

The determinants of venture capital funding: evidence across countries

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Abstract

This paper analyses the determinants of venture capital for a sample of 21 countries. In particular, we consider the importance of initial public offerings (IPOs), gross domestic product (GDP) and market capitalization growth, labor market rigidities, accounting standards, private pension funds, and government programs. We find that IPOs are the strongest driver of venture capital investing. Private pension fund levels are a significant determinant over time but not across countries. Surprisingly, GDP and market capitalization growth are not significant. Government policies can have a strong impact, both by setting the regulatory stage, and by galvanizing investment during downturns. Finally, we also show that different types of venture capital financing are affected differently by these factors. In particular, early stage venture capital investing is negatively impacted by labor market rigidities, while later stage is not. IPOs have no effect on early stage venture capital investing across countries, but are a significant determinant of later stage venture capital investing across countries. Finally, government funded venture capital has different sensitivities to the determinants of venture capital than non-government funded venture capital. Our insights emphasize the need for a more differentiated approach to venture capital, both from a research as well as from a policy perspective. We feel that while later stage venture capital investing is well understood, early stage and government funded investments still require more extensive research. © 2000 Elsevier Science B.V. All rights reserved.

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1. Introduction

Venture capital has been the driving force behind some of the most vibrant sectors of the US economy over the past two decades. Venture capitalists were instrumental in fostering the tremendous growth of firms such as Microsoft, Compaq, Oracle, and Sun Microsystems, which were all founded less than 20 years ago, but have rapidly become dominant players in the high technology arena. While the contributions venture capital makes to the economy overall are underexplored, there exists a widespread belief that venture capital is instrumental in bringing innovations to market at a rapid pace, thereby creating economic growth, jobs, and opportunities for further technological innovation. The 1997 National Venture Capital Association annual study on the impact of venture capital sheds light on some of the job-creating abilities of the sector. The study reveals that between 1991 and 1995, venture-backed companies increased their staffs on average 34% per year. Over the same time period, Fortune 500 companies decreased staffing levels 4% per year.¹

The growth rate of venture capital funding has been high in many countries, but funding levels still vary significantly (see Table 1). In this paper, our goal is to understand the determinants of growth in the venture capital industry. Our work builds on that of Black and Gilson (1998), who examine the importance of well-developed stock markets and initial public offerings (IPOs) for venture capital financing. Black and Gilson's empirical work tests only the significance of IPOs over time in the US. We test a number of other factors in addition to IPOs, and use panel data for 10 years and 15 countries. The factors we test are the ones enumerated in the literature on venture capital: IPOs, gross domestic product (GDP) and market capitalization growth, labor market rigidities, financial reporting standards, private pension funds, and government programs.

Our results indicate that IPOs are the most important determinant of venture capital investing. Private pension fund levels impact venture capital over time, but not across countries. Our analysis demonstrates the necessity of separating venture capital into early (seed and startup) and later (expansion) stage investing, both for the purposes of analysis and for policy considerations. In particular, we show that different types of venture capital are differently affected by the determinants of venture capital. Thus, labor market rigidities negatively affect early stage venture capital investments, but have no impact on later stage venture capital investments. IPOs have no impact on early stage investments across countries, but are a significant determinant for later stage venture capital investments. Government funded venture capital is not as strongly determined by IPOs as non-government funded venture capital. Finally, our qualitative analysis of government programs

¹ *Seventh Annual Economic Impact of Venture Capital Study* (1997), National Venture Capital Association, Venture One, Coopers & Lybrand L.L.P.

gives further insight into the role government funds can play as a catalyst for private sector funding.

This paper is organized as follows: Section 2 discusses the role of small firms in the economy and the link between these firms and venture capital from the perspectives of financial intermediation, corporate governance, and entrepreneurship. Section 3 explains how venture capital firms are organized and how they work. Section 4 surveys the theories that explain what factors affect venture capital investments. Section 5 discusses the data, while Section 6 covers the regression methodology. Section 7 presents our empirical results. Section 8 discusses the role of government programs and includes case studies of the venture capital experience of Israel and Germany. Section 9 concludes.

2. The role of venture capital in the economy

Before we discuss venture capital in more detail, we first need to clarify our use of the term, since it is defined differently in the US and Europe. Venture capital, as we use the term, refers to one type of private equity investing. Private equity investments are investments by institutions or wealthy individuals in both publicly quoted and privately held companies. Private equity investors are more actively involved in managing their portfolio companies than regular, passive retail investors. The main types of financing included in private equity investing are venture capital and management and leveraged buyouts. Outside of the US, the term venture capital is frequently used to describe what we have just referred to as private equity.

The definition of venture capital, as it is used in the US, and as we use it in our paper, comprises three types of investing — seed, startup, and expansion investment — and excludes buyouts. These types represent three stages of investing which are defined with reference to the stage of development of the company receiving the investment.

Seed capital is the very first type of financing a newly founded company might want to secure. These funds are typically used to fund initial product research and development and to assess the commercial potential of ideas. Startup investments, on the other hand, are targeted at companies that have moved past the idea stage and are gearing up to produce, market, and sell their products. Companies at this stage still use more cash than they generate. Investments in either seed or startup stage are also referred to simply as early stage investments.

After a company has passed through the early stage, it becomes a potential candidate for expansion stage investing. In the expansion stage, a company that has already established its product in the marketplace often needs additional capital to fund the growth of its manufacturing and distribution capacity, as well as to fund further R&D.

Table 1
Country comparison

Countries	Venture capital (US\$ in millions)			Early stage (US\$ in millions)			Private equity new funds (US\$ in millions)		
	1986 ^a	1995 ^b	CAGR%	1986 ^a	1995 ^b	CAGR%	1986 ^c	1995 ^d	CAGR%
Australia	417	888	45.9	17	54	76.5	239	249	0.8
Austria	1.9	1.4	−3.8	2	0.4	−16.5	1	2	1.6
Belgium	195	139	−3.7	67	8.4	−20.7	344	210	−5.4
Canada	152	412	15.4	65	182	15.7	230	1,133	19.4
Denmark	22	19	−1.6	4.6	4.5	−0.2	32	37	1.7
Finland	9.7	38	21.7	1.5	1.0	32.4	54	69	3.4
France	195	444	9.6	32	35	1.2	168	1055	22.6
Germany	43	694	36.4	9	116	32.8	50	274	20.9
Ireland	17	25	4.7	8	1	−18.9	34	16	−7.9
Israel	NA	NA	NA	NA	NA	NA	60	139	18.0
Italy	21	246	31.5	11	60	20.9	203	354	6.4
Japan	2351	2524	7.4	18	11	−38.3	258	604	23.7
Netherlands	128	471	15.6	31	100	14.0	260	337	2.9
New Zealand	0.7	3.8	461.9	NA	0.9	NM	14	33	135
Norway	14	154	40.9	1.2	7	28.6	14	60	22.8
Portugal	0.3	57	101.1	0.3	9	54.3	2	143	67.4
Spain	34	180	20.4	14	24	5.7	0	190	−2.35
Sweden	61	31	−7.1	7	9	3.0	114	614	20.5
Switzerland	13	28	9.0	10	1	−22.7	6	64	29.5
United Kingdom	65	883	3.5	158	36	−15.2	777	2363	13.2
United States	3181	3651	1.5	333	1093	14.1	8800	28,369	13.9

The other category of investments included in private equity, in addition to venture capital, is buyouts. Buyouts are usually applied to more mature companies. In a leveraged buyout, debt is used to acquire a company and reduce its equity base. Management buyouts are leveraged buyouts where current management takes control of its company.

Our primary interest is specifically in venture capital, not private equity. We believe venture capital in particular merits interest for several reasons. The past performance of venture capital-backed companies shows that venture capital has been very successful at backing companies with innovative technologies and tremendous growth potential. Companies such as Apple, Compaq, Digital Equipment, Intel, Microsoft, and Sun Microsystems were all backed by venture capital. As a measure of the success of these companies, we can consider their total market capitalization, which in July 1997 was US\$369 billion.

The National Venture Capital Association 1997 report gives further evidence on the beneficial impact of venture capital. In addition to creating jobs at a much faster rate than Fortune 500 companies, venture capital-backed firms have done well even when compared to other high growth companies. 1995 revenue growth for venture capital-backed high growth companies was 36.8% compared to 23.8% for non-venture capital-backed high growth companies.

2.1. The role of venture capital in financial intermediation

Venture capital firms serve as financial intermediaries in a market where lenders and borrowers find it costly to get together. The costs are due to adverse selection and moral hazard, and the cost of administration, information gathering, and search efforts. By and large, the literature focuses on the important role banks play as financial intermediaries (Mayer, 1988; Fama, 1985; Myers and Majluf, 1984). However, for startup ventures, bank financing may not be optimal. In the US, for example, banks are prohibited from holding equity. But startups have few other tangible assets, and the prohibition makes it difficult for banks to obtain

Notes to Table 1:

Venture Capital includes seed, startup and expansion stage investments. Early stage includes only seed and startup investments. Private Equity New funds raised is defined as committed, but not yet paid, capital to private equity funds, i.e., includes money raised for all stages of investment. Source: European Venture Capital Journal, The Guide to Venture Capital in Asia, Venture Economics for US figures, MacDonald and Associates for Canada's figures and the Giza Group for Israel's figures.

^a1988 figures for Canada, Finland and Norway. 1992 Estimated figures for Australia and Japan. 1993 estimated figures for New Zealand.

^b1994 estimated figures for Australia and New Zealand. 1993 estimated figures for Japan. 1994 figures for Portugal.

^c1989 figures for Australia and Japan. 1988 figures for Finland and Norway. 1993 figures for New Zealand 1990 figures for Israel.

^d1994 figures for Australia, New Zealand and US and 1993 figures for Japan.

reasonable collateral on loans to startups. This severely restricts banks' willingness to take the additional risk associated with these new companies. In addition, since startups require a lot of cash in the early stages to finance their growth, debt-based finance is usually inappropriate from a cash management perspective as it strictly ties the cash flows of companies.

Even in countries such as Japan and Germany, where banks can hold equity, startup ventures are not highly funded by banks. This is to a large extent due to corporate governance issues discussed in the next section.

Given the need for financial intermediaries for startups and the unsuitability of banks to this role, the venture capital organization arose to fill this void in startup financing. American Research and Development, founded in Massachusetts in 1946, was the first modern venture capital organization. Venture capital is especially attractive because its equity finance structure gives companies the necessary leeway in their repayment schedule. In addition, by focusing on startups, venture capital firms achieve expertise and economies of scale in locating and financing potentially successful startup ventures.

Gompers (1994) examines "Angels" as an alternative source of funding for startups. "Angels" are essentially wealthy individuals who finance startups out of their own funds. While "Angels" represent an important source of financing, their scope is limited by the wealth of these individuals. "Angels" are not a viable source for large amounts of capital. Another source of startup financing is large corporations. However, Sykes (1990) finds that these programs have had limited success.

2.2. Venture capital vs. other forms of corporate governance

Startup firms present a unique set of issues for corporate governance which makes venture capital particularly suited to the sector. They operate in new markets, where information about the nature of the market is generally poor. Furthermore, they do not have an established track record which could be used as a baseline performance measure. Because so much of their value lies in their potential for future growth and so little in their current, tangible assets, startups place particular demands on monitors of financial performance. Jensen (1993) describes the type of investor needed in this environment as "active investor".

Active investors are investors who have a large financial interest in their investments, and can still provide an impartial view of the management of these firms. Some of the most common financial intermediaries, such as pension funds, insurance companies and money managers, are unable to perform the role of active investor due to legal structures and customs. Roe (1990) outlines the various restrictions on US banks, insurance companies, and mutuals, which prevent them from holding a large equity stake in any one company and from being actively involved on the boards of their investment companies.

Sahlman (1990) and Jensen (1993) find that venture capitalists solve the corporate governance and monitoring problem through extensive initial due diligence about startup companies' businesses. Furthermore, they maintain a close relationship by frequently visiting and talking to company management. The venture capitalists also sit on the boards of directors. In some instances, they even perform some key corporate functions for the firm, such as running the corporate finance department and working with suppliers and customers.

While countries such as Japan and Germany do not have restrictions on equity holding by banks, their banks are still not very adept at filling the necessary role as monitor for startups due to institutional design. A few banks dominate Japan's and Germany's banking industry and, often, only those companies with close relationships to these banks can obtain financing. Also, because they are large and provide a wide range of services, these banks do not have the specialization and focus required to handle small startups. Their involvement in management issues at the firms they lend to is often minimal. Edwards and Fischer (1994) document that German banks do not play an active role in management and that bank representation on boards is generally very small.

Large companies can also play an active role in the development of smaller enterprises with new ideas. However, this governance model possesses many attributes that reduce the chances of success for startups. Hardyman et al. (1983) find that legal difficulties often arise over whether the corporation has access to ventures' proprietary information. In addition, corporate venture capital groups within large organizations may not be able to operate autonomously (Siegel et al., 1988). Furthermore, Sahlman (1991) points out that the approval process within large enterprises is neither fast nor effective enough. He also notes that the entrepreneur is not sufficiently motivated, due to the absence of any equity participation and any negative repercussions of failure.

Thus, venture capitalists are the only ones who can really successfully provide the type of corporate governance that startups need.

2.3. Venture capital and entrepreneurship

While the entrepreneurship literature does not emphasize the role of venture capital, its insights suggest that venture capital can be quite important in the context of entrepreneurial challenges. The recent literature, as summarized by Holmes and Schmitz (1990), focuses on the importance of technological innovation and of matching up entrepreneurs with appropriate projects.

Opportunities for creating new products arise over time as a consequence of technological innovation and demographic change, while the ability to exploit these opportunities varies across the population. Not everyone is capable of starting a new business, and those who have started one are not necessarily capable of managing it competently. Even good business projects must be matched with an appropriate entrepreneur if they are to succeed. If the success of a project

hinges vitally on finding a suitable entrepreneur, venture capitalists can greatly aid the success of a project by providing a matching function. They can also assist the process by developing the manager's skills after she has been brought in, and by bringing in additional management talent as needed.

Furthermore, the literature on entrepreneurship finds that liquidity constraints are binding and, therefore, critical to entrepreneurs (Evans and Jovanovich, 1989). This underscores the importance of venture capital as a way to circumvent liquidity constraints.

3. Venture capital structure and functioning

Both the private equity and the venture capital sectors differ across countries. Their differences start with organizational form. In the US and UK, firms are organized as limited partnerships, while in France and Germany they have a different organizational structure with far more involvement of banks (Lerner, 1995a,b). Another difference in organizational form is the prevalence of so-called captive funds in Europe and their relative absence in the US. Funds are labeled captive if more than 80% of their financing derives from one source. In many instances, captive funds are subsidiaries of banks. In France, in 1995, captive funds accounted for 37.1% of new funds raised.

The management style of venture capitalists differs across countries as well. In Japan and Germany, venture capital firms are not as actively involved in managing their investments as in the US. Japanese and German venture capitalists have traditionally not held board representation, nor have they been involved in day-to-day management issues. Hurry et al. (1991) present evidence on the different degree of involvement of US and Japanese venture capital firms. They show that US firms tend to make fewer investments, but take larger equity stakes in each investment. This strategy confers an advantage over the Japanese one because it allows the venture capitalists to better focus on managing and understanding a few companies and gives them a greater incentive to monitor.

The composition of funding sources also differs dramatically by country. If we consider all private equity investing, the US private equity market received 38%² of its funds from pension funds in 1995. In Germany, by contrast, pension funds supplied only 8.6% of new funds raised and banks supplied 57.2% in that same year.³

Tables 2–4 indicate how levels of venture capital and private equity differ across time and across countries. In order to compare the order of magnitude of

² Represents percent of capital committed to independent private funds. Does not include SBIC, family groups or corporate affiliates. Venture Capital Yearbook, 1996.

³ EVCA Yearbook.

Table 2
Venture capital investment as per mil of average GDP

Country	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	Average level (per mil)	Average growth (%)	CAGR (%)
Australia	NA	NA	NA	NA	NA	NA	0.364	0.358	1.198	1.336	0.814	82	54
Austria	0.014	0.027	0.011	0.058	0.044	0.025	0.006	0.004	0.002	0.007	0.020	60	–7
Belgium	1.207	1.056	0.282	0.444	0.370	0.612	0.737	0.414	0.327	0.628	0.608	8	–7
Canada	0.206	0.252	0.275	0.229	0.197	0.270	0.267	0.413	0.569	0.855	0.353	20	17
Denmark	0.201	0.243	0.211	0.123	0.111	0.168	0.072	0.134	0.170	0.132	0.156	5	–5
Finland	NA	NA	0.087	0.064	0.182	0.203	0.174	0.262	0.282	0.358	0.202	34	22
France	0.194	0.302	0.558	0.516	0.551	0.620	0.464	0.433	0.539	0.336	0.451	12	6
Germany	0.031	0.036	0.045	0.108	0.334	0.386	0.362	0.342	0.376	0.375	0.240	45	32
Ireland	0.425	0.876	0.655	0.416	0.795	0.892	0.584	0.377	0.629	0.557	0.620	15	3
Israel	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Italy	0.021	0.060	0.081	0.208	0.168	0.403	0.418	0.234	0.210	0.295	0.210	54	34
Japan	NA	NA	NA	NA	NA	NA	0.052	0.038	NA	0.216	0.102	–28	61
Netherlands	0.532	0.482	0.546	0.503	0.783	0.795	0.684	0.608	1.063	1.433	0.743	15	12
New Zealand	NA	NA	NA	NA	NA	NA	NA	0.016	0.041	0.517	0.191	658	463
Norway	NA	NA	0.126	0.011	0.520	0.465	0.242	0.420	0.689	1.337	0.476	645	40
Portugal	0.004	0.127	0.072	0.217	0.588	0.727	0.709	1.073	1.185	0.990	0.569	378	84
Spain	0.087	0.221	0.171	0.154	0.125	0.376	0.302	0.322	0.307	0.425	0.249	36	19
Sweden	0.313	0.250	0.131	0.163	0.202	0.079	0.055	0.148	0.524	0.158	0.202	27	–7
Switzerland	0.068	0.010	0.175	0.166	0.205	0.122	0.245	0.159	0.222	0.105	0.157	17	5
UK	0.793	1.057	1.080	1.224	1.076	0.883	0.816	0.726	0.100	1.033	0.969	5	3
US	0.556	0.867	0.434	0.408	0.308	0.177	0.366	0.349	0.457	0.638	0.456	12	2

Venture capital investment levels for 21 countries. Venture capital investment is defined as startup + seed + expansion investments. Data on venture capital is taken from the EVCA yearbooks, AVCA yearbooks, MacDonald and Associates, and Venture Economics. Average growth is the arithmetic annual growth rate over the time period considered. CAGR is the geometric annual growth rate over the time period considered.

Table 3
Early stage investment as per mil of average GDP

Country	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	Average level (per mil)	Average growth (%)	CAGR (%)
Australia	NA	NA	NA	NA	NA	NA	0.069	0.044	0.191	0.526	0.207	159	97
Austria	0.014	0.027	0.001	0.053	0.012	0.006	0.000	0.001	0.0001	0.002	0.012	1300	–19
Belgium	0.417	0.311	0.085	0.146	0.061	0.170	0.089	0.071	0.091	0.038	0.148	–0.4	–23
Canada	0.082	0.100	0.118	0.088	0.067	0.112	0.138	0.176	0.178	0.376	0.144	25	18
Denmark	0.041	0.037	0.050	0.089	0.057	0.051	0.009	0.033	0.036	0.031	0.043	25	–3
Finland	NA	NA	0.013	0.028	0.082	0.102	0.078	0.090	0.074	0.096	0.071	48	33
France	0.032	0.039	0.119	0.088	0.105	0.033	0.042	0.016	0.026	0.027	0.053	20	–2
Germany	0.007	0.012	0.012	0.035	0.027	0.031	0.036	0.039	0.060	0.063	0.032	39	28
Ireland	0.194	0.299	0.315	0.017	0.028	0.127	0.037	0.099	0.071	0.026	0.121	43	–20
Israel	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Italy	0.011	0.014	0.002	0.019	0.014	0.066	0.067	0.007	0.053	0.071	0.033	184	23
Japan	NA	NA	NA	NA	NA	NA	0.005	0.003	NA	0.047	0.018	–45	105
Netherlands	0.127	0.059	0.107	0.058	0.094	0.103	0.082	0.085	0.173	0.304	0.119	24	10
New Zealand	NA	NA	NA	NA	NA	NA	NA	0.000	0.019	0.062	0.027	237	237
Norway	NA	NA	0.011	0.006	0.067	0.027	0.023	0.091	0.153	0.061	0.055	176	28
Portugal	0.004	0.047	0.029	0.037	0.178	0.133	0.110	0.090	0.143	0.087	0.086	153	41
Spain	0.037	0.155	0.098	0.076	0.033	0.094	0.077	0.046	0.033	0.056	0.070	41	5
Sweden	0.034	0.080	0.012	0.041	0.024	0.008	0.006	0.012	0.012	0.043	0.027	57	3
Switzerland	0.050	0.036	0.040	0.073	0.072	0.014	0.002	0.018	0.035	0.004	0.034	70	–26
UK	0.194	0.191	0.254	0.218	0.160	0.086	0.070	0.066	0.082	0.042	0.136	–12	–16
US	0.058	0.055	0.068	0.070	0.045	0.021	0.074	0.062	0.102	0.191	0.075	36	14

Early stage investment levels for 21 countries. Early stage investment is defined as startup + seed investments. Data on venture capital is taken from the EVCA yearbooks, AVCA yearbooks, MacDonald and Associates, and Venture Economics. Average growth is the arithmetic annual growth rate over the time period considered. CAGR is the geometric annual growth rate over the time period considered.

Table 4
Private equity new funds raised as per mil of average GDP

Country	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	Average level (per mil)	Average growth (%)	CAGR (%)
Australia	NA	NA	NA	0.829	0.157	0.964	0.314	0.713	0.881	1.672	0.790	101	12
Austria	0.011	0.032	0.115	0.016	0.007	0.000	0.000	0.000	0.000	0.009	0.019	43	–2
Belgium	2.133	2.409	0.218	0.414	0.221	0.592	0.522	0.635	0.549	0.946	0.864	22	–9
Canada	0.483	0.835	0.840	0.384	0.235	0.501	0.621	1.195	1.520	2.349	0.896	32	19
Denmark	0.288	0.331	0.215	0.079	0.358	0.246	0.099	0.128	1.028	0.253	0.302	93	–1
Finland	NA	NA	0.484	0.316	0.230	0.109	0.042	0.145	0.526	0.641	0.312	50	4
France	0.168	0.758	0.697	1.754	1.079	1.273	0.907	0.855	1.077	0.799	0.937	49	19
Germany	0.036	0.238	0.114	0.178	0.543	0.642	0.636	0.152	0.215	0.148	0.290	80	17
Ireland	0.864	1.091	1.263	0.628	0.515	1.087	1.243	0.848	5.254	0.360	1.315	55	–9
Israel	NA	NA	NA	NA	NA	0.896	1.478	3.313	1.642	0.716	1.610	21	–5
Italy	0.204	0.129	0.268	0.260	0.224	0.256	0.526	0.421	0.450	0.419	0.316	17	8
Japan	NA	NA	NA	0.088	0.288	0.245	0.258	0.161	NA	0.400	0.240	45	29
Netherlands	1.080	0.412	1.063	0.721	0.380	0.475	0.395	0.551	1.063	1.025	0.717	17	–1
New Zealand	NA	NA	NA	NA	NA	NA	NA	0.340	0.694	0.231	0.422	19	–18
Norway	NA	NA	0.129	0.002	0.630	0.368	0.136	0.730	0.440	0.520	0.369	3658	22
Portugal	0.036	0.184	0.163	1.926	0.426	0.227	0.329	1.779	2.388	NA	0.924	206	54
Spain	0.000	0.489	0.239	0.175	0.409	0.374	0.470	0.575	0.187	0.450	0.337	21	–1
Sweden	0.592	0.598	0.135	0.180	0.991	0.613	1.855	0.864	1.633	3.101	1.056	78	20
Switzerland	0.033	0.451	0.109	0.198	0.566	0.119	0.258	0.371	0.284	0.240	0.263	167	25
UK	0.955	2.363	2.403	4.053	2.758	1.665	1.669	1.752	5.433	2.761	2.581	35	13
US	1.539	3.095	2.221	2.518	1.110	1.226	1.751	2.243	3.384	4.960	2.405	23	14

Private equity new funds raised for 21 countries. Private equity new funds raised includes funds raised for venture capital and buyouts. Data on venture capital is taken from the EVCA yearbooks, AVCA yearbooks, the GIZA Group, MacDonald and Associates, and Venture Economics Average growth is the arithmetic annual growth rate over the time period considered. CAGR is the geometric annual growth rate over the time period considered.

private equity and venture capital funding across countries, we normalize our figures by average GDP for each country. Table 4 shows how, in relative terms in 1995, the US had the greatest amount of new fund flows into private equity. Averaged over the whole time period, however, the UK had slightly higher flows into private equity than the US.

The compound annual growth rate of new funds raised was also similar for both countries. This, however, masks some strong differences between the two. US private equity suffered a downswing which bottomed out in 1990, and then steadily rebounded over the next 5 years. UK private equity hit its trough only 1 year later, but then stagnated until 1994.

An even more interesting difference, from the perspective of this paper, concerns the difference in early stage investment patterns between countries. If we again look at the US and UK, we see that the UK suffered a steady, unabated decline in early stage investing that took place over the whole time period (see Table 3). As a per mil of GDP, early stage investing dropped from 0.19 to 0.04 in the UK from 1986 to 1995. In the US, by contrast, early stage investing followed closely the development of private equity, with a trough in the early 1990s and steady recovery since then.

The emphasis on early stage investing is strong and growing in some countries, such as Australia, Canada, the Netherlands, and the US. In other countries — Germany, Japan, and the UK, to name just a few — private equity is more involved in later stage financing. For example, in 1994, 36% of Germany's private equity⁴ was invested in later stage investments. However, for the same time period, only 18% of US private equity⁵ was similarly invested.

While we recognize that great differences exist in venture capital and private equity firms across countries, we limit our description of organizational structure to the case of the US limited partnership. Since our main interest lies with venture capital and not private equity, we find it advantageous to use the US as an example given the specialization in venture capital that prevails there.

Venture capital firms in the US are typically organized as limited partnerships with the venture capitalists serving as general partners and the investors serving as limited partners. It was not until the early 1980s that the limited partnership became the predominant form of venture capital funds in the US. In 1980, only 40% of funds were limited partnerships, but by 1992, over 80% of venture capital funds were organized as such (Gompers and Lerner, 1996). The US venture capital industry exhibits a high degree of geographic concentration. Gompers and Lerner find that 25% of US venture capital firms were based in California over the 1972–1992 time period. A large portion of new capital committed comes from

⁴ EVCA Yearbook.

⁵ Includes LBOs, Acquisitions, Bridge Loans and Public Purchases. Source: Venture Capital Journal, July 1996.

pension funds, endowments, and insurance companies and banks. In 1995, they provided 38%, 22% and 18%, respectively, of new capital committed.

In general, a venture capital firm will manage several pools of capital. Each of these pools of capital, also referred to as funds, is structured as a separate limited partnership. Venture capital firms invest in a broad range of industries, not just high technology startups. A fund will invest in projects over the first 3 to 5 years of its existence. Investments and appreciation are paid out to the partners over the remainder of the fund's life.

We have already spoken about the importance of the monitoring that takes place between venture capitalists and entrepreneurs. The relationship between venture capitalist and entrepreneur is marked by the following monitoring and control arrangements:

- Monitoring frequency. Gompers (1995) shows how decreases in industry ratios of tangible assets to total assets, higher market to book ratios and greater R&D intensities lead to more frequent monitoring.
- Compensation schemes that are designed to provide the entrepreneur with the appropriate incentives. Equity-based compensation gives the entrepreneur the incentive to focus on growth.
- Active involvement of the venture capitalist with the company through board representation. Lerner (1995a,b) shows that venture capitalists' involvement as directors is more intense when the need for oversight is greater.
- Use of convertible securities. These give the venture capitalists the option of selling their stake back to the entrepreneur.

The need for monitoring also extends to the relationship between the investor and the venture capitalist. Just as the entrepreneur has an incentive to deviate from behavior that is optimal for the venture capitalist, the venture capitalist has an incentive to deviate from behavior that is optimal for the investor. Investors monitor venture capitalists in the following ways:

- The life of the venture capital fund is limited, which means that the venture capitalist cannot keep the money forever. The limited lifespan of venture capital funds also ensures that disagreements over when and how to distribute funds are minimized.
- Limited partners can withdraw from funding the partnership after the initial capital investment. In practice, limited partners rarely withdraw their funds from the partnership. They are more likely to withhold new funds from venture capitalists in future fundraising efforts.
- Venture capitalists are explicitly prohibited from self-dealing, i.e., receiving preferential investment terms different from those granted to the limited partner.

In the late 1980s the use of covenants became very popular. The average number of covenants used per contract grew from 4.4 to 7.9 between the two periods of 1978–1982 and 1988–1992, respectively (Gompers and Lerner, 1996). However, Gompers and Lerner (1996) find that restrictive covenants are only used in the most serious cases because they are very costly to negotiate. They also find that the use of covenants decreases during periods of high demand for venture funding, since the supply of venture capitalist services is rather limited. In this situation, the reduction of covenants is viewed as increased compensation for the venture capitalist.

4. Factors that affect venture capital

The previous section described how venture capitalists manage their investments. This section lays out the theoretical underpinnings of our empirical analysis, and explains what the driving forces are behind venture capital flows. We recognize that we have not included all factors that practitioners would deem important for venture capital. Specifically, we think that capital gains tax rates and the efficiency of bankruptcy procedures also impact venture capital. We encounter difficulties, however, in finding good measures for these variables to include in our empirical analysis. Thus, for instance, while we believe that capital gains taxes are important, using data on individual capital gains tax rates, we find no statistically significant impact on venture capital and, for this reason, we do not report the results in our regressions.

4.1. Initial public offerings

The main risk faced by investors and venture capitalists is the risk of not getting their money back. Thus, a viable exit mechanism is extremely important to the development of a venture capital industry. Furthermore, an exit mechanism is essential to the entrepreneur for two reasons. First, it provides a financial incentive for equity-compensated managers to expend effort. Second, it gives the managers a call option on control of the firm, since venture capitalists relinquish control at the time of the IPO (Black and Gilson, 1998).

We focus on IPOs as an exit mechanism for the following reasons. While there are many mechanisms to liquidate a fund, the literature shows that the most attractive option is through an IPO. A study conducted by Venture Economics (1988) finds that US\$1.00 invested in a firm that eventually goes public yields a 195% average return (or an average cash return of US\$1.95 over the original investment) for a 4.2-year average holding period. The same investment in an acquired firm only provides an average return of 40% (or a cash return of only 40 cents) over a 3.7-year average holding period. Also, if regaining control is important to the entrepreneur, IPOs are clearly the best choice, given that the other option, trade sales, frequently entails loss of control. Trade sales are sales of a

Table 5
Percentage of divestments that are trade sales

Country	1991 (%)	1992 (%)	1993 (%)	1994 (%)	1995 (%)	Mean (%)
Austria	22	50	100	NA	24	49
Belgium	52	NA	57	51	32	48
Denmark	24	7	70	62	85	50
Finland	67	37	0	10	48	32
France	41	56	57	33	48	47
Germany	NA	NA	NA	NA	NA	NA
Ireland	82	76	19	13	64	51
Italy	86	89	57	21	52	61
Netherlands	48	44	22	24	44	36
Norway	15	49	18	40	15	27
Portugal	NA	100	57	90	56	76
Spain	72	62	20	31	24	42
Sweden	13	40	78	43	25	40
Switzerland	40	4	24	33	47	30
UK	24	22	41	30	36	30

Trade sales and divestments are measured in local currency terms. Divestments include all private equity. The number reported represents trade sales as a percentage of divestments. The data are taken from the EVCA yearbooks.

startup company to a larger company (also referred to as a strategic buyer). Table 5 shows the importance of trade sales in Europe. The percentage of divestments

Table 6
Percentage of divestments that are public offerings

Country	1991 (%)	1992 (%)	1993 (%)	1994 (%)	1995 (%)	Mean (%)
Austria	0	0	0	NA	0	0
Belgium	2	NA	0	20	39	15
Denmark	24	55	0	0	0	16
Finland	0	0	0	0	1	0.2
France	10	2	12	21	8	11
Germany	NA	NA	NA	NA	NA	NA
Ireland	0	0	0	0	0	0
Italy	5	0	3	0	12	4
Netherlands	8	5	20	12	6	10
Norway	1	17	37	6	31	18
Portugal	0	0	0	0	NA	0
Spain	2	1	0	1	0	1
Sweden	1	0	16	0	52	14
Switzerland	0	2	8	15	0	5
UK	13	34	36	47	45	35

Public offerings and divestments are measured in local currency terms. Divestments include all private equity. The number reported represents public offerings as a percentage of divestments. The data are taken from the EVCA yearbooks.

accounted for by trade sales ranges from 30% in the UK to 76% in Portugal over the whole time period considered (Table 6).

To account for the importance of exit mechanisms, we include both current and lagged IPOs in our statistical analysis. We do not have an explicit measure of trade sales. Increased volume of IPOs should have a positive effect on both the demand and supply of venture capital funds. On the demand side, the existence of an exit mechanism gives entrepreneurs an additional incentive to start a company. On the supply side, the effect is essentially the same; large investors are more willing to supply funds to venture capital firms if they feel that they can later recoup their investment.

4.2. Labor market rigidities

Labor market rigidities present an obstacle to venture capital growth. Sahlman (1990) discusses how labor market rigidities form a large barrier to the success of venture capital investing in countries such as Germany and Japan. In Japan, for instance, leaving a company is not only considered dishonorable, but departing individuals also lose valuable benefits of seniority. Also, should the individual fail in his new venture, it would be difficult for him to find new employment, which would lead to a further loss of social standing. Labor market rigidities are frequently cited as one important reason why venture capital is not more prevalent in Europe and Asia.⁶

Labor market rigidity should impact the demand for venture capital funds negatively (i.e., the higher labor market rigidity, the less demand for venture capital funds we would expect). Strict labor laws make hiring employees difficult for companies, because they deprive the company of the flexibility to let people go later on, should this become necessary. In addition, large benefits payments, which typically accompany more rigid labor markets, make it more expensive to hire in the first place.

We use two measures of labor market rigidity. One reflects rigidity in the market for skilled labor, the other reflects rigidity in the overall labor market.

4.3. Financial reporting standards

Small startup firms are risky prospects. If the market does not have good information on these companies, investors will demand a high risk premium, resulting in more expensive funding for these companies. This cost of asymmetric information can be reduced if the country in which the company operates has strict accounting standards. With good accounting regulation, venture capitalists need to spend less time gathering information to monitor their investments.

⁶ The Economist (1997), “Venture Capitalists: A Really Big Adventure.”

We include an independent variable that measures the level of accounting standards in the various countries for public firms. Since we are dealing with private firms in our sample, we use this variable as a proxy for reporting standards of private firms. On the supply side, this variable should have a positive effect on the supply of venture capital funds.

4.4. Private pension funds

Raising money from pension funds provides numerous advantages to the venture capitalist. Venture capitalists can quickly raise a large amount of investment capital solely by approaching a few large pension funds. Furthermore, with only a few investors, a venture capital firm can economize on the amount of time expended on keeping its investors apprised of its activities. In addition, with changes in legislation and perceived high rates of return, many pension funds became eager to lend to venture capitalists. For all these reasons, private pension funds are an important source of venture capital funds in the US. In 1994, pension funds provided 46% of venture capital money in the United States (Black and Gilson, 1998).

On the other hand, raising money from pension funds may present a few disadvantages. For instance, in the US, there may be regulatory compliance issues with ERISA. In addition, managers of pension funds are sophisticated investors who may require additional disclosure. However, these issues do not present a huge barrier for venture capitalists to raise money, especially for venture capitalists with good reputations.

We have included private pension fund data as an independent variable in our regressions. Private pension funds should have a positive effect on the supply of new funds to venture capital firms. There is no reason to believe that private pension funds have any effect on demand for venture capital funds.

4.5. Macroeconomic variables

The state of the country's economy will also have an effect on venture capital. Acs and Audretsch (1994) suggest that macroeconomic fluctuations influence startup activity in general. Macroeconomic expansions are found to lead to an increase in the number of startups. Since an increase in startup activity increases demand for venture capital funds, we expect a positive relationship between macroeconomic expansion and venture capital investing. We use GDP growth to measure macroeconomic fluctuations in our analysis and expect this variable to be positively correlated with venture capital investment.

We also include growth in market capitalization as an explanatory factor for venture capital investing. We believe that increases in market capitalization create a more favorable environment for investors in general. Therefore, increases in market capitalization should be met by greater supply of funds to venture capital investments.

4.6. *Government programs*

Many governments have begun to recognize the benefits of venture capital and have made efforts to fund startup businesses. Lerner (1997) provides preliminary evidence that government funded programs can yield favorable benefits. However, O'Shea (1996) points out that there may also be disadvantages to these efforts. For instance, government spending on venture capital may hinder the development of a private venture capital sector. Furthermore, many are sceptical about the government's ability to appropriately target healthy ventures. In addition to looking at government funding in our statistical analysis, we also discuss on a more descriptive level the importance of various government programs in Section 8.1.

5. Data

This paper empirically examines 21 countries: Austria, Australia, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Israel, Italy, Japan, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, the United Kingdom and the United States. These countries are selected based on availability of information.

We use panel data covering the years 1986–1995. Data on venture capital investments, early stage investments, and new funds raised are obtained from The European Venture Capital Journal, Asian Venture Capital Journal, The GIZA Group for Israel figures, Macdonald's and Associates for Canada figures and Venture Economics for US figures.

Venture capital investments refer to the total amount disbursed by venture capitalists for seed, startup and expansion stage investments. Early stage investments only include funds used for seed and startup investments. Our New Funds Raised number is dictated by data availability. Ideally, we would look at new funds raised for venture capital. However, the closest we can come to that figure is new funds raised for private equity. New Funds Raised is defined as total funds raised for all private equity investing and includes committed, but not yet paid, capital. Typically, the capital promised by investors to venture capitalists is not immediately paid to the venture capitalists. Most agreements call for a 25–33% cash commitment up-front and stipulate when addition cash is to be phased in at future dates (Sahlman, 1990). The total amount of investment promised to the venture capitalists is referred to as committed capital, even though only approximately one third is initially paid in.

Country GDP data in local currency are provided by the IMF's International Financial Statistics Yearbook. Market capitalization data (annual end of period figures) in billions of US dollars are provided by the IMF's Emerging Markets Fact Book. Total Private Pension fund figures in US Dollars are provided by

InterSec Research. Exchange rates (annual end of period rates) are obtained from the IMF's International Financial Statistics and are expressed as national currency unit per SDR.

IPO data are available for 1986–1995 for Canada, Japan and the US, 1989–1995 for the UK, and 1991–1995 for Australia, other European Countries and New Zealand. They are provided by the Federation Internationale des Bourses de Valeurs, Securities Data, Nomura Securities and the Toronto Stock Exchange. These figures exclude privatizations, real estate trusts, utilities and closed-end funds.

Ratings on accounting standards are measured by an index provided by International Accounting and Auditing Trends, Center for International Financial Analysis and Research. This index is created by examining and rating companies' 1990 annual reports on their inclusion or omission of 90 accounting items. A minimum of three companies in each country were studied.

We include two measures of labor market rigidity. Our first measure gauges the amount of flexibility in a country's skilled labor market, by measuring the average job tenure of individuals who have completed some or all tertiary education. This statistic best represents the class of individuals who are likely to start new enterprises. For the US, this figure is 7.4 years while for Germany and Japan it is 10.5 and 9.5 years, respectively. Our second measure refers more generally to the entire labor market. It measures the percent of the labor force that has job tenure greater than 10 years. This statistic attempts to capture the flexibility of all individuals to leave their current position to join a startup. While there exist better measures of labor turnover,⁷ none offers as broad a cross-section as these two statistics. Data for these two measures are provided by the OECD's 1997 Employment Outlook, Chapter 5 (Draft) and 1994 Employment Outlook, respectively.

We also use variables from the law and finance literature (La Porta et al.) to measure the efficiency of financial markets. The categorization of legal systems as reported by La Porta et al. (1996) divides countries into four legal traditions: English, French, German, and Scandinavian. The English legal tradition is also referred to as the common law tradition, while the other legal traditions can be grouped together as the civil law traditions. The different legal traditions differ by the extent to which shareholder and creditor rights are protected in the various countries. The common law tradition provides the best legal protections, while the French tradition is the worst in this respect.

The variables Rule of Law, Anti-director Rights, and One Share One Vote all describe the amount of protection that shareholders can expect in a given country.

⁷ The Employment Outlook, OECD publishes labor turnover rates which measure the movements of individuals into jobs (hirings) and out of jobs (separations) over a particular period. In addition, it mentions that labor tenure is correlated with labor turnover.

Table 7
Variable descriptions

Variable	Description	Sources
Early Stage Investments	Early stage investments (Seed and Startup, both government and private sector funded) divided by average GDP	European Venture Capital Journal, Asian Venture Capital Journal, Macdonald's and Associates for Canadian data and Venture Economics for US data
Early Stage Investments w/o government funds	Estimated Early Stage Investments, funded by private sector sources, divided by average GDP	European Venture Capital Journal, Asian Venture Capital Journal, Macdonald's and Associates for Canadian data and Venture Economics for US data
New Funds Raised	Annual New Funds raised (both government and private sector funded) domestically divided by average GDP. Includes committed but not yet paid capital	European Venture Capital Journal, Asian Venture Capital Journal, Macdonald's and Associates for Canadian data and Venture Economics for US data
New Funds Raised w/o government funds	Annual New Funds raised domestically divided by average GDP. Excludes Government funds. Includes committed but not yet paid capital	European Venture Capital Journal, Asian Venture Capital Journal, Macdonald's and Associates for Canadian data and Venture Economics for US data
Venture Capital Funds	Annual Expansion and Early Stage Investments (both government and private sector funded) divided by average GDP	European Venture Capital Journal, Asian Venture Capital Journal, Macdonald's and Associates for Canadian data and Venture Economics for US data
Venture Capital Funds w/o government funds	Estimated Expansion and Early Stage Investments, funded by private sector sources, divided by GDP	European Venture Capital Journal, Asian Venture Capital Journal, Macdonald's and Associates for Canadian data and Venture Economics for US data
IPOs	Total Market Value of IPOs divided by average GDP	FIBV, Nomura Securities Securities Data, Toronto Stock Exchange
Labor Market Rigidity (educated)	Average tenure of Employees with some or completed tertiary education	OECD's Draft 1996 Economic Outlook Chapter 5
Labor Market Rigidity (general)	Percent of labor force with a tenure greater than 10 years	OECD's 1993 Economic Outlook
Accounting Standards	Ratings on Accounting Standards	International Accounting and Auditing Trends, Center for International Financial Analysis and Research
Private Pension Growth	Percentage change in Private Pension Fund Levels	InterSec Research
Private Pension Levels	Private Pension Fund Levels divided by GDP	InterSec Research
Market Capitalization Growth	Percentage change in Market Capitalization	Emerging Market's Fact Book, International Monetary Fund

Table 7 (continued)

Variable	Description	Sources
GDP Growth	Percentage change in GDP	International Financial Statistics, International Monetary Fund 1995

They are taken from La Porta et al. (1996). Rule of Law reflects the law and order tradition in a country, as measured by the International Country Risk Guide. The scale ranges from 0 to 10, with lower scores for a weaker law and order tradition. Anti-director Rights is an index aggregating shareholder rights. This index is formed by adding one for each of the following conditions: (1) when the country allows shareholders to mail their proxy vote; (2) when shareholders are not required to deposit their shares prior to the General Shareholders' meeting; (3) when cumulative voting is allowed; (4) when an oppressed minorities mechanism is in place; or (5) when the minimum percentage of share capital that entitles a shareholder to call for an Extraordinary Shareholders' Meeting is less than or equal to 10%. The index ranges from 0 to 5. One Share One Vote equals one if the company law or the commercial code of the country requires that ordinary shares carry one vote per share. Otherwise it is zero.

Table 7 provides a summary of the variables used in this paper and their sources.

6. Methodology

We use a linear specification for the supply and demand schedules of venture capital funds. In our regression analysis, we estimate the coefficients of the equilibrium specification.

6.1. Supply and demand structural equations

As explained in Section 4, we believe the following factors (in addition to return percentage) influence the supply of venture capital: IPOs, accounting standards, GDP growth, and market capitalization growth. The following simple equation describes the supply of venture funds in the economy:

$$\begin{aligned}
 &\text{Venture capital funds supplied}_{it} \\
 &= \alpha_0 + \alpha_1 \text{Return percentage}_{it} + \alpha_2 \text{IPOs}_{it} + \alpha_3 \text{Accounting standards}_i \\
 &\quad + \alpha_4 \text{GDP percentage growth}_{it} \\
 &\quad + \alpha_5 \text{Market capitalization percentage growth}_{it}
 \end{aligned}$$

Section 4 also describes the variables that we believe are important for demand for venture capital: IPOs, accounting standards, labor market rigidities, GDP growth and market capitalization growth. A simple equation for the demand side of venture capital is as follows:

$$\begin{aligned} & \text{Venture capital funds demanded}_{it} \\ &= \beta_0 + \beta_1 \text{Return percentage}_{it} + \beta_2 \text{IPOs}_{it} + \beta_3 \text{Accounting standards}_i \\ &+ \beta_4 \text{Labor market rigidities}_i + \beta_5 \text{GDP percentage growth}_{it} \\ &+ \beta_6 \text{Market capitalization percentage growth}_{it} \end{aligned}$$

To obtain the equilibrium, we solve the supply equation for return percentage, and substitute this expression into the demand equation. Then, taking into account the equality in equilibrium of supply and demand, we solve for the equilibrium quantity. Equilibrium Condition:

$$\begin{aligned} & \text{Venture capital funds}_{it} \\ &= \pi_0 + \pi_1 \text{IPOs}_{it} + \pi_2 \text{Accounting standards}_i \\ &+ \pi_3 \text{Labor market rigidities}_i + \pi_4 \text{GDP percentage growth}_{it} \\ &+ \pi_5 \text{Market capitalization growth}_{it} \end{aligned}$$

where, in equilibrium, Venture capital funds supplied_{it} = Venture capital funds demanded_{it} = Venture capital funds_{it}.

The equilibrium for new funds raised is analogous. The only difference is that the supply of new funds is also affected by private pension funds. Our regression analysis considers two different forms of the equilibrium equation: the cross-sectional form and the within form.

6.2. Between regression (cross-section regression)

The between regression captures the difference in venture capital investments between countries as a result of differences in characteristics across countries.

$$\begin{aligned} & \overline{\text{Venture capital funds}_i} \\ &= \pi_0 + \pi_1 \overline{\text{IPOs}_i} + \pi_2 \text{Accounting standards}_i \\ &+ \pi_3 \text{Labor market rigidities}_i + \pi_4 \overline{\text{GDP percentage growth rate}_i} \\ &+ \pi_5 \overline{\text{Market capitalization percentage growth rate}_i} \end{aligned}$$

where

$$\overline{\text{Venture capital funds}_i} = \text{Average of venture capital funds over time}$$

and likewise for other variables.

Table 8
Venture capital investments, between regressions

Independent variables	Dependent variables					
	(1) Venture capital w/o gov't funds	(2) Venture capital w/o gov't funds	(3) Venture capital w/o gov't funds	(4) Venture capital	(5) Venture capital	(6) Venture capital
IPOs	0.0953 (2.934) ^a	0.0718 (2.067) ^b	0.0976 (3.986) ^a	0.0901 (2.18 0) ^b	0.05814 (1.382)	0.0899 (2.851) ^a
Accounting Standards	– 0.00002 (– 1.723) ^c	– 0.000005 (– 0.341)	– 0.00002 (– 2.514) ^a	– 0.00002 (– 1.482) ^d	0.000006 (0.349)	– 0.00002 (– 2.039) ^b
Labor Market Rigidity (educated)	– 0.00003 (– 0.612)		– 0.00003 (– 0.634)	– 0.00002 (– 0.270)		– 0.00002 (– 0.296)
Labor Market Rigidity (general)		– 0.00001 (– 0.969)			– 0.00001 (– 0.580)	
Market capitalization growth	– 0.0002 (– 0.294)	– 0.0004 (– 0.537)	– 0.00018 (– 0.320)	– 0.00013 (– 0.163)	– 0.00007 (– 0.081)	– 0.0001 (– 0.171)
GDP growth	0.0005 (0.117)	0.0007 (0.176)		– 0.00005 (– 0.010)	0.0019 (0.393)	
Constant	0.0014 (1.603) ^c	0.0010 (0.769)	0.0015 (1.984) ^b	0.0015 (1.297)	0.00015 (0.097)	0.0015 (1.545) ^c
R ²	0.6502	0.7119	0.6497	0.4924	0.6004	0.4923

Between regression of 15 countries. The dependent variables are venture capital (i.e., early stage and expansion) investments with and without government funds, divided by average GDP. The independent variables are: (1) IPOs divided by average GDP; (2) Accounting Standards; (3) Labor Market Rigidity (educated); (4) Labor Market Rigidity (general); (5) Percentage change in Market capitalization; (6) Percentage change in GDP. *T*-statistics for coefficients in parentheses.

^a Significant at 1% level.

^b Significant at 10% level.

^c Significant at 15% level.

^d Significant at 20% level.

Table 9

(A) Venture capital investments, between regressions (1993–1995)¹

Independent variables	Dependent variables			
	(1) Venture capital w/o gov't funds 1993–1995	(2) Venture capital w/o gov't funds 1994–1995	(3) Venture capital 1993–1995	(4) Venture capital 1994–1995
IPOs	0.1043 (5.070) ^a	0.0814 (4.925) ^a	0.0929 (3.731) ^a	0.0701 (3.693) ^a
Accounting Standards	– 0.00003 (– 4.566) ^a	– 0.00002 (– 3.215) ^a	– 0.00003 (– 3.416) ^a	– 0.00002 (– 2.263) ^a
Labor Market Rigidity (educated)	– 0.00005 (– 1.171)	– 0.00004 (– 0.846)	– 0.00005 (– 0.916)	– 0.00002 (– 0.320)
Market capitalization growth	0.00134 (2.857) ^a	0.0021 (2.723) ^a	0.0015 (2.692) ^a	0.0026 (2.875) ^a
GDP Growth	– 0.0071 (– 1.352)	– 0.0096 (– 1.851) ^b	– 0.0069 (– 1.089)	– 0.0111 (– 1.858) ^b
Constant	0.0025 (3.543) ^a	0.0024 (3.161) ^a	0.0024 (2.741) ^a	0.0020 (2.322) ^a
R ²	0.8102	0.8447	0.7161	0.7885

(B) Venture capital investments, between regressions²

Independent variables	Dependent variables					
	(1) Venture capital w/o gov't funds	(2) Venture capital w/o gov't funds	(3) Venture capital w/o gov't funds	(4) Venture capital	(5) Venture capital	(6) Venture capital
GDP Growth	0.0025 (0.685)	0.0033 (0.634)	0.0030 (0.785)	0.0028 (0.700)	0.0037(0.657)	0.0030 (0.707)
Rule of Law	0.0000 (−0.106)	0.0000 (0.020)	0.0000 (−0.002)	0.0000 (0.251)	0.0000 (0.324)	0.0000 (0.277)
One Share One Vote		0.0001 (0.221)			0.0001 (0.239)	
Anti-director rights			0.0001 (0.785)			0.0000(0.316)
French origin	−0.0001 (−0.622)	−0.0001 (−0.558)	0.0001(0.292)	0.0000 (0.018)	0.0000 (0.051)	0.0001 (0.269)
German origin	−0.0004 ^b (−2.181)	−0.0005 ^b (−1.908)	−0.0003 (−0.953)	−0.0004 ^b (−1.895)	−0.0004 ^c (−1.697)	−0.0003 (−1.044)
Scandinavian origin	−0.0004 ^c (−1.762)	−0.0004 ^c (−1.576)	−0.0002 (−0.845)	−0.0003 ^d (−1.435)	−0.0003 (−1.258)	−0.0003 (−0.859)
Constant	0.0006 (0.505)	0.0004 (0.273)	0.0001 (0.107)	0.0002 (0.138)	0.0000 (−0.025)	0.0000 (−0.020)
R ²	0.52	0.53	0.56	0.51	0.51	0.52

^aSignificant at 1% level.^bSignificant at 10% level.^cSignificant at 15% level.^dSignificant at 20% level.

¹Between regression of 15 countries for 1993 to 1995 time span. The dependent variables are venture capital (i.e., early stage and expansion) investments with and without government funds, divided by average GDP. The independent variables are: (1) IPOs divided by average GDP; (2) Accounting Standards; (3) Labor Market Rigidity (educated); (4) Percentage change in Market capitalization; (5) Percentage change in GDP. *T*-statistics for coefficients in parentheses.

²Between regression of 15 countries. The dependent variables are venture capital (i.e., early stage and expansion) investments with and without government funds, divided by average GDP. The independent variables are (1) GDP growth; (2) Rule of Law; (3) One Share One Vote; (4) Anti-director Rights; (5) French legal origin; (6) German legal origin; (7) Scandinavian legal origin. *T*-statistics for coefficients in parentheses.

The dependent variables used in the between regressions are: new funds committed, venture capital investment (seed, startup and expansion stage investments) and early stage investment (seed and startup investments). Each variable is normalized by average GDP. Early stage investments, venture capital investments, and new funds raised all include government funds. However, we believe that government funding is driven by considerations different from the ones driving private sector funding. Therefore, we also consider the three dependent variables without public source funds.

6.3. Within regression (fixed effects regression)

The within regression captures the difference in venture capital funds due to changes over time of the independent variables.

$$\begin{aligned} & \text{Venture capital funds}_{it} - \overline{\text{Venture capital funds}_i} \\ &= \pi_0 + \pi_1(\text{IPOs}_{it} - \overline{\text{IPOs}_i}) \\ & \quad + \pi_2(\text{GDP percentage growth rate}_{it} - \overline{\text{GDP percentage growth rate}_i}) \\ & \quad + \pi_3(\text{Market capitalization percentage growth rate}_{it} \\ & \quad - \overline{\text{Market capitalization percentage growth rate}_i}) \end{aligned}$$

where, $\overline{\text{Venture capital funds}_i}$ = average of Venture capital funds over time and similarly for other variables.

The dependent variables examined are the same ones that we use in the between regressions. We also consider lags of GDP and market capitalization growth. However, these independent variables are not significant and the results do not change. For this reason, we do not report these regressions.

7. Results

Tables 8–11 report the results from the between regressions. Tables 12–14 contain results from the within regressions.

7.1. Between regression results

Table 8 reports results from the between regression of venture capital investments on IPOs, accounting standards, labor market rigidities, market capitalization and GDP growth. The explanatory power of all the regressions is high, with R^2 s ranging from 0.49 to 0.71. The coefficient on IPOs is positive and statistically significant for virtually all specifications. This lends support to the hypothesis advanced in Section 4 that high levels of IPOs in a country will lead to more venture capital.

Table 10
Early stage investments, between regressions

Independent variables	Dependent variables					
	(1) Early stage investments w/o gov't funds	(2) Early stage investments w/o gov't funds	(3) Early stage investments w/o gov't funds	(4) Early stage investments	(5) Early stage investments	(6) Early stage investments
IPOs	0.0044 (0.652)	– 0.0007 (– 0.117)	0.0073 (1.395) ^d	0.0024 (0.289)	– 0.0040 (– 0.579)	0.0049 (0.761)
Accounting Standards	– 0.000001 (– 0.582)	9.3×10^{-9} (– 0.004)	– 0.000002 (– 1.421) ^d	– 0.000001 (– 0.409)	– 0.000003 (0.985)	– 0.000002 (– 1.001)
Labor Market Rigidity (educated)	– 0.00002 (– 1.469) ^d		– 0.00001 (– 1.367)	– 0.00001 (– 0.981)		– 0.00001 (– 0.921)
Labor Market Rigidity (general)		– 0.000006 (– 2.625) ^a			– 0.000006 (– 2.016) ^b	
Market capitalization growth	– 0.00003 (– 0.233)	– 0.0002 (– 1.365)	– 0.00004 (– 0.297)	0.00002 (0.099)	– 0.00007 (– 0.493)	– 0.00009 (0.060)
GDP growth	0.0006 (0.704)	0.00037 (0.509)		0.0005 (0.504)	0.0005 (0.681)	
Constant	0.00024 (1.269)	0.00029 (1.275)	0.0003 (1.867) ^b	0.0002 (0.939)	0.00008 (0.315)	0.0003 (1.387) ^d
R ²	0.3672	0.6760	0.3323	0.1740	0.6152	0.1507

Between regression of 15 countries. The dependent variables are early stage (i.e seed and startup) investments with and without government funds, divided by average GDP. The independent variables are (1) IPOs divided by average GDP; (2) Accounting Standards; (3) Labor Market Rigidity (educated); (4) Labor Market Rigidity (general); (5) Percentage change in Market capitalization; (6) Percentage change in GDP. *T*-statistics for coefficients in parentheses.

^aSignificant at 1% level.

^bSignificant at 10% level.

^dSignificant at 20% level.

Table 11

(A) Private equity new funds raised, between regressions¹

Independent variables	Dependent variables					
	(1) Private equity new funds raised w/o gov't funds	(2) Private equity new funds raised w/o gov't funds	(3) Private equity new funds raised w/o gov't funds	(4) Private equity new funds raised	(5) Private equity new funds raised	(6) Private equity new funds raised
IPOs	0.2113 (2.125) ^b	0.2429 (2.219) ^b	0.2366 (2.856) ^a	0.1928 (1.940) ^b	0.2368 (2.237) ^b	0.2143 (2.605) ^a
Accounting Standards	0.00002 (0.558)	0.000002 (0.029)	0.00001 (0.368)	0.00003 (0.961)	0.000009 (0.121)	0.00003 (0.899)
Labor Market Rigidity (educated)	−0.00013 (−1.066)		−0.00011 (−1.024)	−0.0001 (−0.906)		−0.0001 (−0.875)
Labor Market Rigidity (general)		−0.00004 (−0.819)			−0.0004 (−0.779)	
Private Pension Fund growth	0.00075 (0.343)	−0.0003 (−0.191)	0.0003 (0.166)	0.0003 (0.131)	−0.0004 (−0.267)	−0.00008 (−0.043)
Market capitalization growth	−0.00041 (−0.346)	−0.0010 (−0.391)	−0.0005 (−0.467)	−0.0001 (−0.097)	−0.0008 (−0.336)	−0.0002 (−0.187)
GDP growth	0.0071 (0.533)	0.0056 (0.393)		0.0060 (0.455)	0.0068 (0.497)	
Constant	−0.00015 (−0.051)	0.0013 (0.196)	0.0006 (0.276)	−0.0011 (−0.376)	0.0007 (0.109)	−0.0004 (−0.175)
R ²	0.8332	0.8552	0.8253	0.8381	0.8639	0.8325

(B) Private equity new funds raised, between regressions²

Independent variables	Dependent variables			
	(1) Private equity new funds raised w/o gov't funds	(2) Private equity new funds raised w/o gov't funds	(4) Private equity new funds raised	(5) Private equity new funds raised
IPOs	0.1409 (0.570)	0.2654 (1.974) ^c	0.1580 (0.636)	0.2619 (2.033) ^c
Accounting Standards	0.00002 (0.223)	0.000002 (0.023)	0.00002 (0.263)	0.000009 (0.106)
Labor Market Rigidity (educated)	– 0.0001 (– 0.586)		– 0.0001 (– 0.598)	
Labor Market Rigidity (general)		– 0.00005 (– 0.838)		– 0.00005 (– 0.849)
Private Pension Fund growth	0.0024 (0.468)	– 0.0006 (– 0.327)	0.0017 (0.327)	– 0.0007 (– 0.419)
Private Pension Fund levels	0.0010 (0.379)	– 0.0007 (– 0.414)	0.0006 (0.246)	– 0.0008 (– 0.482)
Market capitalization growth	– 0.0008 (– 0.333)	– 0.0010 (– 0.376)	– 0.0006 (– 0.262)	– 0.0009 (– 0.335)
GDP growth	0.0132 (0.581)	0.0009 (0.044)	0.0111 (0.487)	0.0016 (0.084)
Constant	– 0.0007 (– 0.108)	0.0022 (0.287)	– 0.0007 (– 0.103)	0.0017 (0.233)
R ²	0.8365	0.8630	0.8331	0.8737

In addition to the explanation we present above, one could offer another explanation for why the coefficient on IPOs is positive. This explanation involves reverse causality: Since venture capital investments frequently end up as IPOs, a higher level of such investments will lead to a higher level of IPOs down the road. Thus, our coefficient would be positive not because more IPOs lead to more venture capital, but because higher levels of venture capital eventually show up as greater amounts of IPOs.

To test for this reverse causality story, we examine several subpanels of our original panel, where the subpanels cover shorter time periods. The time periods are chosen such that investment projects started during the period will not have had enough time to progress to the IPO stage. The time periods are 1992–1995 and 1993–1995, and the results are contained in Table 9A. The results allow us to reject the reverse causality story, as the coefficient on IPOs remains positive and significant.

Another way to test the reverse causality explanation is to look at the factors underlying IPOs, which are not dependent on venture capital. La Porta et al. (1996) analyze the legal determinants of IPO finance as part of their study into the legal determinants of external finance. They find that Rule of Law has a large positive effect on the number of IPOs. Furthermore, a higher degree of Anti-director Rights also leads to more IPOs. Even when they correct for specific differences in shareholder rights, they find that civil law countries (the German and French origin ones in particular) still have a significant negative impact on the amount of IPOs in a country.

By regressing venture capital investments on shareholder rights and legal origin dummies in Table 9B, we can show to what extent these investments are dependent on the variables underlying IPOs. Rule of Law and Anti-director Rights are not significant in this regression. The civil law variables, however, are. The

Notes to Table 11:

¹Between regression of 13 countries. The dependent variables are new funds raised for private equity (i.e., venture capital and buyouts) with and without government funds, divided by average GDP. The independent variables are: (1) IPOs divided by average GDP; (2) Accounting Standard Regulation; (3) Labor Market Rigidity (educated); (4) Labor Market Rigidity (general); (5) Percentage change in Private Pension Funds; (6) Percentage change in Market capitalization; (7) Percentage change in GDP. *T*-statistics for coefficients in parentheses.

²Between regression of 13 countries. The dependent variable are new funds raised for private equity (i.e., venture capital and buyouts) with and without government funds divided by average GDP. The independent variables are (1) IPOs divided by average GDP; (2) Accounting Standard Regulation; (3) Labor Market Rigidity (educated); (4) Labor Market Rigidity (general); (5) Percentage change in Private Pension Funds; (6) Private Pension Fund levels, (7) Percentage change in Market capitalization; (8) Percentage change in GDP. *T*-statistics for coefficients in parentheses.

^aSignificant at 1% level.

^bSignificant at 10% level.

^cSignificant at 15% level.

Table 12
Venture capital investments, within regressions

Independent variables	Dependent variables			
	(1) Venture capital w/o gov't funds	(2) Venture capital w/o gov't funds	(3) Venture capital	(4) Venture capital
IPOs	0.0257 (3.094) ^a	0.0148 (2.100) ^a	0.0260 (2.882) ^a	0.0164 (2.207) ^a
Lagged IPOs	0.0076 (0.982)		0.0106 (1.269)	
Market capitalization growth	−0.00003 (−0.390)	−0.000007 (−0.097)	−0.00003 (−0.327)	0.000003 (0.037)
GDP growth	−0.0005 (−0.514)	−0.0000005 (−0.001)	0.0003(0.243)	0.00073 (0.966)
Constant	0.0003 (5.289) ^a	0.0003 (7.179) ^a	0.0003 (5.084) ^a	0.0004 (7.196) ^a
R ²	0.1632	0.0586	0.1679	0.0733

Within regression of 17 countries. The dependent variables are venture capital (i.e., early stage and expansion) investments with and without government funds, divided by average GDP. The independent variables are: (1) IPOs divided by average GDP; (2) Lagged IPOs; (3) Percentage change in Market capitalization; (4) Percentage change in GDP. *T*-statistics for coefficients in parentheses.

^aSignificant at 1% level.

Table 13
Early stage investments, within regressions

Independent variables	Dependent variables			
	(1) Early stage investments w/o gov't funds	(2) Early stage investments w/o gov't funds	(3) Early stage investments	(4) Early stage investments
IPOs	0.0051 (2.271) ^a	0.0018 (0.970)	0.0054 (2.309) ^a	0.0020 (1.026)
Lagged IPOs	0.0008 (0.406)		0.0011 (0.512)	
Market capitalization growth	0.000002 (– 0.099)	0.000002 (0.093)	0.0000007 (0.031)	0.000004 (0.209)
GDP growth	0.00002 (0.062)	0.0001 (0.629)	0.00005 (0.157)	0.0002 (0.815)
Constant	0.00004 (2.598) ^a	0.00005 (3.858) ^a	0.00005(2.981) ^a	0.00006 (4.293) ^a
R ²	0.0919	0.0179	0.0970	0.0228

Within regression of 18 countries. The dependent variables are early stage (i.e., seed and startup) investments with and without government funds, divided by average GDP. The independent variables are: (1) IPOs divided by average GDP; (2) Lagged IPOs; (3) Percentage change in Market capitalization; (4) Percentage change in GDP. *T*-statistics for coefficients in parentheses.

^aSignificant at 1% level.

German and Scandinavian countries in particular have lower levels of venture capital investing. These results indicate that the same factors driving IPOs also drive venture capital investments. The connection between IPOs and venture capital investing appears more substantial than the reverse causality story would indicate. It appears that structural factors are driving the positive relationship between the two, and that we are not just observing the move, over time, of venture capital flows into IPO flows.

When we include government funded investments in total venture capital, the significance of IPOs drops, as measured by the *t*-statistic (Specifications 4–6). This implies that government investments are less sensitive to IPOs. From this, we infer that government funded venture capital supports investments in environments that are less favorable to venture capital (i.e., in environments where the IPO market is not strong).

The government funded projects might nevertheless be sensible from an economic perspective, and might offer adequate returns. In order to decide whether this is the case, it would be helpful to have data on rates of return. There is some US evidence that government supported venture capital can select good projects. Lerner (1999) shows that companies that receive SBIR awards experienced higher growth relative to a matched sample. However, without more comprehensive data on returns for the various funds in our sample, we are unable to say whether government funds support high-return projects in environments that otherwise would not have supported them, or whether government funds back low-return projects. Our result does, however, indicate that government involvement can generate venture capital investments where otherwise there would have been none.

The variable for accounting standards has a statistically significant negative coefficient. This result is surprising, as we expect a positive coefficient. This finding could be explained as follows: as we mentioned earlier, the accounting standards under consideration are those used by public firms. Therefore, they only provide a proxy for accounting standards at privately held firms. This proxy may not be correctly measuring the private firms' accounting standards. Furthermore, Wright and Robbie (1996) provide evidence that accounting information is only one part of the venture capitalist's assessment process. While accounting information is an important piece in the decision making process, other elements, such as discussions with personnel and access to unpublished and subjective assessments, are also widely used. This insight, however, could only explain why accounting standards do not have a positive significant coefficient. The statistically significant negative coefficient, however, can still not be entirely understood.

Table 10 contains the results from the between regression of early stage investments on IPOs, labor market rigidities, accounting standards, market capitalization and GDP growth. While labor market rigidity was not significant in the regressions on venture capital, the coefficients on labor market rigidities in this specification, with early stage venture capital, are negative and significant. The

Table 14

(A) Private equity new funds raised, within regressions¹

Independent variables	Dependent variables			
	(1) Private equity new funds raised w/o gov't funds	(2) Private equity new funds raised w/o gov't funds	(3) Private equity new funds raised	(4) Private equity new funds raised
IPOs	0.0736 (2.188) ^a	0.0509 (2.109) ^a	0.0617 (1.819) ^b	0.0344 (1.218)
Lagged IPOs	0.0721 (2.355) ^a		0.0632 (2.043) ^a	
Private Pension Fund growth	– 0.0002 (– 0.388)	– 0.00009 (– 0.479)	– 0.0002 (– 0.481)	– 0.00007 (– 0.299)
Market capitalization growth	0.00007 (0.234)	– 0.00002 (– 0.092)	0.000002 (0.006)	0.00007 (0.235)
GDP growth	0.0026 (0.585)	0.0023 (1.048)	0.0003 (0.064)	0.0039 (1.181)
Constant	0.0004 (1.607) ^c	0.0006 (3.839) ^a	0.0006 (2.527) ^a	0.0007 (3.139) ^a
R ²	0.2060	0.0504	0.1448	0.0450

(B) Private equity new funds raised, within regressions²

Independent variables	Dependent variables	
	(1) Private equity new funds raised w/o gov't funds	(3) Private equity new funds raised
IPOs	0.0731 (1.976) ^b	0.0786 (2.110) ^a
Lagged IPOs	– 0.0078 (– 0.206)	– 0.0083 (– 0.217)
Private Pension Fund growth	– 0.0004 (– 0.897)	– 0.0004 (– 0.898)
Private Pension Fund levels	0.0036 (2.552) ^a	0.0036 (2.576) ^a
Market capitalization growth	– 0.0001 (– 0.275)	– 0.00006 (– 0.179)
GDP growth	0.0036 (0.804)	0.0031 (0.684)
Constant	– 0.0002 (– 0.600)	– 0.0002 (– 0.545)
R ²	0.3426	0.3251

significance for overall labor market rigidity is higher than that for rigidity of the more highly educated labor market. These results confirm the hypothesis advanced in Section 4 that labor market rigidities pose a hindrance to venture capital.

There are several reasons why labor market rigidities might affect early stage venture capital and not later stage venture capital. First, the probability of an early stage investment going bankrupt is higher, which increases the probability that the employees of the venture will have to find other jobs. All things being equal, this will be more difficult in a country with higher labor market rigidity. Also, given the liquidity constraints of an early stage venture which, in most cases, has no regular revenue stream, it is increasingly difficult to hire employees because the environment offers the employer less flexibility to let people go and imposes higher costs of benefits for unemployment insurance, etc.

It is surprising that the coefficient on IPOs in the early stage investment specification of Table 10 is not significantly different from zero. This implies that countries with higher levels of IPOs do not have significantly higher levels of early stage venture investments as well. This is particularly puzzling in light of our results later on, in Table 13, which show that early stage investments are sensitive to IPOs over time. Since IPOs are significant in the fixed effects, within regression specification of Table 13, it is likely that we have not identified all the variables which affect early stage venture capital in the between regression. Another signal that we do not have all relevant variables is that the R^2 s for early stage investments, with a range of 0.15 to 0.68 (Table 10), are much lower than the R^2 s for venture capital investment, which range from 0.49 to 0.71. One variable that might account for some of the unexplained variation is the amount of trade sales that take place. Trade sales are another exit mechanism, in addition to IPOs. We do not, however, at present have a measure for the prevalence of trade sales.

When we consider new funds raised for all private equity endeavors in Table 11A and B, we find, as we found for venture capital investments, that IPOs have a positive and significant coefficient. As was the case for venture capital invest-

Notes to Table 14:

^aSignificant at 1% level.

^bSignificant at 10% level.

^cSignificant at 15% level.

¹Within regression of 14 countries. The dependent variables are new funds raised for private equity (i.e., venture capital and buyouts) with and without government funds, divided by average GDP. The independent variables are: (1) IPOs divided by average GDP; (2) Lagged IPOs; (3) Percentage change in Private Pension funds; (4) Percentage change in Market capitalization; (5) Percentage change in GDP. *T*-statistics for coefficients in parentheses.

²Within regression of 14 countries. The dependent variables are new funds raised for private equity (venture capital plus buyouts) with and without government funds, divided by average GDP. The independent variables are: (1) IPOs divided by average GDP; (2) Lagged IPOs; (3) Percentage change in Private Pension Funds; (4) Private Pension Fund levels; (5) Percentage change in Market capitalization; (6) Percentage change in GDP. *T*-statistics for coefficients in parentheses.

ments, the explanatory power of our regressions is quite high, with R^2 s ranging from 0.82 to 0.87. Since we are considering funds raised for projects that range in size and riskiness across a broad spectrum, a variable that affects smaller, riskier ventures such as labor market rigidity, does not have a significant coefficient.

The coefficients on pension fund levels and growth rates are not statistically significant. We think that this is due, in part, to the fact that pension funds are regulated differently in the sample countries. The regulations hypothesis is supported by the evidence in Table 14A and B, which shows that, once fixed effects are taken into account, pension fund levels do have a positive and significant impact on new funds raised.

In all regressions, contrary to our expectation, the coefficients on GDP and market capitalization growth are not statistically significant. The absence of significance on our macro-economic variable, GDP growth, underscores the importance of IPOs as the main explanatory factor for venture capital and private equity investments.

7.2. *Within regression results*

The within regressions allow us to understand how variation across time in the explanatory variables affects venture capital, early stage investments, and new fund flows. Table 12 reports the results of the within regression of venture capital investments on IPOs, lagged IPOs, market capitalization growth and GDP growth. The current level of IPOs has a positive, significant coefficient, emphasizing, once again, the importance of IPOs. The other variables are statistically insignificant.

Table 13 reports the results of the within regression for early stage investments. IPOs have a positive effect on the level of early stage investments from year to year. Thus, even though the average level of IPOs does not affect the amount of early stage investments (as we saw in Table 10), early stage investments are still affected by yearly fluctuations in the amount of IPOs.

Table 14A and B reports results on within regressions of new funds raised. IPOs are again strongly significant with a positive sign. Lagged IPOs are also positive and statistically significant in Specifications 1 and 3 of Table 14A. Table 14B shows that private pension fund levels have a positive and significant coefficient, as expected. Again, the implications of these results indicate the omission of an individual country effect in the between regressions which is being picked up in the fixed effect regression.

8. Descriptive analysis

In addition to the statistically measurable factors of the previous section, specific details of institutions, regulation, and culture also affect venture capital.

For this reason, we include a study of government programs for venture capital, as well as brief case studies on venture capital in Germany and Israel. In Germany, venture capital has grown a lot. However, it has still not reached the level of significance that it has in the US or the UK. Israel, by contrast, is an example of successful venture capital development outside of the US. In 1993, new funds raised (per mil of GDP) in Israel exceeded those of any other country within our sample.

8.1. The role of government programs

Government schemes for assisting private equity vary widely, from providing legal infrastructure to establishing funds that invest directly in private equity projects. We examine some of the larger government programs, and show how they influence private equity flows.

Getting the basic legal and tax structures into place appears to be an important factor in aiding the development of private equity funds. For example, the US and the UK, which have good basic regulations, have high levels of private equity and venture capital investments as a percentage of GDP. Austria, on the other hand, lies on the opposite extreme of this spectrum. With no special legal structure for private equity firms and no tax or other incentives aimed at the industry, private equity investment languishes and shows no sign of growth in the near future.

Portugal furnishes another example of the importance of providing an appropriate legal environment for private equity. In 1986, when Portugal had even lower levels of private equity investment (again measured as a proportion of GDP) than Austria, the Portuguese government created a new type of corporate structure, the venture capital corporation. These venture capital corporations were granted a number of tax benefits as follows:⁸

- Exemption from the new company incorporation tax
- Exemption from income tax and other taxes during the year of incorporation and the three following years
- After this period, deduction from tax of the profits appropriated to reserves and reinvested in venture capital projects during the following 3 years

As a consequence, private equity investments in Portugal increased dramatically (by a factor of 38) between 1986 and 1987.

In addition, growth of private equity in Portugal benefited from direct government funding. Through a variety of government agencies (the most important being the two EC supported regional development agencies NORDEPIP and

⁸ EVCA Yearbook.

SULDEPIP), the Portuguese government contributed strongly to the growth in private equity funds in the early 1990s. In 1992, government agencies contributed Esc 460 million (US\$3.1 million) to new funds raised, or 15% of the total. By 1994, this figure had grown to Esc 12.8 billion (US\$80.5 million), which represented 57% of new funds raised. Thus, the large increase in government financing was met by a similarly large increase in private funds. The increase in private funding appears sustainable, independent of continued large government programs. Thus, when government funding decreased from Esc 12.8 billion (US\$80.5 million) in 1994 to Esc 2 billion (US\$13.4 million) in 1995, an increase in bank funding from Esc 8.9 billion (US\$59.5 million) to Esc 13.7 billion (US\$91.7 million) made up much of the shortfall.⁹

In Norway, government funded private equity investments appear to have been a strong factor involved in rebuilding private equity after the banking crisis of the late 1980s. In 1989, Norway's private equity market bottomed out with only Nkr 8 million (US\$1.2 million) in investments (less than 10% of the level of the previous year). The resurgence in the industry in 1990 (when Nkr 392 million (US\$66.4 million) was invested) is, according to the EVCA, in part a consequence of a Nkr 800 million (US\$120.9 million) program launched by the government in 1989 as a way of strengthening the Norwegian venture capital industry.¹⁰

In 1993, the Norwegian State Industrial and Regional Development Fund was started. This marked a transition point in the government's share of venture capital investing. From 1993 to 1995, government source investments increased from Nkr 120 million (US\$16 million), which constituted approximately one third of total investments, to Nkr 535 million (US\$84.7 million), or 50% of private equity investments. Furthermore, the government's involvement appears to have spurred other types of investors, as total investment moved from Nkr 350 million (US\$46.6 million) to Nkr 990 million (US\$156.7 million) over the same period of time.¹¹

Governments can also play a strong role in influencing the growth of other sources of funds. For example, Ireland experienced a large surge in new funds raised as a consequence of a government-recommended increase in private equity investments by pension funds. A commitment of IR £50 million (US\$70.5 million) boosted new funds raised considerably, from IR £23 million (US\$32.4 million) in 1993 to IR £150 million (US\$232.1 million) in 1994.¹²

Similarly, in the US around 1980, a large flow of new funds in venture capital was unleashed with changes in the Employment Retirement Income Securities

⁹ *ibid.*

¹⁰ *ibid.*

¹¹ *ibid.*

¹² *ibid.*

ACT (ERISA), that permitted venture capital investing for pension funds.¹³ In Australia, a similar measure was undertaken in 1985, when the Reserve Bank changed its rules to allow banks to make equity investments in small and medium sized enterprises.¹⁴ The Italian government has also recently given pension funds permission to invest in privately held small and medium sized enterprises.¹⁵ In Finland, banks and pension funds were also encouraged to invest in venture capital and in 1995, the share of these institutions in total venture capital raised went to 79%, up from 20% in 1994.¹⁶

While government funding of private equity is minimal in the UK, government support of the industry occurs through the legislative structure of venture capital. The UK incentive schemes are:¹⁷

- Venture Capital Trust (VCT): VCTs provide income tax relief on investments and capital gains tax deferral in the case of capital reinvestment.
- Enterprise Investment Schemes (EIS): The EIS, successor program to the Business Expansion Scheme, provides up-front tax relief on investments, along with relief from capital taxation.
- Small Firms Loan Guarantee Scheme (SFLGS): SFLGS was introduced in 1981. Under this scheme, 41,000 loans were made between 1986 and 1996.
- Share option schemes, which allow innovative and precisely tailored incentive compensation plans to be implemented
- Direct financing through grants and awards is also available. These programs, however, are fairly small. Thus, for example, two of the large technology-oriented programs distribute only £50 million (US\$75 million) per year.

Another example of government involvement in a mature private equity market is the Netherlands. Government involvement in the Netherlands is still significant, but it is declining. The nominal figure for public investments has not changed substantially since the early 1990s, but its overall importance has declined, as the industry has grown. Thus in 1992, public sector investments were Dfl 65 million (US\$35.8 million) compared to Dfl 55 million (US\$34.3 million) in 1995. As a share of total investments, however, the public sector commitment dropped from 12% to 6% over the same time period.¹⁸

Furthermore, the Netherlands government has scaled back its venture capital commitments in other ways. The guarantee scheme for private venture capital

¹³ O'Shea (1996).

¹⁴ *ibid.*

¹⁵ *ibid.*

¹⁶ *ibid.*

¹⁷ Bank of England: The Financing of Technology-Based Small Firms.

¹⁸ EVCA Yearbook.

companies launched in 1981¹⁹ was a cornerstone of government support. Under this scheme, the government covered up to 50% of losses incurred by venture capital companies. This scheme was reduced in 1990, and discontinued at the end of 1995. However, the reduction of government support programs for venture capital has not reduced the size of the venture capital industry in the Netherlands. On the contrary, over the period from 1990 to 1995, private equity investments as a percentage of GDP grew from 0.11% to 0.15%. Given its level of maturity, the Dutch private equity industry was capable of maintaining its growth, despite the gradual withdrawal of government support.

Thus, whether we consider the legal and tax environment, loss guarantees, direct expenditures, or government encouragement of investment, it is clear that the government can play an important role in the development of private equity. Mature venture capital industries are quite capable of maintaining healthy levels even after this support is withdrawn.

8.2. Israel venture capital case study

Between 1988 and 1992, Israel's venture capital industry was still in its infancy with only one active venture capital fund of US\$30 million. At this time, the major suppliers of capital to emerging companies were large established investment companies belonging to holding groups such as Hapolain, IDB, Leumi, Israel, Koor, Clal and Elron Groups.

In 1992, the Likud government began to promote the venture capital industry. It set up the Yozma venture capital program to provide financing for venture capital funds and to invest directly in companies. Yozma also encouraged foreign and local corporations to coinvest in high technology startups. In 1993, Yozma provided US\$100 million to establish nine venture capital funds. By 1996, Israel's venture capital industry, which had raised more than US\$1 billion, had experienced such phenomenal growth that the government decided to exit the market. However, to continue to foster its venture capital industry, the Israeli government enacted a temporary legislation allowing tax-free investing in Israeli venture capital funds by foreign venture funds which had tax-free status in their home countries. Currently, there are 32 venture capital funds with a total of US\$500 million invested which represents 50% of raised capital.

Another attribute which fostered the growth of Israel's venture capital industry is Israel's favorable taxation laws for individual investors. For persons not in the business of trading securities, capital gains on sales of securities on the Tel Aviv Stock Exchange (TASE) or securities of Israeli companies listed on recognized foreign exchanges are exempt from capital gains taxes in Israel. For individual

¹⁹ *ibid.*

residents, dividends are taxed at a maximum of 25% and interest is taxed at a maximum of 45%. Furthermore, some resident corporations receive a tax break on dividends. Finally, foreign investors face a maximum tax rate of 25% on dividends and interest. These laws made investing in equity securities extremely attractive which, in turn, produced a vibrant equity securities market. For reasons mentioned earlier, this provides a conducive environment for venture capital.

A record number of Israeli firms have successfully gone public. Some recent examples are M-Systems, Gilat Satellite, Mercury Interactive and DSP Group. The TASE is by far the strongest Middle East capital market with 654 listed companies in 1995. Total equity market capitalization as of December 1995 was US\$37 billion, approximately 42% of Israel's GDP. Between 1991 and 1995, Israel's growth in market value was 589% in local currency. At the same time, Israel's economy had been very strong with GDP growth averaging 5.5% per year since 1991.

Initial public offerings for Israeli companies are not limited to TASE. In 1996, approximately 50 Israeli companies raised US\$1.5 billion on US exchanges. In addition, trade sales are a very popular exit mechanism for venture capital startups. In 1995, foreign companies acquired a significant number of Israeli startups. Some recent examples are America-on-Line's acquisition of Ubique, Boston Scientific's acquisition of Medinol and Intel's acquisition of Shamy.

Most portfolio companies in Israel's venture capital funds are in the early stage with an average company age of approximately 1.5–2 years. Currently, Israeli venture capital funds are primarily invested in technology companies such as telecommunications, data communications, industrial electronic equipment, software, multimedia and medical technology.

The bulk of these startup companies were founded by scientists and engineers who left their previous jobs to start their own companies. Also, the immigration of many skilled scientists and researchers from the former Soviet Union fueled Israel's boom in technology research. Venture capitalists are especially attracted to these R&D startups because many of these new enterprises received grants from the Office of the Chief Scientist (OCS) of the Ministry of Industry and Trade. The OCS administers the Law for Encouragement of Industrial Research and Development which targets developing science intensive industry and expands the technology infrastructure of the state. The OCS's 1995 annual budget was US\$370 million, up from US\$110 million in 1990. Currently, it supports close to one thousand companies.

Finally, the BIRD Foundation (Binational Industrial Research and Development) promotes US/Israeli corporate partnership investments in Israeli high technology startups. The average budget is US\$1 million over a 12–15 month period. BIRD typically provides half of all R&D expenses, but does not take an equity position in the enterprise. Instead, BIRD receives 150% repayment from successful projects. Currently, BIRD invests US\$114 million in 391 different projects.

The venture capital industry in Israel is becoming a significant part of the country's economy. Several factors have contributed to its success. While the government has played an important role in nurturing the industry, Israel's strong equity markets, and cultural and institutional factors, have allowed venture capital to prosper.

8.3. Germany venture capital case study

Germany's tradition of government support for the business sector dates back to the post-WWII programs dedicated to rebuilding industry. While these programs bolstered the growth of small to medium sized companies in general, they did not focus on venture capital specifically.²⁰

One of Germany's most important small and medium enterprise programs is the European Recovery Program (ERP) which was started in 1947. It focuses on growing small businesses, primarily by providing low interest loans. ERP funds are disbursed by the Deutsche Ausgleichsbank (German Bank for Compensation) and the Deutsche Bank fuer Wiederaufbau (German bank for Reconstruction).

The ERP also supports research and development programs, as do state and regionally administered funds. In addition to the federally funded and administered programs, the states also have programs intended to support small and medium-sized businesses. Most of these programs emphasize interest rate or loan subsidies to existing businesses, and do not therefore contribute much to the development of startups. Many of the programs weigh non-profit-maximizing objectives, such as labor market or environmental considerations, quite heavily.

Kapitalbeteiligungsgesellschaften (Equity Stock Companies) were initiated in the 1950s and 1960s as yet another government institution intended to foster growth in small and medium-sized companies. Kapitalbeteiligungsgesellschaften (KBGs) are owned and funded by banks and state governments. Depending on whether they are public or private, the KBGs are more or less profit oriented. They provide equity or near-equity to established small firms that require financing for expansion purposes. KBGs are regulated with respect to their portfolio holdings, and for this reason tend to shy away from risky startup ventures. KBG investments are very hands-off. The KBGs provide little management supervision or support even though they might be involved with a company for up to 8 years.

Until the early 1970s, there was no institutional structure available in Germany for the support of more risky startup ventures. When, in the 1970s, Germany's economic growth started to slow, consideration was given to how more growth could be generated in the small business sector. This led to the founding of

²⁰ The following summary of German venture capital relies heavily on Harrison (1990) *The West German Venture Capital Market*.

Germany's first venture capital company, the Deutsche Gesellschaft für Wagniskapital (German Society for Venture Capital, WFG).

The founding of the WFG marked the beginning of modern venture capital in Germany. Its members were a group of 29 German financial institutions. Government involvement in the project was significant. The government agreed to cover 75% of capital losses, and also offered the prospect of generous assistance to cover operating expenses, should the need arise.

While it initially focused on startup enterprises, the WFG shifted emphasis somewhat in the early 1980s, when its funds were divided equally among startups — companies earning DM 1 to 10 million (US\$0.6 to 6 million) per year — and companies earning between DM 20 and 50 million (US\$11.4 to 28.6 million).

In 1984, the WFG was restructured. The emphasis shifted toward later stage investments, and the number of partners was reduced to five. The specific industry focus (on high technology) from earlier years was abandoned, and non-technology investments came to represent a larger portion of the portfolio. Involvement in management decisions was still fairly limited.

In 1988, the WFG underwent another organizational change. Deutsche Bank, one of the partners in the WFG venture, bought out the other partners and integrated the WFG into its own subsidiary.

Other players gradually entered the scene. The initial entrants all had government backing. The second venture capital firm to enter the scene was the Hannover Finanz, in 1979. The third venture capital firm appeared in 1982: the Landesfonds des Landes Berlin. In 1983, eight new companies entered the growing field of competitors. By 1995, the German Venture Capital Association had over 100 members.

From 1989 to 1995, Germany had a program called Beteiligungskapital für Junge Technologieunternehmen (Equity Participation for Young Technology Companies, BJTU),²¹ administered by a subsidiary of the government owned Deutsche Ausgleichsbank. This was a co-investment scheme which gave the owner of the business the option of buying out the government share at a premium over the initial investment. If the company did not fare well, the founder was given the option of selling his share to the government at a discount to book value.

A successor was created to the popular BJTU program. The Beteiligungskapital für Kleine Technologieunternehmen (Equity Participation for Small Technology Companies, BTU) was created in 1995, and slated to last through 2000.²² The BTU focuses on new firms. BTU funds will only be brought in at a level that matches the investment of a private investor. The program also contains a guarantee scheme which covers up to 50% of losses to the private investor.

²¹ O'Shea, 1996.

²² *ibid.*

The institutional structures in place in Germany over the 1980s and, to a lesser extent, the 1990s have hindered the development of a venture capital industry on the scale of the UK or the US. The tax system in Germany does not favor venture capital investments by corporations. They cannot obtain a capital gains tax rates reduction. Corporate investments are taxed at the 56% corporate tax rate. Trade taxes and capital transaction taxes provide an additional burden.

In 1987, the Geregelter Markt was established as a means to provide an exit mechanism for startup firms. The other two markets already available in Germany at this time, the Amtlicher Handel (main stock market) and the Telefonverkehr (an unregulated market similar to the US OTC market), did not provide a sufficiently liquid exit mechanism. However, listing companies on the Geregelter Markt is still not easy, and is subject to stringent requirements. The companies that satisfy these criteria tend to do well, but only a small number of companies can qualify. In 1995 plans were introduced to provide a new exchange, called the Neuer Markt, which would offer young and fast-growing companies a way to raise capital.

Germany has also experimented with regulatory incentives for venture capital. In 1987, Unternehmensbeteiligungsgesellschaften (Societies for Enterprise Participation, UBGs) were introduced, which benefit from a somewhat more favorable tax status than other types of investment vehicles. The pace of regulatory change increased in the 1990s, but still failed to introduce sweeping changes to the system. Regulations for public promoted venture capital companies were loosened in 1991. In 1994, the operating environment for UBGs was improved.

Despite government programs intended to encourage venture capital, venture capital in Germany is still relatively insignificant. New and early stage investments as a percentage of GDP were only 0.0063 in 1995. Part of the problem in Germany appears to be both a cultural and institutional²³ aversion to risk taking. While some recent success stories²⁴ on the German venture capital market indicate that this might be changing, Germany has still not evolved into a hotbed of venture capital activity.

9. Conclusion

Private equity and venture capital markets have been subject to strong cyclical fluctuations over the years. Bygrave and Timmons (1992) describe several cycles that have marked the US venture capital experience. A very slow start in the 1940s eventually led to a boom in the 1960s. A downturn through most of the 1970s gave way to another successful period in the 1980s. A brief but sharp downturn at

²³ An example of an institutional barrier is the ban on a person becoming a director again, if a company goes bankrupt.

²⁴ *The Economist*, June 28, 1997.

the start of the 1990s has been followed by another boom. The experience outside the US has been marked by similar ups and downs, albeit over a shorter period of time, stretching back to the 1970s. We have compiled a statistical track record that allows us to not only understand these swings over time, but that also gives us insight into the differences in private equity and venture capital across countries.

We show that, over time, IPOs are the main force behind the cyclical swings in venture capital. This result confirms the conventional wisdom on venture capital. We also discover a surprising result, which is that early and later stage venture capital investments are affected quite differently by the determinants of venture capital. Over time, IPOs explain less of the year to year fluctuations in early stage than in later stage investments. Our finding across countries is even more surprising: while later stage venture capital investments respond strongly to different levels of IPOs across countries, early stage investments are unaffected.

These results point to the need for further research focusing on early stage venture capital investments, and reinforce the notion that the distinct stages of venture capital are fundamentally different. We believe that there are several factors that are determinants of early, but not later, stage venture capital. One of these factors which we have been able to identify is labor market rigidities. Labor market rigidities affect variation in early stage venture capital across countries, but do not explain variation in later stage venture capital.

Given the importance of IPOs it is surprising that venture capitalists in countries with underdeveloped IPO markets do not avail themselves of the more developed IPO markets in countries like the US. This strategy of bringing companies to the US for the purpose of an IPO has been pursued successfully by the Israeli venture capital industry. A number of Israeli firms have had IPOs on the NASDAQ. It is not clear why venture capitalists in other countries have not pursued a similar strategy.

There still appears to be a very strong home bias in the venture capital industry in general. This is expressed in two ways. First, venture capitalists tend to invest in their home country. The costs of monitoring distant companies (Lerner, 1995a,b) can at least partially explain why the home bias might affect investments. Second, venture capitalists also seek to exit their investments in the home country. This can again be partially explained by the time and effort it takes to sell a business. An IPO in a foreign country involves more cost and effort than an IPO in the home country.

The additional costs incurred do not appear very high, and are unlikely to be as high as the monitoring costs incurred by investing in a foreign country. There may also be certain fixed costs associated with exiting through a non-domestic IPO. Once the barrier is breached, as it clearly is the case with Israel's many successful IPOs in the US market, additional IPOs might become easy to arrange. For venture capital industries that have not yet had many foreign IPOs, as is the case with Germany's, it might still be very costly to arrange these transactions. Given the importance of IPOs and the apparent solution for low IPO countries of listing on

markets like the NASDAQ, the question of why there is such a strong home bias needs to be further addressed.

Our results on private pension fund levels and growth rates point to a need for a greater understanding of cross-country determinants. In our analysis of new private equity funds raised, we find that pension fund levels are significant over time, but insignificant across countries. We believe that some of these additional determinants, which would help explain differences across countries, can be found in regulatory and policy structures.

Our qualitative analysis shows that government policies can act as catalysts to galvanize private fund flows and investments. On a more quantitative, statistical level, our study of government involvement has produced some interesting results. We show that, compared to private venture capital, government-funded venture capital is less sensitive to IPOs across countries. Once again, the story for early stage investing is different: the difference in sensitivity of government-backed and non-government-backed early stage investments to IPOs drops by half in some specifications. These differences are only present when we compare across countries. Over time, the differences between the sensitivity of private and public venture capital to IPOs are negligible.

Our observation that government-backed venture capital is less sensitive to IPOs across countries than non-government-backed venture capital indicates a direction for future research. Governments appear to be willing to finance early stage projects that would not be funded privately. To evaluate the usefulness of the government role, it is important to understand the economic value of these projects. If more data on returns were available, they could be used to better understand the role of government in venture capital.

By providing an empirical analysis of private equity and venture capital across countries, we have been able to confirm the value of having a well-functioning exit mechanism in the form of a strong IPO market. We have also shown that some segments of the venture capital market behave quite differently from others. Our findings regarding the need for a more differentiated approach to venture capital are especially important, in that they concern two areas — early stage investing and government involvement — that are of particular interest to policy makers today.

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