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## Comparative Analysis of Private Equity Investments in Europe and the Asia-Pacific Region

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### ABSTRACT

*The article presents a comparative analysis of private equity (PE) investments in 13 Asian-Pacific and 19 European economies over the period of twenty-nine years from 1990 to 2017 using the fixed effects estimation technique. Results show that ICT, investment profile, human capital, and market capitalization are the strong positive determinants of PE in all the samples. For the rest of the variables, there are significant differences between the two regions. Population growth and real interest rate exert significant influence in the overall samples as well as in the Asia-Pacific region while real exchange rate, unemployment, and tax burden play significant role in the Europe. The article contributes to the PE literature by filling the regional gap and offering new insights into the previously contested results.*

### Keywords

Private Equity, Market Capitalization, Human Capital, ICT

### JEL Classification

B26, B29

### 1. Introduction

Previous studies have investigated determinants of Private Equity (PE) and Venture Capital (VC) using different aspects namely stages of investment (Khan, Khan and Hameed, 2020; Khan et al., 2021), VC availability (Li and Zahra, 2012), investment size (Ning, Wang and Yu, 2015), performance (Hege, Palomino and Schwienbacher, 2011), networks (Guler and Guillén, 2010; Milosevic, 2018) governance (Hearn, Randøy and Oxelheim, 2016) fundraising (Gompers and Lerner, 1998; Oberli, 2014) and exit options (Cumming and Fleming, 2002; Cumming and MacIntosh, 2003; Cumming, Fleming and Schwienbacher, 2006). Other facets examined include decisions to cross border (Hain et al., 2016; Devigne et al., 2018; Ragosa and Warren, 2019), contractual choices and syndications (Lerner, 1994; Da Rin et al., 2006; Tykvová, 2018) structures and deal processes (Karsai, Wright and Filatotchev, 1997; Karsai et al., 1998; Smolarski

et al., 2005; Ahlstrom, Bruton and Yeh, 2007; Klonowski, 2007) and post-investment processes (Wright et al., 1999; Da Rin, Hege, et al., 2006; Cumming, Schmidt and Walz, 2008).

The studies have found that institutional (Cumming and Knill, 2012; Groh and Wallmeroth, 2016), macroeconomic (Baygan, and Freudenberg, 2000; Romain and Pottelsberghe, 2004), technological environment (Schertler, 2003a; Da Rin et al., 2006b; Schertler, 2007) entrepreneurial environment (Gilson and Black, 2000; Jeng and Wells, 2000; Cherif and Gazdar, 2011; Bozkaya and Kerr, 2014), political factors (Bonini and Alkan, 2012) and oil prices and media coverage (Cumming et al., 2010) exert impact over PE/VC. These studies have paid much attention to the US and European PE/VC industries. In a sample of 18 studies, eight articles have incorporated some Asia-Pacific economies (Japan and Australia) in their sample while there is no study focusing exclusively on Asia-Pacific or comparing Asia with other continents. In their analysis of 314 VC/PE research articles since 2011, 52% of all the articles still rely on US data (Tykvova, 2017). This is, despite the fact, that Asian PE market has grown tremendously after the 2000 high-tech market crash. For example, Asia-Pacific region experienced PE investment twice than its European counterpart in 2015. Growth pattern of Asia-Pacific PE is not much different than its European counterpart in the overall period under consideration. Both markets have been affected by the financial crises. However, Asia-Pacific market was less vulnerable to these crises and has surpassed Europe in terms of total PE investments in consequence of the 2008 financial crisis. Asia-Pacific region has also maintained higher PE investments to GDP ratio compared to Europe in the last two decades.

Cumming and Zhang (2016) point out that VC determinants literature still give conflicting results. Among several reasons, one could be that previous studies lack comparative analyses to examine if determinants of PE differ as stage of counties' development, context and geography varies. Comparative analysis will help reduce the conflicting results in the literature and assist policies actors to consider the country or region-specific effects while framing policies to promote PE markets. Moreover, most of the previous studies have used data before Dot-Com era while much PE/VC investments in regions outside US and Western Europe flourished after the bubble was burst in 2000.

Moreover, previous studies have used relatively short time periods mostly involving older periods. Fresh research with long-term data incorporating more countries particularly that have flourished during this period will bring more insight to the literature. We need more cross-country comparisons and inter-disciplinary research on venture capital due to the existing home biases and discipline specific biases where finance and management disciplines are not open to each other when it comes to publishing or citing each other's papers (Cumming and Vismara, 2017). The current article examines the influences on PE investment in 32 economies spanning 1990-2017 using fixed effects. It presents a comparative analysis of PE investments in Asia-Pacific and Europe.

Before proceeding to next section, it is important to clarify the concept of PE and VC. VC is

the mix of early and later stage privately held equity investments whereas PE consists of VC and other privately held equity investments including expansion, replacement, growth, and buyout capital. As VC is a component of PE, previous literature on VC cannot be ignored while discussing PE. The current article examines PE in its analysis and cites both VC and PE literature. This is a standard practice to do so (Kumar and Orleck, 2002).

## **2. Literature Review**

Previous research shows that institutional factors, entrepreneurial environment, general macroeconomic factors, technological opportunity, and political factors play role in VC/PE development.

### **2.1 Entrepreneurial Environment**

An important element of an entrepreneurial environment is the presence of a healthy stock market (Black and Gilson, 1999; Jeng and Wells, 2000). Liquid stock markets provide an exit route from VC investment through an IPO (Schröder, 2009). Another factor that affects the entrepreneurial environment is the taxation regime with some showing that taxation has a negative effect (Cherif and Gazdar, 2011) while others demonstrate that it has no or little importance (Romain and van Pottelsberghe, 2004). Research shows that taxation is more a powerful determinant in the European countries compared to the US and Asia reflect a regional disparity. Labor market also influence a PE market. Studies show that labor market rigidities exert a negative effect on VC/PE market (Jeng and Wells, 2000; Cherif and Gazdar, 2011; Bonini and Alkan, 2012) yet some show a positive impact of labor market rigidities (Schertler, 2003a; Bozkaya and Kerr, 2014). The Level of entrepreneurship represents the favorability of the entrepreneurial environment. Research shows that total entrepreneurial activity (Romain and Pottelsberghe, 2004; Bonini and Alkan, 2012), high-tech investments and a reduction in barriers to entrepreneurship (Da Rin et al., 2006b), and investment opportunities play an important role in the development of venture capital (Avnimelech et al., 2004). Moreover, a strong entrepreneurial culture positively influences the effectiveness of the R&D stock of knowledge for VC (Romain and Pottelsberghe, 2004). According to Baygan and Freudenberg (2000) framework of conditions to spur research and innovation, incentives in exchange of risk, entrepreneurial activities, investment opportunities, and expertise are the keys to VC development across OECD countries. Groh and von Liechtenstein (2009) show that 'entrepreneurial opportunities' are less likely to attract foreign VCs in the CEE than in EU-15.

### **2.2 General Economy**

Business cycles such as the Dot Com bubble and 2008 financial crisis affect risk preferences and investment strategies in the VC markets (Ning, Wang and Yu, 2015). However, the effect of GDP on PE/VC is mixed. For example, Cherif and Gazdar (2011) demonstrate that GDP growth has a positive effect on VC/PE but others show that GDP is not an important factor (Jeng and Wells, 2000; Kumar and Orleck, 2002). Previous studies also demonstrate that interest rate negatively affects VC investment (Bonini and Alkan, 2012). But Füss and Schweizer (2008) find

positive relationship between long-term interest rates and VC investment while a negative relationship between short-term interest rates and VC investment. If cost of capital increases and bank loans get expensive, demand for PE should increase due to substitute effect. On the other hand, low cost of capital lead to economic growth and economic growth lead to more PE investments. However, more economic growth can cause inflation and in response central banks usually enhance interest rates. Finally exchange rate might affect the PE/VC investments particularly cross-border investments as foreign investors may meet losses while converting the local currencies into US dollars after exit from an investment. In their study of Brazilian VC/PE industry, Minardi et al. (2017) finds that currency exchange rates does not have a significant influence on PE returns in long term.

Since total PE investments also include cross border investments and international investors calculate their investments and returns in US dollars, although, they convert US dollars into local currencies while investing in portfolio companies and back into US dollars to receive proceeds upon exits (Minardi et al., 2017). However, it is still not clear how much is the effect of the exchange rate over years on country's PE investment in a cross-country analysis. We expect negative effect of exchange rate.

### **2.3 Technological Opportunity**

Romain and van Pottelsberghe (2004) find that the impact of GDP growth rate and R&D stock of knowledge on VC intensity is subject to a country's labour market rigidities. The lower the labour market rigidities, the higher the positive impact of the GDP growth rate and R&D stock of knowledge on the VC intensity and vice versa. However, the effect decreases with an increase in labour market rigidities. Similarly, the impact of R&D capital stock on VC intensity is positively influenced by a strong entrepreneurial culture and intense technological opportunities.

Schertler (2007), using a panel dataset of 15 European countries, spanning 1991-2001, finds a strong connection between various measures of total knowledge capital (sum of government and business-financed knowledge capital) and VC investments. The number of patents, number of R&D researchers, and the gross domestic expenditures on R&D scaled by GDP (GERD), have a significant and positive impact on the number of early-stage and early- and expansion-stage VC investments. However, the impact of total knowledge capital in terms of volume is not greatly significant and government-financed knowledge capital has weak explanatory power for the size of VC investments, probably due to commercial applications (Keuschnigg and Nielsen, 2003) or due to its long-term focus which is translated into commercial applications in more than two years. Schertler (2007), however, finds that business-financed GERD does not affect volume of investments, which contradicts the results of Romain and van Pottelsberghe (2004), probably due to differences in trends in their data. Schertler (2003) also finds that human capital endowment plays a positive role in VC development. However, according to Da Rin, Nicodano, et al. (2006) R&D has no effect on early stage and high-tech VC investment. They argued that policies intended to increase expected return in investment in new ventures attract VC toward high-tech and early-

stage investments.

## **2.4 Political and Factors**

VC research suggests that politically stable environments grow more VC. Bonini and Alkan (2006) find that investment profile, socioeconomic conditions and corruption affect VC. Eleswarapu and Venkataraman (2006) show that the stability of political systems explains international differences in transaction costs of equity and hence the liquidity of stock markets, expected return on equity, and ultimately VC differs across countries. Institutions are one of the powerful determinants of VC/PE. For instance, US and European investors display different investment patterns (Bertoni and Colombo, 2015). Groh and von Liechtenstein (2009) demonstrate that VC/PE investors are attracted by strong protection of investors' rights and efficient corporate governance mechanisms. Institutional proxies having effect on VC/PE include freedom from corruption (Cherif and Gazdar, 2011); Merges & Acquisitions investment volume, the shareholder suits index, and the legal rights index (Groh and Wallmeroth, 2016) and temperate bankruptcy laws for entrepreneurs (Armour and Cumming, 2006). Cumming, Henriques and Sadorsky (2016), on the other hand, show that cleantech VC activity is negatively influenced by the rule of law and government effectiveness. Legal institutions also influence international allocations in PE/VC. For example, Ragosa and Warren (2019) exhibit that regulatory support measures and feed-in tariffs, coupled with political stability, are strong drivers of cross-border investment in renewable energy in developing countries. Moreover, strong legal frameworks of host economies attract foreign PE investors as such environments protect property rights and reduce agency risks (Guler and Guillén, 2010). Groh and von Liechtenstein (2009) also show that the protection of property rights is the key consideration while allocating private equity globally.

## **2.5 Population Growth**

Population growth has several adverse effects which include environmental degradation, resource depletion, human health, human behaviors, and quality of life (Ehrlich and Holdren, 1971). The downside of population growth is that households' spending on dependent children reduces the ability of the families to save money that ultimately reduces savings. For example, households able to control birth rate in Bangladesh villages experienced higher income, more assets and better health compared to their counterparts in control villages (Joshi and Schultz, 2007). It reduces the pace of development and reduces the ability of families to escape poverty (Klasen and Lawson, 2007). The allocation of resources at the macro level by governments from population growth perspective has also implications on PE. Economies that have achieved birth control have achieved high and sustained economic growth and reduced poverty as governments' per capita allocation to health and education improve (Sinding, 2009). Others suggest that low birth rate in high income countries could be problematic while high birth rate in low income economies can slow down their development (Peterson, 2017). In this context, it is expected that environments where birth control has been achieved are likely to attract VC/PE investments.

## **2.6 ICT**

Internet, Computing and Telecommunication (ICT) has emerged as one of the dominant forces shaping the landscape of business around the globe (Khan, Khan and Hameed, 2020; Khan et al., 2021). ICT has resulted in improved financial participation, financial inclusion, financial access, and the overall financial development (Pradhan, Arvin and Norman, 2015; Asongu and Moulin, 2016; Asongu, S. A., & Acha-Anyi, 2017; Gabor, D., & Brooks, 2017; Pradhan et al., 2017, 2018; Lechman and Marszk, 2019). Considering financial systems as information systems, ICT has changed the information asymmetry in VC/PE markets that has bearing on transaction and agency costs (Ocampo, 2018). VC/PE is an information-dependent industry where investors are largely dependent upon market information for deal selection, deal origination, and post-investment monitoring (Carey, Prowse, Rea & Udell, 1993) that the extent that investors have to rely on informal informants (Fiet, 1995). In this context, ICT is not only a tool making processes more efficient but also a means to creating an entrepreneurial environment by creating enormous amount of business opportunities and thus a positive effect of ICT is expected.

## **3. Data and Methodology**

The article takes data from different sources. Data for dependent variable i.e., private equity investment in Asian-Pacific countries has been taken from Asian Venture Capital Journal and PE investment in European countries has been taken from Eurostat and EVCA yearbooks. In European data, PE investment data from 1990 to 2015 was taken from Eurostat while 2016 to 2017 data was taken from EVCA Yearbooks. ICT, patents, ICT exports, market capitalization, GDP growth, unemployment, real interest rates, real exchange rates, tertiary education and investment profile have been used as independent variables and data of these variables are taken World Bank databank. Data on investment profile has been taken from the International Country Risk Guide (ICRG) whereas tax burden data has been taken from Freedom of the World, Heritage Foundation (See Appendix 1).

The article uses standard Hausman test to decide which method is more appropriate (Greene, 2008). The test rejects the null hypothesis that the errors are not correlated with the regressors, hence, fixed effects (FE) estimation technique was chosen as the estimation technique. We also found heteroskedasticity in the data, but we run a robust option in Stata to obtain heteroskedasticity-robust standard errors. The dependent variable was also checked for autocorrelation using Lagrange-Multiplier. To cope with the autocorrelation, the lag of dependent variable was included in the models that removed autocorrelation.

**Table 1: Summary Statistics**

Variable	Observations	Mean	Standard deviation	Minimum	Maximum
Private equity % GDP	805	0.30	0.50	0.00	6.34
ICT	857	39.52	33.58	0.00	97.30
Market capitalization	724	90.38	142.26	0.86	1273.39
Exchange rate	771	99.29	14.89	42.10	165.88
GDP growth	796	4.00	2.74	0.01	25.12
Unemployment	680	6.19	3.80	0.49	26.09
Patents	869	8149.40	17161.48	17.00	135885.00
Population growth	780	0.89	0.71	0.00	5.32
Tax burden	729	63.39	15.50	29.80	93.80
Investment profile	864	8.97	2.39	3.00	12.00
Real interest rate	469	4.71	2.79	0.03	15.61
Human capital (tertiary)	730	48.19	23.34	1.53	121.86
R&D expenditure	562	1.65	0.94	0.05	4.29

Source: Author own calculation

### 3.1 Fixed Effects Estimation

To examine the impact of variables related to entrepreneurial environment, general economy, technological opportunity and political and institutional factors on private equity (PE) investment, the article uses the following regression model:

$$PrivateEquity_{i,t} = \beta_1 PrivateEquity_{i,t-1} + \beta_2 Internetuse_{i,t} + \beta_3 Marketcap_{i,t} + \beta_4 ExchangeRate_{i,t} + X_{i,t} + \mu_{i,t}$$

Where  $\mu_{it} = \alpha_i + \varepsilon_{it}$   $\alpha_i$  represents the individual country specific effects while  $\varepsilon_{it}$  is independently and identically random variable term. This allows the regressors to be correlated with the time-invariant component of the error captured by  $\alpha_i$  but uncorrelated with the idiosyncratic error captured by  $\varepsilon_{it}$  (Cameron and Trivedi, 2009). Subscript  $i=1,2,3,\dots$  signify country while  $t=1,2,3,\dots$  represent period.

All the variables have been expressed in log form.  $PrivateEquity_{i,t-1}$  is the initial (previous year) volume of PE investments across countries. The expected sign of initial PE investment is positive as already invested PE investment encourages further investment in that country.  $Internetuse_{i,t}$  measures the use of internet over the years by sampled countries.

**Table 2: Pair wise correlation of the variables analyzed**

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(1) Private equity %GDP	1.000												
(2) ICT	0.534	1.000											
(3) Market capitalization	0.396	0.258	1.000										
(4) REER	0.024	0.157	0.276	1.000									
(5) GDP growth	0.015	-0.208	0.083	-0.008	1.000								
(6) Unemployment	0.044	0.144	-0.259	-0.115	-0.280	1.000							
(7) Patents	0.163	-0.107	0.260	0.120	0.199	-0.410	1.000						
(8) Population growth	0.068	-0.080	0.215	0.006	0.276	-0.314	0.166	1.000					
(9) Tax burden	0.023	-0.007	0.212	0.106	0.279	-0.349	0.308	0.362	1.000				
(10) Investment profile	0.488	0.707	0.254	0.191	-0.143	0.032	-0.055	-0.008	-0.101	1.000			
(11) Real interest rate	-0.228	-0.344	-0.160	0.065	0.105	0.198	-0.003	0.106	0.114	-0.287	1.000		
(12) Human capital	0.311	0.707	0.125	0.359	-0.359	0.346	-0.235	-0.336	-0.260	0.548	-0.227	1.000	
(13) R&D expenditure	0.247	0.502	0.188	0.214	-0.270	0.229	0.019	-0.248	-0.420	0.357	-0.231	0.539	1.000



This has expected positive sign as internet represents the technological environment and at the same time facilitates entrepreneurial and financial environment denotes market capitalization in different countries over different periods. It is the market value of shares outstanding for listed companies at the end of respective years. Market capitalization is expected to have positive impact as developed stocks facilities exit from VC (Black and Gilson, 1998; Jeng and Wells, 2002) denotes real effective exchange rate (REER) and have been part of the baseline regression and represents all the other independent variables to be put one by one separately. They include GDP growth, unemployment, patents (resident), tax burden, population growth, investment profile, real interest rate, human capital tertiary and R&D expenditure. The institutional variables will not be examined in this research because they do not frequently vary across time to be captured by the fixed effects models.

### **3.2 Summary Statistics**

Summary statistics of PE investment, macroeconomic variables and innovation indicators variables are presented in Table 1. Total maximum observations are 864. The number of observations varies from one variable to another because of missing observations. The mean values of PE as percentage of GDP is 0.2965 with a minimum value of zero and maximum value Of 6.33. The mean value of PE shows that on the average, the share of PE in GDP is 0.30%. Variation in PE data is the smallest among all the variables as is clear from the table value of standard deviation of PE as percentage of GDP which is 0.503. The average number of patent applications by resident is 8149.397 which minimum value 17 and maximum value is 135885. Patent variable shows the largest variation which is clear from the standard deviation value 17161.74. The correlation matrix in Table 2 shows that ICT, market capitalization and investment profile exhibit high correlation with PE investment. GDP growth, tax burden and exchange rate display least correlation. Table 2 also shows that PE and real interest rate are negatively correlated; however, the correlation coefficient is smaller in magnitude. Among all the variables, the coefficient of interest rate and PE capital shows strong negative correlation. However, higher correlation does not guarantee dependence of a variable on another variable.

### **4. Empirical Results and Discussion**

Results of overall sample have been presented in Table 3, Europe in Table 4 and Asia-pacific in Table 5. Lagged PE investment show strong positive significant effect on PE in all the speciation used in the fixed effects estimation. This confirms the notion that previous year investment facilitates more investment. A population ecology approach suggests that every new entry to the market enhances legitimacy, expertise, and networking opportunities in the market, which further eases new founding (Manigart, 1994). In the overall sample, ICT, investment profile, university education, R&D expenditure, and market capitalization have strong positive impact on PE investment whereas population growth has strong negative effect. Moreover, real interest rates and real exchange rates are also significant determinants displaying negative sign as expected. Rest of the variables such as GDP growth, patents, and tax burden have insignificant

impact on PE while unemployment is unexpectedly positive but insignificant. Region-wise analysis shows that European PE investment is strongly sensitive to ICT, real exchange rate, and R&D expenditure and tax burden and moderately responsive to market capitalization, investment profile, and unemployment and university education. Tax burden, real exchange rate and unemployment have significant negative effect on PE investment while ICT, market capitalization, investment profile, R&D expenditure and university education have significant positive impact on PE. Population growth, real interest rate, GDP growth and patents play insignificant role while the negative sign displayed by patent is unexpected.

In Asia-Pacific region, Investment profile is the strongest determinant of PE investment. Moreover, ICT, and university education have significant positive influence on PE while population growth and real interest rate have significant negative bearing on PE investment. Rest of the factors is insignificant with unemployment and tax burden displaying unexpected positive signs. It could be inferred that despite the unemployment on the rise and increasing taxes in those economies, business still attract VC investments in Asian context. ICT is the strongest determinant of PE investment over time in all the samples, although it is more pronounced in Europe than in the Asia-Pacific region. PE investment represents more the demand side potential compared to fundraising that represents the efficiency of an economy to provide supply of PE, thus it can be argued that internet has created ample entrepreneurial opportunities in these economies. However, more investment could also be due to more local fundraising because major proportion of such investments is raised locally in most of the economies leaving possibility that internet has also positively facilitated the fundraising processes and that is why its scale which triggers more investment. Strong impact of internet also shows that it might have facilitated PE investment processes particularly information for deal origination, business evaluation, monitoring and exits.

Volatility of real exchange rate is strong negative determinant of PE investment in Europe compared to Asia-Pacific. One could expect that high REER would result in high PE investment because cross border PE investments are made in terms of US Dollars which are converted to destination currencies and any loss of value of destination currency over the years would mean loss of value in terms of US dollars when the proceeds are converted back from the undervalued local currency. However, Minardi et al. (2017) show that in the long-term exchange risk does not affect international investors decisions to investors' returns in Brazil because good cycles compensate bad cycles. Moreover, domestic PE investments, which are a major part, are not affected by currency exchange directly as they affect cross border investors. An increase in REER means that exports become costlier, and imports get cheaper or in other words the loss of a country's trade competitiveness in comparison to its major trading partners . For example, US exports of automobiles, aluminum, iron and steel, wood and pulp, and paper plunge when dollar gets strength (Thorbecke, 2018). Thus, countries losing trade efficiency would certainly lose business opportunities as well and leave narrow space for PE/VC actors. Increase in exchange rate reflects a country's lack of trade competitiveness and therefore entrepreneurial opportunities, deal

flow and demand side of PE/VC. Rodrik (2008) argues that currency undervaluation stimulates economic growth. The question why it is more pronounced in Europe than in Asia-Pacific region might be due to the flexible and sustained interventions by Asian governments that have effectively achieved growth through stable and competitive real exchange rate policies (Guzman, Ocampo and Stiglitz, 2018).

**Table 3: Fixed Effects Estimation Results Overall: Dependent Variable is PE Investment**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
PE investment <sub>t-1</sub>	0.521***	0.468***	0.497***	0.514***	0.388***	0.573***	0.338***	0.458***	0.369***
ICT	0.200***	0.259***	0.215***	0.204***	0.323***	--	--	--	--
Market cap.	0.261**	0.280***	0.266***	0.260***	0.338***	0.393***	0.374**	0.328***	0.375***
REER	-0.741*	-0.896*	-1.068**	-0.722	-0.964*	-0.973*	-1.630**	-1.874**	-0.617
GDP growth	0.060	--	--	--	--	--	--	--	--
Unemployment	--	0.044	--	--	--	--	--	--	--
Patents	--	--	0.100	--	--	--	--	--	--
Pop. growth	--	--	--	-0.166***	--	--	--	--	--
Tax burden	--	--	--	--	-0.396	--	--	--	--
Invest. profile	--	--	--	--	--	0.746***	--	--	0.813***
Real interest rate	--	--	--	--	--	--	-0.267**	--	--
Human capital	--	--	--	--	--	--	1.172***	1.173***	--
RD Expenditure	--	--	--	--	--	--	--	--	0.705***
Constant	0.782	1.096	1.474	0.647	2.454	0.402	0.642	1.602	-1.933
Observations	516	437	568	498	514	557	184	447	400
R-squared	0.556	0.533	0.583	0.613	0.479	0.572	0.462	.592	0.393
No. of Countries	28	27	28	26	28	27	16	27	27

\*\*\* p<0.01, \*\* p<0.05, \* p<0.10

**Table 4: Fixed Effects Estimations Results Europe: Dependent Variable is PE Investment**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
PE investment <sub>t-1</sub>	0.572***	0.222*	0.558***	0.386***	0.629***	0.618***	0.239	0.550***	0.358***
ICT	0.147***	0.196***	0.133***	0.279***	0.114***				
Market capitalization	0.205	0.295***	0.248**	0.245**	0.267*	0.365***	0.276	0.288**	0.229**
REER	-1.544***	-2.428***	-1.778***	-2.143***	-1.324***	-1.552***	-2.733	-	-2.051***
GDP growth	0.049	--	--	--	--	--	--	--	--
Unemployment	--	-0.359**	--	--	--	--	--	--	--
Patents	--	--	-0.007	--	--	--	--	--	--
Tax burden	--	--	--	-0.608***	--	--	--	--	--
Population growth	--	--	--	--	-0.095	--	--	--	--
Investment profile	--	--	--	--	--	0.462**	--	--	0.849***
Real interest rate	--	--	--	--	--	--	-0.165	--	--
Human capital	--	--	--	--	--	--	1.018*	0.908***	--
RD Expenditure	--	--	--	--	--	--	--	--	0.687**
Constant	4.932**	8.513***	5.925**	9.096***	3.869*	3.905**	6.294	4.081*	5.019*
Observations	346	258	383	331	322	389	96	348	289
R-squared	0.697	0.595	0.707	0.573	0.773	0.688	.361	.681	0.462
No. of Countries	19	18	19	19	17	19	8	19	19

\*\*\* p<0.01, \*\* p<0.05, \* p<0.10

**Table 5: Fixed Effects Estimation Results Asia-Pacific: Dependent Variable is PE Investment**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
PE investment <sub>t-1</sub>	0.389***	0.370***	0.384***	0.298***	0.385***	0.407***	0.328**	0.347**	0.310**
ICT	0.480***	0.638***	0.502**	0.376*	0.484**				
Market capitalization	0.407*	0.365**	0.262	0.446*	0.240*	0.452*	0.433*	0.444**	0.752*
REER	-0.242	-0.288	-0.729	-0.555	-0.327	-0.082	-1.326	-1.438	0.802
GDP growth	0.064	--	--	--	--	--	--	--	--
Unemployment	--	0.725	--	--	--	--	--	--	--
Patents	--	--	0.226	--	--	--	--	--	--
Tax burden	--	--	--	4.842	--	--	--	--	--
Population growth	--	--	--	--	-0.338**	--	--	--	--
Investment profile	--	--	--	--	--	3.246***	--	--	1.951
Real interest rate	--	--	--	--	--	--	-0.286**	--	--
Human capital	--	--	--	--	--	--	1.463**	1.655**	--
RD Expenditure	--	--	--	--	--	--	--	--	0.707
Constant	-3.297	-4.465	-2.556	-22.583	-2.092	-9.889**	-2.015	-2.474	-12.717
Observations	170	179	185	183	176	168	88	99	111
R-squared	0.488	0.580	0.533	0.479	0.551	0.520	.506	.478	0.393
No. of Countries	9	9	9	9	9	8	8	8	8

\*\*\* p<0.01, \*\* p<0.05, \* p<0.10

**Table 6: Lag effects of GDP Growth and Patents: Dependent Variable is PE Investment**

	(1)	(2)	(4)	(5)
PE investment <sub>t-1</sub>	0.521***	0.537***	0.497***	0.493***
ICT	0.200***	0.214***	0.215***	0.222***
Market capitalization	0.261**	0.205**	0.266***	0.262***
REER	-0.741*	-1.219**	-1.068**	-1.056**
GDP growth	0.060	--	--	--
Lagged GDP growth	--	0.059*	--	--
Patents	--	--	0.100	--
Lagged Patents	--	--	--	0.123*
Constant	0.782	3.185	1.474	1.227
Observations	516	518	568	567
R-squared	0.556	0.606	0.583	0.584
Number of Countries	28	28	28	28

\*\*\* p<0.01, \*\* p<0.05, \* p<0.10

Market capitalization is strong in overall sample than the regional samples and European investors are more sensitive to stock market signals compared to their Asia-Pacific counterparts in within regressions. In terms of political risk factors, Asia-Pacific PE market is more sensitive to investment profile compared to its European counterpart in within regressions although both are significant. The tax results are interesting in the sense that tax burden does not refrain PE investors in Asia-Pacific from investment quite opposite to their European counterparts who are strongly sensitive to taxation. This is also consistent with the previous research. Studies showing that taxation is not significant determinant have taken countries such as US, Australia, and Japan along with European countries (Jeng and Wells, 2000; Romain and van Pottelsberghe, 2004) while studies showing that taxation is significant have taken only European countries in their sample (Cherif and Gazdar, 2011, Schroder, 2009; Groh and von Liechtenstein, 2009). The results of unemployment confirm the previous studies that it has significant negative effect on PE/VC investment in Europe unemployment (Cherif and Gazdar, 2011). We could not find studies on Asia-Pacific region studying unemployment as independent variable. There are certain features that cause a rise in unemployment which are unemployment benefits, high unionisation, high payroll taxes and poor educational standards and usually these features are found in the European economies (Nickell, 1997). Thus, the significant negative impact in European context is comprehensible and the results support the overall sense that labour market have negative effect on VC investment.

Showing positive sign, GDP growth does not exert significant influence on the PE in all the three samples in within regressions. However, when we took the lag GDP growth, it displays significance (see

Table 6). Similarly, lag of patent was taken and again it got significance. Reason for this is that both GDP and patents should have influence on the PE investments in the following year. Although, projected GDP growth is reported during the year from time to time, the annual GDP growth is determined and published after the completion of financial year. If GDP growth has any signaling value, then the previous year growth rate should be meaningful compared to current year because investors would not be knowing the current year growth rate as such. This is different from other variables such as taxation, interest rates or exchange rate which have impact after they are in effect. Similarly, patents should have slow effect whether we talk about signaling influence or actual influence.

Strong positive effect of R&D expenditure on VC investment in the European countries was expected. Results of Asia-Pacific countries are surprising though. R&D expenditure is not only insignificant, but it also reduces the effect of other variables in the specification i.e., investment



profile, market capitalization, and real exchange rate. The previous research on effect of R&D on VC investment has been conducted in Europe (Schertler, 2007; Romain and van Pottelsberghe, 2004; to Da Rin et al., 2006b), and hardly any research on Asian context has taken this variable. The fact that R&D expenditure take time to fuel entrepreneurial activities, we take log1 and log 2 to see its impact on PE. The results confirmed that it is still insignificant.

Population growth exhibit interesting results. Population growth significantly and negatively influences Asia-Pacific PE but not European PE. Overall, it has negative impact on venture capital and PE investments. We can conclude that international risk investors choose destinations with increasing prospects for prosperity (which is linked with low birth rates). High domestic PE investment in low birth rate countries reflect their rising household savings at micro level and high human capital investment for sustained economic growth and reduction in poverty at macro level (Sinding, 2009).

Asian economies display strong negative impact of interest rate on PE investment compared to European countries during the period under consideration. Overall, the results support the findings of Bonini and Alkan (2012) that interest rates play negative role opposite to Romain and Pottelsberghe (2004) and Füß and Schweizer (2008) who found positive relationship between interest rates and venture capital investment. It can be inferred that as interest rates increase, economic growth weakens and fundraising reduces, both affecting PE investment (Bonini and Alkan, 2012). However, Romain and Pottelsberghe (2004) found that cost of capital has more impact on demand side than on fundraising. The Asian markets might be more responsive to interest rates because of fluctuation. As Figure 3 shows that interest rates fluctuate more in Asian context and the fluctuation goes against the fluctuation in PE investment in Figure 2 or in other words interest rates push PE investments in its opposite direction. Overall, the trend analysis also show that interest rates have gradually decreased while PE investments have increased both in Europe and Asia attesting a negative relationship in long term. Finally, the university enrollment demonstrating strong positive sign in all samples point to the importance of science and technological base or human capital that fuels an entrepreneurial economy.

## **5. Conclusion**

The study has analyzed the impact of different factors influencing PE investment using data of 32 European and Asia-Pacific countries over the period 1990-2017. Results show that ICT, stock market capitalization, investment profile and human capital are strongly linked to PE investments in the overall sample as well as in Europe and Asia-Pacific. In addition, population growth and real interest rate have significant negative impacts while R&D expenditure has strong positive impact on PE investment in the overall sample. Region-wise, PE investment significantly and positively respond to ICT and market capitalization in Europe and to investment profile in the Asia-Pacific region. Real exchange rate, unemployment and tax burden exert significant negative impact on European PE whereas the population growth and real interest rates have significant negative impact in Asia-Pacific context.

The article claims important contributions to the research on private equity. ICT, population growth, and real exchange rate have been identified new determinates in the empirical investigation which also have theoretical relevance. Moreover, the regional comparisons reveal important differences that helps interpret the conflicted results in previous research. The article also fills the regional gap in literature by focusing on Asia-Pacific region. In future, more comparative studies are required that will remove the conflicting accounts in PE/VC research that will result into broader consensus and convergence. In future more research with latest data will be helpful because much of the developing PE has gained momentum after the 2000 Dot Com bubble and is still growing and spreading to other developing economies.

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### **Appendix 1: Variable Descriptions and Data Sources**

<b>Variables</b>	<b>Description</b>	<b>Source</b>	
Private equity Investment	Private equity investment as percentage of GDP. It includes all stages of venture capital, expansion, growth, and buyout investments.	AVCJ, Eurostat, EVCA Yearbooks	1990-2017
ICT	ICT represents individuals who have used the internet (from any location) in the last 3 months. The Internet can be used via a computer, mobile phone, personal digital assistant, games machine, digital TV etc.	World Development Indicators, World Bank databank	1990-2017
Market capitalization	Market capitalization (also known as market value) is the share price times the number of shares outstanding (including their several classes) for listed domestic companies. Investment funds, unit trusts, and companies whose only business goal is to hold shares of other listed companies are excluded. Data are end of year values.	World Development Indicators, World Bank databank	1990-2017
Real effective exchange rate (REER)	Real effective exchange rate is the nominal effective exchange rate (a measure of the value of a currency against a weighted average of several foreign currencies) divided by a price deflator or index of costs.	World Development Indicators, World Bank databank	1990-2017
GDP growth	Annual percentage growth rate of GDP. Aggregates are based on constant 2010 U.S. dollars.	World Development Indicators, World Bank databank	1990-2017
Unemployment (national)	Unemployment refers to the share of the labor force that is without work but available for and seeking employment. Definitions of labor force and unemployment differ by country.	World Development Indicators, World Bank databank	1990-2017
Patent (residents)	Patent applications are worldwide patent applications filed through the Patent Cooperation Treaty procedure or with a national patent office for exclusive rights for an invention--a product or process that provides a new way of doing something or offers a new technical solution to a problem. A patent provides protection for the invention to the owner of the patent for a limited period, generally 20 years.	World Development Indicators, World Bank databank	1990-2017
Population growth	Annual population growth rate for year t is the exponential rate of growth of midyear population from year t-1 to t, expressed as a percentage. Population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship.	World Development Indicators, World Bank databank	1990-2017
Tax burden	Tax burden is a composite measure that reflects marginal tax rates on both personal and corporate	Freedom of the World (Heritage)	1995-2017

	income and the overall level of taxation (including direct and indirect taxes imposed by all levels of government) as a percentage of gross domestic product (GDP).	Foundation)	
Real interest rate	It is the lending interest rate adjusted for inflation as measured by the GDP deflator. The terms and conditions attached to lending rates differ by country, however, limiting their comparability.	World Development Indicators, World Bank databank	1990-2017
Human capital	Gross enrollment ratio is the ratio of total enrollment, regardless of age, to the population of the age group that officially corresponds to the level of education shown. Tertiary education, whether to an advanced research qualification, normally requires, as a minimum condition of admission, the successful completion of education at the secondary level.	World Development Indicators, World Bank databank	1990-2017
R&D Expenditures (% of GDP)	Gross domestic expenditures on research and development (R&D), expressed as a percent of GDP. They include both capital and current expenditures in the four main sectors: Business enterprise, Government, Human capital and Private non-profit. R&D covers basic research, applied research, and experimental development.	World Development Indicators, World Bank databank	1996-2016
Investment profile	This is an assessment of factors affecting the risk to investment that are not covered by other political, economic and financial risk components. The risk rating assigned is the sum of three subcomponents, each with a maximum score of four points and a minimum score of 0 points. A score of 4 points equates to Very Low Risk and a score of 0 points to Very High Risk. The subcomponents are: <ul style="list-style-type: none"> <li>• Contract viability/expropriation</li> <li>• Profits repatriation</li> <li>• Payment delays</li> </ul>	ICRG	1990-2017

**Note: The description of the data has been taken from the source document/site of the data without making any changes.**