP. This is similar in spirit to other papers in the venture capital literature, such as Kortum and Lerner (2000) and Mollica and Zingales (2007). In the nations with larger pension pools, domestic PE funds are more likely to raise capital and invest it locally. This is an attractive instrumental variable, because pension policy is typically driven by broader socio-economic considerations, and not by the relative health of the local PE industry.

5. CONCLUSIONS

The growth of the PE industry has spurred concerns about its potential impact on the economy more generally. In this analysis, we look across nations and industries to assess the impact of private equity on industry performance.

The key results are, first, that industries where PE funds have invested in the past five years have grown more quickly, using a variety of measures. There are few significant differences between industries with limited and high PE

activity. Second, it is hard to find support for claims that economic activity in industries with PE backing is more exposed to aggregate shocks. The results using lagged PE investments suggest that the results are not driven by reverse causality. Finally, these patterns are not driven solely by common law nations such as the United Kingdom and United States, but also hold in Continental Europe.

These findings suggest a number of avenues for future research. First, it would be interesting to look at finer data on certain critical aspects of industry performance, such as the rates of layoffs, plant closings and openings, and product and process innovations. Second, it is important to better understand the mechanisms by which the presence of private equity-backed firms affects their peers. While Chevalier's (1995) study of the supermarket industry during the 1980s was an important first step, much more remains to be explored here. Finally, we are only able to look backwards in this analysis. The buyout boom of the mid 2000s was so massive, and the subsequent crash in activity so dramatic, that the consequences may have been substantially different from other economic cycles (see Kosman (2009)). The impact of the recent cycle will be an important issue to explore in the years to come.

REFERENCES

Andrade, G. and Kaplan, S. (1998) How Costly is Financial (Not Economic) Distress? Evidence from Highly Leveraged Transactions that Became Distressed. In *Journal of Finance* 53(5), 1443-1493.

Axelson, U., Strömberg, P., Jenkinson, T. et al (2009) Leverage and Pricing in Buyouts: An Empirical Analysis. EFA 2009 Bergen Meetings Working Paper. Available at http://ssrn.com/abstract=1344023.

Bloom, N., Sadun, R. and Van Reenen, J. (2009) Do Private Equity-Owned Firms Have Better Management Practices? In Gurung, A. and Lerner, J. (eds.) *Globalization of Alternative Investments Working Papers Volume 2: Global Economic Impact of Private Equity 2009*, New York: World Economic Forum USA, 2009, 1-23. Available at http://www.weforum.org/pdf/cgi/pe/Full_Report2.pdf.

Cao, J. and Lerner, J. (2009) The Performance of Reverse-Leveraged Buyouts. In *Journal of Financial Economics* 91 (February), 139-157.

Chevalier, J. (1995) Capital Structure and Product-Market Competition: Empirical Evidence from the Supermarket Industry. In *American Economic Review* 85 (June), 415-435.

Davis, S., Haltiwanger, J., Jarmin, R., et al (2009) Private Equity, Jobs and Productivity. In Gurung, A. and Lerner, J. (eds.) *Globalization of Alternative Investments Working Papers Volume 2: Global Economic Impact of Private Equity 2009*, New York: World Economic Forum USA, 2009, 27-43. Available at http://www.weforum.org/pdf/cgi/pe/Full_Report2.pdf.

European Commission (2009), *Commission Staff Working Document Accompanying the Proposal for a Directive of the European Parliament and of the Council on Alternative Investment Fund Managers and amending Directives 2004/39/EC and 2009/…/EC: Impact Assessment*, COM(2009) 207/SEC (2009) 577. Brussels: European Commission.

Guo, S., Hotchkiss, E. and Song, W. (2009) Do Buyouts (Still) Create Value? In *Journal of Finance*, forthcoming. Available at http://ssrn.com/abstract=1108808.

Jensen, M. (1986) Agency Costs of Free Cash Flow, Corporate Finance and Takeovers. In *American Economic Review Papers and Proceedings* 76 (May), 323-329.

Jensen, M. (1989) The Eclipse of the Public Corporation. In *Harvard Business Review* 67 (September/October), 61-74.

John, K., Lang, L. and Netter, J.(1992) The Voluntary Restructuring of Large Firms in Response to Performance Decline. In *Journal of Finance* 47 (July), 891-917.

Kaplan, S. (1989) The Effects of Management Buyouts on Operating Performance and Value. In *Journal of Financial Economics* 24 (October), 217-254.

Kaplan, S. and Schoar, A. (2005) Private Equity Performance: Returns, Persistence and Capital Flows. In *Journal of Finance* 60 (August), 1791-1823.

Kaplan, S. and Stein, J. (1993) The Evolution of Buyout Pricing and Financial Structure in the 1980s. In *Quarterly Journal of Economics* 108 (May), 313-357.

Kortum, S. and Lerner, J. (2000) Assessing the Contribution of Venture Capital to Innovation. In *RAND Journal of Economics* 31 (Winter), 674-692.

Kosman, J. (2009) *The Buyout of America: How Private Equity Will Cause the Next Great Credit Crisis*, New York: Penguin, 2009.

Mollica, M. and Zingales, L. (2007) The Impact of Venture Capital on Innovation and the Creation of New Business. Unpublished Working Paper, University of Chicago.

Muscarella, C. and Vetsuypens, M. (1990) Efficiency and Organizational Structure: A Study of Reverse LBOs. In *Journal of Finance* 45 (December), 1389-1413.

Rasmussen, P. (2008) Taming the Private Equity Fund "Locusts". In *Europe Today* 8 (Spring), 130-133.

Sabbagh, D. (2009) Terra Firma Injects Cash into Struggling EMI. In *The Times* newspaper. London, 30 January.

Service Employees International Union (2007) *Behind the Buyouts: Inside the World of Private Equity*. Washington, DC: SEIU.

Service Employees International Union (2008) Private Equity's Appetite for Infrastructure Could Put State and Local Taxpayers and Services at Risk. Draft policy discussion paper SEIU. Available at http://www.behindthebuyouts.org/storage/Copy_of_DRAFT_SEIU_Infrastructure_Policy_Paper_Oct_2008.pdf.

Strömberg, P. (2008) The New Demography of Private Equity. In Gurung, A. and Lerner, J. (eds.) *Globalization of Alternative Investments Working Papers Volume 1: Global Economic Impact of Private Equity 2008*, New York: World Economic Forum USA, 2008, 3-26. Available at http://www.weforum.org/pdf/cgi/pe/Full_Report.pdf.

Table 1: Descriptions of OECD STAN industry variables

Industry variable	Description
Production (gross output)	Value of goods and/or services produced in a year, whether sold or stocked, measured at current prices.
Value added	Industry contribution to national GDP. Value added comprises Labor costs, Consumption of fixed capital, taxes less subsidies, measured at current prices.
Labor costs (compensation of employees)	Wages and salaries of employees paid by producers as well as supplements such as contributions to social security, private pensions, health insurance, life insurance and similar schemes.
Number of employees	Persons engaged in domestic production excluding self-employed and unpaid family workers.
Gross fixed capital formation	Acquisitions, less disposals, of new tangible assets (such as machinery and equipment, transport equipment, livestock, constructions) and new intangible assets (such as mineral exploration and computer software) to be used for more than one year, measured at current prices.
Consumption of fixed capital	Reduction in the value of fixed assets used in production resulting from physical deterioration, normal obsolescence or normal accidental damage.

Source: OECD, STAN database, 2003

Table 2: Distribution of deals by industry

Observations is the number of country-industry-year observations in the sample (after 1991). *PE industries* contains the number of observations classified as *PE Industries* (after 1991). An industry is a *PE industry*, if it had at least one PE investment during the previous five years. *Deals* is the number of deals, and *Deal volume* is the combined size of the deals (normalized to US$ billions 2008). *Imputed deal volume* imputes the size for deals with missing size information.

Industry	Observations	PE industries	Deals	Deal volume	Imputed deal volume
Agriculture, hunting, forestry and fishing	432	84	54	6.18	10.25
Basic metals and fabricated metal products	431	234	782	77.20	130.64
Chemical, rubber, plastics and fuel products	431	223	757	116.17	169.29
Community, social and personal services	430	216	1,162	323.37	391.99
Construction	430	173	328	28.44	48.04
Electrical and optical equipment	431	229	879	146.87	193.08
Electricity gas and, water supply	431	84	109	100.90	123.29
Financial Intermediation	426	232	586	156.39	212.19
Food products, beverages and tobacco	431	221	572	114.45	156.51
Hotels and restaurants	426	171	454	135.58	159.36
Machinery and equipment	431	255	1,316	135.92	219.85
Manufacturing and recycling	431	166	394	32.70	60.15
Mining and quarrying	429	98	157	32.87	45.73
Other non-metallic mineral products	431	131	163	19.35	30.32
Pulp, paper, paper products, printing publishing	431	216	556	115.74	150.16
Real estate, renting and business activities	426	284	2,737	372.99	522.91
Textiles, textile products, leather	431	213	447	32.02	67.14
Transport equipment	431	113	111	15.73	23.07
Transport, storage and communications	430	231	595	257.11	296.96
Wholesale and retail trade – repairs	426	279	1,725	358.60	481.98
Total	8,596	3,853	13,884	2,578.58	3,492.91

Table 3: Distribution of deals by year

Observations is the number of country-industry-year observations per year. *PE industries* contains the number of observations classified as *PE industries*. An industry is a *PE industry* if it had at least one *PE investment* during the previous five years. *Deals* is the number of deals, and *Deal volume* is the combined size of the deals (normalized to 2008 US$ billions). *Imputed deal volume* imputes the deal size for deals with missing size information.

Year	Observations	PE industries	Deals	Deal volume	Imputed deal volume
1986	n/a	n/a	95	19.56	27.15
1987	n/a	n/a	109	18.51	27.43
1988	n/a	n/a	157	42.83	60.77
1989	n/a	n/a	137	59.75	68.07
1990	n/a	n/a	120	21.41	32.47
1991	456	116	158	13.29	21.88
1992	469	139	178	15.73	26.80
1993	509	177	197	16.44	29.61
1994	516	191	262	15.57	25.68
1995	520	202	347	35.05	49.86
1996	520	204	431	43.53	57.30
1997	520	206	655	55.41	86.12
1998	520	202	871	94.46	144.40
1999	520	217	824	86.41	131.17
2000	520	228	780	105.44	138.76
2001	520	251	687	80.83	102.62
2002	520	269	722	93.28	122.11
2003	520	276	945	145.73	178.78
2004	520	293	1,217	203.73	278.14
2005	520	293	1,428	258.58	368.21
2006	520	316	1,788	404.54	552.20
2007	406	273	1,776	748.42	963.42
Total	8,596	3,853	13,884	2,578.48	3,492.93

Table 4: Distribution of deals by country

The sample consists of 8,596 country-industry-year observations of OECD countries between 1991 and 2007. *Observations* is the number of observations in each country. *PE industries* contains the number of observations classified as *PE industries*. An industry is a PE industry if it had at least one PE investment during the previous five years. *Deals* is the number of deals, and *Deal volume* is the combined size of the deals (normalized to 2008 US$ billions). *Imputed deal volume* imputes the size for deals with missing size information.

Country	Observations	PE industries	Deals	Deal volume	Imputed deal volume
Australia	320	125	124	14.67	18.66
Austria	340	77	54	1.79	3.98
Belgium	340	129	118	13.00	22.70
Canada	340	218	294	99.48	117.61
Czech Republic	300	158	37	5.06	5.89
Denmark	340	94	143	9.79	17.33
Finland	340	161	192	7.66	16.06
France	339	274	1,294	122.34	179.05
Germany	340	220	598	109.79	187.06
Greece	324	30	7	4.45	6.14
Hungary	320	142	18	1.15	3.39
Ireland	340	104	49	19.09	21.07
Israel	339	6	4	0.00	0.01
Italy	340	210	345	42.83	58.94
Japan	328	70	73	20.79	26.71
Netherlands	340	204	323	85.15	125.95
Norway	340	73	71	5.00	9.53
Poland	286	171	41	2.34	2.61
Portugal	320	63	27	0.25	0.33
Slovakia	300	111	13	0.18	0.93
South Korea	340	47	20	4.81	4.81
Spain	320	171	222	38.98	42.86
Sweden	340	186	271	43.33	58.31
Switzerland	340	158	111	17.66	31.46
United Kingdom	340	318	2,312	390.44	441.10
United States	340	333	7,123	1,518.47	2,090.46
Total	8,596	3,853	13,884	2,578.48	3,492.93

Table 5: Industry growth variables

The sample consists of 8,596 country-industry-year observations of OECD countries between the years 1991-2007. An industry is considered as a *PE industry* if it had at least a single PE deal in previous five years. P-value provides the p-value of a test of equality of the means of PE and non-PE industries. See table 1 for variable definitions.

	All industries			PE industries			Non-PE industries			
	Observations	Average growth	Std. dev.	Observations	Average growth	Std. dev.	Observations	Average growth	Std. dev.	P-value
Production (gross output)	7,351	5.9	8.8	3,318	6.2	8.5	4,033	5.7	9.1	0.03
Value added	8,238	5.6	10.2	3,635	5.8	9.8	4,603	5.5	10.5	0.17
Labor costs (compensation of employees)	7,831	5.1	7.5	3,398	5.3	7.4	4,433	5.0	7.6	0.18
Number of employees	6,269	0.0	5.0	2,862	0.3	4.1	3,407	-0.3	5.6	0.00
Gross fixed capital formation	7,004	7.1	76.6	3,223	6.8	27.6	3,781	7.5	101.1	0.67
Consumption of fixed capital	7,351	5.9	8.8	3318	6.2	8.5	4,033	5.7	9.1	0.03

Table 6: PE activity and growth rate of productivity

The table contains OLS regression coefficients. An observation is a country-industry-year pair. The endogenous variable is the deviation of the annual growth rate of production or value added (as defined by OECD) relative to the average rate in the same industry and year. The exogenous variables are an indicator for positive PE activity over the previous five years at the country-industry level *(PE)*, indicators for whether the measured PE activity is below or above the median activity level *(PE Low and PE High)*, and indicators for quartiles. The omitted base category is no PE activity over the previous five years. The regressions contain industry, country and country-industry *(Co-Ind)* fixed effects as indicated. Standard errors are calculated with clustering at the country-year level and presented in parenthesis. $PE_L = PE_H$ contains the significance level of a Wald test of equality of the *PE Low* and *PE High* coefficients or the quartile coefficients. Statistical significance at the 1%, 5% and 10% levels are indicated by ***, **, and *, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Production (gross output)	**Production (gross output)**	**Production (gross output)**	**Production (gross output)**	**Production (gross output)**	**Value added**	**Value added**	**Value added**	**Value added**	**Value added**
PE	0.906***					1.117***				
	(0.241)					(0.270)				
PE Low		0.886***	1.033***				0.924***	0.893***		
		(0.243)	(0.300)				(0.279)	(0.338)		
PE High		0.932***	1.452***				1.377***	1.755***		
		(0.288)	(0.374)				(0.327)	(0.414)		
PE Q1				0.551**	0.850**				0.660**	0.731**
				(0.265)	(0.330)				(0.298)	(0.361)
PE Q2				1.224***	1.218***				1.188***	1.044***
				(0.293)	(0.345)				(0.338)	(0.396)
PE Q3				1.131***	1.549***				1.413***	1.702***
				(0.291)	(0.364)				(0.342)	(0.424)
PE Q4				0.786**	1.393***				1.398***	1.884***
				(0.358)	(0.466)				(0.392)	(0.498)
Industry FE	Yes	Yes	No	Yes	No	Yes	Yes	No	Yes	No
Country FE	Yes	Yes	No	Yes	No	Yes	Yes	No	Yes	No
Co-Ind FE	No	No	Yes	No	Yes	No	No	Yes	No	Yes
$PE_L = PE_H$		0.832	0.129	0.037**	0.206		0.093*	0.009***	0.087*	0.056*
Observations	6,976	6,976	6,976	6,976	6,976	7,013	7,013	7,013	7,013	7,013
R-squared	0.177	0.177	0.271	0.177	0.272	0.130	0.130	0.199	0.130	0.199

Table 7: Twice-lagged PE activity and growth rate of productivity

The table contains OLS regression coefficients. An observation is a country-industry-year pair. The endogenous variable is the deviation of the annual growth rate of production or value added (as defined by OECD) relative to the average rate in the same industry and year. The exogenous variables are an indicator for positive PE activity over the previous four years -2 to -5, ie *not* including the year previous to the year where the growth in the endogenous variable is measured *(PE)*, indicators for whether the measured PE activity is below or above the median activity level (*PE Low* and *PE High*), and indicators for quartiles. The omitted base category is no PE activity. The regressions contain industry, country and country-industry *(Co-Ind)* fixed effects as indicated. Standard errors are calculated with clustering at the country-year level and presented in parenthesis. $PE_L = PE_H$ contains the significance level of a Wald test of equality of the *PE Low* and *PE High* coefficients or the quartile coefficients. Statistical significance at the 1%, 5% and 10% levels are indicated by ***, **, and *, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Production (gross output)	**Production (gross output)**	**Production (gross output)**	**Production (gross output)**	**Production (gross output)**	**Value added**	**Value added**	**Value added**	**Value added**	**Value added**
PE	0.869***					1.140***				
	(0.239)					(0.269)				
PE Low		0.875***	0.982***				0.943***	0.906***		
		(0.241)	(0.285)				(0.280)	(0.324)		
PE High		0.862***	1.278***				1.395***	1.710***		
		(0.287)	(0.363)				(0.320)	(0.393)		
PE Q1				0.542**	0.775**				0.633**	0.647*
				(0.267)	(0.308)				(0.299)	(0.332)
PE Q2				1.210***	1.187***				1.251***	1.148***
				(0.282)	(0.328)				(0.343)	(0.395)
PE Q3				1.039***	1.298***				1.437***	1.619***
				(0.304)	(0.369)				(0.343)	(0.403)
PE Q4				0.736**	1.324***				1.414***	1.912***
				(0.339)	(0.436)				(0.389)	(0.483)
Industry FE	Yes	Yes	No	Yes	No	Yes	Yes	No	Yes	No
Country FE	Yes	Yes	No	Yes	No	Yes	Yes	No	Yes	No
Co-Ind FE	No	No	Yes	No	Yes	No	No	Yes	No	Yes
$PE_L = PE_H$		0.952	0.284	0.048**	0.418		0.079*	0.012**	0.057*	0.031**
Observations	6,976	6,976	6,976	6,976	6,976	7,013	7,013	7,013	7,013	7,013
R-squared	0.176	0.176	0.271	0.177	0.271	0.130	0.130	0.199	0.130	0.199

Table 8: PE activity and growth rate of employment

The table contains OLS regression coefficients. An observation is a country-industry-year pair. The endogenous variable is the deviation of the annual growth rate of labor costs or total employment (as defined by OECD) relative to the average rate in the same industry and year. The exogenous variables are an indicator for positive PE activity over the previous five years at the country-industry level *(PE)*, indicators for whether the measured PE activity is below or above the median activity level (*PE Low* and *PE High*), and indicators for quartiles. The omitted base category is no PE activity over the previous five years. The regressions contain industry, country and country-industry *(Co-Ind)* fixed effects as indicated. Standard errors are calculated with clustering at the country-year level and presented in parenthesis. $PE_L = PE_H$ contains the significance level of a Wald test of equality of the *PE Low* and *PE High* coefficients or the quartile coefficients. Statistical significance at the 1%, 5% and 10% levels are indicated by ***, ** and *, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Labour costs (compensation of employees)	**Labour costs (compensation of employees)**	**Labour costs (compensation of employees)**	**Labour costs (compensation of employees)**	**Labour costs (compensation of employees)**	**Number of persons engaged**	**Number of persons engaged**	**Number of persons engaged**	**Number of persons engaged**	**Number of persons engaged**
PE	0.684***					0.587***				
	(0.253)					(0.161)				
PE Low		0.540**	0.587*				0.710***	0.840***		
		(0.262)	(0.320)				(0.158)	(0.197)		
PE High		0.887***	1.203***				0.422**	0.646**		
		(0.281)	(0.370)				(0.195)	(0.258)		
PE Q1				0.071	0.112				0.549***	0.679***
				(0.290)	(0.346)				(0.167)	(0.216)
PE Q2				1.017***	1.054***				0.876***	1.018***
				(0.286)	(0.347)				(0.184)	(0.215)
PE Q3				0.907***	1.185***				0.661***	0.906***
				(0.294)	(0.379)				(0.207)	(0.258)
PE Q4				0.984***	1.410***				0.194	0.368
				(0.310)	(0.411)				(0.218)	(0.296)
Industry FE	Yes	Yes	No	Yes	No	Yes	Yes	No	Yes	No
Country FE	Yes	Yes	No	Yes	No	Yes	Yes	No	Yes	No
Co-Ind FE	No	No	Yes	No	Yes	No	No	Yes	No	Yes
$PE_L = PE_H$		0.075*	0.010**	0.001***	0.002***		0.039**	0.272	0.001***	0.002***
Observations	6,743	6,743	6,743	6,743	6,743	6,768	6,768	6,768	6,768	6,768
R-squared	0.225	0.225	0.304	0.227	0.305	0.052	0.052	0.173	0.053	0.174

Table 9: Twice-lagged PE activity and growth rate of employment

The table contains OLS regression coefficients. An observation is a country-industry-year pair. The endogenous variable is the deviation of the annual growth rate of labor costs or total employment (as defined by OECD) relative to the average rate in the same industry and year. The exogenous variables are an indicator for positive PE activity over the previous four years -2 to -5, ie *not* including the year previous to the year where the growth in the endogenous variable is measured *(PE)*, indicators for whether the measured PE activity is below or above the median activity level (*PE Low* and *PE High*), and indicators for quartiles. The omitted base category is no PE activity. The regressions contain industry, country and country-industry *(Co-Ind)* fixed effects as indicated. Standard errors are calculated with clustering at the country-year level and presented in parenthesis. $PE_L = PE_H$ contains the significance level of a Wald test of equality of the *PE Low* and *PE High* coefficients or the quartile coefficients. Statistical significance at the 1%, 5% and 10% levels are indicated by ***, ** and *, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Labour costs (compensation of employees)	**Labour costs (compensation of employees)**	**Labour costs (compensation of employees)**	**Labour costs (compensation of employees)**	**Labour costs (compensation of employees)**	**Number of employees**	**Number of employees**	**Number of employees**	**Number of employees**	**Number of employees**
PE	0.594**					0.528***				
	(0.239)					(0.171)				
PE Low		0.426*	0.423				0.677***	0.743***		
		(0.245)	(0.292)				(0.169)	(0.205)		
PE High		0.824***	1.085***				0.318	0.495*		
		(0.273)	(0.345)				(0.215)	(0.283)		
PE Q1				-0.023	-0.052				0.574***	0.690***
				(0.275)	(0.314)				(0.181)	(0.209)
PE Q2				0.879***	0.898***				0.799***	0.842***
				(0.268)	(0.325)				(0.200)	(0.244)
PE Q3				0.947***	1.155***				0.789***	0.964***
				(0.295)	(0.358)				(0.226)	(0.280)
PE Q4				0.786**	1.167***				-0.189	-0.087
				(0.306)	(0.398)				(0.251)	(0.335)
Industry FE	Yes	Yes	No	Yes	No	Yes	Yes	No	Yes	No
Country FE	Yes	Yes	No	Yes	No	Yes	Yes	No	Yes	No
Co-Ind FE	No	No	Yes	No	Yes	No	No	Yes	No	Yes
$PE_L = PE_H$		0.040**	0.003***	0.001***	0.001***		0.033**	0.207	0.000***	0.000***
Observations	6,743	6,743	6,743	6,743	6,743	5,771	5,771	5,771	5,771	5,771
R-squared	0.225	0.225	0.304	0.226	0.305	0.067	0.068	0.195	0.070	0.198

Table 10: PE activity and growth rate of capital formation

The table contains OLS regression coefficients. An observation is a country-industry-year pair. The endogenous variable is the deviation of the annual growth rate of gross fixed capital formation or consumption of fixed capital (as defined by OECD) relative to the average rate in the same industry and year. The exogenous variables are an indicator for positive PE activity over the previous four years -2 to -5, ie *not* including the year previous to the year where the growth in the endogenous variable is measured *(PE)*, indicators for whether the measured PE activity is below or above the median activity level (*PE Low* and *PE High*), and indicators for quartiles. The omitted base category is no PE activity. The regressions contain industry, country and country-industry *(Co-Ind)* fixed effects as indicated. Standard errors are calculated with clustering at the country-year level and presented in parenthesis. $PE_L = PE_H$ contains the significance level of a Wald test of equality of the *PE Low* and *PE High* coefficients or the quartile coefficients. Statistical significance at the 1%, 5% and 10% levels are indicated by ***, ** and *, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Gross fixed capital formation	Gross fixed capital formation	Gross fixed capital formation	Gross fixed capital formation	Gross fixed capital formation	Consum-ption of fixed capital	Consum-ption of fixed capital	Consum-ption of fixed capital	Consum-ption of fixed capital	Consum-ption of fixed capital
PE	-0.890					0.106				
	(1.881)					(0.291)				
PE Low		-0.697	-1.145				-0.113	0.092		
		(1.601)	(1.352)				(0.316)	(0.362)		
PE High		-1.145	-0.372				0.366	0.401		
		(2.412)	(1.501)				(0.332)	(0.375)		
PE Q1				0.123	0.240				-0.567	-0.474
				(1.401)	(1.283)				(0.357)	(0.380)
PE Q2				-1.458	-2.307				0.347	0.641
				(2.038)	(1.719)				(0.371)	(0.438)
PE Q3				-0.803	0.192				0.196	0.141
				(2.458)	(1.626)				(0.454)	(0.489)
PE Q4				-1.691	-1.543				0.615**	0.841**
				(2.628)	(1.807)				(0.312)	(0.368)
Industry FE	Yes	Yes	No	Yes	No	Yes	Yes	No	Yes	No
Country FE	Yes	Yes	No	Yes	No	Yes	Yes	No	Yes	No
Co-Ind FE	No	No	Yes	No	Yes	No	No	Yes	No	Yes
$PE_L = PE_H$		0.733	0.533	0.694	0.226		0.096*	0.360	0.007***	0.004***
Observations	6,074	6,074	6,074	6,074	6,074	4,712	4,712	4,712	4,712	4,712
R-squared	0.004	0.004	0.054	0.004	0.054	0.115	0.116	0.192	0.116	0.192

Table 11: PE activity and productivity cycles

The table contains OLS regression coefficients. An observation is the annual growth rate of the indicated productivity measure (subtracting its average growth rate across countries) at the country-industry-year level. The exogenous variable *PE x Avg growth* contains the interaction between *PE* and the average growth rate of the endogenous variable, averaged over countries. *PE* is an indicator for positive PE activity in the country-industry during the previous five years. The variables PE Low x Avg growth and PE High x Avg growth are constructed similarly, where PE Low and PE High are indicators for below or above median PE activity. The regressions contain industry, country, and country-industry *(Co-Ind FE)* fixed effects as indicated. Standard errors are calculated with clustering at the country-year level and presented in parenthesis. $PA_L = PA_H$ contains the significance level of a Wald test of equality of the *PE Low x Avg growth* and *PE High x Avg growth* coefficients. Statistical significance at the 1%, 5% and 10% levels are indicated by ***, ** and *, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	Production (gross output)	**Production (gross output)**	**Production (gross output)**	**Value added**	**Value added**	**Value added**
PE x Avg growth	-0.085**			-0.102*		
	(0.042)			(0.058)		
PE Low x Avg growth		-0.124**	-0.085		-0.159*	-0.112
		(0.057)	(0.060)		(0.088)	(0.095)
PE High x Avg growth		-0.051	-0.021		-0.036	-0.013
		(0.042)	(0.045)		(0.061)	(0.065)
PE	1.357***			1.678***		
	(0.311)			(0.390)		
PE Low		1.641***	1.517***		1.870***	1.568**
		(0.374)	(0.425)		(0.539)	(0.612)
PE High		1.123***	1.365***		1.549***	1.732***
		(0.350)	(0.422)		(0.451)	(0.523)
Industry FE	Yes	Yes	No	Yes	Yes	No
Country FE	Yes	Yes	No	Yes	Yes	No
Co x Ind FE	No	No	Yes	No	No	Yes
$PA_L = PA_H$		0.167	0.254		0.200	0.338
Observations	6,976	6,976	6,976	7,013	7,013	7,013
R-squared	0.177	0.178	0.271	0.131	0.131	0.199

Table 12: PE activity and productivity cycles

The table contains OLS regression coefficients. An observation is the annual growth rate of the indicated employment measure (subtracting its average growth rate across countries) at the country-industry-year level. The exogenous variables *PE x Avg growth* contains the interaction between *PE* and the average growth rate of the endogenous variable, averaged over countries. *PE* is an indicator for positive PE activity in the country-industry during the previous five years. The variables PE Low x Avg growth and PE High x Avg growth are constructed similarly, where PE Low and PE High are indicators for below or above median PE activity. The regressions contain industry, country, and country-industry *(Co-Ind FE)* fixed effects as indicated. Standard errors are calculated with clustering at the country-year level and presented in parenthesis. $PA_L = PA_H$ contains the significance level of a Wald test of equality of the *PE Low x Avg growth* and *PE High x Avg growth* coefficients. Statistical significance at the 1%, 5% and 10% levels are indicated by ***, ** and *, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	Labour costs (compensation of employees)	**Labour costs (compensation of employees)**	**Labour costs (compensation of employees)**	**Number of employees**	**Number of employees**	**Number of employees**
PE x Avg growth	-0.203***			-0.098**		
	(0.041)			(0.045)		
PE Low x Avg growth		-0.277***	-0.229***		-0.172***	-0.114**
		(0.049)	(0.055)		(0.050)	(0.054)
PE High x Avg growth		-0.112**	-0.111*		-0.039	-0.036
		(0.050)	(0.059)		(0.055)	(0.063)
PE	1.591***			0.538***		
	(0.306)			(0.171)		
PE Low		1.910***	1.657***		0.750***	0.792***
		(0.361)	(0.415)		(0.173)	(0.206)
PE High		1.295***	1.517***		0.324	0.493*
		(0.345)	(0.431)		(0.215)	(0.282)
Industry FE	Yes	Yes	No	Yes	Yes	No
Country FE	Yes	Yes	No	Yes	Yes	No
Co x Ind FE	No	No	Yes	No	No	Yes
$PA_L = PA_H$		0.004***	0.080*		0.016**	0.213
Observations	6,743	6,743	6,743	5,771	5,771	5,771
R-squared	0.228	0.228	0.306	0.068	0.069	0.196

Table 13: International PE activity and productivity

The table contains OLS regression coefficients. An observation is the annual growth rate of the indicated productivity measure (subtracting its average growth rate across countries) at the country-industry-year level, separating US/UK and Continental European countries. The exogenous variables are an indicator for positive PE activity over the previous five years at the country-industry level *(PE)*, and indicators for whether the measured PE activity is below or above the median activity level *(PE Low and PE High)*. The omitted base category is no PE activity over the previous five years. The regressions contain industry and country fixed effects as indicated. Standard errors are robust and presented in parenthesis and $PE_L = PE_H$ contains the significance level of a t-test of equality of the *PE Low* and *PE High* coefficients. $PE_{US} = PE_{CON}$ contains the significance level of a test for equality of the coefficients *PE* for US/UK and *PE* for Continental Europe. Statistical significance at the 1%, 5% and 10% levels are indicated by ***, ** and *, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Production (gross output)	**Production (gross output)**	**Production (gross output)**	**Production (gross output)**	**Value added**	**Value added**	**Value added**	**Value added**
	US/UK	**US/UK**	**CON**	**CON**	**US/UK**	**US/UK**	**CON**	**CON**
PE	-0.299		0.878***		0.289		1.225***	
	(1.001)		(0.187)		(1.430)		(0.231)	
PE Low		-0.535		0.893***		-0.208		0.951***
		(1.006)		(0.213)		(1.444)		(0.260)
PE High		0.050		0.861***		1.024		1.526***
		(1.069)		(0.227)		(1.499)		(0.293)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
$PE_L = PE_H$		0.257		0.892		0.049**		0.057*
$PE_{US} = PE_{CON}$	0.245		0.245		0.473		0.473	
Observations	660	660	5,037	5,037	660	660	5,074	5,074
R-squared	0.141	0.143	0.175	0.175	0.101	0.107	0.135	0.135

Table 14: International PE activity and employment

The table contains OLS regression coefficients. An observation is the annual growth rate of the indicated employment measure (subtracting its average growth rate across countries) at the country-industry-year level, separating US/UK and Continental European countries. The exogenous variables are an indicator for positive PE activity over the previous five years at the country-industry level *(PE)*, and indicators for whether the measured PE activity is below or above the median activity level (*PE Low* and *PE High*). The omitted base category is no PE activity over the previous five years. The regressions contain industry and country fixed effects as indicated. Standard errors are robust and presented in parenthesis and $PE_L = PE_H$ contains the significance level of a Wald test of equality of the *PE Low* and *PE High* coefficients. $PE_{US} = PE_{CON}$ contains the significance level of a t-test of equality of the coefficients *PE* for US/UK and *PE* for Continental Europe. Statistical significance at the 1%, 5%, and 10% levels are indicated by ***, ** and **, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Labour costs (compensation of employees)	Labour costs (compensation of employees)	Labour costs (compensation of employees)	Labour costs (compensation of employees)	Number of employees	Number of employees	Number of employees	Number of employees
	US/UK	US/UK	CON	CON	US/UK	US/UK	CON	CON
PE	-0.237		0.639***		1.736**		0.400***	
	(1.258)		(0.156)		(0.768)		(0.127)	
PE Low		-0.295		0.408**		1.965**		0.554***
		(1.239)		(0.183)		(0.800)		(0.140)
PE High		-0.150		0.906***		1.396*		0.213
		(1.332)		(0.186)		(0.774)		(0.160)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
$PE_L = PE_H$		0.734		0.010**		0.108		0.033**
$PE_{US} = PE_{CON}$	0.372		0.372		0.131		0.131	
Observations	660	660	4,804	4,804	660	660	4,245	4,245
R-squared	0.058	0.058	0.266	0.267	0.144	0.148	0.082	0.082

Part 2

Governments as venture capitalists: Striking the right balance

Governments as venture capitalists: Striking the right balance*

JAMES BRANDER
Sauder School of Business
University of British Columbia

THOMAS HELLMANN
Sauder School of Business
University of British Columbia

QIANQIAN DU
Shanghai Advanced Institute of Finance (SAIF)
Shanghai Jiao Tong University

1. INTRODUCTION

Governments around the world have taken a strong interest in entrepreneurship, particularly in technology-intensive areas such as information technology. This interest stems in part from the fact that some of the world's most influential enterprises, such as Microsoft, Intel and Apple began as small entrepreneurial ventures only relatively recently. Furthermore, there are many important examples from emerging economies. Infosys, for example, was founded in India in 1981 by N. Murthy on the basis of a loan of under US$ 1,000 from his wife and is now one the world's leading software companies with annual revenues on the order of US$ 4 billion.

In addition, rapidly growing entrepreneurial enterprises are viewed as important sources of innovation, employment and productivity growth. Thus, it seems natural that governments would be interested in the provision of financial support for the development of successful entrepreneurial ventures. One important source of finance for high-technology entrepreneurial enterprises is venture capital. Venture capitalists are financial intermediaries that seek out and invest in high-potential entrepreneurial ventures, predominantly in high-technology sectors. They often provide managerial assistance to enterprises that they invest in.

Many governments and international organizations have tried to promote high-tech entrepreneurship through various forms of support for venture capital. The intellectual foundations for such policies, as described in the literature review, are well-established in economics. Specifically, innovation in such areas as information technology might generate positive spillovers or externalities throughout the economy that justify public support. In addition, what economists refer to as "market failure" might arise in entrepreneurial finance because many potential investors lack the information they need to be willing to invest. The resulting shortfall of finance creates a breach that governments often seek to fill.

However, notwithstanding the possible merits of government support for venture capital, such intervention might be subject to the usual problems often attributed to government. Such problems might include poor incentives for government managers, insufficient information to make good decisions, subversion of legitimate economic objectives in favour of short-run political expediency and unnecessary expenditure of taxpayers' money.

Our main objective in this paper is to assess the record of government support for venture capital. We focus on three channels for such support. One channel is the direct provision of venture capital through government-owned venture capital funds. A second channel is investment in independently managed venture capital funds that also rely on private investors. A third channel is to provide subsidies or tax concessions to venture capitalists. These three types of government-supported venture capitalists (GVCs) are referred to as full GVCs, partial GVCs and indirect GVCs, respectively.

We analyse over 28,800 enterprises (based in 126 different countries) that received venture capital funding in the 2000-2008 period. The enterprises cover a wide range of industries but have strong representation in high technology. Our method is to compare the performance of enterprises financed by GVCs with those supported by private venture capitalists (PVCs). We put enterprises into three categories: those financed entirely by PVCs, those with moderate GVC support (that is, those with some but less than 50% of their venture capital from GVCs) and those with extensive GVC support (those with 50% or more of their venture capital funding from GVCs). The primary question is whether extensive, moderate or no GVC support leads to the best performance by the supported enterprises.

We consider enterprise performance in several areas. One performance measure is based on whether the enterprise becomes successful. For the purposes of this paper, we consider successful enterprises as those that either 'go public' with an initial public offering (IPO) or are acquired by a third party. These 'exit' events signal the end of the firm's life as a privately held enterprise and allow venture capitalists and other early investors to realize what are sometimes large returns by selling some or all of their ownership share in the enterprise.[1]

* Acknowledgements: We express special thanks to Josh Lerner and Anuradha Gurung for very helpful comments and other assistance and to Brad MacLean for generously providing access to the Asian Venture Capital Journal (AVCJ) database. We are also very grateful to members of the World Economic Forum's Globalization of Alternative Investments Advisory Board and to our research assistants, Lynn Chang, Lingxiang Gao, Florian Guhr, Joel Jaffe, Armin Navabi, and Yan Li, for their valuable contributions. We also thank the World Economic Forum for financial support. All errors are of course the responsibility of the authors.

[1] The term 'exit' refers to exit of the venture capitalist, and possibly other early investors. It does not refer to the exit of the firm itself from relevant output markets. These exit events are sometimes called liquidity events.

In our data only about 14% of enterprises had an IPO or were acquired by a third party over the time period studied. Many enterprises went out of business and others were not yet successful enough to have an IPO or to be acquired. While not every IPO, and certainly not every acquisition, is a definitive indicator of strong performance, we view these exit events as the best available general indicator of enterprise success.

We also consider the value of the enterprise when exit occurs and the total venture capital investment received by the enterprise as performance measures. We refer to these three measures (whether a successful exit occurs, the value of the enterprise and the total amount of investment) as 'value creation' measures because they are closely related to the economic value of the enterprise. When determining performance measures, in addition to value creation measures, we also consider innovation (as represented by patents) and employment creation.

These performance measures are of interest in part because they reflect 'private' returns – returns to venture capitalists, other investors and entrepreneurs. However, we also care about these measures because they reflect benefits to other parties such as customers, workers and other enterprises. In addition, successful enterprises help generate tax and other revenues for governments. These measures are a long way from being complete or ideal measures of the social benefits of government support for venture capital but they provide an important first step in assessing the role of government in this area.

Value creation measures are more closely associated with private returns to investors and entrepreneurs, while innovation and employment are more closely associated with other social benefits. Most of the attention in our paper is focused on value creation, partly because of its importance, but partly because we have relatively good data in this area. However, we also regard linking patent data to venture capital data to assess innovation performance as a major contribution of this paper. Data availability for employment creation is very limited.

Our main findings are as follows:

- **Value creation:** Enterprises with moderate GVC support outperform enterprises with only PVC support and those with extensive GVC support.
- **Innovation:** Enterprises with moderate GVC support outperform those with only PVC support and those with extensive GVC support in patent creation.
- **Employment:** With our very limited employment data we are unable to find significant differences in employment creation performance for GVCs and PVCs.
- **Type of government:** GVCs associated with national governments and international organizations have stronger performance than PVCs, which in turn do better than sub-national government GVCs.
- **Type of GVC:** Partial GVCs and indirect GVCs exhibit stronger performance than full (i.e., government-owned) GVCs.
- **Country-specific effects:** GVC performance appears to differ markedly by country.

This paper provides one valuable step in the analysis of government-supported venture capital. An additional step would be to analyse the role of government in the evolution of venture capital markets. In many countries, venture capital markets are still in their relative infancy. It is possible that governments might play an important role in the early stages of venture capital development, but might play a more modest role in later stages. As our data covers only the nine-year period from 2000 to 2008, we do not have a long enough time series to rigorously assess the long-run evolution of venture capital markets. Another useful step would be to analyse additional performance measures, such as the rate of return earned by venture capitalists. We do not have rate of return data but, given the close relationship between successful exits and rates of return, we would expect similar results as for successful exits.

GVC support might have either positive or negative effects on PVCs. For example, positive effects might result if GVCs help entrepreneurs gain valuable experience. A GVC-supported enterprise might fail, but the entrepreneur's experience might contribute to success in a later PVC-supported enterprise. GVCs can also be a valuable training ground for venture capitalists who later join private venture capital firms. In addition, GVC activity might provide an improved pipeline of opportunities for PVCs. On the other hand, GVCs might take projects that would otherwise be funded by PVCs and thus 'crowd out' PVCs. Whether GVC activities enhance or reduce the pool of opportunities available for PVCs is therefore an important question.[2]

Section 2 provides a literature review, Section 3 is devoted to a description of the data and Section 4 contains the main empirical analysis. Section 5 provides a discussion and interpretation of the main results and Section 6 contains concluding remarks. An appendix provides a detailed definition of all the variables used in the paper.

2. LITERATURE REVIEW

Innovative entrepreneurs often seek to provide new products, the likely success of which is hard for potential investors to assess. Such enterprises often lack a significant track record for investors to rely on. Investors might not even be able to usefully assess the entrepreneur's reliability. In short, potential investors lack important information and, as would be expected, are often less well-informed than the entrepreneur about the nature of both the product and the entrepreneur. Thus information is distributed 'asymmetrically' in that investors, know less than entrepreneurs about various important considerations.

The study of asymmetric information has been a major area of economics over the past few decades (contributing to the research portfolio of several Nobel Prize winners). Economists have shown that, when informational asymmetries are severe, there might be 'market failure' in that some potentially valuable transactions might fail to take place. Some potentially important markets might completely fail to

[2] Cumming and MacIntosh (2006) analyse crowding out in a Canadian context.

operate. The result would be a shortfall in entrepreneurial finance. Such market failure concerns can create a rationale for government intervention to try to increase the supply of venture capital towards a socially desirable level.

The basic theory of asymmetric information was pioneered by Akerlof (1970), Arrow (1973) and Jensen and Meckling (1976), among others. Early work on venture capital, including Sahlman (1990) and Amit, Glosten and Muller (1990) emphasizes the importance of informational asymmetries. Amit, Brander and Zott (1998) suggest that venture capitalists exist as specialized financial intermediaries precisely because they reduce information problems. Venture capitalists obtain information about particular enterprises and technologies, and often have a highly relevant technical background. Thus, venture capitalists can invest on behalf of investors, who would be unable to make informed investment decisions themselves, by using their informational advantage to make good investments in entrepreneurial enterprises. The question is whether government intervention can improve upon the response of private sector venture capitalists to information problems.

A second type of problem or market failure that is relevant to government intervention in venture capital is the externality associated with R&D and innovation. A valuable textbook treatment of this topic is provided by Tirole (1988, Chapter 10). The key point is that there is reason to believe that innovation might be underprovided as one firm's innovation often provides benefits to other firms that copy it or learn from it. These are positive externalities or spillovers. Since the original innovating firm cannot fully capture these external benefits for itself, it might be less inclined to undertake innovative activity than would be best from a societal point of view. Much effort has gone into estimating the extent of such externalities. See, for example, classic articles by Bresnahan (1986), Griliches (1992) and Jaffe (1996).

For our purposes, one important question concerns the relationship between venture capital and R&D. If there is underprovision of innovation, does venture capital act to partially offset this underprovision? The literature on this topic is not extensive, but we would draw attention to Kortum and Lerner (2000), Gans and Stern (2000) and Hellmann and Puri (2000), all of which suggest that venture capital does tend to promote innovation. Accordingly, it is possible that government support for venture capital might expand the supply of venture capital and might therefore boost innovation towards the efficient level by partially offsetting the market failure associated with insufficient innovation.

We have found only a handful of papers that address the effects of government intervention on venture capital. Both Cumming and MacIntosh (2006) and Leleux and Surlemont (2003) find significant 'crowding out' of private venture capital by GVCs. On the other hand, Lerner (1999, 2002) suggests some evidence of success for the US Small Business Investment Research (SBIR) programme. Anderson and Tian (2003) document the poor investor returns in the Canadian Labour-Sponsored Venture Capital Corporation (LSVCC) programme.

The most closely related work to the current paper is Brander, Egan and Hellmann (2009), which addresses the performance of GVCs and PVCs in Canada. Our paper is also closely related to Lerner (2009), which provides a general critique of government efforts to promote entrepreneurship through venture capital finance and other channels, along with valuable suggestions for improvement.

3. DATA DESCRIPTION

The primary unit of observation in our analysis is the venture or enterprise that receives venture capital. As described in the introduction, we classify such enterprises into three subcategories – those that receive no GVC support, those that receive moderate GVC support (some but less than 50% of their venture capital) and those that receive extensive GVC support (50% or more of their venture capital).

We have two primary sources of venture capital data. The larger source, which has been widely used by researchers, is the VentureXpert (VX) database provided by Thomson Reuters. From this database, we use all recorded enterprises that received their first venture capital funding between 2000 and 2008.

The VX database has very good coverage for the US and Canada and significant coverage for Europe, but has only rather limited coverage for Asia. However, we are able to augment the VX data with data from Asian Venture Capital Journal (AVCJ), which has good coverage for Asia. The combined dataset contains 28,824 enterprises, of which 3,142 are a net addition due to the AVCJ database. There are 5,466 venture capitalists represented in the data.

In identifying which venture capitalists are GVCs there is an issue of definition – what should count as a GVC? A venture capitalist that is owned by a government (a 'full' GVC) would certainly qualify. Examples include development banks (such as Germany's KfW or the Small and Medium Enterprise Development Bank of Thailand), investment boards (such as Singapore's Economic Development Board) or even direct investments by government departments (such as the US Central Intelligence Agency (CIA), which runs a venture capital fund called In-Q-Tel).

We are also interested in venture capital funds that are owned by the private sector but receive significant investments from governments ('partial' GVCs). Rather than focusing on government investments by public sector pension funds that are purely interested in returns (as are most private investors) we focus on government investments that have a public policy objective to promote venture capital. We therefore do not count public sector pension fund investments in venture capital funds and comparable profit-oriented investments made by public sector organizations as reflecting government intervention. If the only government investment in a venture capital firm comes from such organizations, that firm is treated as a PVC.Examples of government investments that do lead to a partial GVC designation include those made by the US Small Business Investment Company (SBIC) and the UK Innovation Investment Fund (IIF). Both of these government programmes invest in venture capital funds alongside private investors.

Indirect GVCs arise when governments play a significant role in a venture capital firm, such as through a subsidy or tax credit programme, but do not make investments directly. Examples include Canada's Labour-Sponsored Venture Capital Programme (see Insert 1), or Australia's Early Stage Venture Capital Limited Partnership (ESVCLP) programme, where registered partners benefit from favourable tax treatment.

INSERT 1: Different types of government involvement: The Canadian example

Canada is one of the most active countries for GVC activity. In fact, in our data almost 50% of Canadian enterprises have some support from GVCs, a considerably higher percentage than for any other country with significant venture capital activity. Therefore, it is perhaps not surprising that Canada shows all the major forms of GVC activity. Canada has significant GVC activity at both the national level and the provincial (sub-national) level. In particular, the three largest provinces (Ontario, Quebec and British Columbia) have all been very active in supporting venture capital through a variety of programmes.

At the national level, Canada has an example of a full GVC – the Business Development Bank of Canada (BDC). Much of the BDC's business consists of making loans to entrepreneurial firms. However, the BDC also carries out venture capital activities – making equity investments in entrepreneurial firms and providing mentoring contributions. Thus the BDC includes a venture capital business that is, in effect, owned by the Government of Canada. The BDC evolved from the Industrial Development Bank (IDB), founded during the Second World War to assist small manufacturers who required financial support to carry out production of military equipment. After the war ended the IBD gradually evolved into its current role, including changing its name to the BDC in 1975. Although the record of the BDC is at least reasonable, its history illustrates a major concern of many economists in which a 'temporary' emergency programme acquires permanent status.

Quantitatively, the most important form of GVC activity has been carried out by the Labour-Sponsored Venture Capital Corporations (LSVCCs). These venture capital funds are supported by both the national and provincial governments. LSVCCs are a form of indirect GVC activity in that funds are provided by private investors who receive tax concessions from both provincial and national governments when they make these investments. The national government provides a 15% refundable tax credit and some provincial governments provide an additional 15% refundable tax credit. This refundable tax credit is, in effect, a subsidy to invest in such funds. The funds are called 'labour-sponsored' because each fund must be sponsored by an organized labour organization, normally a labour union. The objectives of the funds include stimulating the growth of small entrepreneurial ventures, with a focus on job creation.

The first Canadian LSVCC, the Fond de Solidarité des Travailleurs du Québec (FSTQ), was founded in 1983 in the province of Quebec and was directed by the province's largest trade union in an effort to support businesses that would "create, maintain or preserve jobs" following the 1981-1983 recession. Thus the original motivation for this fund was to provide temporary macroeconomic stimulus but, as with the BDC, the temporary objective was transformed into an ongoing programme. Concerns about the performance of LSVCCs have received considerable attention. In 2005 the Province of Ontario implemented a plan to gradually terminate its participation in the programme.

In addition to the BDC and the LSVCCs, both federal and provincial governments engage in other forms of GVC activity, including investing in partial GVCs – venture capital funds that receive investment from both private investors and governments.

We are able to identify which governments are national and which are sub-national, such as governments of US states, Canadian provinces or German Länder. We also identify venture capitalists associated with international public sector organizations such as the World Bank or the European Investment Bank. Such venture capitalists are classified as GVCs. We can therefore compare the performance of these different levels of government (sub-national, national and international) in venture capital markets.

It is sometimes difficult to distinguish between true investments in venture capital and investments in other types of private equity, such as investments in large, well-established, privately held companies. In order to do so, as a first step, we use the categorization provided by VenturExpert and AVCJ. We also do some additional checks and eliminate enterprises with more than US$1 billion in sales or that receive more than US$1 billion of investments (as venture capital investments are typically a lot less). We also acknowledge that the distinction between PVCs and GVCs is less than clear in some countries, such as China, where many enterprises in the financial sector are, in effect, transitioning from the public sector to the private sector. However, we believe that our classification is very reasonable overall.

Our dataset includes enterprises from all major regions in the global economy. Table 1 shows the number of enterprises supported by venture capital on a regional basis. The East Asia row, for example, indicates that our dataset includes 6,508 enterprises based in East Asia, that 10.6% of these enterprises received some government-supported venture capital, and that 14.2% had successful exits, including 10.66% that had IPOs.

We rely primarily on the VenturExpert and AVCJ datasets to identify venture capital investments. We go to considerable effort to determine whether and to what extent these venture capitalists are connected to governments.

Table 1 indicates that much of the data comes from the United States and Canada, but we also have significant coverage of Western Europe and East Asia, along with some coverage from other regions. On a global basis, 9.4% of enterprises covered by our data received some GVC support and about 14% of the enterprises had successful exits.

Table 2 provides information on the top 10 countries in venture capital activity as measured by the number of supported enterprises and indicates that the US accounts for 11,502 enterprises supported by VCs or about 40% of the total. There is large variation in the frequency of GVC activity by country. In Canada, almost 50% of the enterprises in the dataset had GVC support, whereas in the US the rate of GVC support was only about one-tenth as much – about 4.4%. Germany, China and France all have relatively high levels of GVC involvement.

In looking at differences across countries in VC activity, we might ask how the presence of government-sponsored venture capital is related to country characteristics, such as stage of development or the depth of the financial system. Table 3 shows some simple correlations at the country level between two main variables of interest – the share of enterprises that receive funding from GVCs and the share of VC-backed enterprises that experience an exit – and a set of commonly used country metrics consisting of several World Bank Development Indicators, published by the World Bank. We use the data for our sample period (2000-2008).

Table 3 and all subsequent analysis is based on all enterprises in the dataset, including those that have not had enough time after first VC investment for us to reasonably expect an exit.[3] We track exits through 2009 but, even so, an enterprise that receives its first VC investment in 2008 or even 2007 is unlikely to have an exit event only a year or two later. It would be possible to restrict attention to more mature enterprises. However, we believe it is better to include all the data. First, while quick exits are rare, they do occur and should not be arbitrarily discarded. Second, the relative pattern of GVC and PVC activity is stable over time so, by including all the data, we would not expect to introduce any bias when comparing GVC and PVC activity. Third, at a technical level, our econometric analysis includes adjustments ('year fixed effects') that should correct any such bias that is introduced.

The correlations in Table 3 are small and, in almost all cases, not statistically significant at conventional levels so we cannot draw strong conclusions. However, higher-income countries, measured by per capita GDP, tend to have less GVC activity and stronger exit performance. Higher-growth countries also tend to have less GVC activity but weaker exit performance. Exit performance appears correlated with measures of financial depth, such as bank credit and the size of the stock market.

Figure 1 shows the number of enterprises entering the dataset for each particular year in the sample period. As can be seen, the dataset begins in the boom year of the high-tech 'bubble', shows the subsequent crash and the relatively stable activity from 2002 through 2008. The share of GVC-backed enterprises is relatively stable over time.

Venture capital activity is concentrated in the high-tech sector, as evidenced in Figure 2.

Table 4 shows the frequency of enterprises with each subcategory of venture capital activity, including moderate and extensive GVC support (overall and in the first round of investment), the level of government involved and whether the GVC is full, partial or indirect.

Our most important measure of value creation is whether a particular enterprise has a successful exit. A successful exit could be an initial public offering (IPO), which occurs when a privately held firm makes its first stock offering on a public stock exchange. The other form of successful exit is a third-party acquisition, when an outside party, usually another firm, purchases the venture. Therefore, whether an IPO or third-party acquisition has occurred is an important performance measure. If enterprises receiving investments from GVCs tend to be more likely to have successful exits than other enterprises, such a finding would be a positive indicator regarding government-supported venture capital.

Furthermore, when an exit occurs it is possible in principle to assess the value of the enterprise. All monetary values are converted to 2008 US dollars. For an IPO, this value is the market value of the company's stock. For an acquisition, the value of the enterprise is the price paid for it by the acquirer. It is therefore possible to use the value of the enterprise at exit as a measure of performance. However, we have exit value data for only about 25% of the approximately 4,000 successful exits. Even so, this information is of interest, particularly because we tend to have data for larger exits – the exits of most interest.

Table 5 provides summary information regarding the frequency of successful exit; exit values; time to exit; frequency of IPOs; amount of investment; whether an enterprise receives additional VC funding rounds beyond the first; and total later-round investment.

Table 5 contains considerable information. The first data row, labelled Exits, refers to an indicator variable that takes on value 1 if the enterprise has a successful exit in the sample period (2000-2008) or in 2009 and takes on the value 0 if it did not. All 28,834 enterprises in the dataset have a value (either 0 or 1) for this variable. The sample average for this indicator variable is 0.144, indicating that 14.4% of enterprises had a successful exit in the time period covered. It is possible (and indeed very likely) that some enterprises that did not have a successful exit in this period would have a successful exit later, so the ultimate success rate would be higher. The GVC sample average shows that enterprises with GVC support have an exit rate of 0.157 (or 15.7%) – higher than for the full sample and therefore higher than for enterprises

[3] The analysis is based on all enterprises in the dataset, including those that have not enough time after first investment to reasonably expect an exit. Including all data should not create bias in results as GVC and PVC activity follow a similar pattern over time. We feel it is better to include all data rather than introduce an arbitrary maturity criterion for including an enterprise as some enterprises do have relatively early successful exits.

funded purely by PVCs. The difference between GVCs and PVCs is significant at the 95% level of confidence.

The GVC effect is subdivided into two parts – an effect arising in enterprises with moderate GVC support and an effect arising in enterprises with extensive GVC support. The results are shown in the last two columns. The results show that enterprises with moderate GVC support – enterprises that had some GVC support but for whom less than 50% of their venture capital was provided by GVCs – did well on a number of dimensions. Compared with enterprises that were fully supported by PVCs, and enterprises with extensive GVC support, enterprises with moderate GVC support had greater exit frequency and higher value when they did exit. They also received more investment in total and in later rounds.

One other very important aspect of venture capital activity in general and GVC activity in particular is what might be called the 'home run' factor. Most of the money that is made in venture capital finance, and most of the social benefit, comes from a small number of highly successful enterprises. Using a baseball analogy, such highly successful ventures are often referred to as 'home runs'. In this respect venture capital is similar to the movie industry or the music industry, where most of the money is made by a few productions and most productions have very modest returns.

Even one highly successful company, such as Research in Motion (RIM) in Canada, can generate enough benefits to more than pay for the full cost of GVC programmes for many years. Our use of value at exit as a performance measure makes some attempt to capture 'home runs', but obviously it does not capture the benefits associated with the enterprise after the exit event. Thus, for example, the tremendous economic growth experienced by RIM subsequent to its IPO would not be captured by our analysis. Therefore, a full assessment of GVC activity might seek to identify specific 'home runs' as an important additional indicator of success. We identify 'home runs' as those exits with an exit value greater than US$ 250 million, admittedly an arbitrary threshold. Table 5 shows that only about a quarter of a percent (0.28%) of all enterprises achieve an exit value exceeding this threshold.

We now turn to a description of the data on patents and employment, summarized in Table 6. We are interested in patent activity as a proxy for innovation. To obtain information on patents we use the EPO Worldwide Patent Statistical Database (PATSTAT) delivered by the European Patent Office in April 2009. (This includes worldwide patents, not just European patents.) We then match the assignees from PATSTAT to the VC-backed enterprises in our dataset to count the number of patents granted to each of these enterprises. Specifically, we take the following steps to obtain information on patents for each enterprise: we are able to identify 7,092 VC-backed enterprises in PATSTAT. For those enterprises, we obtain all of their patents and associated publication dates. We then count the number of patents granted to each enterprise before it received any VC investments at the end of our sample period (31 December 2008). In total, we are able to identify 150,294 patents.

We use publication dates of patents to identify timing. The publication date is the date at which the patent is made public by the relevant patent office. This is typically about 18 months after the application date. We do not give different quality weights to patents granted in different jurisdictions. For example, a European patent counts the same as a US patent. We count each patent only once, even if it is awarded in multiple countries. We acknowledge that we simply measure the number of successful patents, not the economic value of the patents.

While standard venture capital sources do not keep track of employment in venture capital-backed enterprises, we match our dataset to a global dataset called Bureau van Dijk (BvD). This is an amalgamation of country-specific data collection efforts, such as Dun and Bradstreet in the US and Amadeus in Europe, which is itself a compilation obtained from various national statistics offices. The BvD database covers a relatively large number of privately held enterprises. However, its coverage is far from complete. We obtain employment data for 5,283 enterprises, which constitutes 18.3% of our sample.

BvD also does not have information for every year for a given enterprise. We obtain employment numbers at two points in time: the year the enterprise obtained its first venture capital investment or, if unavailable, the closest year thereafter, and in 2008 or, if unavailable, the closest year before.[4] This allows us to estimate the employment level at the time of the first venture capital investment, and the subsequent creation of employment, as measured by the difference in employment at the end of 2008. The distribution of employment is highly skewed: while the average number of employees prior to VC is approximately 137, the median number of employees is 20. In the analysis, we use natural logarithms to account for this skew.

4. ANALYSIS AND RESULTS

4.1 Regression specification

The main objective is to assess whether GVCs are associated with better or worse enterprise performance than PVCs. The unit of observation (i.e., each data point) is an enterprise. If the performance measure is P and the GVC indicator is GVC, then we are interested in a regression of the form

$$P = f(GVC,C) + \varepsilon$$

where C is a vector of control variables and ε is the random error. We assume the standard independence properties for ε but note that, at this stage, our analysis cannot distinguish between selection and treatment effects. A treatment effect is an effect caused by the explanatory variable. In this case, a treatment effect would arise if government venture capital causes either stronger or weaker performance than other venture capitalists. A selection effect would arise if GVCs simply select either strong or weaker enterprises in which to invest. We therefore do not recommend that our regression coefficients necessarily be given a causal or 'treatment-based' interpretation. Nonetheless, we note that the statistical results that we measure remain important in

[4] We acknowledge that this approach is not perfect. For example, an enterprise that lacks an employment number for 2008 might have gone out of business, but we count its most recent reported employment number. However, in most such cases even the most recent employment number would exhibit decline. Overall, using the most recent employment number appears preferable to any alternative procedure.

shedding light on the relative performance of GVC versus PVC-backed enterprises.

We normally expect monotonic relationships between variables. A monotonic relationship is one that is consistently increasing or decreasing. For example, those who believe that government activity tends to underperform private sector activity might expect that the higher the level of GVC activity, the weaker the performance. However, it is important to realize that non-monotonic relationships are common, and often important. For example, it is possible that GVC activity might have positive effects at low levels but negative effects at high levels, as with the relationship between water and many agricultural crops. Yields increase with water supply up to a point, but excessive amounts of water will flood crops and reduce yields. In this case, we find that non-monotonic effects are important.

We seek to explain the various performance measures on the basis of the extent of GVC activity after taking account of other factors, namely industry effects, country effects and 'vintage' effects. Country effects are not only important to account for the many institutional differences across countries but they are also useful to control for all country-wide variations in data collection methods. Vintage effects are captured by the year in which an enterprise received its first VC investment and reflect the possibility that some years yield different average times to exit than others due to business cycle and other related factors.

4.2 The relationship between GVC activity and value creation

One performance measure in the value creation category is whether a successful exit occurs. Each observation or data point is a single enterprise. The dependent variable, Exit, is simply a categorical variable that takes on the value 1 if the enterprise has a successful exit and 0 if it does not have a successful exit in our data. Explanatory variables would include some measure of the GVC presence and any control variables, namely year, industry fixed effects and country fixed effects. As the dependent variable is an indicator variable we use a Probit regression technique. Table 7 provides the estimates for a set of regressions with various combinations of control variables.

The first regression is shown in the second column. The variable Moderate GVC takes the value 1 if the enterprise has some support from GVCs but less than 50% of the funding in the enterprise comes from GVCs, otherwise this variable takes the value 0. The variable Extensive GVC takes the value 1 if 50% or more of the venture capital investment in an enterprise comes from GVCs. Enterprises that have only PVC investment form the base category. The coefficient on the Moderate GVC variable shows the effect of having moderate GVC support relative to the base situation – pure PVC support.

The moderate GVC indicator variable is highly significant in predicting successful exit events relative to the base case of pure PVC support. This means that enterprises with moderate GVC support are more likely to have successful exits than enterprises supported by just PVCs. On the other hand, the extensive GVC indicator has a negative coefficient, indicating that extensive GVC activity is associated with less likelihood of a successful exit than pure PVC support, although the coefficient is not statistically significant.

It is possible that the positive association between moderate GVC activity and successful exits might arise from GVCs contributing to successful enterprises late in their development in some sort of 'bandwagon' effect. If so, we could not infer that GVCs add much value. We check for this possibility in the second column, where the GVC variables are based only on the role of GVCs in the first round of venture capital investment. This adjustment has virtually no effect on the results, suggesting that the positive association between GVCs and exit outcomes is based on early-stage decisions of GVCs rather than on late-stage bandwagon effects.

The third and fourth regression columns cover the same ground as the first two, except that the level of investment is included as a control variable. We find that the level of investment is significant – enterprises that receive more investment are more likely to have a successful exit. However, even after correcting for this effect, the results related to GVC activity have the same general pattern as in the other regressions.

Table 8 provides results using alternative measures of successful exit activity. The first results column looks at initial public offerings (IPOs) as the indicator of successful exits without including third-party acquisitions. The next column looks at what we call 'home runs' – large exits that exceed a US$ 250 million exit value. The third column uses exit values as the dependent variable. With this variable we ask whether, given that a successful exit occurs, the presence of GVCs as investors in an enterprise tends to be associated with larger exit valuations. Finally, the fourth column assesses the effect of GVC activity on how long it takes between first investment and when a successful exit ultimately occurs.

Table 8 provides striking results in that enterprises with moderate GVC support do remarkably well with respect to all measures. Such enterprises are more likely to have successful exits than other enterprises and, conditional on a successful exit, they have larger exit values. Moderate GVC support therefore seems associated with both more exit activity and higher-quality exit activity. However, we have exit value information on only 947 of approximately 4,000 successful exits, so the data are clearly incomplete. The included observations tend, however, to be the larger and more important exits. The Cox regressions show that enterprises with moderate GVC support achieve successful exits more slowly than other enterprises.[5] Once again, however, we have Time to exit information for only a modest number of enterprises. Extensive GVC enterprises are not significantly different from PVCs.[6]

[5] Note that the coefficient of a Cox regression describes the probability that an exit occurs. The hazard ratio is also below 1, indicating that the odds of having an exit are lower in the presence of a Moderate GVC.

[6] In unreported regressions we controlled further for investment amounts, and found that the coefficients for Moderate GVC, while still positive, tend to become statistically insignificant. This might be due to losing observations and having a smaller sample size. Another possible interpretation is that the effect of Moderate GVC is mainly to increase investment, which in turn has a positive effect on performance.

Table 9 provides results on a third value creation measure: total investment. We ask whether GVC activity of either the extensive or moderate type is associated with increased total VC investment in an enterprise. The amount of investment is strongly correlated with having successful exit events and the advantage is that we have data for a large number of observations rather than just actual exits. Once again, we see strong performance from enterprises with moderate GVC support, weak performance from enterprises with extensive GVC support and, by inference, intermediate performance from enterprises with only PVC support.

We now check whether different levels of government have different effects. As previously described, both national governments and sub-national governments, such as state or provincial governments, provide significant support to the venture capital sector. In addition, international institutions also provide some venture capital support that we count as GVC activity. Table 10 reports the effect of different levels of government on the three value creation measures: the occurrence of successful exits, the value of the exit and the amount of investment.[7] Table 10 shows that both national governments and international organizations are associated with value-promoting GVC activity, while sub-national units have a negative but statistically insignificant effect.

Some GVC activity is conducted by venture capital funds that are fully owned and managed by governments. We refer to such GVCs as full GVCs. Some GVC activity is conducted by partial GVCs, which receive financial capital from both governments and private investors. In addition, some GVCs, referred to as indirect GVCs, do not receive capital directly from governments but benefit from subsidies or tax concessions. Table 11 reports the effect of these different types of government support on the three value creation measures.

The results in Table 11 are not completely clear-cut. However, they suggest that the partial GVC model performs best. In this case, GVCs are independent bodies that get some investment capital from governments and some from other sources. The better performance is certainly reflected in both the occurrence of exits and in exit values. The partial and indirect models have similar effects on investment.

4.3. The effect of GVCs on innovation and employment

The previous section deals with the effects of government-supported venture capital on value creation as represented by successful exits, exit values and investment. Such measures are closely associated with private returns to the parties directly involved with the enterprise, such as the venture capitalists, other investors and the entrepreneur. Governments frequently emphasize the employment and innovation objectives of providing support to venture capital. These outcomes reflect, at least in part, social benefits that accrue to other parties in addition to the firm's insiders.

Innovation is difficult to measure. One commonly used measure of innovation is patents. In some studies efforts are made to weight patents by some measure of importance, such as how often they are cited by other patents. In this study, however, we use a simple count of patents. Thus, an enterprise that obtains three patents in a given time period is treated as being more innovative than an enterprise that obtains only two patents in the same time period. While it is quite possible that one patent in an enterprise might represent more innovation than two, three or more patents in some other enterprise, on average patent counts are a good measure of innovation. For our analysis we use two patent-based measures of innovation. One measure is simply an indicator variable that takes the value 1 if the enterprise obtains a patent subsequent to VC investment and takes the value 0 otherwise. The other measure is based on the number of patents obtained subsequent to the first VC investment.[8]

Table 12 looks at the effect of GVC activity on these two measures of patent activity.[9] As in the previous section, we put enterprises in three categories: those that receive no GVC support (i.e., those whose venture capital comes entirely from PVCs), those with moderate GVC support and those with extensive GVC support. These categories can be created based either on total investment in the enterprise or only on the first round of venture capital investment.

It is important to control for an enterprise's general inclination to patent. Presumably, enterprises that obtain patents prior to receiving VC financing are more likely to obtain patents subsequently as well. If, for example, GVCs happened to be more inclined than PVCs to invest in enterprises that have previously obtained patents we might mistakenly attribute subsequent patents to the nature of the GVC activity when in fact it was due only to the firms' prior propensity to patent. When we use a post-VC patent indicator as the innovation variable to be explained, we use a variable that indicates whether any prior patents had been obtained as a control. We also use a count of prior patents as a control variable to measure the performance of patents.

Table 12 shows that moderate GVC activity is associated with more patent activity than the base case of pure PVC support. Thus an enterprise with moderate, but not extensive, GVC participation is more likely to obtain a patent than an enterprise that has only PVC support. An enterprise with moderate GVC participation is also expected to obtain a larger number of patents. The same conclusions apply if we focus only on first-round VC investment. We acknowledge that it would be interesting to investigate whether these results persist after weighting patents by some measure of quality, such as citations.

[7] To keep the analysis tractable and focused, we now abstract from the distinction between moderate versus extensive GVCs, and look only at the overall effect of different types of GVC.

[8] The actual count measure we use is the natural logarithm of 1 + the number of patents obtained. Taking logarithms is standard as patent counts are highly skewed and adding 1 to the number of patents is necessary as many companies have no patents and the logarithm of 0 is not defined.

[9] We acknowledge that the time required to move from early R&D to a patent application, and the lag between application and ultimate publication of the patent after review, imply that we would expect some lag, typically two or more years, between initial VC involvement and ultimate publication of a patent.

[10] In an unreported regression we examined whether the BvD sample of enterprises suffered from a success bias in that enterprises that have a successful exit are more likely to be in the dataset than other VC-supported enterprises. We found some evidence that having an IPO is likely to generate inclusion in the BvD data, but IPOs are only a small fraction of exits. Overall, there was no significant positive correlation between successful exits and inclusion in the BvD data. This suggests that success bias should not be a major concern.

The prior patent variable is, of course, highly statistically significant: enterprises that do more patenting before obtaining VC funding are also likely to do more patenting after receiving VC funding. However, even after correcting for this effect, the moderate GVC variable has a strongly significant coefficient indicating a positive impact on patenting.

The other performance variable of interest is employment creation. We have employment data for just over 5,000 enterprises (less than 20% of the observations).[10] To focus on employment creation, we use the GVC variables as explanatory variables, but also control for prior employment. The unit of observation is, once again, the enterprise. Thus the employment variable we consider is the total employment growth in the enterprise from the time of first VC investment to 2008 if data for 2008 is available. Otherwise we use the latest year for which employment data is available. Table 13 reports the results for employment.

The first results column in Table 13 shows that we have no statistically significant effects of overall GVC activity on employment creation. The second column indicates that when we look at first-round VC activity for each enterprise only, we have a negative and marginally significant effect of extensive GVC activity. Overall, we cannot make strong claims about employment effects. One point of interest is that prior employment is a strong predictor of employment creation. The coefficient is negative, indicating the plausible result that enterprises that are large to begin with are less likely to have high employment creation in the future. The highest growth rates are generated by enterprises that start small.

Table 14 summarizes the effects of different levels of government and different types of GVC support (full, partial or indirect) on innovation and employment.

Interestingly, GVC activity associated with sub-national governments has a strongly positive effect on patenting. National governments' VC activity also has a significant effect but international organizations' GVC activity does not have a significant effect. Full and partial GVCs do well in promoting patent creation. With respect to employment creation, however, there is not much statistical significance in the results.

4.4 Country-specific effects of GVCs

We have a large volume of venture capital activity in only a few countries. Still, it is possible to undertake a preliminary assessment of country-specific effects, asking whether GVC activity performs differently in different countries. Results are shown in Figures 3 to 5.

Overall, there seem to be considerable differences across countries in the nature and performance of GVC programmes. Going into the details of each country's approach to GVC is clearly beyond the scope of this paper. However, Insert 2 provides a description of Germany, a country with substantial government involvement in venture capital and, as shown in Figures 3 to 5, a unique performance pattern.

INSERT 2: Explaining country-specific effects: The German example

The German case provides a useful example to consider how the experience of a particular country can be interpreted in light of our overall results. As shown in Figure 3, Germany has relatively poor results regarding the effect of GVCs on successful exits. On the other hand, Figure 5 illustrates a very strong positive effect of GVCs on patent performance.

At the national level, the primary source of venture capital support in Germany is the KfW (Kreditanstalt für Wiederaufbau). It is a development bank that was started in 1948 to aid with recovery after the Second World War. Its initial role was that of a traditional development bank, focusing particularly on loans to finance the rebuilding of Germany's energy infrastructure and on financing housing construction. In the past two decades the KfW has become increasingly active in venture capital and private equity, taking equity positions in small and medium-sized entrepreneurial firms in the high-technology sector. The KfW is now a large participant in German venture capital markets.

In addition to the KfW, a substantial amount of German GVC activity arises from sub-national (Länder) governments. Support for venture capital is carried out through several types of organizations, including Landesbanken (provincial banks), Förderbanken (development banks) and Mittelstandsbeteiligungsgesellschaften (equity participation firms). The institutions often have their own venture capital departments and their own particular mandates.

A substantial part of German GVC activity is carried out by the KfW – a full (i.e., government-owned) GVC – and another substantial part is carried out by sub-national governments, many of which are again fully government-owned. Thus the full GVC form is relatively important in Germany, as are sub-national GVCs.

As Table 11 shows, full GVCs are associated with relatively weak exit performance, yet Table 14 shows that full GVCs are also associated with relatively strong patent performance. Thus the importance of full GVCs in Germany is consistent with relatively weak exit performance and relatively strong patent performance. Turning to the importance of sub-national GVCs, Table 10 shows that sub-national GVCs tend to have weak exit performance, yet they have a strong patent performance, as shown in Table 14. Thus sub-national GVCs have the same pattern of performance as full GVCs. The importance of sub-national GVCs in Germany is therefore also consistent with Germany's relatively poor GVC exit performance and relatively strong GVC patent performance.

5. DISCUSSION AND INTERPRETATION

Sections 3 and 4 contain considerable data description and formal regression analysis of the relationship between government-supported venture capital (GVC) activity and various performance indicators. In addition, we have run many other regressions that are not reported in the paper but that are consistent with the reported results. The main performance indicators include the likelihood of successful exit events (IPOs and third-party acquisitions) for supported enterprises, the value of the enterprise when exit occurs, the amount of investment generated by the enterprise, the amount of successful innovation (represented by patents) undertaken by the enterprise and the record of employment creation. In this section we step back to assess the 'big picture' – identifying and interpreting the main themes arising from our analysis.

The most striking result is something we have not seen mentioned in previous work. Specifically, GVC activity seems to have a non-monotonic relationship with the major performance indicators. A modest amount of GVC seems to improve the performance of entrepreneurial ventures relative to ventures supported purely by PVCs. However, high levels of support from GVCs are associated with weaker performance.

Perhaps the most obvious way of testing whether GVC activity affects performance is to regress a performance measure, such as whether a successful exit occurs, on some measure of GVC activity, such as the share of VC investors in the enterprise that are GVCs. A typical such specification would presume a monotonic relationship. One might find that GVC activity tends to increase success, to reduce success, or has no significant effect on the likelihood of a successful exit. In this case, such analysis (which we have done but not reported) does not reveal a clear picture.

The specifications that we do report, where we separately identify enterprises that receive only a moderate amount of GVC and those that receive extensive GVC support, allow the strong non-monotonic effect in the data to be identified. We can think of this effect as being like an inverted U-shape. At low levels of government support, success increases in GVC activity. At high levels of GVC support, additional government support reduces success. Thus, a little bit of government support appears to be a good thing but it is also possible to have too much government support.

It is noteworthy that this inverted-U effect (small government = good; big government = bad) applies to most of the major success indicators. There is no computational reason why the pattern that applies to, for example, successful exits, should also apply to exit values or to innovation. But the same pattern does apply, making the effect quite striking.

The observation that moderate government activity is associated with good performance but extensive government activity is associated with weaker performance is consistent with the results concerning different types of GVCs. Full GVCs are fully owned and operated by governments. Partial GVCs receive investment from governments but also receive private investment and are independently managed. Indirect GVCs are not based on investment by government but receive subsidies and/or preferential tax treatment. The partial GVCs have the strongest performance among these three types, particularly on the value creation measures. If our results are indicative of genuine causal effects, the model of having independent venture capitalists who receive some government investment would appear to have a better track record than government-owned venture capital funds.

The same theme – moderation – also arises from the country-specific effects identified in Figure 3. We note that the countries with the highest levels of GVC activity – Canada and Germany – have relatively poor records of GVC impact on successful exit. Admittedly, the pattern is somewhat different between investment and innovation, so we would not want to overstate the case. However, the country-specific results are at least suggestive.

On reflection, this inverted U-shape for the effect of GVC activity on performance should not be surprising, as it applies to many areas of government activity. The analogy of 'low-hanging fruit' would seem to apply. In small amounts GVCs can address obvious market failures and improve economic outcomes – picking the low-hanging fruit. In large amounts, however, GVCs may simply compete with and crowd out PVC activity.

Overall, we observe good performance when government support is present but not dominant. This applies to both enterprises and venture capital funds. The evidence suggests that GVCs may be helpful in providing certain kinds of support, including financial support, but may become less useful when they have actual control over business decisions. If they lack control then the usual concerns about subverting sound economic objectives to achieve questionable political objectives is less likely to arise. Put differently, government venture capital may be at its most effective when it remains disciplined by private venture capital.

We hasten to re-emphasize the usual warning about causal interpretations. Given the preliminary nature of our inquiry, and the fact we do not have direct experimental evidence, we suggest a cautious interpretation of our results. What we know is that, in our data, moderate GVC activity is associated with good performance by enterprises. This does not mean that GVC activity is necessarily the cause of this good performance. If GVCs really do contribute to good enterprise performance, we can describe this as a 'treatment' effect: GVC funding would be like a treatment that improves the outcome for the client enterprise. Any treatment effect would presumably arise in large part from the resources, mentoring and other management services provided by the GVC to the client enterprise.

However, the possibility remains that there might be no treatment effect. There are several other possible explanations of the positive association between moderate GVC activity and enterprise performance. One possibility that often comes up with regression analysis is reverse causality: perhaps high-performing enterprises cause or induce GVCs to invest – possibly through some sort of bandwagon effect. A related possibility is that GVCs do well through a 'selection effect' – simply by selecting good enterprises in which to invest. It is also possible that the relationship between moderate GVC activity and enterprise performance is induced by some other factor, including simple coincidence.

In the absence of direct experimental evidence it is difficult to be confident about causality. However, we have investigated various alternative possibilities and have concluded that the evidence for GVC having some impact on enterprise success is at least suggestive.

6. CONCLUDING REMARKS

In the wake of the recent financial crisis, governments have started to play a more important role in the financial landscape. Governments in many countries have long been involved in providing venture capital to entrepreneurial enterprises as such enterprises are believed to be important sources of innovation, employment and productivity growth.

In this paper we assess the relative performance of private venture capital (PVC) and government-sponsored venture capital (GVC) in an international setting. We focus first on the role of venture capital in promoting value creation as reflected by successful 'exit' events for client ventures – where the supported enterprise either has an initial public offering (IPO) or is acquired by a third party. We also focus on the value of the exits, which is an indication of the size and importance of the supported enterprises, and we consider the role of GVCs in affecting the total investment made in supported enterprises. We also consider the effect of GVC activity on innovation, as measured by patents, and on employment.

Our principal finding is the striking result that the strongest performance is associated with moderate levels of GVC. Enterprises with moderate GVC support perform better on most dimensions than enterprises with no GVC support (that is, those that are supported exclusively by private venture capital) and they perform better than enterprises with extensive GVC support. One interpretation is that public venture capital support has legitimate contributions to make but that it seems to perform better when it is 'disciplined' by the presence of private venture capitalists.

We emphasize that our analysis stops well short of a full welfare analysis. We compare GVC and PVC activity by looking at how the presence of GVC relates to enterprise performance. In addition, we should also be concerned about whether the aggregate level of venture capital is sufficient in light of various market failures that might restrict the supply of venture capital. If so, there would be a case for GVC activity even if the PVCs managed to 'cherry pick' and get the best client enterprises. As it happens, purely private venture capital does not perform as well as a mix of moderate GVC activity combined with private venture capital, at least for the world as a whole. There are a few countries where the picture is reversed.

However, even in the few countries where GVC support does not perform as well as PVC support, GVCs might still be a good investment from the public point of view. In principle we should not be surprised or alarmed if GVC-supported enterprises exhibit weaker performance than enterprises supported purely by PVCs. This would be expected under a well-designed programme. The fact that moderate levels of GVC activity appears to outperform pure PVC activity is therefore noteworthy.

We should be concerned if the external (i.e. non-private) effects of GVC-supported enterprises fall short of PVC-supported enterprises. While we cannot measure external benefits directly, we believe that the innovation process is characterized by positive externalities and we therefore take patents as an indicator of innovation externalities. The fact that GVCs have fairly strong performance in promoting patents is therefore a reassuring positive indicator for GVC activity.

There are some additional considerations that should be borne in mind. One consideration is a potential 'training effect' of GVC programmes. Individual VC fund managers are typically less experienced and less well paid in the GVC sector than in the PVC sector. Furthermore, individuals sometimes move from the GVC sector to the PVC sector, but rarely move the other way. Thus, one additional benefit of GVC programmes might lie in providing training for venture capitalists.

Overall, there is suggestive, albeit far from definitive, evidence that moderate GVC activity provides significant value creation and innovation benefits relative to purely private PVC activity and relative to extensive GVC activity. However, some countries (such as Canada and Germany) might have gone too far, as high levels of GVC activity seem to be counterproductive. Moreover, the record of sub-national governments (such as state or provincial governments) is not impressive. Still, we are cautiously optimistic about the record and potential for moderate, well-designed government support for venture capital.

REFERENCES

Akerlof, G. (1970) The Market for Lemons: Quality Uncertainty and the Market Mechanism. In *Quarterly Journal of Economics* 84, 488-500.

Amit, R., Brander, J. and Zott, C. (1998) Why do Venture Capital Firms Exist? Theory and Canadian Evidence. In *Journal of Business Venturing* 13, 441-466.

Amit, R., Glosten, L. and Muller, E. (1990) Entrepreneurial Ability, Venture Investments and Risk Sharing. In *Management Science* 36, 1232-1245.

Anderson, S. and Tian, Y. (2003) Incentive Fees Valuation and Performance of Labour-Sponsored Investment Funds. In *Canadian Investment Review* (16) (Fall), 20-27.

Arrow, K. (1973) *The Limits of Organization*. New York: Norton.

Brander, J., Egan, E. and Hellmann, T. (2009) Government-Sponsored versus Private Venture Capital: Canadian Evidence. Forthcoming in Lerner, J. and Shoar, A. (eds) International Differences in Entrepreneurship. NBER volume based on conference held in Cambridge, Mass. 1-2 February 2008, to be published by the University of Chicago Press.

Bresnahan, T. (1986) Measuring the Spillovers from Technical Advance: Mainframe Computers in Financial Services. In *American Economic Review* 76, No. 4 (September), 742-755.

Cumming, D. and MacIntosh, J. (2002) Venture Capital Exits in Canada and the United States. In *University of Toronto Law Journal* 53, 101-200.

Cumming, D. and MacIntosh, J. (2003) Canadian Labour-Sponsored Venture Capital Corporations: Bane or Boon? Forthcoming in Ginsberg, A. and Hasan, I. (eds.) *New Venture Investment: Choices and Consequences*. New York: Elsevier, 2003, 169-200.

Cumming, D. and MacIntosh, J. (2006) Crowding Out Private Equity: Canadian Evidence. In *Journal of Business Venturing* 21, 569-609.

Gans, J. and Stern, S. (2000) When Does Funding Research by Smaller Firms Bear Fruit?: Evidence from the SBIR Program. NBER Working Paper No. 7877, (September, 2000). Cambridge, Mass.: National Bureau of Economic Research.

Griliches, Z. (1992) The Search for R&D Spillovers. In *Scandinavian Journal of Economics* 94, 29-47.

Hall, B., Jaffe, A. and Trajtenberg, M. (2001) The NBER Patent Citations Data File: Lessons, Insights and Methodological Tools. NBER Working Paper No. 8498, October 2001. Cambridge, Mass.: National Bureau of Economic Research. Available at: http://www.nber.org/papers/w8498.

Hellmann, T. and Puri, M. (2000). The Interaction between Product Market and Financing Strategy: The Role of Venture Capital. In *Review of Financial Studies* 13, No. 4, 959-984.

Hellmann, T. and Puri, M. (2002) Venture Capital and the Professionalization of Start-Up Firms: Empirical Evidence. In *Journal of Finance* 57, 169-197.

Jaffe, A. (1996) *Economic Analysis of Research Spillovers: Implications for the Advanced Technology Program*. Washington, DC: Advanced Technology Program, National Institute of Standards and Technology, US Department of Commerce.

Jensen, M. and Meckling, W. (1976) Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure. In *Journal of Financial Economics* 3, 305-360.

Kortum, S. and Lerner, J. (2000) Assessing the Contribution of Venture Capital to Innovation. In *RAND Journal of Economics* 31, No. 4 (Winter), 674-692.

Leleux, B. and Surlemont, B. (2003) Public Versus Private Venture Capital: Seeding or Crowding Out?: A Pan-European Analysis. In J*ournal of Business Venturing* 18, 81-104.

Lerner, J. (1999) The Government as a Venture Capitalist: The Long-Run Impact of the SBIR Program. In *Journal of Business* 72, No. 3 (July), 285-318.

Lerner, J. (2002) When Bureaucrats Meet Entrepreneurs: The Design of Effective 'Public Venture Capital' Programmes. In *The Economic Journal* 112 (February), 73-84.

Lerner, J. (2009) *Boulevard of Broken Dreams: Why Public Efforts to Boost Entrepreneurship and Venture Capital Have Failed – and What to Do About It*. Princeton, New Jersey: Princeton University Press.

Osborne, D. and Sandler, D. (1998) A Tax Expenditure Analysis of Labour-Sponsored Venture Capital Corporations. In *Canadian Tax Journal* 46, No. 3, 499-574.

Sahlman, W. (1990) The Structure and Governance of the Venture Capital Organizations. In *Journal of Financial Economics* 27, 473-521.

Tirole, J. (1988) *The Theory of Industrial Organization.* Cambridge, Mass.: MIT Press.

Table 1: Venture capital activity by region: 2000-2008

Region	No. of enterprises	% of enterprises with GVC	% of enterprises with exit	% of enterprises with IPO
North America*	11,977	6.19%	17.50%	1.75%
Western Europe	7,930	13.06%	10.38%	3.37%
East Asia	6,508	10.60%	14.20%	10.66%
Oceania	921	3.58%	17.81%	7.49%
Eastern Europe	481	13.72%	7.69%	3.53%
Middle East	443	12.64%	11.96%	4.29%
Latin America	329	16.11%	11.55%	5.78%
Africa	235	10.21%	6.81%	5.11%
Total	28,824	9.36%	14.4%	4.53%

Table 2: Top 10 countries for venture capital activity

Table 2 provides a summary of venture capital activity for the 10 most active countries by indicating the percentage of the total number of enterprises in each country that has GVC, successful exit and IP0.

Country name	No. of enterprises	% of enterprises with GVC	% of enterprises with exit	% enterprises with IPO
United States	11,502	4.41%	17.37%	1.60%
UK	1,860	3.33%	12.53%	3.92%
China	1,769	21.37%	13.45%	11.14%
South Korea	1,584	4.42%	16.70%	14.20%
France	1,518	22.27%	10.14%	4.61%
Germany	1,097	33.00%	9.39%	3.01%
Japan	1,081	1.76%	13.60%	6.75%
India	1,050	15.62%	13.52%	6.19%
Australia	772	3.50%	18.52%	8.16%
Canada	475	49.47%	20.63%	5.47%

Table 3: Correlations at country level

Table 3 shows some simple correlations at the country level between two main variables of interest – the share of enterprises that receive funding from GVCs and the share of VC-backed enterprises that experience an exit – and a set of commonly used country metrics consisting of several World Bank Development Indicators, published by the World Bank. We use the data for our sample period (2000-2008).[11] Bank credit is defined as the percentage of firms using banks to finance purchases of fixed assets. The Legal Rights Index measures the degree to which collateral and bankruptcy laws facilitate lending. It is a count variable, equal to 0 when the legal rights are the weakest and 10 when the legal rights are the strongest. The Number of start-up procedures is a count variable that reports the number of procedures it takes to register a business.

	% of enterprises with GVC	% of enterprises with exit
% of enterprises that exit	-0.0875	
GDP per capita	-0.0616	0.1164
GDP annual growth	-0.1226	-0.1503
Bank credit	-0.0378	0.1695
Market capitalization	-0.0248	0.0623
Legal rights	0.0474	0.0238
Number of start-up procedures	0.0450	-0.1154

* North America consists of Canada and the United States. Mexico and Central America are included in Latin America.

[11] The analysis is based on all enterprises in the dataset, including those that have not enough time after first investment to reasonably expect an exit. Including all data should not create bias in results as GVC and PVC activity follow a similar pattern over time. We feel it is better to include all data rather than introduce an arbitrary maturity criterion for including an enterprise as some enterprises do have relatively early successful exits.

Table 4: Frequency of different categories of GVC activity across enterprises

Share in full sample shows the percentage of enterprises as a fraction of all enterprises in the dataset. Share in GVC sample shows the percentage of enterprises as a fraction of all enterprises that receive some funding from government-backed venture capitalists (GVCs). The variable list refers to attributes of enterprises in the dataset. PVC refers to enterprises financed entirely by private venture capital, GVC for enterprises financed at least in part by GVCs. Moderate GVC means that some but less than half of the enterprises' VC investments were provided by GVCs. Extensive GVC means that half or more of the enterprises' investments are from GVCs. The First-round qualifier indicates that the distinction between Moderate and Extensive GVC is calculated on the basis of the first round of venture capital only. The shares in the GVC sample sum to less than 1 because some GVC-backed enterprises obtain their GVC funding after the first round. The qualifiers Sub-national, National and International refer to GVCs that are backed by sub-national governments, national governments or international organizations. The shares in the GVC sample of these three categories sum to more than 100% because some enterprises receive funding from GVCs associated with different levels of government. The qualifiers Full, Partial and Indirect refer to the nature of government involvement, as discussed in Section 3. Again, the shares in the GVC sample of these three categories sum to more than 100% because some enterprises receive funding from more than one type of GVC.

Variable name	No. of enterprises	Share in full sample	Share in GVC sample
PVC	26,124	90.63%	0.00%
GVC	2,700	9.37%	100.00%
Moderate GVC	1,079	3.74%	39.96%
Extensive GVC	1,621	5.62%	60.04%
Moderate GVC First-round	551	1.91%	20.41%
Extensive GVC First-round	1,703	5.91%	63.07%
Sub-national GVC	689	2.39%	25.51%
National GVC	1,864	6.47%	69.04%
International GVC	273	0.95%	10.11%
Full GVC	840	2.91%	31.11%
Partial GVC	1,725	5.98%	63.89%
Indirect GVC	389	1.35%	14.40%

Table 5: Value creation descriptive statistics for enterprises

The Full sample average column shows the average values for all enterprises in the dataset. The GVC sample average column shows the average values for enterprises that receive some funding from government-backed venture capitalists (GVCs). The Moderate and Extensive GVC average columns show the average values for enterprises that receive moderate or extensive funding from government-backed venture capitalists. Moderate means that some but less than half of the enterprises' VC investment came from GVCs. Extensive means that 50% or more of the enterprises' VC investments were from GVCs. All dollar values are in 2008 US dollar millions. Exits indicates the percentage of enterprises that had an IPO or were acquired by a third party. Exit value indicates the enterprise value at the time of exit. This variable is only collected if an exit occurred. Home runs indicates the percentage of enterprises that had a successful IPO or acquisition with an exit value above U$ 250 million. Years to exit indicates the time in years from the first venture capital investment to the date of exit. This variable is only collected if an exit occurred. IPO indicates the percentage of enterprises that had an IPO. Investments indicates the enterprises' total amount of venture capital investment. Later-round indicates the percentage of enterprises that obtained more than one round of venture capital investments. Investments later rounds indicates the enterprises' total amount of venture capital investment obtained after the first round. This variable is only collected if a later round occurred. Asterisks show the significance level of a *t*-test of the hypothesis that the average value of the variable in the relevant GVC category differs from the average value over enterprises with just private venture capital support. ***, ** and * indicate statistical significance at confidence levels of 99%, 95% and 90% respectively.

Variable name	No. of enterprises	Full sample average	GVC sample average	Moderate GVC average	Extensive GVC average
Exits	28,824	14.40%	15.70%**	22.24%***	11.35%***
Exit value	947	84.57	92.80	120.75**	58.78
Home runs	28,824	0.28%	0.26%	0.56%*	0.06%*
Years to exit	1,456	3.34	3.88***	4.37***	3.00
IPOs	28,824	4.53%	6.15%***	7.04%***	5.55%**
Investments	23,431	23.05	23.75	38.14***	10.22***
Later rounds	28,824	36.33%	43.07%***	72.20%***	23.69%***
Investments later rounds	9,646	35.16	30.34**	37.19*	13.69***

Table 6: Descriptive statistics for patent and employment variables

The Full sample average column shows the average values for all enterprises in the dataset. The GVC sample average column shows the average values for enterprises that receive some funding from government-backed venture capitalists (GVCs). The Moderate and Extensive columns show the average values for enterprises that receive some moderate and extensive funding from government-backed venture capitalists, where Moderate and Extensive means less than half /half or more of the enterprises' investments were provided by GVCs. Prior patenting indicates the percentage of enterprises that published at least one patent prior to obtaining their first venture capital investment. Number of prior patents indicates the number of patents published prior to obtaining the first venture capital investment. Patenting indicates the percentage of enterprises that had published at least one new patent after obtaining their first venture capital investment. Number of new patents indicates the number of new patents published after obtaining the first venture capital investment. Prior employment indicates the number of employees prior to obtaining the first venture capital investment. Employment creation indicates the increase in the number of employees after obtaining the first venture capital investment. Asterisks show the significance level of a *t*-test of the hypothesis that average value of the variable in the relevant GVC category differs from the average value over enterprises with just PVC support. ***, ** and * indicate statistical significance at confidence levels of 99%, 95% and 90% respectively.

Variable name	No. of enterprises	Full sample average	GVC sample average	Moderate GVC average	Extensive GVC average
Prior patenting	28,824	9.22%	9.44%	11.12%**	8.33%
No. of prior patents	28,824	1.09	0.89	0.92**	0.86
Patenting	28,824	22.51%	24.70%***	33.18%***	19.06%***
No. of new patents	28,824	4.13	4.54***	7.72***	2.42***
Prior employment	5,283	137.12	103.88	82.75	124.78
Employment creation	5,283	46.75	57.92	60.07	55.80

Table 7: Explaining successful exit events

Table 7 reports estimation results from four Probit regressions. Probit regressions are appropriate when the variable to be explained is a binary or indicator variable that can be only 1 or 0. In this case the variable to be explained is Exits, which takes the value 1 if an enterprise experienced a successful exit event (an IPO or a third-party acquisition) and 0 otherwise. The main explanatory variables are Moderate GVC and Extensive GVC where GVC stands for enterprises financed at least in part by government-backed venture capital. The qualifier Moderate indicates that some but that less than half of the enterprises' VC investments were provided by GVCs. Extensive means that 50% or more of the enterprises' VC investments are from GVCs. The First-round qualifier indicates that the distinction between Moderate and Extensive GVC is calculated on the basis of the first round of venture capital only. The coefficients compare the performance of these GVC categories with the base category, which is enterprises financed purely by private venture capitalists. Investments indicates the enterprises' total amount of venture capital investment. All regressions include controls for Industry, Year and Country without reporting their coefficients. These control variables are described in Section 3. The Probit regressions first report the coefficient. The marginal effects are shown in square brackets. Robust standard errors, clustered at the country level, are shown in (rounded) parentheses. ***, ** and * indicate statistical significance at confidence levels of 99%, 95% and 90% respectively.

	Probit regression	**Probit regression**	**Probit regression**	**Probit regression**
Dependent variable	**Exits**	**Exits**	**Exits**	**Exits**
Moderate GVC	0.234*** (0.053) (0.064)		0.135** (0.030) (0.058)	
Extensive GVC	-0.050 (-0.010) (0.055)		-0.054 (-0.011) (0.067)	
Moderate GVC First-round		0.246*** (0.056) (0.078)		0.166** (0.038) (0.077)
Extensive GVC First-round		-0.030 (-0.006) (0.059)		-0.042 (-0.008) (0.062)
Investments			0.072*** (0.015) (0.013)	0.074*** (0.015) (0.014)
Industry, Year and Country controls	Yes	Yes	Yes	Yes
No. of enterprises	28,555	28,555	23,174	23,174
(Pseudo) R-squared	0.081	0.080	0.089	0.089

Table 8: Alternative exit measures

The first column reports estimation results from a Probit regression where the dependent variable is IPO, which is an indicator variable that takes the value 1 if an enterprise had an IPO, and 0 otherwise. The second column reports estimation results from a Probit regression where the dependent variable is Home runs, which is an indicator variable that takes the value 1 if an enterprise had an exit value exceeding US$ 250 million and 0 otherwise. The third column reports estimation results from an OLS regression where the dependent variable is Exit value, given by the natural logarithm of 1 plus the value of the enterprise at the time of exit. This variable is only collected if an exit occurred. The fourth column reports estimation results from a Cox regression where the dependent variable is Time to exit, which measures the time from the first venture capital investment to the date of exit in years. This variable is only collected if an exit occurred. For the Cox regression, a negative coefficient, or a hazard rate below 1, indicates that it takes longer to reach an exit. The main independent variables are Moderate GVC and Extensive GVC, where GVC stands for enterprises financed at least in part by government-backed venture capital, and the qualifiers Moderate and Extensive indicate the enterprise received some GVC support and that less than half (moderate) or half or more (extensive) of the enterprises' investments were provided by GVCs. The coefficients compare the performance of these GVC categories against the base category, which are enterprises financed purely by private venture capitalists. All regressions include controls for Industry, Year and Country without reporting their coefficients. These control variables are described in Section 3. All regressions first report the coefficient. Robust standard errors, clustered at the country level, are shown in (rounded) parentheses. For the Probit regressions, the marginal effects are shown in square brackets. For the Cox regression, the hazard rate is shown in the square bracket. ***, ** and * indicate statistical significance at confidence levels of 99%, 95% and 90% respectively.

	Probit	Probit	OLS	Cox
Dependent variable	**IPOs**	**Home runs**	**Exit value**	**Time to exit**
Moderate GVC	0.180** (0.013) (0.088)	0.244** (0.003) (0.122)	0.496*** (0.123)	-0.396*** (0.673) (0.103)
Extensive GVC	-0.011 (-0.001) (0.090)	-0.450 (-0.002) (0.338)	-0.250 (0.225)	-0.081 (0.922) (0.165)
Industry, Year and Country controls	Yes	Yes	Yes	Yes
No. of enterprises	28,399	19,137	947	1,456
(Pseudo) R-squared	0.132	0.048	0.319	0.023

Table 9: The effect of GVC activity on investment

The first two columns report OLS estimation results, where the dependent variable is Investments, given by 1 plus the enterprises' total VC investments. The third column reports a Probit regression where the dependent variable is Later rounds, which is an indicator variable that is 1 if an enterprise had more than one venture capital round and 0 otherwise. The fourth column results from an OLS regression where the dependent variable is Investments in later rounds, given by the natural logarithm of 1 plus the enterprises' total venture capital investments after the first venture capital round. The main explanatory variables are Moderate GVC and Extensive GVC. Moderate GVC means the enterprise received some but less than half of its venture capital from GVCs and Extensive CVC means the enterprise received 50% or more of its venture capital from GVCs. The First-round qualifier indicates that the distinction between Moderate and Extensive GVC is calculated on the basis of the first round of venture capital only. The coefficients compare the performance of these GVC categories against the base category: enterprises financed purely by private venture capitalists. All regressions include controls for Industry, Year and Country. All regressions first report the coefficient. Robust standard errors, clustered at the country level, are shown in (rounded) parentheses. For the Probit regressions, the marginal effects are shown in square brackets. ***, ** and * indicate statistical significance at confidence levels of 99%, 95% and 90% respectively.

	OLS	OLS	Probit	OLS
Dependent variable	**Investments**	**Investments**	**Later rounds**	**Investments in later rounds**
Moderate GVC	1.038*** (0.098)			
Extensive GVC	-0.264 (0.150)			
Moderate GVC First-round		0.701*** (0.110)	0.229** (0.087) (0.090)	0.129* (0.066)
Extensive GVC First-round		-0.185 (0.131)	-0.032 (-0.012) (0.056)	-0.217* (0.126)
Industry, Year and Country controls	Yes	Yes	Yes	Yes
No. of enterprises	23,431	23,431	28,641	9,646
(Pseudo) R-squared	0.223	0.214	0.147	0.219

Table 10: The effect of different levels of government

The first column reports estimation results from a Probit regression, where the dependent variable is Exits, which is an indicator variable that takes the value 1 if an enterprise experienced a successful exit (an IPO or third-party acquisition) and 0 otherwise. The second column reports estimation results from an OLS regression where the dependent variable is Exit value, given by the natural logarithm of 1 plus the value of the enterprise at the time of exit. This variable is only collected if an exit occurred. The third column reports estimation results from OLS regressions, where the dependent variable is Investments, which indicates the natural logarithm of 1 plus the enterprises' total amount of venture capital investments. The main independent variables all pertain to subcategories of GVCs, enterprises financed at least in part by government-backed venture capital. The qualifiers Sub-national, National and International refer to the government venture capital firm being backed by sub-national governments (for example, US states), national governments (for example, US federal government) or international organizations (for example, the European Investment Bank). All regressions include controls for Industry, Year and Country without reporting their coefficients. These control variables are described in Section 3. All regressions first report the coefficient. Robust standard errors, clustered at the country level, are shown in (rounded) parentheses. For the Probit regressions, the marginal effects are shown in square brackets. ***, ** and * indicate statistical significance at confidence levels of 99%, 95% and 90% respectively.

	Probit	OLS	OLS
Dependent variable	**Exits**	**Exit value**	**Investments**
Sub-national GVC	-0.077 (-0.015) (0.081)	-0.084 (0.200)	-0.268 (0.260)
National GVC	0.094* (0.020) (0.054)	0.094 (0.168)	0.520*** (0.088)
International GVC	0.257* (0.060) (0.133)	0.839*** (0.266)	0.808*** (0.166)
Industry, Year and Country controls	Yes	Yes	Yes
No. of enterprises	28,555	947	23,431
(Pseudo) R-squared	0.080	0.317	0.216

Table 11: The effect of different types of government involvement

The first column reports estimation results from a Probit regression, where the dependent variable is Exits, which is an indicator variable that takes the value 1 if an enterprise has experienced a successful exit (an IPO or third-party acquisition) and 0 otherwise. The second column reports estimation results from an OLS regression where the dependent variable is Exit value, given by the natural logarithm of 1 plus the value of the enterprise at the time of exit. This variable is only collected if an exit occurred. The third column reports estimation results from OLS regressions, where the dependent variable is Investments, which indicates the natural logarithm of 1 plus the enterprises' total amount of venture capital investments. The main independent variables all pertain to subcategories of GVCs, enterprises financed at least in part by government-backed venture capital. The qualifiers Full, Partial and Indirect refer to the nature of government involvement, as discussed in Section 3. All regressions include controls for Industry, Year and Country without reporting their coefficients. These control variables are described in Section 3. All regressions first report the coefficient. Robust standard errors, clustered at the country level, are shown in (rounded) parentheses. For the Probit regressions, the marginal effects are shown in square brackets. ***, ** and * indicate statistical significance at confidence levels of 99%, 95% and 90% respectively.

	Probit	OLS	OLS
Dependent variable	**Exits**	**Exit value**	**Investments**
Full GVC	0.007 (0.001) (0.113)	-0.347 (0.225)	0.261* (0.135)
Partial GVC	0.083* (0.018) (0.050)	0.431*** (0.140)	0.404*** (0.097)
Indirect GVC	0.040 (0.008) (0.131)	0.027 (0.372)	0.545*** (0.108)
Industry, Year and Country controls	Yes	Yes	Yes
No. of enterprises	28,555	947	23,431
(Pseudo) R-squared	0.080	0.319	0.214

Table 12: The effect of GVC activity on patents

The first two columns report estimation results from Probit regressions, where the dependent variable is Patenting, which is an indicator variable that takes the value 1 if the enterprise published at least one new patent after obtaining their first venture capital investment, 0 otherwise. The last two columns report estimation results from Tobit regressions, where the dependent variable is Number of new patents, which measures the natural logarithm of 1 plus the number of new patents published after obtaining the first venture capital investment. Tobit regressions are appropriate when the variable to be explained cannot be less than zero, as in this case. The main explanatory variables are Moderate GVC and Extensive GVC. Moderate GVC means the enterprise received some but less than half of its venture capital from GVCs and Extensive GVC means the enterprise received 50% or more of its venture capital from GVCs. The First-round qualifier indicates that the distinction between Moderate and Extensive GVC is calculated on the basis of the first round of venture capital only. The coefficients compare the performance of these GVC categories against the omitted category, which is enterprises financed purely by private venture capitalists. Prior patenting indicates the percentage of enterprises that published at least one patent prior to obtaining their first venture capital investment. Number of prior patents indicates the natural logarithm of 1 plus the number of patents published prior to obtaining the first venture capital investment. All regressions include controls for Industry, Year and Country without reporting their coefficients. These control variables are described in Section 3. A more detailed variable description can also be found in the appendix. All regressions first report the coefficient. For the Probit regressions, robust standard errors, clustered at the country level, are shown in (rounded) parentheses. For the Tobit regressions, standard errors are shown in (rounded) parentheses. For the Probit regressions, the marginal effects are shown in square brackets. ***, ** and * indicate statistical significance at confidence levels of 99%, 95% and 90% respectively.

	Probit	Probit	Tobit	Tobit
Dependent variable	**Patenting**	**Patenting**	**Number of new patents**	**Number of new patents**
Moderate GVC	0.212*** (0.058) (0.037)		0.532*** (0.091)	
Extensive GVC	0.114* (0.030) (0.062)		0.145 (0.094)	
Moderate GVC First-round		0.143** (0.038) (0.059)		0.318** (0.129)
Extensive GVC First-round		0.118** (0.031) (0.578)		0.170* (0.091)
Prior patenting	1.680*** (0.582) (0.057)	1.680*** (0.582) (0.057)		
No. of prior patents			0.815*** (0.027)	0.817*** (0.027)
Industry, Year and Country controls	Yes	Yes	Yes	Yes
No. of enterprises	28,338	28,338	28,823	28,823
(Pseudo) R-squared	0.261	0.261	0.134	0.134

Table 13: The effect of GVC activity on employment

This table reports estimation results from OLS regressions, where the dependent variable is Employment creation. The unit of analysis is the enterprise. To get employment creation for an enterprise we take the difference between the number of employees it has when it gets its first venture capital investment and the number it has in 2008 (or in the latest year for which employment data are available). We then take the natural logarithm of 1 plus this incremental number of employees the enterprise employs after obtaining the first venture capital investment. The main explanatory variables are Moderate GVC and Extensive GVC. Moderate GVC means the enterprise received some but less than half of its venture capital from GVCs and Extensive GVC means the enterprise received 50% or more of its venture capital from GVCs. The First-round qualifier indicates that the distinction between Moderate and Extensive GVC is calculated on the basis of the first round of venture capital only. The coefficients compare the performance of these GVC categories against the omitted category, which is enterprises financed purely by private venture capitalists. Prior employment indicates the natural logarithm of 1 plus the number of employees prior to obtaining the first venture capital investment. All regressions include controls for Industry, Year and Country without reporting their coefficients. These control variables are described in Section 3. A more detailed variable description can also be found in the appendix. All regressions first report the coefficient. Robust standard errors, clustered at the country level, are shown in (rounded) parentheses. ***, ** and * indicate statistical significance at confidence levels of 99%, 95% and 90% respectively.

	OLS	OLS
Dependent variable	**Employment creation**	**Employment creation**
Moderate GVC	0.060 (0.067)	
Extensive GVC	-0.039 (0.042)	
Moderate GVC First-round		0.057 (0.094)
Extensive GVC First-round		-0.066* (0.038)
Employment prior to VC	-0.080*** (0.016)	-0.080*** (0.015)
Industry, Year and Country controls	Yes	Yes
No. of enterprises	5,283	5,283
(Pseudo) R-squared	0.052	0.053

Table 14: The effect of government level and GVC type on patents and employment

The first and third columns report estimation results from Tobit regressions. Tobit regressions are appropriate when the variable to be explained cannot be less than zero, as in this case. The dependent variable is Number of new patents, which measures the natural logarithm of 1 plus the number of new patents published after obtaining the first venture capital investment. The second and fourth columns report estimation results from OLS regressions, where the dependent variable is Employment creation, which measures the natural logarithm of 1 plus the incremental number of employees after obtaining the first venture capital investment. The main independent variables all pertain to subcategories of GVCs, enterprises financed at least in part by government-backed venture capital. The qualifiers Sub-national, National and International refer to the GVC firm being backed by sub-national governments (for example, US states), national governments (for example, US federal government) or international organizations (for example, the European Investment Bank). The qualifiers Full, Partial and Indirect refer to the nature of government involvement, as discussed in Section 3. The coefficients compare the performance of these GVC categories against the base category, which is enterprises financed purely by private venture capitalists. Prior patenting indicates the percentage of enterprises that published at least one patent prior to obtaining their first venture capital investment. Prior employment indicates the natural logarithm of 1 plus the number of employees prior to obtaining the first venture capital investment. All regressions include controls for Industry, Year and Country without reporting their coefficients. These control variables are described in Section 3. A more detailed variable description can also be found in the appendix. All regressions first report the coefficient. For the OLS regressions, robust standard errors, clustered at the country level, are shown in (rounded) parentheses. For the Tobit regressions, standard errors are shown in (rounded) parentheses. ***, ** and * indicate statistical significance at confidence levels of 99%, 95% and 90% respectively.

	Tobit	OLS	Tobit	OLS
Dependent variable	**Number of new patents**	**Employment creation**	**Number of new patents**	**Employment creation**
Sub-national GVC	0.660*** (0.132)	0.001 (0.067)		
National GVC	0.235*** (0.078)	0.019 (0.056)		
International GVC	0.221 (0.228)	0.012 (0.116)		
Full GVC			0.467*** (0.120)	0.164** (0.066)
Partial GVC			0.364*** (0.080)	-0.023 (0.038)
Indirect GVC			-0.016 (0.167)	-0.019 (0.072)
Prior patents	0.817*** (0.027)		0.816*** (0.027)	
Prior employment		-0.080*** (0.016)		-0.080*** (0.015)
Industry, Year and Country controls	Yes	Yes	Yes	Yes
No. of enterprises	28,823	5,283	28,823	5,283
(Pseudo) R-squared	0.134	0.052	0.134	0.053

Figure 1: Number of enterprises first funded in each year

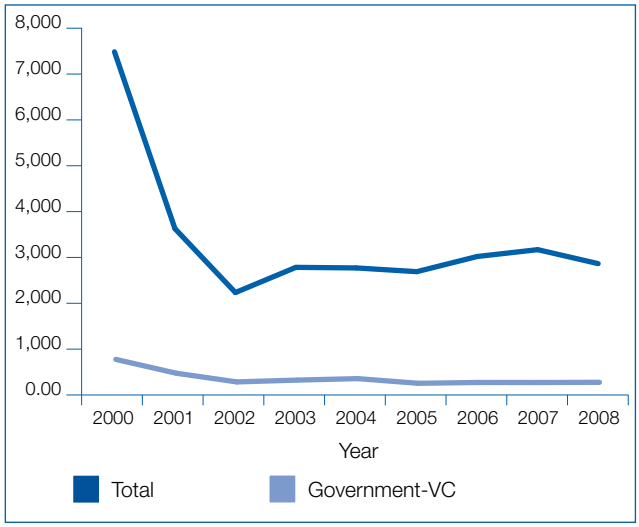


Figure 2: Distribution of enterprises by industry

Figure 2 shows the distribution of the enterprises in our dataset across the major industries represented.

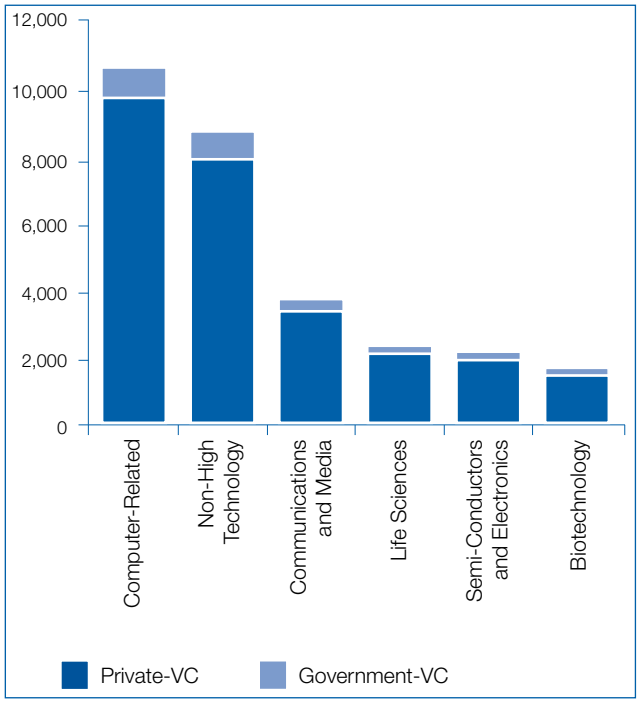


Figure 3: Country-specific effects of GVC activity on successful exits

Figure 3 is a graphical representation of regression coefficients that show the effect of country-specific GVC variables on exits. The coefficients show how the presence of a GVC in the particular country changes the likelihood of exit relative to the base case, where enterprises are financed purely by PVCs. A positive coefficient means that in this country GVCs outperform PVCs. While the numerical value of the coefficient cannot be interpreted directly, the relative sizes of the coefficients reflect the comparative performance of GVCs across countries. Figure 3 shows, for example, that an enterprise with GVC support in Australia, South Korea, France or the US has a higher likelihood of a successful exit than a representative PVC-supported enterprise. On the other hand, Germany, Japan and Canada all have significantly negative GVC effects.

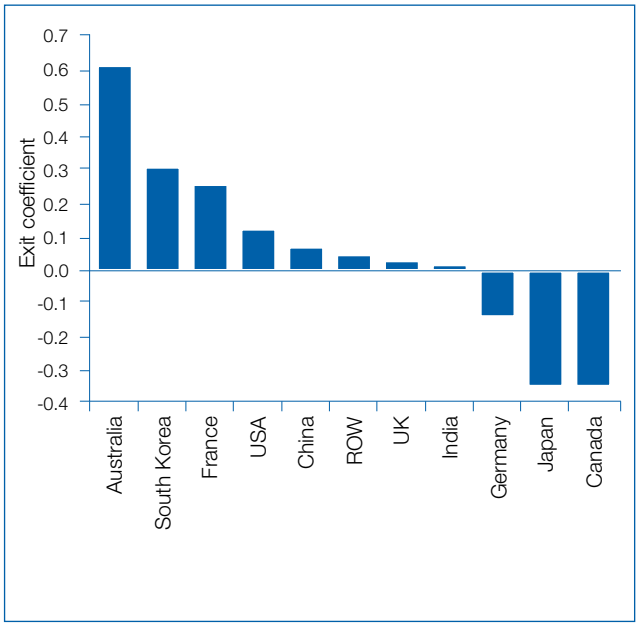


Figure 4: Country-specific effects of GVCs on subsequent investment

Figure 4 provides the same type of analysis, looking at the country-specific effect of GVCs on investments. We ask whether a GVC investment is associated with greater investment in later rounds. We note a similar pecking order: countries such as Australia and South Korea have GVCs that attract high investment levels to the enterprises in which they invest, whereas Germany has relatively poor performance, both relative to GVC in other countries, and relative to PVC.

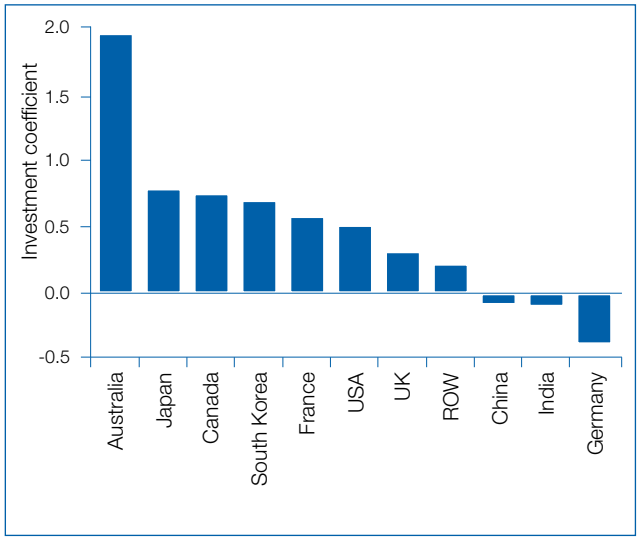
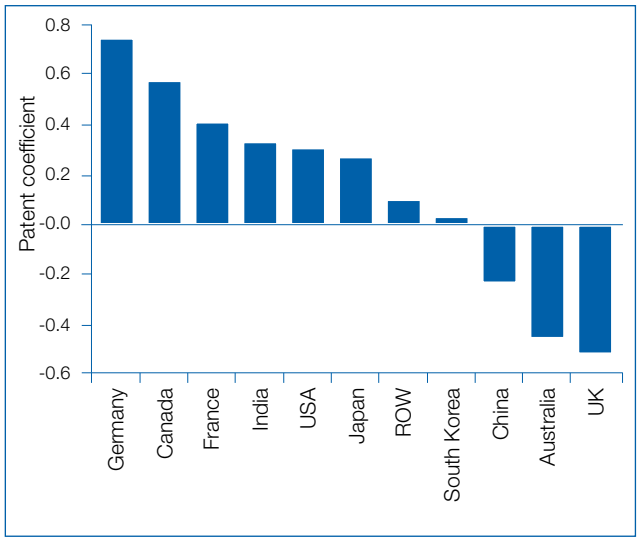


Figure 5: Country-specific effects of GVC activity on patents

Figure 5 illustrates country-specifc effects of GVC activity on patent creation. We note a dramatic reversal of the pecking order: German GVCs have the highest relative performance, and Australia has a highly negative coefficient.



Moderate GVC	This is an indicator variable that takes the value 1 if it is estimated that an enterprise received less than half of its venture capital funding from government-backed venture capital firms (GVCs). If funding amount information is incomplete, the available investment amounts are used to determine whether more or less than half the funding was received from GVCs. If no funding amount information is available, a count of the enterprise's distinct venture capital investors is performed. The indicator variable takes the value 1 whenever less than half of the distinct venture capital investors are GVCs.
Extensive GVC	This is an indicator variable that takes the value 1 if it is estimated that an enterprise received half or more of its venture capital funding from government-backed venture capital firms (GVCs). If funding amount information is incomplete, the available investment amounts are used to determine whether half or more of the funding was received from GVCs. If no funding amount information is available, a count of the enterprise's distinct venture capital investors is performed. The indicator variable takes the value 1 whenever half or more of the distinct venture capital investors are GVCs.
Moderate GVC First-round	This is an indicator variable that takes the value 1 if it is estimated that in its first round of venture capital financing an enterprise received less than half of its funding from government-backed venture capital firms (GVCs). The same procedure as for the Moderate GVC variable is used when funding information is absent or incomplete.
Extensive GVC First-round	This is an indicator variable that takes the value 1 if it is estimated that in its first round of venture capital financing an enterprise received half or more of its funding from government-backed venture capital firms (GVCs). The same procedure as for the Extensive GVC variable is used when funding information is absent or incomplete.
Sub-national GVC	This is an indicator variable that takes the value 1 if an enterprise received venture capital funding from a venture capital firm that was backed by a sub-national government entity.
National GVC	This is an indicator variable that takes the value 1 if an enterprise received venture capital funding from a venture capital firm that was backed by a national government entity.
International GVC	This is an indicator variable that takes the value 1 if an enterprise received venture capital funding from a venture capital firm that was backed by an international government entity
Full GVC	This is an indicator variable that takes the value 1 if an enterprise received venture capital funding from a venture capital firm that was fully owned by the government.
Partial GVC	This is an indicator variable that takes the value 1 if an enterprise received venture capital funding from a venture capital firm that was partially owned by the government.
Indirect GVC	This is an indicator variable that takes the value 1 if an enterprise received venture capital funding from a venture capital firm that was indirectly supported by the government.
Investments	This continuous variable measures the natural logarithm of 1 plus the total known amount of investments received by the company. Investments are measured in current US$ millions. This variable is set to missing if no investment amounts are known.

Later rounds	This is an indicator variable that takes the value 1 if an enterprise received more than one round of venture capital financing.
Investments later rounds	This continuous variable measures the natural logarithm of 1 plus the total known amount of investments received by the company after the first round. Investments are measured in current US$ millions. This variable is set to missing if no investment amounts are known in later rounds.
Industry controls	This is a set of dummy variables for each of the industry classifications, given by (i) computer-related, (ii) communication technologies and media, (iii) semiconductors and electronics, (iv) biotechnology, (v) other life sciences and (vi) other (i.e., non-high-technology).
Year controls	This is a set of dummy variables for each year between 2000 and 2008, indicating the year of the first venture capital investment.
Country controls	This is a set of dummy variables for the country of the enterprise's headquarters.
Exits	This is an indicator variable that takes the value 1 if an enterprise had an exit, either through an initial public offering (IPO) or by acquisition. The variable is meant to capture successful venture capital outcome. Therefore the variable is set to zero if the exit value is known to lie below the total investment amount.
Exit value	This continuous variable measures the natural logarithm of 1 plus the value of exit. The value of exit is the company's total value at the time of the IPO or acquisition, and is measured in current US$ millions. This variable is set to missing if no exit occurred, if the value of the exit is unknown, or if the value of the exit is known to lie below the total investment amount.
Home runs	This is an indicator variable that takes the value 1 if an enterprise had an exit with a known exit value greater than US$ 250 million; 0 otherwise.
Time to exit	This continuous variable measures in years the time between the first venture capital investment and the time of exit. This variable is set to missing if no exit occurred, if the time of exit is unknown, or if the value of exit is known to lie below the total investment amount.
IPOs	This is an indicator variable that takes the value 1 if an enterprise had an initial public offering (IPO). The variable is meant to capture successful venture capital outcome. Therefore the variable is set to zero if the exit value is known to lie below the total investment amount.
Prior patenting	This is an indicator variable that takes the value 1 if an enterprise had published at least one patent prior to the first date of venture capital investments.
Number of prior patents	This continuous variable measures the natural logarithm of 1 plus the number of patents published prior to the first date of venture capital investments.
Patenting	This is an indicator variable that takes the value 1 if an enterprise had published at least one patent between the first date of venture capital investments and the end of the sample period in October 2009.
Number of new patents	This continuous variable measures the difference between (i) the natural logarithm of 1 plus the number of patents published between the first date of venture capital investment and the end of the sample period in October 2009, and (ii) the natural logarithm of 1 plus the number of patents published prior to the first date of venture capital investment.
Prior employment	This continuous variable measures the natural logarithm of 1 plus the number of employees, measured in the earliest year available for the period starting with the year of the enterprise's first venture capital investment. This variable is set to missing if employment information is not available or only available for a single year.
Employment creation	This continuous variable measures the difference between (i) the natural logarithm of 1 plus the number of employees measured in the last year available, and (ii) the natural logarithm of 1 plus the number of employees, measured in the earliest year available for the period starting with the year of the enterprise's first venture capital investment. This variable is set to missing if employment information is not available or only available for a single year.

About the Contributors

CO-EDITORS

Anuradha Gurung is Associate Director of the Investors Industries at the World Economic Forum. Anu leads projects that relate to venture capital, private equity, hedge funds, institutional investors and sovereign wealth funds. One such project investigates the 'Globalization of Alternative Investments', while another identifies opportunities in 'Green Investing' and a third one on 'Investing in Infrastructure' explores public-private solutions to bridge the financing gap for infrastructure. With Josh Lerner of Harvard Business School, Anu is co-editor of all three volumes of the Globalization of Alternative Investments Working Papers: The Global Economic Impact of Private Equity Report. Prior to joining the Forum, Anu was an Investment Banker in the Mergers and Acquisitions (M&A) team at UBS Warburg LLC (now UBS Investment Bank) and in the M&A and Financial Sponsor teams at Banc of America Securities, LLC. She was also a Research Analyst at Schneeweis Partners (now Alternative Investments Analytics, LLC), a research and consulting firm for hedge funds and other alternative investments.

Anu was Phi Beta Kappa and graduated cum laude from Smith College with a BA in Economics (High Honours). She completed her Master of Public Policy at Duke University, where she was a James B. Duke Fellow and a Terry Sanford Scholar and holds a Masters in Global Leadership (awarded by the World Economic Forum in conjunction with Columbia University, INSEAD, London Business School and select faculty). Anu co-wrote the proposal for a mobile library system in rural Nepal, which was one of the top five recipients of a World Bank Development Marketplace grant in 2003. Anu was named a Global Leadership Fellow of the World Economic Forum in 2006.

Josh Lerner is the Jacob H. Schiff Professor of Investment Banking at Harvard Business School, with a joint appointment in the Finance and Entrepreneurial Management Units. He graduated from Yale College with a Special Divisional Major that combined physics with the history of technology. He worked for several years on issues concerning technological innovation and public policy, at the Brookings Institution, for a public-private task force in Chicago, and on Capitol Hill. He then obtained a PhD from Harvard's Economics Department.

Much of his research focuses on the world of alternative investments, with a particular emphasis on venture capital, private equity and sovereign wealth funds. (This work is collected in two books, *The Venture Capital Cycle* and *The Money of Invention*.) He also examines how public policies can boost entrepreneurship and technological innovation. (These topics are explored in *Innovation and Its Discontents* and the recent *Boulevard of Broken Dreams: Why Public Efforts to Boost Entrepreneurship and Venture Capital Have Failed – and What to Do About It*.) He founded, raised funding for, and organizes two groups at the National Bureau of Economic Research (NBER): Entrepreneurship and Innovation Policy and the Economy. His work has been published in a variety of top academic journals.

In the 1993-94 academic year, he introduced an elective course for second-year MBAs on private equity finance. In recent years, "Venture Capital and Private Equity" has consistently been one of the largest elective courses at Harvard Business School. (The course materials are collected in *Venture Capital and Private Equity: A Casebook*, now in its fourth edition, and the forthcoming textbook *Private Equity, Venture Capital and the Financing of Entrepreneurship*.) He teaches a doctoral course on entrepreneurship and in the Owners-Presidents-Managers Program, and organizes annual executive courses on private equity in Boston and Beijing. He is leading an international team of scholars in a multi-year study of the global economic impact of alternative investments for the World Economic Forum.

RESEARCH TEAM

Josh Lerner is the Jacob H. Schiff Professor of Investment Banking at Harvard Business School, with a joint appointment in the Finance and Entrepreneurial Management Units. He graduated from Yale College with a Special Divisional Major that combined physics with the history of technology. He worked for several years on issues concerning technological innovation and public policy, at the Brookings Institution, for a public-private task force in Chicago, and on Capitol Hill. He then obtained a PhD from Harvard's Economics Department.

Much of his research focuses on the world of alternative investments, with a particular emphasis on venture capital, private equity and sovereign wealth funds. (This work is collected in two books, *The Venture Capital Cycle* and *The Money of Invention*.) He also examines how public policies can boost entrepreneurship and technological innovation. (These topics are explored in *Innovation and Its Discontents* and the recent *Boulevard of Broken Dreams: Why Public Efforts to Boost Entrepreneurship and Venture Capital Have Failed – and What to Do About It*.) He founded, raised funding for, and organizes two groups at the National Bureau of Economic Research (NBER): Entrepreneurship and Innovation Policy and the Economy. His work has been published in a variety of top academic journals.

In the 1993-94 academic year, he introduced an elective course for second-year MBAs on private equity finance. In recent years, "Venture Capital and Private Equity" has consistently been one of the largest elective courses at Harvard Business School. (The course materials are collected in *Venture Capital and Private Equity: A Casebook*, now in its fourth edition, and the forthcoming textbook *Private Equity, Venture Capital and the Financing of Entrepreneurship*.) He teaches a doctoral course on entrepreneurship and in the Owners-Presidents-Managers Program, and organizes annual executive courses on private equity in Boston and Beijing. He is leading an international team of scholars in a multi-year study of the global economic impact of alternative investments for the World Economic Forum.

Shai Bernstein is a doctoral student in Economics at Harvard University. His interests include corporate finance, private equity and contract theory. Current empirical research projects are focused on understanding the investment strategies of sovereign wealth funds and the impact of private equity investments on industry performance. In a theoretical research project, he asks questions related to the interaction of externalities and incentives. Prior to Harvard, Shai obtained a BA in Mathematics and Economics from Ben-Gurion University, and an MA in Financial Economics from the Hebrew University.

James Brander is the Asia-Pacific Professor of International Business and Public Policy in the Sauder School of Business at the University of British Columbia (UBC). A native of Vancouver, he completed his BA in Economics at UBC in 1975 and received his PhD from Stanford University in 1979.

He joined the Economics Department at Queen's University, Kingston, Ontario in 1979 and began working on the role of trade policy under imperfect competition, largely in collaboration with Barbara Spencer. This work is often credited as having started the area known as 'strategic trade policy'. In the mid-1980s, after moving to UBC, he began working on the impact of market structure on financial decision-making. His most recent body of work relates to venture capital finance and to the financing of innovation more broadly. He and his co-author, Barbara Spencer, were honoured in the February 2000 issue of the *Journal of International Economics* (JIE) as the authors of the most cited paper ever published up to that time in the JIE. A paper he wrote with Paul Krugman was also sixth on that list. In 1998 he received the Jacob Biely Prize, UBC's top research prize. He served as managing editor of the *Canadian Journal of Economics* (1997-2001) and as Associate Dean in the Sauder School (1999-2003).

Since 2003, he has resumed an active research career focusing on the economics and financing of innovation, including work on venture capital finance. He is currently President of the Canadian Economics Association (for the 2009-10 academic year). His teaching activities have focused on managerial economics, government policy towards business, and international business. He is the author of a textbook, *Government Policy Toward Business*, published by Wiley and now its fourth edition.

Qianqian Du joined Shanghai Advanced Institute of Finance (SAIF) at Shanghai Jiao Tong University in September 2009 as an Assistant Professor of Finance. She received her PhD in Strategy and Business Economics from the University of British Columbia and her MSc in Economics from the University of Oxford. She has broad research and teaching interests, including private equity, mergers and acquisitions, managerial success, and law and economics. She is currently teaching a graduate course on financial economics and co-teaching an MBA course on investment banking and mergers and acquisitions at SAIF.

Thomas Hellmann is the B.I. Ghert Family Foundation Professor of Finance and Policy at the Sauder School of Business at the University of British Columbia (UBC). Dr Hellmann holds a BA from the London School of Economics and a PhD from Stanford University. He is the director of the W. Maurice Young Entrepreneurship and Venture Capital Research Centre at UBC. Prior to joining UBC, he spent 10 years as an Assistant Professor at the Graduate School of Business, Stanford University. He also held visiting positions at the Hoover Institution at Stanford, the Wharton School of Business, University of Pennsylvania, INSEAD (France) and the University of New South Wales. He teaches executive, MBA and undergraduate courses in the areas of venture capital, entrepreneurship and strategic management.

Professor Hellmann's research interests are venture capital, entrepreneurship, innovation, strategic management and public policy. He has published in many leading economics, finance and management journals, including the *American Economic Review*, the *Journal of Finance* and *Management Science*, and is an associate editor at the *Journal of Economics & Management Strategy*. He is the founder of the NBER Entrepreneurship Research Boot Camp, which teaches the frontiers of entrepreneurship economics and entrepreneurial finance to PhD students and has performed several consulting studies related to government policy in venture capital. He led the development of a library of case studies focused on high-technology companies and British Columbia, and is currently writing a textbook on venture capital and private equity.

Morten Sørensen is the Daniel W. Stanton Associate Professor of Business in the Finance and Economics division of Columbia Business School and a Research Fellow at NBER and the Stockholm Institute for Financial Research (SIFR). Previously, he has been an Assistant Professor of Finance at the University of Chicago Graduate School of Business (now Booth School of Business), where he was named the William S. Fishman Scholar for the 2007-08 academic year. He received his PhD in Economics from Stanford University in 2005, where he was a Kapnick Fellow at the Stanford Institute for Economic Policy Research in 2003-2004. He earned an MSc in Economics and a BSc in Mathematical Economics from Aarhus University in Denmark.

Morten's teaching and research interests centre primarily on entrepreneurial finance, venture capital and private equity, and the features that distinguish the markets for entrepreneurial finance and private equity from classical financial markets. This includes the impact of private equity investors on the companies they finance, the factors that influence the investment decisions of private equity funds and the outcomes of investments, and the broader economic impact of entrepreneurship and private equity.

Per Strömberg joined the Swedish Institute of Financial Research (SIFR) in 2004 and became Director of SIFR in 2008. He is also a Professor of Finance at the Stockholm School of Economics, and an Adjunct Professor of Finance at the University of Chicago Graduate School of Business. He received his PhD in Financial Economics from Carnegie Mellon University in 1997. Between 1997 and 2004, Dr Strömberg was a faculty member at the University of Chicago. He is also a faculty Research Fellow of the National Bureau of Economic Research (NBER), a Research Affiliate of the Center for Economic Policy Research (CEPR), and a Research Associate of the European Corporate Governance Institute (ECGI).

Dr Strömberg's academic work has primarily focused on the two areas of bankruptcy and private equity finance. His research has been acknowledged by the 2001 Brattle Prize for best corporate finance paper published in the *Journal of Finance*, the 2004 NASDAQ award for best paper on capital formation at the Western Finance Association meetings, the 2006 Researcher of the Year award at the Stockholm School of Economics, and the JFI Stuart Greenbaum Prize for the most significant paper published in the *Journal of Financial Intermediation* in 2007. He has also won the Best Teacher award in the University of Chicago GSB European Executive MBA programmes in 2004 and 2005, and was named "Professor of the year" by the Asia programme in 2006.

Apart from his academic appointments, Dr Strömberg is a scientific adviser to the Swedish Financial Supervision Authority (Finansinspektionen) and an independent board member of Conversus Capital, L.P., a publicly listed portfolio of private equity funds.

FROM THE WORLD ECONOMIC FORUM

Max von Bismarck is Director and Head of the Investors Industries at the World Economic Forum. He leads an international team based in New York and Geneva which globally oversees all substantive activities and relationships of the World Economic Forum related to private equity, venture capital, hedge funds, institutional investors and sovereign funds. Max currently champions projects concerning an emerging 'New Financial Architecture', the 'Globalization of Alternative Investments', 'Entrepreneurship and Growth Strategies' and opportunities in 'Green Investing' and 'Investing in Infrastructure'.

Max also created and oversees the World Economic Forum's Global Agenda Council on 'The Future of Long-Term Investing'. As an adviser to the Chairman he also led the process for the World Economic Forum 2005-2008 strategy development. Prior to joining the World Economic Forum, Max helped to build two companies as an entrepreneur. He was Co-Founder and Managing Director at Public One Strategy Consulting and Director, Legal of the Oxford-based technology company Mondus Limited. He studied Law and Modern History at St John's College, Oxford University and Humboldt Universität, Berlin and holds an Executive Masters in Global Leadership (World Economic Forum in collaboration with Columbia University and INSEAD). Max was named a German-American Young Leader of the Atlantik-Brücke in 2004 and a Global Leadership Fellow of the World Economic Forum in 2005. Max is a trustee of the World Economic Forum USA Retirement Plan.

Anuradha Gurung is Associate Director of the Investors Industries at the World Economic Forum. Anu leads projects that relate to venture capital, private equity, hedge funds, institutional investors and sovereign wealth funds. One such project investigates the 'Globalization of Alternative Investments', while another identifies opportunities in 'Green Investing' and a third one on 'Investing in Infrastructure' explores public-private solutions to bridge the financing gap for infrastructure. With Josh Lerner of Harvard Business School, Anu is co-editor of all three volumes of the Globalization of Alternative Investments Working Papers: The Global Economic Impact of Private Equity Report. Prior to joining the Forum, Anu was an Investment Banker in the Mergers and Acquisitions (M&A) team at UBS Warburg LLC (now UBS Investment Bank) and in the M&A and Financial Sponsor teams at Banc of America Securities, LLC. She was also a Research Analyst at Schneeweis Partners (now Alternative Investments Analytics, LLC), a research and consulting firm for hedge funds and other alternative investments.

Anu was Phi Beta Kappa and graduated cum laude from Smith College with a BA in Economics (High Honours). She completed her Master of Public Policy at Duke University, where she was a James B. Duke Fellow and a Terry Sanford Scholar and holds a Masters in Global Leadership (awarded by the World Economic Forum in conjunction with Columbia University, INSEAD, London Business School and select faculty). Anu co-wrote the proposal for a mobile library system in rural Nepal, which was one of the top five recipients of a World Bank Development Marketplace grant in 2003. Anu was named a Global Leadership Fellow of the World Economic Forum in 2006.

Kevin Steinberg is Chief Operating Officer and Head of the Centre for Global Industries for the World Economic Forum USA, the North American affiliate of the Forum based in New York which acts as global headquarters for its industry-related efforts. His primary focus is on its Financial Institutions sectors including the Investors Community, as well as overall operations of the organization. Kevin's prior roles included overseeing the Foundation's Industry teams; leading its Membership and Partnership department; and guiding its Institutional Strategy function. Since 1992, internally or as an external adviser, he has led several initiatives including the launch of the Global Leaders for Tomorrow community, organized worldwide industry summits, and led Foundation-level strategy projects. Before joining the World Economic Forum, Kevin spent 10 years with the Wholesale and Investment Banking Practice of McKinsey & Company in New York and Switzerland, primarily focused on corporate, business unit and product strategy, serving wholesale and retail financial companies as well as non-profit institutions. He holds an AB in Economics from Harvard University and a JD and an MBA from Stanford University.

Note from the Editors

ANURADHA GURUNG
World Economic Forum USA

JOSH LERNER
Harvard Business School

This volume of the Global Economic Impact of Private Equity Working Papers would not have been possible without the intellectual stewardship and invaluable contributions of the members of the Advisory Board for the World Economic Forum's Globalization of Alternative Investments project. On behalf of the World Economic Forum and the research team, we would like to express our gratitude to them.

Chris Allen, Lynn Chang, Lingxiang Gao, Florian Guhr, Joel Jaffe, Yan Li, Armin Navabi, Jacek Rycko and numerous other associates provided exemplary help with the research. Thanks are also due to Edward Whitehouse at the OECD.

Thank you to Debra Sheehan for sub-editing the Working Papers, to Alex Gilham, Michelle Kelly and the team at Wardour, and to Kamal Kimaoui and the Publications Team at the World Economic Forum for their assistance in the production of this volume of Working Papers. Samantha Tonkin at the World Economic Forum also deserves special thanks for assisting in the communications process.

WORLD ECONOMIC FORUM

COMMITTED TO IMPROVING THE STATE OF THE WORLD

The World Economic Forum is an independent international organization committed to improving the state of the world by engaging leaders in partnerships to shape global, regional and industry agendas. Incorporated as a foundation in 1971, and based in Geneva, Switzerland, the World Economic Forum is impartial and not-for-profit; it is tied to no political, partisan or national interests.

(www.weforum.org)