Venture Capital Without Borders? A Gravity Model Analysis of Inbound Cross-Border Venture Capital Flows in Europe, 2007-2024

Simen Solli

Dissertation written under the supervision of Professor Fatima Shuwaikh

Dissertation submitted in partial fulfillment of requirements for the MSc in International Finance, at the Universidade Católica Portuguesa, 05.01.2026.

Abstract

This thesis examines the drivers of cross-border venture capital flows into European countries from 2007 to 2024 and explores how these factors vary across different macroeconomic regimes and regions. Using a panel of Refinitiv deal-level data aggregated into bilateral country-pair flows for 32 European host countries, the study estimates a gravity model using Poisson pseudo-maximum likelihood. The analysis considers both the number of cross-border deals and the total investment amount, including fixed effects and interaction terms to capture changes across the periods 2007-2012, 2013-2019, and 2020-2024. Key findings show that origin-country economic mass (GDP) is a strong positive predictor of inbound venture capital activity, while host-country market size has no positive effect (and is negative or insignificant in some specifications). Geographical and informational proximity significantly facilitates cross-border venture capital flows. Shorter distances and shared language or borders are associated with more deals and, more weakly, with higher investment amounts. In contrast, host-country macro-financial conditions do not show a consistent significant influence on venture capital inflows. The results reveal limited changes over time across the three periods, but there is some evidence that the effect of distance on invested amounts was smaller from 2013 to 2019. Regional differences are noticeable. Small Nordics and peripheral European markets appear more sensitive to distance and host-country fundamentals than the major venture capital hubs. These findings highlight the importance of economic size and information frictions in shaping cross-border venture capital flows in Europe, suggesting that integration challenges remain for smaller ecosystems despite recent market growth.

Title: Venture Capital Without Borders? A Gravity Model Analysis of Inbound Cross-Border-Venture Capital Flows in Europe, 2007-2024

Author: Simen Solli

Key Words: Cross-border venture capital, gravity model, Poisson pseudo-maximum likelihood (PPML), dyad-year, extensive margin, intensive margin, geographic distance, common language, shared border, information frictions, regional heterogeneity, macro-financial conditions.

Resumo

Esta dissertação analisa os determinantes dos fluxos transfronteiriços de venture capital para países europeus entre 2007 e 2024 e como estes variam entre regimes macroeconómicos e regiões. Com dados ao nível de transação da Refinitiv, agregados em fluxos bilaterais país-par-ano para 32 países europeus de destino, estima-se um modelo gravitacional através de Poisson pseudo-maximum likelihood. A análise considera o número de operações e o montante total investido, com efeitos fixos e termos de interação para os períodos 2007-2012, 2013-2019 e 2020-2024.

Os resultados mostram que a massa económica do país de origem (PIB) é um forte preditor positivo da atividade inbound, enquanto a dimensão do mercado do país de destino não apresenta um efeito positivo robusto e é por vezes negativa ou estatisticamente insignificante. A proximidade geográfica e informacional facilita os fluxos: menor distância e partilha de língua ou fronteira associam-se a mais operações e, de forma mais fraca, a maiores montantes investidos. Em contraste, as condições macrofinanceiras do país de destino não exibem uma influência significativa consistente. No tempo, observam-se mudanças limitadas, embora exista evidência de que o efeito da distância sobre os montantes investidos foi menor entre 2013 e 2019. Regionalmente, os Pequenos Países Nórdicos e mercados europeus periféricos parecem ser mais sensíveis à distância e aos fundamentos do país de destino do que os principais hubs de venture capital.

Em conjunto, os resultados salientam a importância da dimensão económica e das fricções informacionais para os fluxos transfronteiriços de venture capital na Europa.

Título: Venture Capital Without Borders? Uma Análise por Modelo de Gravidade dos Fluxos de Venture Capital Transfronteiriços de Entrada na Europa, 2007–2024.

Autor: Simen Solli

Palavras-chave: venture capital transfronteiriço, modelo de gravidade, Poisson pseudo-máxima verosimilhança (PPML), díade-ano, margem extensiva, margem intensiva, distância geográfica, língua comum, fronteira partilhada, fricções de informação, heterogeneidade regional, condições macrofinanceiras.

Table of Content

Introduction 5

Theoretical Framework 7

2.1 Cross-Border venture capital and European fragmentation 7

2.2 Gravity framework for cross-border capital flows 7

2.3 Foreignness, informational frictions, and host-country conditions 8

2.4 Local ties, venture capital ecosystems, and regional heterogeneity 9

2.5 Summary and theoretical implications 10

Literature Review 10

3.1 Cross-border venture capital in Europe: growth, fragmentation, and home bias 10

3.2 Venture capital effect on innovation and economic growth 11

3.3 Market size and gravity frictions in cross-border capital flows 11

3.4 Foreignness, institutions, and host-country macro-financial conditions 12

3.5 Local ties, syndication, ecosystems, and regional heterogeneity 13

3.6 Synthesis and link to hypotheses 14

Methodology 15

4.1 Sample and data sources 15

4.2 Variables Description 17

4.3 Estimation approach 18

Results and Discussion 19

5.1 Descriptive statistics and sample patterns 19

5.2 Baseline Results: Intensive and Extensive Margins 20

5.3 Robustness and sensitivity analysis 24

5.3.1 Alternative clustering and inference assumptions 24

5.3.2 Dyad fixed effects as a stricter within-pair design 25

5.3.3 Alternative measures of host country economic mass 25

5.3.4 Sensitivity to extreme observations on the venture capital amount margin 26

5.3.5 Placebo falsification test using lead values of macro variables 26

5.3.6 Host-macro-conditional robustness 26

5.3.7 Regional robustness checks for H5 27

5.3.8 Summary of robustness evidence 27

5.4 Discussion and analysis of results 28

5.4.1 Economic mass in a bilateral framework: why origin GDP is stable while host GDP is not 28

5.4.2 Gravity frictions and the extensive versus intensive margin 29

5.4.3 Macro financial host country conditions: limited H3 evidence and why regime dependence matters 29

5.4.4 Regional heterogeneity: hubs versus smaller ecosystems 30

Conclusion, limitations, and future research 32

References 34

Appendix 37

Table list 37

Table 3: H1. Economic mass and cross-border VC flows (PPML) 37

Table 4: H2. Gravity frictions and cross-border VC flows 38

Table 5: H3. Macro-financial conditions 39

Table 6: H4. Period interactions: distance & interest rate, base period 2007–2012 40

Table 7: H5. Regional differences 41

Table 8: dyad-clustered standard errors 42

Table 9: dyad FE + year FE (distance/lang/border absorbed) 43

Table 10: host GDP per capita + host population 44

Table 11: trim top 1% of amount 45

Table 12: Placebo: leads t+1 & t+2 (IR & unemployment) 46

Table 13: real interest rate replaces nominal rate 47

Table 14: dyad-clustered standard errors, by region 48

Table 15: LODO (Small Nordics) 49

Introduction

Venture capital is a specialized form of private equity where professional investors provide risk capital to young, innovative, high-potential start-ups and small and medium-sized enterprises (SMEs) that lack access to traditional bank lending or public markets. It is considered a key driver of productivity growth and job creation, and an essential channel for financing innovation and entrepreneurship in many developed and emerging economies. Venture investors accept high uncertainty in exchange for potentially high returns when their portfolio companies succeed (Gompers & Lerner, 2001; Kato, 2025; OECD, 2025a).

The European venture capital market has grown dramatically over the past 15 years. Annual investment increased from about €3.2 billion in 2010 to €17.6 billion in 2024 (peaking at €20.7 billion in 2021). Europe's share of global venture funding increased from roughly 5% in 2004 to around 20% in 2024 (Dealroom, 2025; Invest Europe, 2025a).

Over the past two decades, empirical research on European venture capital has increased significantly, linking venture capital to innovation and economic performance. Higher venture funding is associated with more patenting and new firm creation (Popov & Roosenboom, 2012, 2013) and with long-run relationships between venture activity, digital infrastructure, and growth in Europe (Pradhan et al., 2017, 2019). This implies that the geography of venture investment can influence where innovation occurs within Europe.

Despite this expansion, European venture activity remains geographically concentrated, with a small set of major hubs, such as London, Paris, and Berlin, dominating activity (EIF & Invest Europe, 2023). Geographic frictions also shape cross-border investment. For example, by 2014, the top 20 hubs accounted for more than 80 percent of EIF-backed venture capital investments (Kraemer-Eis et al., 2016). Moreover, a large share of investment volume has moved between distinct hubs, while cross-hub transactions do not necessarily imply cross-border investment when hubs are located within the same country, such as London-Cambridge (Dealroom, 2025; EIF & Invest Europe, 2023). This uneven distribution motivates the question of whether smaller innovation-driven economies can attract cross-border venture capital on terms comparable to those of large ecosystems. It also motivates an examination of how economic size and bilateral frictions, such as distance, language, and borders, correlate with inbound cross-border venture capital flows.

Cross-border investors have become increasingly important in Europe. While domestic investors still account for the largest share of activity, the cross-border share of European venture

capital investment value has increased (Invest Europe, 2025a). Empirical evidence from gravity-flow research suggests that the European venture capital market is not frictionless and exhibits systematic patterns associated with economic size, geographic distance, macroeconomic and financial factors, and institutional quality. Cross-border venture capital remains fragmented along national and regional boundaries (Asdrubali, 2023). However, much of the existing evidence is either highly aggregated or focused on specific segments. As a result, it remains unclear whether the determinants of inbound cross-border venture capital differ across macroeconomic regimes and across distinct European regions.

This thesis examines how economic, geographic, and macro-financial factors shape inbound cross-border venture capital investment into European countries, and whether these relationships differ across macroeconomic regimes. Using Refinitiv deal-level data aggregated to country-pair-year flows for 2007-2024, the analysis compares three regional groups: small Nordic economies (Norway, Denmark, and Finland), major venture capital hubs (the United Kingdom, Germany, France, the Netherlands, and Sweden), and the rest of Europe. Sweden is included in the hub group due to Stockholm's dominance in European venture capital activity. The main research question is:

"Which economic, geographic, and macro-financial factors drive cross-border venture capital investments into European countries between 2007 and 2024, and how have these determinants changed across major macroeconomic periods and regions within Europe?"

This thesis makes three contributions. First, it applies a gravity-type framework to inbound cross-border venture capital flows using bilateral macroeconomic and geographic indicators combined with Refinitiv data. Second, it incorporates host-country macro-financial conditions, in particular long-term government bond yields and unemployment rates, and tests whether their relevance differs across three regimes (2007-2012, 2013-2019, and 2020-2024). Third, it documents regional heterogeneity by estimating the model separately for each regional group, highlighting differences between smaller innovation-driven economies and mature hub ecosystems. Throughout the thesis, cross-border venture capital refers to transactions where the investor (origin) and the investee (host) are located in different countries. The analysis examines both the extensive margin (the number of deals) and the intensive margin (total investment, in EUR millions) at the country-pair-year level.

The remainder of the thesis is organized as follows. Chapter 2 develops the theoretical framework and reviews related literature. Chapter 3 provides a focused literature review. Chapter 4

presents the data and empirical methodology. Chapter 5 reports the results and robustness checks, and Chapter 6 concludes with limitations and future research.

Theoretical Framework

This chapter develops a theoretical framework for analyzing cross-border venture capital flows into Europe. The analysis employs gravity models of international venture capital investments, examines the liability of foreignness in the literature, and incorporates research on local venture capital ecosystems. These approaches help form expectations about how economic size, geographical distance, and macro-financial conditions affect inbound venture capital across European regions.

2.1 Cross-Border venture capital and European fragmentation

Venture capital finances young, high-growth firms and combines funding with active screening and governance that can alleviate financing constraints for innovative entrepreneurs (Gompers & Lerner, 2001). In Europe, however, cross-border venture capital activity remains characterized by persistent home bias and incomplete market integration. Cross-border deals are fragmented and regionally asymmetric, with activity concentrated in a limited number of hubs in Northern and Western Europe (Asdrubali, 2023; Kraemer-Eis et al., 2016; Pavlova & Signore, 2019). Recent institutional reports further emphasize structural constraints, related to exits, fundraising, and scale-up financing, that may reinforce segmentation and limit the ability of smaller ecosystems to attract international risk capital on comparable terms (Botsari & Lang, 2024; James, 2024). This motivates a closer examination of which economic mass, bilateral frictions, and macro-financial conditions drive inbound venture capital to European countries and whether these factors vary across different regions and macroeconomic periods.

2.2 Gravity framework for cross-border capital flows

The use of gravity models to study bilateral cross-border flows is well established. In the standard gravity framework, flows between an origin country and a host country increase with the economic size of both countries and decrease with bilateral frictions, typically proxied by geographic distance (Head & Mayer, 2014). While distance was originally interpreted as transportation costs in goods trade, gravity models in international finance highlight that distance reflects informational and transactional frictions, including search, screening, and monitoring costs in cross-border transactions (Aizenman & Kendall, 2012; Portes & Rey, 2005)

This logic can be summarized using a multiplicative flow structure, in which expected inbound venture capital activity increases with the origin and host “mass” and decreases with friction.

In this context, mass captures supply- and opportunity-set fundamentals. It is typically proxied by GDP or related size measures, whereas frictions include geographic distance and informational proximity, such as common language and shared borders (Head & Mayer, 2014; Portes & Rey, 2005). The finance gravity literature shows that market size and bilateral information frictions together explain patterns in cross-border asset transactions (Martin & Rey, 2004; Portes & Rey, 2005). Applied to venture capital, this implies that larger origin economies are expected to supply more cross-border capital, whereas distance should reduce activity. On the contrary, common language and shared borders are expected to facilitate cross-border investment by reducing these frictions (Aizenman & Kendall, 2012; Head & Mayer, 2014).

This gravity mechanism directly motivates the core empirical emphasis on economic mass (GDP and related size proxies) and bilateral frictions (distance, common language, shared border) as primary correlates of inbound cross-border venture capital.

2.3 Foreignness, informational frictions, and host-country conditions

A defining feature of cross-border venture capital is that foreign investors may face liability of foreignness and informational disadvantages compared to domestic investors. Geographic, institutional, and cultural distance can increase the costs of search, screening, contracting, and monitoring, making it harder for foreign investors to identify suitable targets (Aizenman & Kendall, 2012; Head & Mayer, 2014). Evidence from venture capital return data is consistent with such foreignness-related frictions affecting selection and post investment involvement, although return-based evidence does not directly identify the determinants of cross-border flow volumes (Buchner et al., 2018). The implication for a flow-based analysis is therefore not necessarily that foreign investors invest less, but that cross-border allocation should be more sensitive to frictions and to host-country conditions that proxy for risk, stability, and the broader investment environment.

If foreignness increases the cost and risk of investing abroad, foreign investors have stronger incentives to focus on host-country fundamentals that mitigate these disadvantages. Two sets of host country conditions are particularly relevant. First, institutional and legal quality affects contract enforcement, investor protection, and the predictability of the investment environment, which are commonly linked to venture capital market development and investment incentives (Alhorr et al., 2008; Bonini & Alkan, 2012). Second, macro-financial conditions influence interest rates, financing constraints, and the broader risk environment. In the capital-flows literature, both domestic "pull" factors like growth prospects and macro stability, and global "push"

factors, as global risk appetite and liquidity conditions shape cross-border allocation, with changing importance across periods of stress (Forbes & Warnock, 2012; Fratzscher, 2012). Related work further indicates that distance and institutions can interact with volatility and risk in shaping international financial flows, implying that frictions may become more binding as uncertainty rises (Cavallaro & Cutrini, 2019).

In the venture capital context, these arguments motivate including host-country macro-financial variables, such as interest rates and unemployment rates, as correlates of inbound cross-border venture capital flows. A natural expectation is that tighter macro-financial conditions are associated with lower inbound activity, and that sensitivities may differ across macroeconomic regimes rather than being constant over time (Fratzscher, 2012; Frimpong et al., 2024).

2.4 Local ties, venture capital ecosystems, and regional heterogeneity

Cross-border venture capital depends not only on macroeconomic conditions and geographic distance, but also on local investor networks and the maturity of venture capital ecosystems. Because venture capital is relationship-intensive, syndication can partly substitute for missing local knowledge by improving deal sourcing, due diligence, and monitoring. Evidence suggests that local ties and prior cross-border syndication are associated with both more frequent and larger cross-border venture capital flows, consistent with the view that networks reduce information frictions and facilitate cross-border intermediation (Tykvová & Schertler, 2011). Related work also suggests that repeated cross-border collaboration can generate learning effects that improve investors' ability to operate internationally and may gradually lower barriers created by unfamiliarity (Meuleman & Wright, 2011). In addition, broader reviews of venture capital internationalization indicate that investors tend to favor host countries with stronger institutions, deeper financial markets, and denser networks that lower the costs of foreign investment and support effective screening and governance (Devigne et al., 2018).

Relational proximity, including bilateral trust, represents an additional channel that may support cross-border transactions, but are difficult to measure consistently across countries and are not directly tested in this thesis (Bottazzi et al., 2016). Instead, the empirical strategy captures these ecosystem and relational differences indirectly through regional heterogeneity. If major hubs feature deeper investor networks, stronger intermediaries, and more developed exit environments, they may attract inbound venture capital on different terms than smaller ecosystems, where frictions and local conditions may be more binding. Accordingly, the thesis differs between (1) small Nordic economies excluding Sweden, (2) major hubs (the United Kingdom, Germany, France, the Netherlands, and Sweden), and (3) the rest of Europe, and examines

whether the estimated sensitivities to gravity factors and host country conditions differ across these groups (Asdrubali, 2023; Pavlova & Signore, 2019).

2.5 Summary and theoretical implications

The theoretical framework highlights three mechanisms likely to shape cross-border venture capital flows into European countries. First, gravity-type considerations imply that inbound activity increases with origin and host economic mass and declines with geographic and informational distance (Head & Mayer, 2014; Martin & Rey, 2004; Portes & Rey, 2005). Second, foreignness implies that cross-border investors place greater weight on host country fundamentals and institutional quality, motivating the inclusion of host macro-financial conditions such as interest rates, unemployment, and inflation, with effects that may vary across macroeconomic environments (Alhorr et al., 2008; Bonini & Alkan, 2012; Forbes & Warnock, 2012; Fratzscher, 2012). Third, local connections, trust, and the maturity of venture capital ecosystems affect foreign investor' ability to form syndicates, diversify geographically, and monitor portfolio companies. These factors may lead to systematic differences between smaller economies and major hubs (Bottazzi et al., 2016; Meuleman & Wright, 2011; Tykvová & Schertler, 2011).

Literature Review

3.1 Cross-border venture capital in Europe: growth, fragmentation, and home bias

Empirical research on cross-border venture capital flows has expanded over the past two decades, alongside the increasing internationalization of venture capital markets. Despite strong growth in European venture capital, domestic investors still account for the majority of investment activity, consistent with persistent home bias and incomplete market integration (Asdrubali, 2023). Institutional and descriptive evidence further characterize the European venture capital market as fragmented across national borders and geographically uneven, with cross-border activity concentrated in a limited number of major hubs and metropolitan ecosystems (Kraemer-Eis et al., 2016; Pavlova & Signore, 2019).

Recent institutional reports point to structural constraints that may reinforce this segmentation. This includes limitations related to exits, fundraising conditions, and scale-up financing, which can disadvantage smaller ecosystems relative to established hubs (Botsari & Lang, 2024). Similarly, recent IMF analysis argues that European risk-capital markets remain less integrated and offer fewer opportunities to finance and scale up innovative start-ups than in the United States (James, 2024). A key limitation of evidence is that much of it is primarily descriptive. It doc-

uments concentration and constraints, but it typically does not quantify which bilateral determinants drive inbound cross-border venture capital across country pairs. Additionally, they do not test whether these relationships vary systematically across macroeconomic regimes and regional groups. This motivates a gravity-style empirical analysis that tests how economic size, bilateral frictions, and host-country macro-financial conditions correlate with inbound cross-border venture capital flows over time and across regions.

3.2 Venture capital effect on innovation and economic growth

Several studies have examined the relationship between venture capital activity, innovation, and growth in European economies. This suggests that the allocation of venture capital across countries and regions may shape the concentration of innovation and economic activity. Evidence for Europe indicates long-term relationships among venture capital, innovation-related variables, and growth outcomes, often highlighting the importance of digital infrastructure and broader development in countries (Pradhan et al., 2017, 2019, 2020). Furthermore, evidence suggests that venture capital is associated with improved innovation outcomes and the creation of new firms. This is especially true in environments with supportive policies and institutions, as well as in countries with high levels of venture capital activity (Popov & Roosenboom, 2012, 2013).

For a thesis focused on inbound cross-border venture capital flows, this literature is mainly relevant as motivation. If venture capital supports innovation and entrepreneurship, then frictions that shape the geography of inbound venture capital matter economically, especially for smaller or peripheral European economies.

3.3 Market size and gravity frictions in cross-border capital flows

A standard approach to modeling bilateral cross-border flows is the gravity framework, where flows increase with the economic "mass" of the origin and host countries and decrease with bilateral frictions. In International Finance, theory highlights that market size matters for cross-border asset trade under segmentation and diversification. This supports the use of GDP, financial wealth, or market capitalization as economic "mass" variables (Martin & Rey, 2004). Consistent with this view, empirical finance-gravity finds that cross-border equity transactions increase with the size of both origin and host country markets and decrease with the distance between them, which reflects information and transaction costs rather than physical transportation costs (Portes & Rey, 2005).

The broader gravity literature similarly uses distance as a proxy for trade and information costs and common language and shared border to capture lower information asymmetries and cultural proximity (Head & Mayer, 2014). A critical implication of this interpretation is that "distance" functions as a composite proxy that reflects informational frictions, cultural proximity, monitoring costs, and institutional differences simultaneously.

This is relevant for venture capital, where deal sourcing, due diligence, and monitoring are information-intensive. Evidence on international venture capital and private equity flows shows that distance, common language, and historical ties correlate systematically with cross-border activity, while host-country characteristics such as human capital and the business environment are associated with larger inflows (Aizenman & Kendall, 2012). Related venture capital evidence indicates that hosts countries with stronger capital markets and more favorable environments attract larger cross-border inflows (Schertler & Tykvová, 2011; Tykvová & Schertler, 2011). Asdrubali (2023) argues that GDP is an empirically valuable proxy for market size in European venture capital gravity settings when detailed financial-market measures are unavailable across the whole sample.

A further empirical challenge is that measured cross-border flows can differ depending on whether invested amounts or deal counts are used as the outcome measure, and deal data may contain missing or unevenly reported deal values. Since many country pairs record zero cross-border activity for many years, the analysis considers both deals and amounts and applies an estimator that accommodates many zeros. Overall, this literature supports the use of GDP-based mass variables and bilateral frictions, such as distance, language, and borders, as correlates of cross-border venture capital flows.

3.4 Foreignness, institutions, and host-country macro-financial conditions

A central theme in the cross-border venture capital literature is the "liability of foreignness," including informational, cultural, legal, and institutional disadvantages relative to domestic investors. Buchner et al. (2018) find that foreign investments on average underperform domestic ones and that syndication with local partners and prior host-country experience can mitigate disadvantages. These factors highlight the role of local knowledge and institutions. While this evidence is based on returns rather than flow volumes, it supports the interpretation that cross-border investors face higher costs and therefore may be more selective and more sensitive to host-country conditions.

Further evidence suggests that cross-border venture capital inflows are affected by financial conditions in both the origin and the host countries. Tykvová & Schertler (2011) document macroeconomic factors and country risk, together with investor and deal characteristics, influence the likelihood and size of cross-border venture capital investments. This supports the view that host-country fundamentals and institutional quality are important for attracting foreign venture capital. Related literature on capital flows emphasizes that country-specific "pull" factors and global "push" factors can vary in importance over time. Pull factors such as domestic fundamentals tend to matter more in normal times, while global risk and liquidity conditions become more influential during stress episodes (Forbes & Warnock, 2012; Fratzscher, 2012). Related evidence also indicates that bilateral frictions and institutional quality can interact with global risk, implying that gravity-type frictions may become more binding when uncertainty increase (Cavallaro & Cutrini, 2019).

These arguments motivate examining whether the sensitivity of inbound cross-border venture capital to host-country macro-financial conditions varies across macroeconomic regimes. Research on venture capital market development further emphasizes that stable macroeconomic environments and robust legal protections can support the maturity of such markets (Bonini & Alkan, 2012). Moreover, evidence also links macroeconomic factors such as growth, interest rates, and financial development to venture capital market liquidity in Europe (Frimpong et al., 2024). At the same time, macro-financial variables may be endogenous and correlated with omitted changes in investment conditions. Because of this, fixed effects are necessary, and macro coefficients should be interpreted cautiously as conditional associations rather than definitive causal effects.

3.5 Local ties, syndication, ecosystems, and regional heterogeneity

Growing empirical research shows that cross-border venture capital is affected not only by macroeconomic and geographic conditions but also by the structure and maturity of local venture capital ecosystems and the strength of local investor networks. Tykvová and Schertler (2011) analyze cross-border venture capital flows at the country-pair level and find that both the number and value of cross-border flows increase with tie intensity in the local venture capital industry. This is consistent with networks reducing information, contracting, and monitoring frictions. Related evidence indicates that repeated cross-border private equity syndication is influenced by the institutional environment and by learning from repeated international partnerships (Meuleman & Wright, 2011).

Relational factors, such as trust, may also facilitate cross-border transactions by reducing frictions, but they are not easily measured consistently across countries and over time. As a result, empirical work often relies on proxies, and it can be challenging to separate ecosystem and network channels from standard gravity variables such as distance and language (Bottazzi et al., 2016; Devigne et al., 2018). This challenge is relevant in Europe, where both domestic and cross-border venture activity is concentrated in a limited set of hubs, while many other countries have smaller markets and weaker international syndication (Asdrubali, 2023; Botsari & Lang, 2024; EIF & Invest Europe, 2023; Pavlova & Signore, 2019). This suggests that European averages can hide critical regional differences, and variables such as distance and GDP may be less binding in mature hubs than in smaller or less connected ecosystems. This motivates testing for regional heterogeneity by comparing coefficients across country groups rather than attempting to measure ecosystem maturity directly with noisy proxies.

3.6 Synthesis and link to hypotheses

The theoretical framework and literature review highlight several key factors likely to influence cross-border venture capital flows in Europe. First, gravity-finance indicates that bilateral flows increase with the economic size of both the origin and host countries, and decrease with distance and other frictions, where distance is often proxied as information and transaction costs (Head & Mayer, 2014; Martin & Rey, 2004; Portes & Rey, 2005). Evidence from venture capital and private equity also supports this logic, with GDP as economic "mass" and bilateral frictions such as distance, language, and borders related to cross-border venture capital flows (Aizenman & Kendall, 2012; Asdrubali, 2023; Schertler & Tykvová, 2012; Tykvová & Schertler, 2011). Because these variables are proxies for broader sets of frictions, coefficients should be interpreted as reduced form associations rather than isolated mechanisms

Second, research on foreignness and capital flows indicates that cross-border investors face informational and institutional disadvantages and therefore respond to host-country fundamentals and risk conditions. This motivates including host macro financial variables, such as interest rates and unemployment rates, and allowing them to vary across macroeconomic regimes, consistent with the importance of pull and push forces that can shift over time (Buchner et al., 2018; Cavallaro & Cutrini, 2019; Forbes & Warnock, 2012; Fratzscher, 2012; Schertler & Tykvová, 2011). A critical implication is that estimated macro-financial effects may differ across regimes and reflect broader shifts in global risk appetite and strengthen the motivation for period-spe-

cific estimation. This supports including host-country macro-financial variables and geographical frictions, such as interest rate and distance, to examine whether sensitivities shift across macroeconomic regimes (Bonini & Alkan, 2012; Frimpong et al., 2024).

Third, the ecosystem literature emphasizes that network depth and local connections can reduce information frictions and help explain why venture capital activity is concentrated in hubs and why they differ across regions. Since ecosystem maturity is difficult to observe directly, an empirical approach is to test heterogeneity across regional groups and assess whether the same baseline gravity and macro financial relationships operate differently in hubs versus smaller markets (Asdrubali, 2023; Pavlova & Signore, 2019). Building on these insights, this thesis formulates and tests a set of hypotheses on the determinants of bilateral inbound venture capital flows, which are stated below:

H1 (economic mass): Larger origin-country and host-country GDP are associated with higher bilateral inbound venture capital flows.

H2 (Gravity frictions): Bilateral frictions affect cross-border venture capital flows: geographic distance reduces inbound venture capital, whereas common language and shared borders increase it by lowering information and transaction costs.

H3 (Macro-financial conditions): More favorable host-country macro-financial environments, characterized by lower unemployment and more favorable interest-rate conditions, are associated with higher levels of inbound venture capital.

H4 (Macroeconomic regimes): The sensitivity of inbound venture capital to host-country macro-financial conditions and gravity frictions differs across macroeconomic regimes (2007-2012, 2013-2019, 2020-2024).

H5 (Regional heterogeneity): The effects of economic mass, distance, language, borders, and macro-financial variables differ systematically between (1) small Nordic economies, (2) major hubs, and (3) the rest of Europe.

Methodology

4.1 Sample and data sources

This thesis analyzes bilateral inbound venture capital activity into 32 European host countries (United Kingdom, Spain, Germany, Ireland, France, Netherlands, Sweden, Austria, Hungary, Lithuania, Denmark, Italy, Portugal, Switzerland, Romania, Finland, Latvia, Bulgaria, Poland, Estonia, Norway, Moldova, Belgium, Croatia, Ukraine, Czech Republic, Slovakia, Slovenia,

Luxembourg, Greece, North Macedonia, Albania), with investor countries consisting of more than 100 nations worldwide. For simplicity and to obtain a more homogeneous and concentrated sample, several small offshore or dependent territories are under their respective sovereigns: the Channel Islands, Bermuda, the Cayman Islands, the Virgin Islands, and Gibraltar are grouped under the United Kingdom, while French Polynesia is grouped under France. These territories appear only in the host country and constitute a small proportion of the dataset.

Deal-level data are retrieved from Refinitiv Deal Screener using the "Private Equity/VC" universe and the "Investment Details" report type. To ensure that the sample reflects only venture capital activity, the dataset is restricted to transactions classified as seed, early-stage, expansion, and late-stage, and all venture capital deals are set to "True". The investee nation is limited to the 32 European countries included in the Invest Europe internal document to ensure alignment between deal data and the country-year macroeconomic panel used in the empirical analysis.

Macroeconomic variables for European host countries are primarily obtained from an internal Invest Europe (IE) document, which provides annual venture capital data for each European country in addition to macroeconomic indicators (Invest Europe, 2025b). Where IE provides merged groups, such as Estonia, Lithuania, and Latvia, which are combined in one sheet as "Baltic countries", and Albania, Bosnia-Herzegovina, Croatia, Macedonia, Moldova, Montenegro, Serbia, Slovakia, and Slovenia, are grouped under "Other CEE". In line with the IE dataset, GDP for the merged country groups and for investor nations outside the IE sample is obtained from the IMF's World Economic Outlook (WEO) database**.** Since the IMF WEO GDP is reported in current U.S. dollars, GDP is converted to euros using the IMF exchange rate data (International Monetary Fund, 2025). For Liechtenstein, where IMF data are not available in the required format, GDP is taken from TradingEconomics (TradingEconomics, 2025). Unemployment rates are drawn from the same sources as interest rates, where available.

Interest rates are measured as long-term government bond yields, obtained from the OECD long-term interest rate indicator (OECD, 2025b)**,** except for Moldova, which is sourced from the IMF (International Monetary Fund, 2025). Due to missing observations, Albania, Estonia, North Macedonia, and Ukraine have incomplete interest rate series and are therefore excluded from interest rate specifications. For consistency and because of limited and uneven coverage across investor countries, interest rates are not included for investor nations.

4.2 Variables Description

Table 1: Description of variables

Variable	Definition	Construction/unit	Expected effect on VC in-flows
VC_amount_*ijt*	Bilateral VC invested amount	Sum of equity invested from investor country *i* into host country *j* in year *t*, in EUR millions	
VC_deals_*ijt*	Number of VC deals	Count of VC deals from *i* to *j* in year *t*	
ln_GDP_*it*	Origin-country economic mass	Natural log of annual GDP of investor country *j* in EUR	+
ln_GDP_*jt*	Host-country economic mass	Natural log of annual GDP of host country *j* in EUR	+
ln_distance_*ij*	Geographic distance	Natural log of great-circle distance in km (Haversine) between capital cities of *i* and *j*	-
common_language_*ij*	Common language dummy	Dummy = 1 if *i* and *j* share an official or widely spoken language; 0 otherwise	+
border_*ij*	Shared land border dummy	Dummy = 1 if *i* and *j* share a land border; 0 otherwise	+
ir_*jt*	Host-country interest rate	Long-term government bond yield of host country *j* in year *t* (percent per annum)	-
unemp_*jt*	Host-country unemployment rate	Unemployment rate in host country *j* in year *t (percent of labor force)*	-

Note: i denotes the origin investor country, j the host destination country, and t the year. "Expected effect" reports the predicted sign of the coefficient on inbound VC flows: + indicates a positive association and − a negative association.

Geographic distance between countries i and j is computed as the great-circle distance between their capital cities, based on latitude and longitude. This approach follows standard practice in international gravity settings. CEPII's GeoDist documentation describes geodesic distances computed using the great-circle formula (Mayer & Zignago, 2011). Specifically, the thesis computes distance using the haversine formula:

$$Distance_{\{ij\}} = 2Rarcsin\left(\sqrt{\left\{sin^2\left(\frac{\{\varphi_j - \varphi_i\}}{\{2\}}\right) + cos(\varphi_i)\, cos(\varphi_j)\, sin^2\left(\frac{\{\lambda_j - \lambda_i\}}{\{2\}}\right)\right\}}\right)$$

where φ denotes latitude (in radians), λ longitude (in radians), and R is Earth's radius set to 6,371 km. The host-country macro-financial controls Z_{jt} include interest rates (long-term government bond yields) and unemployment rates.

4.3 Estimation approach

The thesis estimates gravity-type dyad-year models using PPML with origin, destination (host country), and year fixed effects, absorbing time-invariant heterogeneity across countries and common year shocks. Standard errors are adjusted for two-way clustering by origin and destination to account for correlation across dyads that share the same investor or host country (Cameron et al., 2011).

Venture capital deal databases typically exhibit time-varying coverage, with early years often characterized by underreporting of smaller deals and peripheral markets and later years showing greater reporting. In this setting, many country-pair-year cells contain zeros, especially in the early sample period. Methodologically, this motivates estimating the gravity model using Poisson pseudo-maximum likelihood (PPML) with year fixed effects, which allows zeros in the dependent variable and is robust to heteroskedasticity in the multiplicative gravity specification (Silva & Tenreyro, 2006).

This thesis adopts a gravity-type panel model of bilateral venture capital flows. The unit of observations in this model is an origin-host-year (i, j, t), where i is the origin country, j represents the host country, and t is the specific year of the investment. The dependent variable VC is the annual amount or the number of deals of venture capital invested from country i into country j in year t, measured in EUR millions.

$$E\left[VC_{\{ijt\}} \mid X\right] = exp\Big(\alpha_i + \beta_{1ln(GDP_{\{it\}})} + \beta_{2ln(GDP_{\{jt\}})} + \gamma_{1ln(Distance_{\{ij\}})} + \gamma_{2Language_{\{ij\}}} + \gamma_{3Border_{\{ij\}}} + \delta' Z_{\{jt\}} + \gamma_j + \tau_t\Big)$$

where VC_{ijt} is either VC_{ijt}^{amt}(EUR millions) or VC_{ijt}^{deals}(deal counts). $GDP_{it}$and GDP_{jt}measure the economic size of origin and host countries; $Distance_{ij}$, $Language_{ij}$, and $Border_{ij}$capture bilateral frictions and informational proximity, and $Z_{jt}$is a vector of time-varying host-country macro-financial controls (interest rates and unemployment). $\alpha_i$and $\gamma_j$are origin and host fixed effects, and τ_t are year fixed effects. Standard errors are clustered at the country-pair level to account for serial correlation within bilateral relationships.

PPML is preferred over log-linear OLS for three reasons. First, PPML can handle zeros in the dependent variable without dropping dyads, whereas log-linear models typically exclude zero observations. Second, when the outcome's variability varies across observations (heteroskedasticity), log-linear OLS can yield biased or inconsistent estimates of the multiplicative gravity model. In contrast, PPML remains consistent under standard conditions when the conditional mean is correctly specified.(Silva & Tenreyro, 2006). Third, PPML coefficients remain a convenient semi-elasticity interpretation for log-transformed regressors, for example, coefficients on $\ln(GDP)$ and $\ln(Distance)$can be interpreted as elasticities of expected flows.

Results and Discussion

This section presents descriptive statistics and empirical results from gravity-type PPML models of bilateral cross-border venture capital flows into Europe. The analysis considers two dependent variables: the total invested amount (vc_eur_m, intensive margin) and the number of deals (n_deals, extensive margin). The unit of observation is the origin-destination-year (dyad-year), restricted to cross-border only.

5.1 Descriptive statistics and sample patterns

Table 2: Descriptive statistics

Variable	N	mean	sd	p25	p50	p75	min	max
VC amount (EUR m)	5,456	193	1,250	3.09	17	80	0	48,014
Number of deals	5,456	7.60	32.87	1	2	5	1	1,093
GDP, origin (EUR bn)	5,456	2,398	4,276	287	593	2,129	1.260	26,964
GDP, host (EUR bn)	5,456	1,228	1,159	316	644	2,256	3.211	4,351
Distance (km)	5,456	3,514	3,743	819	1,600	6,164	82	18,826
Common language (dummy)	5,456	0.136	0.343	0	0	0	0	1
Shared border (dummy)	5,456	0.142	0.349	0	0	0	0	1
Interest rate, host (pp)	5,456	2.07	1.73	0.65	1.90	3.14	-0.52	14.70
Unemployment rate, host (pp)	5,456	6.40	3.50	3.90	5.70	7.85	2.00	27.50
Population, host (in millions)	5,456	32.22	29.43	7.59	11.74	65.11	0.48	84.72

Note: Sample includes cross-border dyad–year observations with non-missing host interest rates and unemployment rates. Host population is included only in robustness specifications.

Table 2 reports descriptive statistics for the dyad-year panel of cross-border venture capital flows. The sample contains 5,456 cross-border dyad-year observations with non-missing host interest rates and unemployment rates. The distribution of venture capital amounts is highly skewed. The mean invested amount is about EUR 193 million, while the median is 17, and the maximum exceeds 48,000. This indicates that a small number of dyads and years account for a large share of total invested capital. Deal counts show a similar concentration. The average is

7.6 deals; the median is 2; the 75th percentile is 5; and the maximum exceeds 1,000, consistent with a heavy-tailed distribution common in venture capital flow data.

Bilateral frictions and proximity measures vary substantially across dyads. Great-circle distances range from 82 km to approximately 18,826 km, with a median of approximately 1,600 km, indicating that most cross-border activity is geographically concentrated within Europe. About 13.6% of observations involve a common language, and 14.2% share a border. Host-country macroeconomic and financial variables also show significant dispersion. Interest rates range from negative values to approximately 14.7%, reflecting economic variation across countries and over time. Unemployment rates range from 2.0% to 27.5%. Host population, measured in millions, varies widely across the European host countries in the sample.

5.2 Baseline Results: Intensive and Extensive Margins

H1 (Economic mass): Table 3 (appendix) indicates that economic mass on the investor side is an important predictor of bilateral inbound venture capital activity. Origin country GDP is positively associated with both the number of deals and the total venture capital amount. In the venture capital amount, the coefficient for investor GDP is 0.471 and statistically significant at the 1% level. This implies that a 1% increase in origin-country GDP is associated with an expected 0.47% increase in bilateral inbound venture capital, conditional on origin, destination, and year fixed effects. In the deal count model, the investor GDP coefficient is 0.77 and statistically significant at the 1% level, implying that a 1% increase in investor GDP is associated with an expected 0.77% increase in the number of cross-border deals into a given host country in a given year (Silva & Tenreyro, 2006).

Host country GDP is negative in both specifications, but the evidence differs across margins. In the deal-count model, the host GDP coefficient is -0.836 and statistically significant at the 1 percent level. In contrast, the host GDP coefficient in the venture capital amount model is -0.280 and not statistically significant, providing limited evidence that host GDP systematically affects invested amounts within dyad-year pairs. Overall, the baseline supports an origin-side economic mass relationship, whereas the host-side size relationship is negative and appears to be concentrated on the extensive margin.

With destination fixed effects, the host GDP coefficient is identified from within-host changes over time rather than cross-sectional differences across hosts. The host GDP result should therefore be interpreted as a conditional within-host association in this dyad year setting (Head & Mayer, 2014).

H2 (Gravity frictions): Geographic distance is negatively associated with cross-border venture capital activity, but the evidence differs across margins, as shown in Table 4. In the deal count model, distance has a negative and statistically significant coefficient of -0.266 at the 1% level, showing fewer bilateral deals between countries with greater distance. In contrast, the distance coefficient in the venture capital amount model is small and not statistically significant, which gives limited evidence that distance reduces invested amounts. Overall, the results suggest that distance primarily operates through the extensive margin by reducing the likelihood and frequency of cross-border transactions, rather than by lowering the amount of the investment (Head & Mayer, 2014).

Evidence is strongest for the common language, which is positive and highly significant in both specifications. This is consistent with lower information and contracting frictions when countries share a common language. Shared borders are also positively associated with cross-border activity, but the association is statistically significant only on the extensive margin at the 5 percent level. These findings are consistent with gravity research showing that bilateral frictions often have larger effects on the extensive margin than on the intensive margin (Head & Mayer, 2014). Relative to H1, the inclusion of distance, common language, and shared border does not alter the statistical significance of the GDP variables, and the coefficients and standard errors change only slightly.

H3 (Macro-Financial Conditions): Table 5 extends the baseline gravity specification by including host-country macro-financial variables. The interest rate in the host country shows a positive coefficient in both specifications, but it is not statistically significant in the baseline estimates. The unemployment rate is negative in both models, but it is statistically insignificant. These estimates provide limited evidence that host-country macroeconomic and financial conditions are associated with bilateral inbound venture capital activity, even after controlling for origin and destination fixed effects, year effects, and standard gravity controls.

The other variables remain stable when macroeconomic controls are added. Investor-country GDP remains positive and highly significant on both margins, whereas host-country GDP remains negative and precisely estimated in the deal-count model but not significant in the amount model. Similarly, distance remains negative and significant for deal counts, whereas common language remains positive and significant in both specifications. Therefore, the H3 results suggest that the cross-border structure of venture capital flows is driven more by economic mass and bilateral frictions than by the included macro-financial indicators in the host country. Ro-

bustness checks reported in the robustness section show that the interest rate coefficient is sensitive to alternative clustering choices and sample restrictions, while the gravity covariates remain stable.

H4 (Macroeconomic Regimes): Table 6 examines whether the sensitivity of inbound cross-border venture capital differs across macroeconomic periods, 2013 to 2019 and 2020 to 2024, using 2007 to 2012 as the reference period. Here, the effect in a given period equals the baseline coefficient for 2007 to 2012 plus the relevant interaction term. In the deal count model, the distance effect from 2020 to 2024 is -0.286 + 0.050 = -0.236, which is less negative than in the reference period. However, the interaction term is not statistically significant. Therefore, we cannot conclude that it reflects a change in how distance affects venture capital investments across those regimes.

For distance, the baseline coefficient is negative and statistically significant in the deal-count model. The interaction terms for 2013 to 2019 and 2020 to 2024 are positive but not statistically significant in the deal-count specification, providing limited evidence that the distance sensitivity of deal frequency differs from that observed for 2007 to 2012. In the venture capital amount model, distance is negative and marginally significant in the baseline period at the 10% level, and the 2013-2019 interaction term is positive and statistically significant at the 1% level. This indicates that the negative effect of distance for invested amounts is weaker from 2013 to 2019 than from 2007 to 2012. The interaction from 2020 to 2024 is also positive but not statistically significant.

For the host-country interest rate, the baseline-period coefficients are positive and statistically significant in both models. In the deal count model, the 2013 to 2019 interaction is negative and marginally significant at the 10% level. Using the same logic, the implied coefficient for 2013 to 2019 is 10.975 + (-11.174) = -0.199, suggesting that the positive association between host interest rates and deals is concentrated in the 2007 to 2012 period. The 2020 to 2024 interaction is also negative but not statistically significant, providing limited evidence that the post-2020 relationship differs from the reference period. In the venture capital amount model, the interaction terms are negative but not statistically significant, providing limited evidence that the interest rate of the invested amounts differs across regimes. Unemployment rates show expected negative sign but remain imprecisely estimated.

In conclusion, Table 6 provides partial support for H4. The clearest regime dependence appears in the deal-count to-host country interest-rates relationship from 2013 to 2019, where it changes

from a large positive coefficient to a small but significant negative one. Distance sensitivities show stronger time-variation in invested amounts than in deal counts, particularly from 2013 to 2019. At the same time, various interaction estimates are imprecise. Therefore, conclusions about regime shifts should be cautious and focus on the importance of interactions rather than only on changes in point estimates.

H5 (Regional Heterogeneity): Table 7 estimates the baseline PPML gravity specification separately for three host country groups, Small Nordics, Hubs, and Rest of Europe, for both the number of deals and total venture capital amount. The different regions highlight heterogeneity in both economic mass and bilateral frictions. At the same time, it is important to note that the Small Nordics and Hubs subsamples should be interpreted with caution, as the number of destination clusters is very low under two-way clustering. This limits the precision of clustered standard errors and makes significance levels less reliable in those two subsamples

For the deal count, the effect of origin-country GDP is positive and statistically significant across all three regions, with larger coefficients in the Small Nordics at the 1% level and at the 5% level in the other two regions. This aligns with empirical evidence and previous hypotheses. However, host-country GDP varies by region. For the Small Nordics, host GDP is positive and highly significant (at the 1% level), indicating that the number of deals increases with host-market size. In contrast, host GDP is strongly negative and statistically significant for both Hubs and the Rest of Europe (at the 1% level). This suggests that, within these groups and controlling for controls and fixed effects, the number of deals tends to be lower in years when host GDP exceeds its typical level. Gravity frictions also differ across regions.

Distance is negative and statistically significant for the Small Nordics and Rest of Europe, but not statistically significant for Hubs, suggesting that the distance estimate is imprecise in the hub subsample. Common language is strongly positive and significant for Hubs, but not significant for the Small Nordics or Rest of Europe. Shared borders are positive and significant for Hubs and the Rest of Europe. On the contrary, the border coefficient is negative and significant for the Small Nordics deal count model. This suggests that the model does not operate in the same way in that subsample. Macro variables are generally insignificant, but the Small Nordics deal count model stands out with a strongly negative and significant interest rate coefficient and a positive and significant (at the 10% level) coefficient on the unemployment rate. These patterns should be interpreted with caution, given the small number of destination clusters for this group and the extremely large coefficients.

For the venture capital amount outcome, regional differences remain, but the patterns differ from those in the deal count. Origin GDP remains positive and significant for the Small Nordics and Rest of Europe, but it is not significant for Hubs. This points to the origin economic mass is less linked to invested amounts in the hub subsample. We observe the same pattern in host-country GDP, with the Small Nordics and the Rest of Europe being significant, whereas Hubs are insignificant. Host GDP is positive and significant for the Small Nordics, and strongly negative and significant for Rest of Europe. Distance is negative and significant only for the Small Nordics in the amount model, while it is insignificant for the other two regions. Common language is strongly negative and highly significant for Small Nordics amounts, in contrast to Hubs, which is positive and significant. The rest of Europe has an insignificant coefficient for the number of deals. Borders are positive and significant for the Rest of Europe amounts, but not significant for the Small Nordics or Hubs amounts. Among macro variables, the only precise estimate is a positive, marginally significant (at the 10% level) relationship between interest rates and the amount invested in Hubs. The remaining macro coefficients are insignificant.

In conclusion, Table 7 supports H5 by showing that both gravity frictions and host-side conditions are not uniform across European regional groups. The most robust differences appear in host GDP and in the roles of language and borders, whereas distance is consistently relevant outside hubs and for investment levels in the Small Nordics. Given the small number of destination clusters in the Small Nordics and Hubs subsamples, the strongest conclusions should be drawn from patterns that are consistent across margins and align with the full-sample results, whereas marginal findings in those subsamples should be presented more cautiously.

5.3 Robustness and sensitivity analysis

This section assesses whether the baseline estimates are sensitive to alternative assumptions about inference, alternative fixed-effects structures, measurement choices for economic mass, and extreme observations in the venture capital amount margin. The goal is to evaluate the stability of the estimations rather than to introduce additional mechanisms. The robustness evidence is organized around six components: alternative clustering, a stricter within-dyad specification, alternative host-size proxies, sensitivity to extreme-amount observations, placebo-timing tests, and additional robustness checks for the regional split in H5.

5.3.1 Alternative clustering and inference assumptions

Because dyad-year panels may exhibit serial correlation within origin-host pairs, the baseline specifications are re-estimated with standard errors clustered by dyad (Cameron & Miller, 2015). Table 8 reports the H3 specification with dyad-clustered standard errors, while Table 4

reports the same baseline with two-way clustering by origin and host. This compares inference under alternative clustering choices that account for residual correlation within dyads versus within origin and destination clusters (Cameron et al., 2011).

Under dyad clustering, the host interest rate becomes marginally significant in both the deal count and the venture capital amount specifications, whereas it is not statistically significant in the two-way clustered baseline. This implies that inference on the interest rate coefficient is sensitive to the choice of clustering, even though the estimated magnitude is stable. The same occurs with the origin GDP coefficient, which shifts from highly significant at the 1% level to insignificant, with a larger standard error. The rest of the variables remains the same as the H3 baseline.

5.3.2 Dyad fixed effects as a stricter within-pair design

A stricter specification with dyad- and year-fixed effects is presented in Table 9. This design absorbs all time-invariant dyad characteristics, including distance, common language, and shared borders (Head & Mayer, 2014). The remaining coefficients are identified from within-dyad changes over time, providing a conservative check on whether baseline relationships are cross-sectional.

The origin GDP coefficient remains positive and statistically significant on both margins, supporting the interpretation that the origin side economic mass relationship is not purely cross-sectional. Host GDP remains negative and statistically significant in the deal-count model, whereas it is imprecisely estimated for venture capital amounts. The host interest rate and unemployment remain statistically insignificant. Overall, Table 9 reinforces that the most stable relationships are those associated with origin-side economic mass, while the macro-financial coefficients remain comparatively weak under a within-dyad identification approach.

5.3.3 Alternative measures of host country economic mass

To test whether the host size results depend on the specific proxy used for host economic mass, Table 10 replaces host GDP with host GDP per capita and host population. This distinguishes scale from income level and provides an additional check on whether a single measure drives the host side patterns.

In the deal-count model, host GDP per capita is negative and statistically significant, as in the host GDP model. At the same time, the host population is negative but imprecisely estimated. In the venture capital amount model, host GDP per capita is not statistically significant, whereas the host population is negative and statistically significant. This indicates that the host side is

not tied to a single-size proxy and that the amount margin is more sensitive to how host scale is measured than the deal-count margin.

5.3.4 Sensitivity to extreme observations on the venture capital amount margin

Because venture capital amounts are heavy-tailed, as seen in the descriptive statistic table, Table 11 re-estimates the venture capital amount model after trimming the top 1% of the distribution. This check evaluates whether a small number of extreme dyad years disproportionately influence the intensive margin estimates.

After trimming, several coefficients change relative to the baseline amount model. The origin GDP coefficient is imprecisely estimated, with significance at the 1% level in the baseline model. Host country GDP changes from insignificant to marginally significant at the 10% level, while distance becomes statistically significant and negative. Common language remains positive and statistically significant at the 1% level, and shared borders and the host interest rate become statistically significant and positive (5 % significance level). These results indicate that intensive margin inference is sensitive to extreme observations, supporting a more cautious interpretation of the amount results when the data consist of a small number of very large observations.

5.3.5 Placebo falsification test using lead values of macro variables

Table 12 reports a placebo-timing exercise using lead values of host macroeconomic variables. Specifically, interest rates and unemployment are included at lead horizons t+1 and t+2 to test whether future fundamentals predict current bilateral venture capital activity, controlling for fixed effects and controls for current conditions (Eggers et al., 2024).

Consistent with the placebo logic, the lead coefficients for interest rates and unemployment rates are statistically insignificant across specifications. At the same time, gravity covariates and origin GDP remain stable, similar to the H3 baseline. This provides an additional check against reverse-timing interpretations in which future macroeconomic conditions do not predict current flows.

5.3.6 Host-macro-conditional robustness

A robust test of interest rates, substituting the interest rate (government bond yield) with the real interest rate (i.e., the interest rate minus inflation) is shown in Table 13. This robustness check addresses the possibility that nominal yields partly reflect inflation dynamics rather than the real cost of capital. Regarding the venture capital amount, there are no changes as it remains insignificant. However, on the extensive margin, it shifts from insignificant for the interest rate

to significant at the 5% level for the real interest rate, while the remaining coefficients are unchanged.

5.3.7 Regional robustness checks for H5

The regional split in Table 7 requires additional robustness checks because the Small Nordics and Hubs subsamples have very few host countries, implying very few host-country clusters under two-way clustering (Cameron & Miller, 2015; MacKinnon & Webb, 2017).

Table 7 is based on two-way clustered standard errors (origin and host). For Small Nordics and Hubs, there are very few host countries, so the number of destination clusters is low, and the significance levels can be unreliable (MacKinnon & Webb, 2017). Due to this, Table 14 re-estimates the same regional models using standard errors clustered by dyad (origin-host pair). The main results are mostly the same, as the signs are the same, and the main gravity patterns remain. However, some coefficients become less precise. Origin GDP is still positive in Rest of Europe, but it is no longer statistically significant because the standard error increases. The same can be observed for the venture capital amount for Small Nordics. These results suggest that a single clustering choice does not drive regional patterns and that inference remains sensitive in small subsamples.

Second, Table 15 reports LODO results for the Small Nordics, dropping Norway, Denmark, and Finland, respectively. The results show that several coefficients, especially proximity variables and some macro variables, change when a single country is removed. In particular, the common language coefficient in the venture capital amount model becomes more negative when Denmark is excluded, not significant when Norway is dropped, and is not estimated when Finland is excluded. This is because the language indicator has limited within-group variation and is driven by a narrow set of dyads. It is also observed that common language coefficients disappear, removing Finland, and shared-border coefficients disappear, dropping Denmark. For origin GDP, it remains the same as the H5 baseline, whereas for host GDP, we observe a change when Norway is excluded. Overall, Table 15 confirms that some Small Nordics coefficients reflect subsample composition rather than stable region-wide patterns, whereas the most persistent patterns concern origin GDP and the positive association between host GDP and origin GDP within the Small Nordics group.

5.3.8 Summary of robustness evidence

Overall, the robustness checks indicate that the extensive margin results are comparatively stable. Origin GDP remains a robust predictor of deal counts, and the main gravity covariates

retain their expected signs and broad relevance across specifications. The intensive margin is more sensitive, particularly to trimming extreme amounts and, for the interest rate coefficient, to the clustering choice. The placebo leads provide reassurance that future macro fundamentals do not systematically predict current flows. Finally, the regional robustness checks indicate that the main regional contrasts in H5 are largely preserved, whereas some coefficients in the Small Nordics subsample, particularly for common language, are sensitive to the composition of a very small set of host countries.

5.4 Discussion and analysis of results

5.4.1 Economic mass in a bilateral framework: why origin GDP is stable while host GDP is not

Across specifications, the most stable economic mass relationship is on the origin side. Higher origin-country GDP is consistently associated with higher bilateral inbound venture capital activity, particularly on the extensive margin. This pattern is consistent with gravity research that larger economies invest more capital abroad because they have more mature financial markets, more investor capacity, and stronger incentives to diversify internationally (Head & Mayer, 2014; Martin & Rey, 2004). In Europe, where cross-border venture capital remains fragmented and home-biased, a strong origin side aligns with the fact that internationally active investor are concentrated in the largest and most mature markets (Asdrubali, 2023; Kraemer-Eis et al., 2016; Pavlova & Signore, 2019). However, this does not imply that larger origin economies invest more in aggregate. With origin, host, and year fixed effects, the GDP coefficient is identified from within-origin changes over time and captures whether years of higher origin GDP are associated with more bilateral deals, holding constant time-invariant host factors and common year shocks.

By contrast, the host-country GDP coefficient does not support a positive host-size effect at the bilateral dyad-year level. In the amount specification, host GDP is weak and insignificant, whereas in deal-count, it is negative and statistically significant. This suggests that, as host markets grow, they attract interest from more origin countries and investor networks, thereby spreading activity across multiple sources. This means that the number of deals from any single origin-host pairing may decline, even if the host receives more total venture capital. This idea aligns with evidence that European venture capital markets remain uneven and concentrated in hubs, with cross-border activity shaped by networks rather than scaling linearly with market size (Asdrubali, 2023; Pavlova & Signore, 2019). Another explanation is that a strong GDP year may lead to more domestic deals as the domestic investors take the deals themselves, indicating continued home bias in venture capital (Asdrubali, 2023; Kraemer-Eis et al., 2016).

While this analysis cannot clearly separate these two effects, both suggest that host GDP does not always have a positive effect in a bilateral fixed-effects model.

5.4.2 Gravity frictions and the extensive versus intensive margin

The results show differences in margins for gravity frictions. Greater distance is associated only with the number of deals (extensive margin) within a country pair and does not provide evidence that it affects investment size. This is consistent with the finance gravity model that distance proxies information and transaction costs, and that these frictions matter most for whether cross-border relationships are initiated and repeated (Head & Mayer, 2014; Portes & Rey, 2005).

Common language is one of the strongest and most stable in the baseline models. This supports the view that informational proximity reduces distance frictions, which is consistent with both gravity evidence in international finance and venture capital-specific evidence that common language and shared borders facilitate cross-border activity (Aizenman & Kendall, 2012; Tykvová & Schertler, 2011). Shared borders are associated only with the number of deals, not with the amount invested. This may be because they primarily facilitate coordination and repeated interaction, whereas the amounts invested depend more on deal mix, stage composition, and the presence of a small number of very large rounds.

As seen in Table 11, trimming the 1% largest amounts reinforces the same interpretation of the intensive margin. When the largest observed amounts are removed, several coefficient estimates shift in precision and, in some cases, in significance level. This aligns with expectations in venture capital data, in which a small number of deals can dominate. As host-country GDP and distance change from insignificant to significant at the 10% and 5% levels, and origin GDP loses its explanatory value. This suggests that, when excluding the largest deals, distance reduces the amount of cross-border investment investors are willing to make, whereas host-country GDP is the one that becomes as a more relevant predictor of investment amounts once extreme deals are removed.

5.4.3 Macro financial host country conditions: limited H3 evidence and why regime dependence matters

In the H3 baseline, host-country interest rates and unemployment rates are not statistically significant in either the deal-count or the amount specification. They should not be seen as stable macro-financial pull factors. This also implies limited support for the claim that lower interest rates automatically lead to more venture capital. In cross-border, yields and macro variables

often co-move with broader risk premia, liquidity conditions, and global push factors, and their importance can vary across stress and non-stress periods (Forbes & Warnock, 2012; Fratzscher, 2012). With host and year fixed effects, the macro variables are identified from within-host-country variation over time, which may be limited and correlated with unobserved shifts in policy, risk appetite, and financial market conditions.

In the robustness check, in which nominal interest rates are replaced with real interest rates, the real rate is significant for deal counts but not statistically significant for invested amounts. This change in the significance level may indicate that inflation was a noise factor and that investors looked beyond nominal figures, thereby making the underlying economic relationship more visible and significant. However, this is inconsistent with the hypothesis that lower interest rates lead to more venture capital.

The regime analysis in H4 is therefore important because it allows us to see whether interest rates and macroeconomic regimes differ across regimes. The estimates suggest that the interest rate relationship is associated with more deals and larger deal sizes in the reference period 2007 to 2012, becomes weaker in 2013-2019, and changes sign. 2020-2024 shows no empirical evidence of change relative to the base period. This is consistent with the fact that stress episodes change risk appetite, and the relative importance of push and pull factors changing the cross-border allocation (Forbes & Warnock, 2012; Fratzscher, 2012).

For distance, the point estimates suggest that geographic frictions were most binding for the number of deals in the early and latest period, while for 2013-2019, distance has a less negative effect. One interpretation is that cross-border investing has become operationally easier over time as European ecosystems have matured and cross-border syndication and networks have strengthened (Meuleman & Wright, 2011; Tykvová & Schertler, 2011). This may also indicate that, in stable economic times, distance has less of an effect on investment levels. However, as 2021 was a record year for European venture capital investments, this should be interpreted with caution.

5.4.4 Regional heterogeneity: hubs versus smaller ecosystems

The regional estimates clearly show that gravity coefficients hide significant differences among European host groups. In the Hub group, distance is not statistically significant for either deal count or amount specification. For both the Small Nordics and the Rest of Europe, it is negative and statistically significant under the deal count. This pattern is consistent with the idea that

ecosystems with stronger infrastructure and more international networks can reduce the constraints of geographic separation in major hubs, while distance-related information and coordination frictions remain more binding outside the hub environments (Asdrubali, 2023; Pavlova & Signore, 2019; Tykvová & Schertler, 2011).

The proxies of common language and shared border differ across regions. Common language is strongly positive and statistically significant in Hubs for both margins. This aligns with the view that informational proximity and lower contracting frictions play a central role in hub-directed cross-border activity (Schertler & Tykvová, 2012). For the Rest of Europe, a common language is not statistically significant, while shared borders are positive and statistically significant, suggesting that shared border effects are more important than language ties in that subsample. In contrast, the Small Nordics estimates differ from standard gravity. Shared borders are negative and statistically significant for deal counts, and common language is strongly negative for amounts. This indicates that standard reduced-form proximity indicators may behave differently in different subsamples, and that the estimated coefficients are influenced by sample composition and limited bilateral variation.

The robustness checks for H5 reinforce this caution. The comparison between the two-way clustered baseline and dyad-clustered standard errors shows that the coefficients are the same, but with different standard errors and significance. This tells us that the uncertainty of the estimates rises when the standard errors increase. This is, for example, expected for the Small Nordics, which have few host countries. When the main gravity results and coefficient signs stay similar under different clustering choices, it suggests that the regional differences reflect real patterns in the data rather than being driven by one specific modeling or inference setup. At the same time, the sensitivity in significance highlights that conclusions for the smallest subsamples should be stated cautiously.

Second, the Small Nordics LODO robust check shows that the language result is sensitive to dropping a country. This is consistent with the data structure, in which the common-language dummy shows limited variation and is driven by a small set of dyads. This stems from Finland and Sweden, which share Swedish as an official language, while the other countries do not share any language. The same pattern holds when Finland is excluded: the common language coefficient disappears, indicating that the two countries drive the common language. The same occurs with shared borders when excluding Denmark, because the border dummy becomes collinear with the origin- and destination-fixed effects in the very small subsample and is therefore not separately identified. We also find that, excluding Finland and Norway, the shared border

coefficient is negative and significant in both specifications, suggesting that these countries may not invest cross-border with one another and prefer alternative host countries. Overall, the regional evidence supports H5 in that gravity frictions and proximity proxies are not uniform across Europe, but it also implies that inference for small regional subsamples should be assessed carefully and closely tied to the underlying variation in the dyad structure (Asdrubali, 2023; Pavlova & Signore, 2019; Tykvová & Schertler, 2011; Meuleman & Wright, 2011).

Conclusion, limitations, and future research

This thesis examined the determinants of inbound cross-border venture capital flows into European countries between 2007 and 2024, and whether these relationships differ across macroeconomic periods and regional groups. Using a gravity-model framework estimated on country-pair-year data, the results point to a clear and stable set of drivers.

First, origin-country economic size is a robust predictor of cross-border venture activity. Larger investor economies consistently generate more inbound deals and larger investment volumes abroad, indicating that the supply of venture capital remains concentrated in a small set of financially mature markets. Second, the expected positive effect of host-country market size is not consistently supported. Conditional on fixed effects and bilateral controls, host GDP is not a reliable positive predictor of inbound venture capital and is often negatively associated with deal counts. Third, gravity frictions remain central. Geographic distance significantly reduces the number of cross-border deals, while shared language and, to a smaller extent, shared borders facilitate cross-border investment. These patterns suggest that informational barriers and proximity continue to matter in venture capital investing, even in an increasingly international market.

By contrast, host-country macro-financial conditions show limited explanatory power in the aggregate. Interest rates and unemployment do not consistently predict inbound venture when economic mass and bilateral frictions are accounted for. Results across different regimes provide only partial evidence of regime changes: the main gravity relationships remain broadly stable across 2007-2012, 2013-2019, and 2020-2024, although some effects (such as the distance penalty on investment amounts) appear weaker from 2013-2019. Finally, the regional analysis indicates meaningful heterogeneity where smaller and more peripheral markets appear more sensitive to gravity frictions and host conditions.

There are some limitations to consider in this thesis. First, macro-financial controls are included only for host countries, not origin countries, due to limited available data. This means the baseline may miss investor-side push factors that might influence outward venture capital activity, especially in global cycles (Forbes & Warnock, 2012; Fratzscher, 2012). Second, deal databases can have time-varying coverage and missingness in deal values. This motivates PPML and robustness checks, but it also implies that the amount margin can remain noisier than deal counts in parts of the sample (Silva & Tenreyro, 2006). Third, key gravity proxies are reduced form. Distance, language, and borders bundle multiple channels such as information frictions, monitoring costs, institutional proximity, and cultural affinity (Head & Mayer, 2014; Portes & Rey, 2005). The results, therefore, describe conditional associations rather than isolating a single mechanism.

A natural extension of future research is to incorporate additional origin-country macroeconomic and financial variables, where data coverage allows, including interest rates, unemployment rates, and measures of financial market depth. This would allow a clearer separation of pull factors and push factors in cross-border venture capital allocations (Forbes & Warnock, 2012; Fratzscher, 2012). Second, future work could include additional mass and opportunity set measures such as market capitalization, stock market liquidity, or indicators of ecosystem maturity and network embeddedness, which are highlighted as important in venture capital internationalization research (Devigne et al., 2018; Schertler & Tykvová, 2012; Tykvová & Schertler, 2011). Third, the regional results suggest the need for more detailed research. Country-specific case studies or city-level analyses could show how hub dynamics differ from peripheral markets, and whether the same gravity frictions operate differently across sub-ecosystems within Europe (Asdrubali, 2023; Pavlova & Signore, 2019). Finally, relational proximity and trust are difficult to measure in country pair panels, but prior research suggests they can matter for cross-border venture capital behavior (Bottazzi et al., 2016). Integrating trust proxies, cultural distance measures, or network-based indicators could help explain why proximity effects differ across regional groups.

In conclusion, the findings imply that European cross-border venture capital is still shaped primarily by capital supply in large origin markets and by persistent information and proximity frictions, rather than by host macro conditions. This supports the view that deeper integration of European venture capital markets is likely to depend on reducing cross-border frictions and strengthening connectivity between investors and startups across countries.

References

Aizenman, J., & Kendall, J. (2012). The internationalization of venture capital. *Journal of Economic Studies*, *39*(5), 488–511. https://doi.org/10.1108/01443581211259446

Alhorr, H. S., Moore, C. B., & Payne, G. T. (2008). The Impact of Economic Integration on Cross–Border Venture Capital Investments: Evidence from the European Union. *Entrepreneurship Theory and Practice*, *32*(5), 897–917. https://doi.org/10.1111/j.1540-6520.2008.00261.x

Asdrubali, P. (2023). *Patterns of cross-border venture capital flows in Europe.* Publications Office. https://data.europa.eu/doi/10.2765/92492

Bonini, S., & Alkan, S. (2012). The political and legal determinants of venture capital investments around the world. *Small Business Economics*, *39*(4), 997–1016. https://doi.org/10.1007/s11187-011-9323-x

Botsari, A., & Lang, F. (2024). EIF VC Survey 2024: Market sentiment. *EIF*. https://www.eif.org/news_centre/publications/eif-vc-survey-2024-market-sentiment.pdf

Bottazzi, L., Da Rin, M., & Hellmann, T. (2016). The Importance of Trust for Investment: Evidence from Venture Capital. *Review of Financial Studies*, *29*(9), 2283–2318. https://doi.org/10.1093/rfs/hhw023

Buchner, A., Espenlaub, S., Khurshed, A., & Mohamed, A. (2018). Cross-border venture capital investments: The impact of foreignness on returns. *Journal of International Business Studies*, *49*(5), 575–604. https://doi.org/10.1057/s41267-017-0116-6

Cameron, A. C., Gelbach, J. B., & Miller, D. L. (2011). Robust Inference With Multiway Clustering. *Journal of Business & Economic Statistics*, *29*(2), 238–249. https://doi.org/10.1198/jbes.2010.07136

Cameron, A. C., & Miller, D. L. (2015). A Practitioner's Guide to Cluster-Robust Inference. *Journal of Human Resources*, *50*(2), 317–372. https://doi.org/10.3368/jhr.50.2.317

Cavallaro, E., & Cutrini, E. (2019). Distance and beyond: What drives financial flows to emerging economies? *Economic Modelling*, *81*, 533–550. https://doi.org/10.1016/j.econmod.2018.06.001

Dealroom. (2025). *Europe*. Dealroom.Co. https://dealroom.co/guides/europe?

Devigne, D., Manigart, S., Vanacker, T., & Mulier, K. (2018). VENTURE CAPITAL INTERNATIONALIZATION: SYNTHESIS AND FUTURE RESEARCH DIRECTIONS. *Journal of Economic Surveys*, *32*(5), 1414–1445. https://doi.org/10.1111/joes.12276

Eggers, A. C., Tuñón, G., & Dafoe, A. (2024). Placebo Tests for Causal Inference. *American Journal of Political Science*, *68*(3), 1106–1121. https://doi.org/10.1111/ajps.12818

EIF & Invest Europe. (2023). *The VC factor—Gender lens edition*. https://www.eif.org/news_centre/publications/vc-factor-gender-lens-edition.pdf

Forbes, K. J., & Warnock, F. E. (2012). Capital flow waves: Surges, stops, flight, and retrenchment. *Journal of International Economics*, *88*(2), 235–251. https://doi.org/10.1016/j.jinteco.2012.03.006

Fratzscher, M. (2012). Capital flows, push versus pull factors and the global financial crisis. *Journal of International Economics*, *88*(2), 341–356. https://doi.org/10.1016/j.jinteco.2012.05.003

Frimpong, F. A., Akwaa-Sekyi, E. K., Anyars, I. S., Peprah-Yeboah, A., & Saladrigues Sole, R. (2024). Macroeconomic factors and venture capital market liquidity: Evidence from Europe*. *Cogent Economics & Finance*, *12*(1), 2401477. https://doi.org/10.1080/23322039.2024.2401477

Gompers, P., & Lerner, J. (2001). The Venture Capital Revolution. *Journal of Economic Perspectives*, *15*(2), 145–168. https://doi.org/10.1257/jep.15.2.145

Head, K., & Mayer, T. (2014). Gravity Equations: Workhorse,Toolkit, and Cookbook. In *Handbook of International Economics* (Vol. 4, pp. 131–195). Elsevier. https://doi.org/10.1016/B978-0-444-54314-1.00003-3

International Monetary Fund. (2025, November 18). *IMF Data World Economic Outlook (WEO)*. nternational Monetary Fund. https://data.imf.org/en/Data-Explorer?datasetUrn=IMF.RES:WEO(9.0.0)

Invest Europe. (2025a). *Investing in Europe: Private Equity activivity 2024*. Invest Europe.

Invest Europe. (2025b). *Private Equity Activity Report by country 2007-2024 (Excel Data)*. Invest Europe.

James, J. (2024). Stepping Up Venture Capital to Finance Innovation in Europe. *IMF*.

Kato, A. I. (2025). Venture Capital as a Catalyst for Innovation and Economic Growth in Emerging Economies: A Systematic Review and Future Research Agenda. *Administrative Sciences*, *15*(11), 405. https://doi.org/10.3390/admsci15110405

Kraemer-Eis, H., Signore, S., & Prencipe, D. (2016). The European venture capital landscape: An EIF perspective. *St. Louis: Federal Reserve Bank of St. Louis*, *1*.

MacKinnon, J. G., & Webb, M. D. (2017). Wild Bootstrap Inference for Wildly Different Cluster Sizes. *Journal of Applied Econometrics*, *32*(2), 233–254. https://doi.org/10.1002/jae.2508

Martin, P., & Rey, H. (2004). Financial super-markets: Size matters for asset trade. *Journal of International Economics*, *64*(2), 335–361. https://doi.org/10.1016/j.jinteco.2003.12.001

Mayer, T., & Zignago, S. (2011). Notes on CEPII's Distances Measures: The GeoDist Database. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.1994531

Meuleman, M., & Wright, M. (2011). Cross-border private equity syndication: Institutional context and learning. *Journal of Business Venturing*, *26*(1), 35–48. https://doi.org/10.1016/j.jbusvent.2009.06.003

OECD. (2025a). *Benchmarking government support for venture capital: A comparative analysis* (71st ed., OECD SME and Entrepreneurship Papers) [OECD SME and Entrepreneurship Papers]. https://doi.org/10.1787/81e53985-en

OECD. (2025b). *OECD Data Explorer*. OECD. https://data-explorer.oecd.org/vis?lc=en&pg=0&tm=Long-term%20interest%20rates&fs[0]=Frequency%20of%20observation%2C0%7CAnnual%23A%23&fc=Unit%20of%20measure&snb=16&vw=ov&df[ds]=dsDisseminateFinalDMZ&df[id]=DSD_STES%40DF_FINMARK&df[ag]=OECD.SDD.STES&df[vs]=4.0&dq=AUT%2BBEL%2BCAN%2BCHL%2BCOL%2BCRI%2BCZE%2BDNK%2BEST%2BFIN%2BFRA%2BDEU%2BGRC%2BHUN%2BISL%2BIRL%2BISR%2BITA%2BJPN%2BKOR%2BLVA%2BLTU%2BLUX%2BNLD%2BNZL%2BNOR%2BPOL%2BPRT%2BSVK%2BSVN%2BESP%2BSWE%2BCHE%2BGBR%2BUSA%2BEA19%2BBRA%2BBGR%2BCHN%2BHRV%2BIND%2BIDN%2BROU%2BZAF%2BAUS.A.IRLT.PA.....&pd=2007%2C2024&to[TIME_PERIOD]=false

Pavlova, E., & Signore, S. (2019). The European venture capital landscape: An EIF perspective Volume V: The economic impact of VC investments supported by the EIF. *St. Louis: Federal Reserve Bank of St. Louis*, *5*. https://www.eif.org/news_centre/publications/EIF_Working_Paper_2019_55.pdf

Popov, A., & Roosenboom, P. (2012). Venture capital and patented innovation: Evidence from Europe: VENTURE CAPITAL. *Economic Policy*, *27*(71), 447–482. https://doi.org/10.1111/j.1468-0327.2012.00290.x

Popov, A., & Roosenboom, P. (2013). Venture capital and new business creation. *Journal of Banking & Finance*, *37*(12), 4695–4710. https://doi.org/10.1016/j.jbankfin.2013.08.010

Portes, R., & Rey, H. (2005). The determinants of cross-border equity flows. *Journal of International Economics*, *65*(2), 269–296. https://doi.org/10.1016/j.jinteco.2004.05.002

Pradhan, R. P., Arvin, M. B., Nair, M., & Bennett, S. E. (2020). Sustainable economic growth in the European Union: The role of ICT , venture capital, and innovation. *Review of Financial Economics*, *38*(1), 34–62. https://doi.org/10.1002/rfe.1064

Pradhan, R. P., Arvin, M. B., Nair, M., Bennett, S. E., & Bahmani, S. (2019). Short-term and long-term dynamics of venture capital and economic growth in a digital economy: A study of European countries. *Technology in Society*, *57*, 125–134. https://doi.org/10.1016/j.techsoc.2018.11.002

Pradhan, R. P., Maradana, R. P., Zaki, D. B., Dash, S., Jayakumar, M., & Gaurav, K. (2017). Venture Capital and Innovation: Evidence from European Economic Area Countries. *International Journal of Innovation and Technology Management*, *14*(06), 1750031. https://doi.org/10.1142/S0219877017500316

Schertler, A., & Tykvová, T. (2011). Venture capital and internationalization. *International Business Review*, *20*(4), 423–439. https://doi.org/10.1016/j.ibusrev.2010.07.009

Schertler, A., & Tykvová, T. (2012). What lures cross-border venture capital inflows? *Journal of International Money and Finance*, *31*(6), 1777–1799. https://doi.org/10.1016/j.jimonfin.2012.03.012

Silva, J. M. C. S., & Tenreyro, S. (2006). The Log of Gravity. *The Review of Economics and Statistics*, *88*(4), 641–658. https://doi.org/10.1162/rest.88.4.641

TradingEconomics. (2025). *Liechtenstein GDP*. https://tradingeconomics.com/liechtenstein/gdp

Tykvová, T., & Schertler, A. (2011). Cross-border venture capital flows and local ties: Evidence from developed countries. *The Quarterly Review of Economics and Finance*, *51*(1), 36–48. https://doi.org/10.1016/j.qref.2010.09.005

Appendix

Table list

Table 3: H1. Economic mass and cross-border VC flows (PPML)

	2007 - 2024	
	1	2
Dependent Variable:	**Number of deals**	**VC amount**
ln(GDP), origin country	0.768***	0.471***
	(0.198)	(0.132)
ln(GDP), host country	-0.836***	-0.280
	(0.280)	(0.754)
Constant	3.166	5.317
	(2.932)	(6.474)
Dyad-year observations	5,561	5,561
Pseudo R-squared	0.77	0.86
Clusters (origin)	90	90
Clusters (destination)	32	32
Origin, destination, and year fixed effects	Yes	Yes
Two-way clustered standard errors (origin and destination)	Yes	Yes
Standard errors in parentheses		

** p<0.10 | ** p<0.05 | *** p<0.01*

Table 4: H2. Gravity frictions and cross-border VC flows

	2007 - 2024	
	1	2
Dependent Variable:	**Number of deals**	**VC amount**
ln(GDP), origin country	0.758***	0.482***
	(0.148)	(0.126)
ln(GDP), host country	-0.760***	-0.257
	(0.253)	(0.735)
ln(Bilateral distance)	-0.266***	-0.070
	(0.082)	(0.115)
Common Language (dummy)	0.652***	0.526***
	(0.141)	(0.112)
Shared Border (dummy)	0.242**	0.140
	(0.106)	(0.184)
Constant	4.545*	5.476
	(2.532)	(6.307)
Dyad-year observations	5,561	5,561
Pseudo R-squared	0.80	0.87
Clusters (origin)	90	90
Clusters (destination)	32	32
Origin, destination, and year fixed effects	Yes	Yes
Two-way clustered standard errors (origin and destination)	Yes	Yes

Standard errors in parentheses

** p<0.10 | ** p<0.05 | *** p<0.01*

Table 5: H3. Macro-financial conditions

	2007 - 2024	
	1	2
Dependent Variable:	**Number of deals**	**VC amount**
ln(GDP), origin country	0.739***	0.456***
	(0.147)	(0.139)
ln(GDP), host country	-0.850***	-0.649
	(0.225)	(0.762)
ln(Bilateral distance)	-0.252***	-0.064
	(0.078)	(0.114)
Common Language (dummy)	0.646***	0.524***
	(0.141)	(0.112)
Shared Border (dummy)	0.253**	0.144
	(0.105)	(0.192)
Interest Rate (host country, t)	4.355	11.159
	(3.245)	(10.109)
Unemployment Rate (host country, t)	-1.262	-4.517
	(2.613)	(3.994)
Constant	5.250**	8.617
	(2.269)	(6.645)
Dyad-year observations	5,456	5,456
Pseudo R-squared	0.80	0.87
Clusters (origin)	90	90
Clusters (destination)	29	29
Origin, destination, and year fixed effects	Yes	Yes
Two-way clustered standard errors (origin and destination)	Yes	Yes

Standard errors in parentheses

** p<0.10 | ** p<0.05 | *** p<0.01*

Table 6: H4. Period interactions: distance & interest rate, base period 2007–2012

	2007 - 2024	
	1	2
Dependent Variable:	**Number of deals**	**VC amount**
ln(GDP), origin country	0.637***	0.200
	(0.199)	(0.280)
ln(GDP), host country	-0.824***	-0.680
	(0.191)	(0.757)
ln(Bilateral distance)	-0.286***	-0.214*
	(0.087)	(0.122)
Common Language (dummy)	0.648***	0.525***
	(0.149)	(0.146)
Shared Border (dummy)	0.252**	0.144
	(0.110)	(0.153)
Interest Rate (host country, t)	10.975**	23.666***
	(4.447)	(8.609)
Unemployment Rate (host country, t)	-1.961	-6.226
	(2.558)	(4.737)
2013-2019 x ln(Bilateral distance)	0.015	0.134***
	(0.033)	(0.051)
2020-2024 x ln(Bilateral distance)	0.050	0.166
	(0.049)	(0.101)
2013-2019 x Interest rate (host country, t)	-11.174*	-3.548
	(6.669)	(11.486)
2020-2024 x Interest rate (host country, t)	-10.489	-16.702
	(6.442)	(11.038)
Constant	5.935***	11.060
	(1.862)	(7.659)
Dyad-year observations	5,456	5,456
Pseudo R-squared	0.80	0.87
Clusters (origin)	90	90
Clusters (destination)	29	29
Origin, destination, and year fixed effects	Yes	Yes
Two-way clustered standard errors (origin and destination)	Yes	Yes

Standard errors in parentheses

** p<0.10 | ** p<0.05 | *** p<0.01*

Table 7: H5. Regional differences

	2007 - 2024		2007 - 2024		2007 - 2024	
	Small Nordics		Hubs		Rest of Europe	
	1	2	3	4	5	6
Dependent Variable:	**Number of deals**	**VC amount**	**Number of deals**	**VC amount**	**Number of deals**	**VC amount**
ln(GDP), orgin country	1.239***	0.871***	0.596**	0.288	0.629**	0.814*
	(0.321)	(0.178)	(0.234)	(0.199)	(0.311)	(0.461)
ln (GDP) host country	2.307***	3.173**	-1.625***	-0.916	-0.832***	-1.978***
	(0.391)	(1.278)	(0.105)	(1.468)	(0.083)	(0.398)
ln(Bilateral distance)	-0.326**	-0.352**	-0.139	-0.074	-0.309***	0.059
	(0.153)	(0.150)	(0.119)	(0.112)	(0.075)	(0.202)
Common Language (dummy)	-0.058	-0.618***	0.620***	0.483**	0.078	0.102
	(0.100)	(0.185)	(0.093)	(0.199)	(0.250)	(0.233)
Shared Border (dummy)	-0.221**	-0.140	0.443**	0.148	0.503***	0.508*
	(0.094)	(0.198)	(0.221)	(0.317)	(0.194)	(0.300)
Interest Rate (host country, t)	-50.282***	-24.611	5.574	33.618*	0.038	-7.814
	(13.899)	(28.167)	(7.459)	(19.630)	(1.823)	(5.895)
Unemployment Rate (host country, t)	9.079*	-5.816	-9.806	-4.988	2.554	-1.596
	(5.359)	(4.388)	(8.635)	(8.157)	(1.703)	(4.185)
Constant	-17.911***	-16.197***	12.973***	12.681	4.328**	10.860*
	(3.875)	(6.074)	(1.139)	(13.433)	(2.014)	(5.648)
Dyad-year observations	624	622	2,286	2,286	2,528	2,528
Pseudo R-squared	0,54	0,84	0,87	0,90	0,59	0,74
Clusters (origin)	50	49	87	87	73	73
Clusters (destination)	3	3	5	5	21	21
Origin, destination and, year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Two-way clustered standard errors (origin and destination)	Yes	Yes	Yes	Yes	Yes	Yes
Standard errors in parentheses						

** p<0.10 | ** p<0.05 | *** p<0.01*

Note: Inference for Small Nordics and Hubs should be interpreted with caution due to very few destination clusters (N_dest>=5) under two-way clustering.

Table 8: dyad-clustered standard errors

	2007 - 2024	
	1	2
Dependent Variable:	**Number of deals**	**VC amount**
ln(GDP), origin country	0.739***	0.456
	(0.177)	(0.278)
ln(GDP), host-country	-0.850***	-0.649
	(0.206)	(0.538)
ln(Bilateral distance)	-0.252***	-0.064
	(0.063)	(0.079)
Common Language (dummy)	0.646***	0.524***
	(0.088)	(0.088)
Shared Border (dummy)	0.253***	0.144
	(0.089)	(0.129)
Interest Rate (host-country, t)	4.355*	11.159*
	(2.627)	(6.324)
Unemployment Rate (host-country, t)	-1.262	-4.517
	(1.619)	(2.796)
Constant	5.250**	8.617**
	(2.207)	(4.270)
Dyad-year observations	5,456	5,456
Pseudo R-squared	0.80	0.87
Clusters (dyad)	812	812
Origin, destination, and year fixed effects	Yes	Yes
Standard errors clustered by dyad (origin–destination pair)	Yes	Yes

Standard errors in parentheses

** p<0.10 | ** p<0.05 | *** p<0.01*

Table 9: dyad FE + year FE (distance/lang/border absorbed)

	2007 - 2024	
	1	2
Dependent Variable:	**Number of deals**	**VC amount**
ln(GDP), origin county	0.739***	0.354***
	(0.162)	(0.092)
ln(GDP), host country	-1.055***	-0.799
	(0.266)	(0.743)
Interest Rate (host country, t)	4.487	11.685
	(3.397)	(10.087)
Unemployment Rate (host country, t)	-1.647	-5.407
	(2.795)	(3.799)
Constant	5.159**	10.365*
	(2.405)	(6.296)
Dyad-year observations	5,145	5,136
Pseudo R-squared	0.84	0.91
Clusters (origin)	85	85
Clusters (destination)	29	29
Dyad fixed effects (origin×destination pair)	Yes	Yes
Year fixed effects	Yes	Yes
Two-way clustered standard errors (origin and destination)	Yes	Yes
Standard errors in parentheses		

** p<0.10 | ** p<0.05 | *** p<0.01*

Table 10: host GDP per capita + host population

	2007 - 2024	
	1	2
Dependent Variable:	**Number of deals**	**VC amount**
ln(GDP), origin country	0.739***	0.472***
	(0.147)	(0.140)
ln(GDP per capita), host country	-0.843***	-0.169
	(0.255)	(0.734)
ln(Population), host country	-0.899	-4.713***
	(0.960)	(1.396)
ln(Bilateral distance)	-0.251***	-0.063
	(0.078)	(0.114)
Common Language (dummy)	0.646***	0.524***
	(0.140)	(0.115)
Shared Border (dummy)	0.253**	0.146
	(0.105)	(0.183)
Interest Rate (host country, t)	4.364	10.998
	(3.297)	(10.314)
Unemployment Rate (host country, t)	-1.228	-1.966
	(2.654)	(3.974)
Constant	5.393*	20.774***
	(3.031)	(6.605)
Dyad-year observations	5,456	5,456
Pseudo R-squared	0.80	0.87
Clusters (origin)	90	90
Clusters (destination)	29	29
Origin, destination, and year fixed effects	Yes	Yes
Two-way clustered standard errors (origin and destination)	Yes	Yes

Standard errors in parentheses

** p<0.10 | ** p<0.05 | *** p<0.01*

Table 11: trim top 1% of amount

	2007 - 2024
	1
Dependent Variable:	**VC amount**
ln(GDP), orgin country	0.090
	(0.273)
ln(GDP), host country	-0.748*
	(0.430)
ln(Bilateral distance)	-0.159**
	(0.075)
Common Language (dummy)	0.326***
	(0.111)
Shared Border (dummy)	0.335**
	(0.139)
Interest Rate (host country, t)	9.568**
	(4.423)
Unemployment Rate (host country, t)	-2.866
	(2.205)
Constant	11.051***
	(3.746)
Dyad-year observations	5,345
Pseudo R-squared	0.65
Clusters (origin)	90
Clusters (destination)	29
Origin, destination, and year fixed effects	Yes
Two-way clustered standard errors (origin and destination)	Yes
Standard errors in parentheses	

** p<0.10 | ** p<0.05 | *** p<0.01*

Table 12: Placebo: leads t+1 & t+2 (IR & unemployment)

	t+1	t+1	t+2	t+2
	2007 - 2023		2007 - 2022	
	1	2	3	4
Dependent Variable:	**Number of deals**	**VC amount**	**Number of deals**	**VC amount**
ln(GDP), orgin country	0.745***	0.580***	0.778***	0.927***
	(0.130)	(0.223)	(0.157)	(0.266)
ln(GDP), host country	-0.919***	-0.877	-0.831***	-0.351
	(0.261)	(0.591)	(0.241)	(0.831)
ln(Bilateral distance)	-0.255***	-0.102	-0.235***	-0.134
	(0.078)	(0.106)	(0.082)	(0.110)
Common Language (dummy)	0.662***	0.537***	0.676***	0.535***
	(0.145)	(0.135)	(0.155)	(0.120)
Shared Border (dummy)	0.253**	0.100	0.253**	0.133
	(0.107)	(0.156)	(0.116)	(0.151)
Interest Rate (host country, t+h)	0.568	7.228	2.791	3.022
	(3.070)	(6.201)	(3.751)	(9.411)
Unemployment Rate (host country, t+h)	-2.228	-4.131	-2.492	-6.221
	(2.851)	(3.825)	(3.051)	(4.055)
Constant	5.779**	9.539	4.567	3.277
	(2.567)	(5.811)	(2.886)	(7.457)
Dyad-year observations	4,752	4,752	4077	4077
Pseudo R-squared	0.79	0.87	0.78	0.88
Clusters (origin)	88	88	84	84
Clusters (destination)	28	28	28	28
Origin, destination, and year fixed effects	Yes	Yes	Yes	Yes
Two-way clustered standard errors (origin and destination)	Yes	Yes	Yes	Yes

Standard errors in parentheses

** p<0.10 | ** p<0.05 | *** p<0.01*

Note: Lead specifications reduce the sample due to data availability; t+2 uses fewer dyad–years than t+1.

Table 13: real interest rate replaces nominal rate

	2007 - 2024	
	1	2
Dependent Variable:	**Number of deals**	**VC amount**
ln(GDP), orgin country	0.749***	0.467***
	(0.146)	(0.127)
ln(GDP), host country	-0.859***	-0.562
	(0.221)	(0.900)
ln(Bilateral distance)	-0.251***	-0.063
	(0.078)	(0.113)
Common Language (dummy)	0.646***	0.524***
	(0.139)	(0.111)
Shared Border (dummy)	0.254**	0.146
	(0.102)	(0.180)
Real Interest Rate (host country, t)	1.834**	-2.434
	(0.876)	(2.988)
Unemployment Rate (host country, t)	-1.039	-2.781
	(2.299)	(3.861)
Constant	5.339**	7.886
	(2.287)	(7.592)
Dyad-year observations	5,456	5,456
Pseudo R-squared	0.80	0.87
Clusters (origin)	90	90
Clusters (destination)	29	29
Origin, destination, and year fixed effects	Yes	Yes
Two-way clustered standard errors (origin and destination)	Yes	Yes
Standard errors in parentheses		

** p<0.10 | ** p<0.05 | *** p<0.01*

Table 14: dyad-clustered standard errors, by region

	2007 - 2024		2007 - 2024		2007 - 2024	
	Small Nordics		Hubs		Rest of Europe	
	1	2	3	4	5	6
Dependent Variable:	**Number of deals**	**VC amount**	**Number of deals**	**VC amount**	**Number of deals**	**VC amount**
ln(GDP), orgin country	1.239***	0.871	0.596***	0.288	0.629	0.814
	(0.273)	(0.615)	(0.218)	(0.338)	(0.421)	(0.506)
ln(GDP), host country	2.307***	3.173***	-1.625***	-0.916	-0.832***	-1.978***
	(0.406)	(0.876)	(0.617)	(1.164)	(0.217)	(0.373)
ln(Bilateral distance)	-0.326***	-0.352**	-0.139	-0.074	-0.309***	0.059
	(0.086)	(0.140)	(0.089)	(0.115)	(0.070)	(0.136)
Common Language (dummy)	-0.058	-0.618***	0.620***	0.483***	0.078	0.102
	(0.061)	(0.126)	(0.087)	(0.133)	(0.177)	(0.201)
Shared Border (dummy)	-0.221***	-0.140	0.443***	0.148	0.503***	0.508**
	(0.067)	(0.134)	(0.097)	(0.169)	(0.152)	(0.259)
Interest Rate (host country, t)	-50.282***	-24.611	5.574	33.618*	0.038	-7.814
	(15.475)	(29.884)	(10.742)	(17.911)	(2.823)	(6.100)
Unemployment Rate (host country, t)	9.079*	-5.816	-9.806***	-4.988	2.554	-1.596
	(5.429)	(4.832)	(2.797)	(5.659)	(1.791)	(2.711)
Constant	-17.911***	-16.197***	12.973***	12.681	4.328	10.860**
	(3.853)	(6.209)	(4.473)	(8.184)	(3.682)	(4.756)
Dyad-year observations	624	622	2,286	2,286	2,528	2,528
Pseudo R-squared	0.54	0.84	0.87	0.90	0.59	0.74
Clusters (dyad)	121	120	334	334	650	650
Origin, destination, and year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Standard errors clustered by dyad (origin–destination pair)	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors in parentheses

** p<0.10 | ** p<0.05 | *** p<0.01*

Table 15: LODO (Small Nordics)

	2007 - 2024		2007 - 2024		2007 - 2024	
	Drop Norway		Drop Denmark		Drop Finland	
	1	2	3	4	5	6
Dependent Variable:	**Number of deals**	**VC amount**	**Number of deals**	**VC amount**	**Number of deals**	**VC amount**
ln(GDP), orgin country	1.139***	1.092***	1.458***	0.805**	1.161***	0.484
	(0.273)	(0.100)	(0.296)	(0.390)	(0.322)	(0.439)
ln(GDP), host country	4.423***	-3.292**	2.403***	3.120**	1.415***	5.010***
	(0.392)	(1.447)	(0.350)	(1.229)	(0.430)	(1.195)
ln(Bilateral distance)	-0.383**	-0.321	-0.005	-1.313***	-1.126***	0.369
	(0.151)	(0.207)	(0.163)	(0.187)	(0.366)	(0.354)
Common Language (dummy)	-0.047	-0.243	0.005	-1.058***		
	(0.096)	(0.149)	(0.086)	(0.108)		
Shared Border (dummy)	-0.298**	-0.408**			-0.533***	0.404***
	(0.119)	(0.183)			(0.189)	(0.150)
Interest Rate (host country, t)	-96.664***	1.303	-59.618**	-71.660***	-30.210	11.163
	(10.019)	(34.910)	(25.966)	(21.612)	(20.917)	(10.710)
Unemployment Rate (host country, t)	11.460***	-20.784***	41.951***	33.201**	1.275	-8.693
	(1.854)	(6.829)	(6.116)	(14.110)	(6.438)	(9.220)
Constant	-27.948***	19.276**	-24.563***	-9.366***	-6.356	-30.502***
	(0.005)	(7.486)	(0.095)	(3.326)	(5.475)	(10.330)
Dyad-year observations	460	458	422	420	348	348
Pseudo R-squared	0.57	0.86	0.51	0.86	0.57	0.86
Clusters (origin)	45	44	47	46	34	34
Clusters (destination)	2	2	2	2	2	2
Origin, destination, and year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Two-way clustered standard errors (origin and destination)	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors in parentheses

** p<0.10 | ** p<0.05 | *** p<0.01*