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The local economic impact of the Swedish higher education system

Andrés Rodríguez-Pose[a] and Han Wang[b]

ABSTRACT

This article examines the role of Swedish higher education institutions (HEIs) in economic development, focusing on the impact of their research capacities on local economic activity. Globally, HEIs are increasingly prioritising research, frequently at the expense of education and local economic engagement, as a means to climb the university ranking ladder. Sweden has been no exception. Our findings indicate that research intensity at Swedish HEIs does not correlate with higher local income. Rather, the opposite is the case: more emphasis on top-end research seems to undermine local income. We explore human capital and innovation as possible mechanisms for the limited local economic influence of Swedish HEIs. The results reveal that HEIs do not significantly improve local human capital. Moreover, despite Swedish HEIs holding intellectual property rights to foster innovation, the actual economic translation of this knowledge faces considerable hurdles, including a misalignment with industry needs and limited local business collaboration.

KEYWORDS

research capacity; higher education institutions; human capital; innovation; Sweden

JEL I23, I25, R11

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1. INTRODUCTION

There is a widespread belief that higher education institutions (HEIs) are fundamental for local economic development. Many of the world's leading HEIs are situated in economically thriving cities and it is widely considered that the close geographical proximity between research-intensive HEIs and dynamic firms is fundamental to fostering innovation, productivity and economic achievement. HEIs not only contribute a more abundant supply of human capital to these firms but also see their university researchers directly engage in innovative activities or collaborate with local businesses (Valero & Van Reenen, 2019). Successful companies can benefit from labour pooling and knowledge spillovers generated by research conducted at nearby HEIs, particularly as knowledge tends to be sticky and subject to significant distance-decay effects (Moreno et al., 2005). Prominent HEIs – such as Stanford and MIT – have been known to drive the economic success of regions such as Silicon Valley in northern California and Route 128 around Boston (Jaffe, 1989). Based on these examples, it is generally assumed that investing in HEIs' research capabilities will significantly boost the creation of new economic activity at the local level. From this perspective, HEIs are seen as fundamental sources of change in local economies, leading to policies aimed at enhancing research within local HEIs increasingly featuring in development strategies (Power & Malmberg, 2008).

Leveraging HEIs' research capacity as a means to boost local economic development aligns well with the efforts by universities to climb the university rankings. These rankings are not merely measures of prestige; they also serve as magnets for attracting fee-paying students, donors and government support. Sweden has embraced this global trend, with successive Swedish governments explicitly adopting measures to enhance research in HEIs with the dual goals of raising the status of Swedish research institutions and simultaneously promoting greater national development through the exploitation of university research knowledge spillovers. It is also recognised that dynamic, research-led HEIs can attract private-sector activity to an area and enhance local productivity (Neumark & Simpson, 2015). This approach has unfolded in

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a context where, since 1977, Sweden has decentralised its higher education system by establishing 11 new HEIs and promoting 14 previously established university colleges to the status of universities (Andersson et al., 2009). Additionally, Swedish governments have progressively increased funding for HEIs. By 2019, Swedish HEIs accounted for 0.80% of gross domestic product (GDP) on research and development (R&D) – a proportion significantly higher than that of most Organisation for Economic Co-operation and Development (OECD) (second only to Denmark) and emerging economies (Figure 1).[1]

Despite significant government expenditure on subsidising university research, a crucial question remains unresolved: to what extent does the research capability of HEIs act as a driving force for local development? This paper seeks to answer this question by presenting the first systematic assessment of the interaction between HEIs' research capacity and economic development at the neighbourhood level in Sweden. To address the event selection issue prevalent in research on HEI roles, we generalise and measure the impact of HEIs in terms of their research capacity. To date, only a few studies have examined HEI effects from the perspective of research capacity (Aldieri et al., 2018; Atta-Owusu et al., 2020). Research capacity is quantified using Scopus – one of the most widely used abstracting and indexing datasets for scientific publications – to measure the research publication outputs of various Swedish HEIs and assess the global citations these outputs receive.

Our findings reveal that neither the intensity nor the impact of research significantly drives local income level in Sweden. Specifically, local research impact, as measured by citation rates, is negatively correlated with average income levels, with the adverse effects being more pronounced in newer HEIs established after the 1977 reforms. These results suggest that the considerable research rise in academic output has not brought about the anticipated economic benefits at the local level, thereby exacerbating regional inequalities. Furthermore, our analysis of the disciplinary impacts on economic development revealed no significant positive effects, indicating that the research outputs of HEIs, irrespective of the field, contribute far less effectively than expected to local economic development. These findings are consistent across a set of robustness checks.

In examining the mechanisms through which HEIs affect local economic development, we identify two key channels: human capital and innovation. Our analysis indicates that the focus of HEIs on high-end research does not contribute to successfully enhancing local human capital; in fact, a strong research focus may trigger brain drain and resource misallocation, potentially detracting from local educational and professional training needs. Moreover, while the successful commercialisation of HEIs' own research is evident, our estimates also emphasise the limited effectiveness of university–business partnerships in translating research results into local economic benefits. In other words, there is a growing disconnect between the research being conducted in HEIs and the practical human capital and innovation needs of local industries. This mismatch and the inefficient collaboration mechanisms seem to be impeding the translation of academic research into tangible local economies.

The rest of the paper is organised as follows. Section 2 provides the background of the Swedish HEIs. Section 3 reviews the literature on HEIs' research capacity,

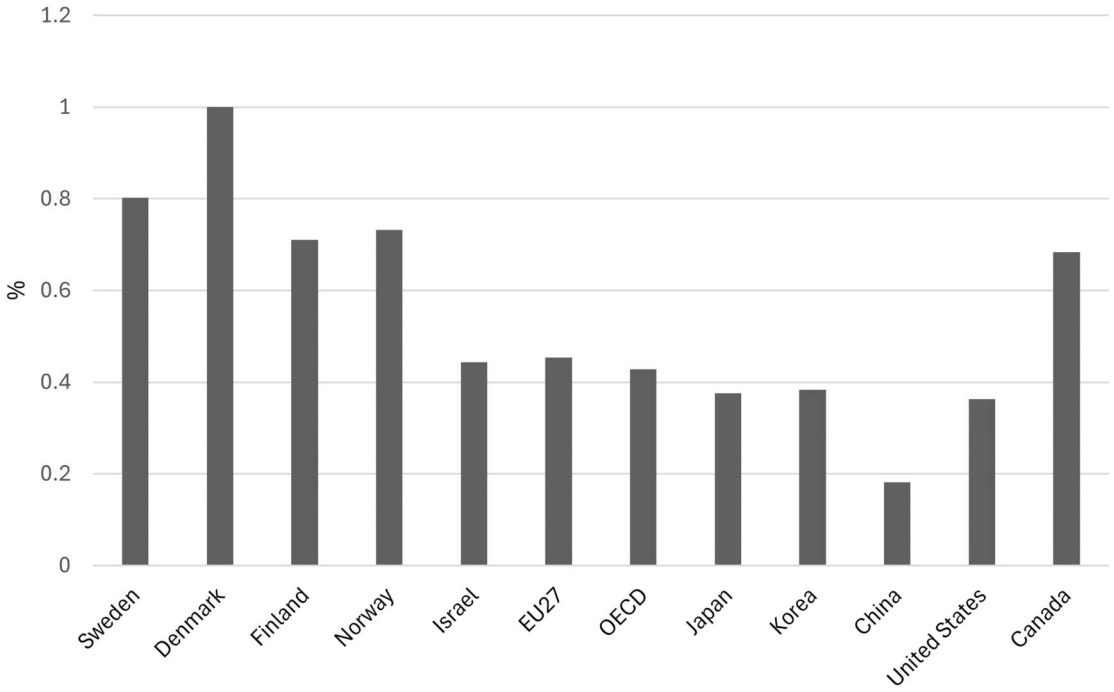

Figure 1. Higher education institutions' (HEIs) research and development (R&D) expenditure as a percentage of gross domestic product (GDP), 2019.

economic development, human capital and innovation in cities. Section 4 lays out the data and empirical strategy. Section 5 presents the baseline results of our analysis. Section 6 explores the mechanisms through which HEIs fail to promote local development successfully. Section 7 concludes with some policy recommendations.

2. BACKGROUND OF SWEDISH HEIs

2.1. The development of Swedish HEIs

The Swedish higher education system has undergone significant changes over the past four decades. Before 1977, there were only six research universities and five technical institutes, with institutions such as Uppsala University (founded in 1477) and Lund University (1666) representing a longstanding tradition of higher education in Sweden. However, despite these historical roots, the overall system remains relatively new, with Gothenburg University – the third oldest – established only in 1954.

The most significant transformation occurred in 1977, when the Swedish government launched a major reform aimed at decentralising the higher education system. This reform had multiple objectives. A primary goal was to address geographical imbalances in access to higher education by creating 11 new HEIs and upgrading 14 university colleges to full research universities. This effort was intended to 'democratise' higher education, making it accessible to a broader range of students, beyond the traditional elite and those living in urban centres (Bergh et al., 2024). The government aimed to extend educational opportunities to populations in more remote regions, broadening the representation of students from diverse social backgrounds and geographical areas (Hallonsten & Holmberg, 2013).

Another key objective of the reform was to stimulate regional economic development. By placing new HEIs in geographically diverse areas, the reform aimed to create local employment opportunities and stimulate economic activity outside of traditional university towns. To support this, vocational programmes closely linked to local industries were introduced, aligning educational offerings with regional economic needs and providing more career-oriented education (Bergh et al., 2024). This policy was also seen as a tool for regional redistribution, with the hope that the new institutions would promote long-term growth by attracting businesses and creating jobs in these areas (Andersson et al., 2004). Indeed, in the decades following the reform, municipalities that gained new HEIs saw population growth of 4.6%, compared to a 1.6% increase in cities with older HEIs (Andersson et al., 2009). This demographic growth suggests that the establishment of HEIs contributed to economic vitality in these regions, attracting students and spurring local services, housing and other economic activity in what, in some cases, may have been previously stagnant areas.

The policy of decentralising higher education also had a strong regional development component. By establishing HEIs in both major cities and more remote areas such as Luleå and Karlstad, the Swedish government aimed to reduce regional disparities in education and employment. These institutions were intended to retain local talent, raise workforce education levels, and attract additional economic activity. This effort can be seen as part of a broader strategy to distribute economic benefits more evenly across the country.

Another aspect of this policy was the expectation that the new HEIs would foster innovation and entrepreneurship (Bergh et al., 2024). By creating local knowledge hubs, the government hoped to spur business development and innovation, taking inspiration from the Silicon Valley model. The presence of HEIs was seen as a catalyst for start-up creation and local business growth, with spillover effects benefiting various sectors of the local economy. These effects included increases in regional output and productivity as businesses gained access to a more educated and skilled workforce (Andersson et al., 2004).

In summary, the 1977 reform aimed to expand access to higher education, diversify the student body, and use higher education as a tool for regional economic development. By decentralising the higher education system, the Swedish government sought to address regional disparities and promote long-term socio-economic growth across the country.

2.2. The strength of Swedish HEIs' research capacity

In recent years, Sweden has increasingly tended to concentrate funding on R&D at the expense of spending on other pillars of higher education, such as education and connections with local industry (UKÄ, 2020). Figure A1 in Appendix A in the supplemental data online shows that the R&D budget allocated to HEIs in Sweden increased steadily from around SEK 24 billion in 2007 to SEK 37 billion in 2019. During this period, the share of R&D funding provided as grants to HEIs remained relatively stable, fluctuating around 50%. Government funding is typically provided by agencies such as the Swedish Research Council, which supports research across a broad range of disciplines. This funding targets specific areas considered priorities for national interest or development, such as sustainability, technology, health and social sciences (OECD, 2021). To examine the impact of government support on research funding in enhancing universities' research capabilities, we employ two indicators: the number of academic publications stemming from Swedish HEIs and their position in world university rankings. We draw on Scopus data – which records academic publications with a track record of authors and affiliated organisations – to measure research publications. HEIs' research quantity and impact are quantified by the number of publications and citations, respectively.

Figure A2 in Appendix A in the supplemental data online shows that – with levels of funding that are among the highest in the world and with a more even distribution of funding across HEIs than in most other developed countries – the research intensity of the Swedish system has grown rapidly. The leader in number of

publications, the Karolinska Institute, specialised in medical sciences, has always been among the top institutions in publications. But the trajectory of other elite institutions has also been upward. However, it is not just the top tier that has benefited from these changes. Many of the new HEIs have kept pace in publications with the top Swedish HEIs. Moreover, there appears to be fierce competition in research intensity among HEIs in the middle of the rankings, possibly contributing to an increase in academic publications across the board and, therefore, benefiting Sweden as a whole. When we turn our attention to research impact, proxied by the citations those publications have received, the picture is similar. In Figure A3 online, citations to articles published by both the top and median Swedish HEIs have followed a similar trajectory from 2007 to 2019. There are no significant changes in terms of trajectory, implying that research impact is not solely reliant on financial support, but also on the long-term accumulation of skills and past research trajectories.

The effort to enhance HEI research across the board has, to a certain extent, paid dividends by positioning of the Swedish higher education system prominently in world university rankings. According to the Quacquarelli Symonds (QS) World University Rankings, Sweden ranks 14th in the world for the strength of its higher education, which is considerably higher than its rank in terms of GDP (24th). Overall, eight Swedish HEIs are ranked in the top 500 in the world in the QS 2021 ranking. The Academic Ranking of World Universities (ARWU) (popularly known as the Shanghai ranking) – a ranking more based on research performance – delivers very similar information. Figures A4A and A4B in Appendix A in the supplemental data online show the trajectory of the top two Swedish institutions in the Shanghai ranking (the Karolinska Institute and Uppsala University). These two HEIs have managed to maintain their ranking over the last two decades, despite fierce competition worldwide. But this performance is not exclusive to the top research institutions in Sweden. Universities further down the rankings, such as Gothenburg University or Linköping University, have not only performed well but, in some cases, have succeeded in improving their position (see Figures A4C and A4D online).

In sum, all of the above evidence shows that investment in the Swedish HEI system has contributed to uplifting the research capacity and, simultaneously, has had a reputational effect as a country at the forefront of knowledge generation. Undoubtedly, Swedish HEIs have performed strongly, especially in research intensity, over the last 15 years. The expectation of the Swedish government was for this strong research showing to trickle down to the economic fabric of the country (Andersson et al., 2009). In the following sections, we will analyse whether these expectations have been fulfilled and address the questions of, first, the local economic impact of Swedish HEIs, before concentrating on the link between research and innovation.

3. HEIs RESEARCH AS A DRIVER OF ECONOMIC DYNAMISM

3.1. HEIs and local economic development

There is certainly no shortage of academic research focusing on the relationship between HEIs and local development (Aghion et al., 2009). HEIs are generally regarded as engines of local economic development. Cermeño (2019) finds that US counties hosting new universities saw annual population and GDP growth of 1% to 3% above general trends from 1930 to 2010, with spillover effects extending to neighbouring counties. Similarly, Kantor and Whalley (2014) find that there is a noticeable spillover effect on nearby businesses, particularly pronounced for research-intensive HEIs or firms closely aligned with HEIs' technology, especially in the less developed states of the United States (Rodríguez-Pose & Wilkie, 2019). At the global level, Valero and Van Reenen (2019) argue that places with higher HEI density in the past show better GDP growth in the long run.

However, the empirical results remain mixed and often contradictory. It has also been found that the positive relationship between HEIs and local growth is highly dependent on the period chosen. Goldstein and Renault (2004) find that for the period 1969–98 the influence of research conducted by US HEIs on regional development was particularly weak. Likewise, Drucker (2016) only reports a week relationship between university research and regional growth in the United States for the period 2001–11. In a more recent study focusing on the land-grant programme in the United States, Liu (2015) obtain negligible effects of US universities on local outputs over the short - and medium-term (up to a maximum of 10 years), but highly positive effects in the long term (over periods of 80 years).

The scarce research on the economic impact of HEIs in Sweden delivers similarly inconclusive results. Andersson et al. (2004, 2009) show that increases in the number of researchers in the HEI sector considerably improved local output in Sweden. However, the evidence does not always necessarily go in the same direction. Bonander et al. (2016), for instance, report that granting research university status has had limited effect in fostering regional growth. All these conflicting results demonstrate that the impact of the HEI sector on local prosperity is not automatic and likely to vary based on the period considered and the type of research analysed. In fact, over the past 15 years, Sweden has witnessed a significant transformation in its local industrial structure. Notably, considerable progress has been made in high-tech sectors such as information technology, biotechnology, and green technologies and renewable energy sources. Nevertheless, it remains to be seen whether academic research conducted by universities can effectively align with the upgrading and adjustment of these local industries to foster regional development.

In response to these mixed findings, we examine changes in the research capacity of Swedish HEIs from

2007 to 2019, providing new evidence on their local economic impact. Given the substantial growth in HEI research output during this period and the policies aimed at promoting economic development, we propose the following hypothesis:

Hypothesis 1: The research capacity of Swedish HEIs is positively associated with higher local income levels.

3.2. HEIs, human capital and innovation

Understanding how HEIs impact socio-economic activity requires further investigation. The two main functions of HEIs – teaching and research – are fundamental for human capital development and innovation advancement, respectively.

3.2.1. HEIs and human capital

A region's stock of human capital helps determine its economic vitality. Research in economic geography consistently demonstrates that high levels of human capital strongly correlate with local population and employment growth and income levels (Carlino et al., 2007). Human capital is also at the base of long-term economic growth (Glaeser, 2005). This is because human capital significantly enhances individual productivity. Therefore, improving human capital in a region is perceived as an important driver of overall economic dynamism.

One of the main objectives of HEIs is to increase and improve human capital. Skilled workers are more productive than unskilled ones. HEIs provide skilled labour, meaning that the location and proximity of HEIs significantly influence local human capital. Areas with HEIs not only offer better educational opportunities for local youth but also attract students who are likely to seek employment nearby after graduation (Card, 2001; Valero & Van Reenen, 2019). If graduates stay and work locally, they directly enhance the region's stock of human capital. However, due to the high mobility of HEI graduates (Eriksson & Rodríguez-Pose, 2017; Faggian et al., 2007), more local graduates do not always translate into improvements in local human capital, as other factors related to labour supply and demand come into play.

While the ways in which universities' educational activities can be used to improve local human capital levels are clear, the research documenting this relationship empirically is scarce. In Sweden, human capital data are available at the neighbourhood level, enabling us to investigate how university research contributes to local human capital development and the interaction between human capital, HEIs, and economic growth. Given the role of HEIs in promoting human capital, we propose the following hypothesis:

Hypothesis 2: The research capacity of Swedish HEIs is positively associated with the development of local human capital, which in turn enhances regional economic performance.

3.2.2. HEIs and innovation

A second channel through which HEIs may affect local development condition is innovation. Under the linear model of innovation, local HEIs could influence overall economic performance through innovation. Innovation, in turn, trickles down from HEIs via mechanisms involving the commercialisation of HEI-owned research and university–industry collaborations (Giunta et al., 2016; Hausman, 2022).

In a direct influence approach, HEI researchers themselves could commercialise their research, generate new ideas, and thereby enhance the local innovation ecosystem automatically. The motivation to commercialise research is closely tied to the ownership of intellectual property (IP) rights. However, when universities or even governments own the IP from which HEIs generate patents, university researchers often lack strong incentives to engage in the commercialisation of their research (Hausman, 2022). For example, in the United States, prior to 1980, the federal government held default rights over IP developed by HEIs in the course of federally funded research. Many US HEIs exhibited reluctance in directly engaging in commercialising research due to the absence of a targeted Institutional Patent Agreement (IPA) with a funding agency, which consequently deprived researchers of licensing benefits. The situation did not improve until the enactment of the Bayh–Dole Act in 1980. This legislation grants HEIs property rights over innovations developed using federal funding, thereby providing them with powerful incentives to engage in patenting and licensing activities as they establish their technology transfer infrastructure (Sampat, 2006).

The process of academic patenting in Sweden differs largely from that in the United States. The Swedish legal framework for patenting and knowledge transfer is distinctively shaped by the concept known as the 'professor's privilege'. This principle allows HEI researchers and professors to retain ownership of the IP they create, rather than the HEIs owning the inventions made by their faculty. This contrasts with practices in many other countries where HEIs often claim IP rights over discoveries made by their employees (Ejermo & Källström, 2016). The professor's privilege in Sweden is intended to encourage individual researchers to engage in innovative and entrepreneurial activities by providing them direct control and potential financial benefits from their inventions. Thus, this incentive drives the assumption that the research capacity of Swedish HEIs can propel innovation based on the research they conduct.

In addition to HEIs' research commercialisation, collaborations between HEIs and local firms can also facilitate the dissemination of research innovations at the local level. This university–industry partnership is a two-way relationship. On the one hand, firms are drawn to collaborate with HEIs by the new knowledge they generate, the quality capacity of the researchers, and the excellent resources, such as facilities, equipment, and extensive networks, they possess (Mansfield, 1995; Santoro & Chakrabarti, 2002). On the other hand, HEIs are drawn to

industry as a way to test theories in the real world and to acquire additional resources.

However, HEIs and firms are very different entities. They have different motivations and pursue different goals. This can end up creating friction between both and limiting their capacity to collaborate (Bruneel et al., 2010; Hewitt-Dundas et al., 2019). One example of this is the case of the diffusion of knowledge: while the objective of HEI researchers is fundamentally to put any new knowledge generated by university–industry collaborations out in the open by publishing it, most firms would prefer to appropriate and monetise the returns of any new knowledge, often by patenting it or keeping it secret. Moreover, HEI researchers are bound to prioritise their own research – especially in periods of intense pressure – which might jeopardise the interaction with local industries (Jongbloed et al., 2008).

Geographical proximity plays a crucial role in facilitating collaboration between HEIs and industry. Research shows that close proximity encourages interaction and knowledge exchange between HEIs and firms (Rodríguez-Pose & Crescenzi, 2008). Firms located near HEIs gain easier access to new knowledge through frequent face-to-face interactions, which reduces transaction costs and mitigates risks such as moral hazard (Fitjar & Gjelsvik, 2018). Bellucci and Pennacchio (2016) find that research capacity is positively correlated with knowledge exchange between HEIs and firms, suggesting that proximity to research institutions is a key factor in local innovation dynamics. Based on this evidence, we propose the following hypothesis:

Hypothesis 3: The research capacity of Swedish HEIs is positively associated with local innovation, particularly in regions where firms are in close geographical proximity to HEIs.

4. DATA AND MODEL

4.1. Data sources

To estimate the potential economic effects of Swedish HEIs, we have collected data on research capacities and economic level, along with data relevant to potential mechanisms at the local level. We first measure the research capacity of HEIs using Scopus, a leading abstracting and indexing database. Scopus contains 75 million documents sourced from over 24,000 active journal titles and 5000 publishers. It features enhanced sorting and searching capabilities, enabling researchers to access over one billion citations dating back to the 1970s. A key strength of Scopus is its system of unique identifiers, which assists users in tracking the research outputs of individual authors and organisations. Using the profiles of authors or institutions, we compute the number of publications and citations for HEIs within a specific period (Aldieri et al., 2018). Following this approach, we collect the number of publications and citations from all Swedish HEIs and aggregate the data at the local level. Recognising that the overall number of publications and citations in HEIs is influenced by the number of researchers, we follow Gross and Sampat (2023) in using the number of publications or citations normalised by the number of HEI researchers as our key explanatory variables.

We proxy local economic development using income per capita. The mean value of individuals' income covers local residents aged 20–64 years. To account for the impact of inflation, we convert the mean value of the individuals' income into a number of price base amounts. To enhance the accuracy of our estimates, we control for covariates likely to impact local income level. These include the local population, share of working age individuals, gender ratio, and local unemployment rate to capture the socio-economic conditions in the locality. Both the income per capita and the socio-economic covariates are sourced from Statistics Sweden.

To explore potential mechanisms, we collect information on human capital and innovative activities. Specifically, we use the proportion of residents with a HEI degree provided by Statistics Sweden as a proxy variable for our human capital. Ideally, variables such as years of schooling would be more accurate in characterising human capital. However, given our analysis level is conducted at the neighbourhood level, the share of population with a HEI degree is the most accurate indicator of human resources available.

To measure local innovative activities, we resort to the patent data from OECD REGPAT. Although patent data have its limitations, including the fact that not all inventions are patented and the varying likelihood of filing patent applications across different technical fields and firms, it remains the most widely used method for quantifying innovation. This is largely because patent data are easily accessible, significantly simplifying the data collection process. Furthermore, patent data offer extensive geographical and temporal coverage, providing researchers with a dataset that spans extensive periods. In our analysis, we use the patents filed at the European Patent Office, available from our study period. Importantly, locational information of inventors' patents is also available, which allows us to geocode the address information and aggregate the number of patents into the corresponding locales. The descriptive analysis and the sources of our data are presented in Table 1.

4.2. Unit of spatial analysis

Aware that the boundaries of municipalities could be largely affected by historical and political factors, our study follows Statistics Sweden's recent local classification in 2021 and conducts our spatial analysis at regional statistics areas (RegSo).[2] RegSo delineates 3363 units of analysis covering the entire country. This geographical specification is especially advantageous for studying neighbourhood effects since the purpose of RegSo is to allow for statistical studies that assess socioeconomic conditions. The classification of RegSo remains unchanged over time. An additional advantage of using this micro-geographical scale is that it ensures a one-to-one correspondence between each HEI and its respective region. This

Table 1. Descriptive statistics.

Variable	Source	Observations	Mean	SD
Income per capita (logged)	Statistics Sweden	43,386	1.723	0.207
Population (logged)	Statistics Sweden	43,399	7.796	0.570
Working age (%)	Statistics Sweden	43,388	53.991	6.945
Gender ratio (%)	Statistics Sweden	43,399	50.260	2.138
Unemployment ratio (%)	Statistics Sweden	43,381	13.184	6.778
Proportion with HEI degree (%)	Statistics Sweden	43,380	34.707	14.783
Patent (logged)	OECD REGPAT	43,420	0.518	0.836
HEIs' research-owned patents (logged)	OECD REGPAT, patent-to-paper citation database	43,420	0.074	0.330
Industry-owned patents (logged)	OECD REGPAT, patent-to-paper citation database	43,420	0.043	0.218
Ln (pub. rate) of local areas	Scopus	43,420	0.005	0.064
Ln (pub. rate) of neighbouring areas	Scopus	43,420	0.032	0.153
Ln (cit. rate) of local areas	Scopus	43,420	0.024	0.267
Ln (cit. rate) of neighbouring areas	Scopus	43,420	0.032	0.153

Note: HEI, Higher education institution.

precision allows us to more accurately assess the potential impact of each university on its local economy. If the geographical scope were expanded to the municipal or metropolitan level, the effects of multiple universities would be aggregated into a single large area. This would not only reduce the richness of the original data but also obscure the contributions of universities with relatively lower research capacities. By adopting the RegSo level as our unit of spatial analysis, we effectively minimise this potential measurement error. Figure 2 illustrates the geographical scale of RegSo. Our analysis covers the period from 2007 to 2019. The year 2007 marks the beginning of recorded socioeconomic conditions at the RegSo level, and we choose 2019 as the endpoint to exclude the potential effects of COVID-19 from our study.

Additionally, we recognise that the generation and diffusion of knowledge by HEIs is more likely to occur in urban areas. For instance, firms that use knowledge generated by HEIs are usually located in or in the vicinity of urban areas. Therefore, we follow Kantor and Whalley (2014) and limit our sample to urban areas, which can make our analysis results more rigorous. In Sweden, urban areas (or localities as per their official donation) are built-up areas with at least 200 inhabitants. Around 88% of the Swedish population lived in a total of 2011 urban areas in 2018. We link the urban area data with our RegSo level map and then obtain the urban conditions at the neighbourhood level (Figure 2A).[3] Figure 2B visualises the distribution of income per capita across different neighbourhoods of Sweden, with darker shades indicating higher income levels. It also marks the locations of HEIs with green dots. These are concentrated in regions with higher income, particularly in the southern and eastern parts of the country.

4.3. The model

To examine the extent to which HEIs' research capacity has affected local development, we adopt a spatial lagged model, wherein local research capacity is a function of (1) local investment in knowledge generation; (2) the research activities occurring in neighbouring regions; and (3) a vector of socioeconomic factors (Gibbons & Overman, 2012). This two-way fixed effect model is specified as follows:

$$Y_{i,t} = \beta_1 research\ capacity_{i,t} + \beta_2 Wresearch\ capacity_{i,t} + X_{i,t} + \theta_i + \gamma_t + \epsilon_{i,t} \quad (1)$$

$$Wresearch\ capacity_i = \sum_j research\ capacity_i \left(\frac{contig_{ij}}{\sum_j contig_{ij}} \right) \quad \forall i \neq j \quad (2)$$

where i represents a given neighbourhood and t a given year. The outcome variable $y_{i,t}$ reflects local development measured by income per capita. $research\ capacity_{i,t}$ is measured by publications and citations at the RegSo neighbourhood level. $Wresearch\ capacity_i$ represents average research capacity in the surrounding neighbourhoods. More specifically, $research\ capacity_i$ denotes the level of publication or citation of neighbouring regions j and $contig_{ij}$ is indicative of whether region j is contiguous to region of interest i. $contig_{ij}$ assumes a value of 1 if this is true, and 0 if false. $X_{i,t}$ represents a set of covariates, including overall population, proportion of working age population, gender ratio in the region, and unemployment ratio at the local level. Neighbourhood and time fixed effects are included to account potential unobservable differences across territories over time. Specifically, θ_i is a set of neighbourhood fixed effect that absorb time-invariant characteristics across territories. γ_t is a set of year fixed effects that flexibly control for national time-series trends in economic outcomes.

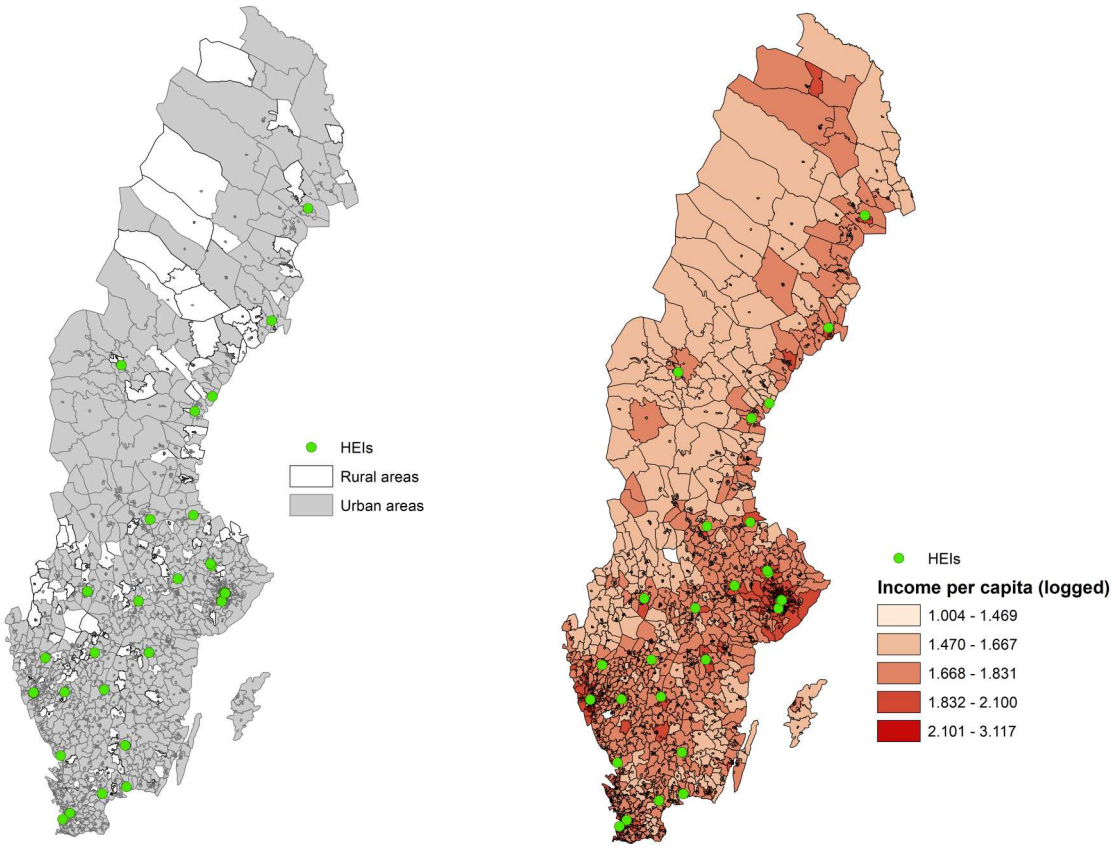

Figure 2. (a) Urban and rural area in Sweden; and (b) income per capita in Sweden, 2007–19.

Table 2. Higher education institution (HEI) research capacity and income level in Sweden, 2007–19.

	Income per capita (logged)					
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Ln (pub. rate) of local areas	−0.0481	−0.0532	−0.0522			
	(0.0326)	(0.0330)	(0.0331)			
Ln (pub. rate) of neighbouring areas	0.0205	0.00428	0.00517			
	(0.0168)	(0.0148)	(0.0148)			
Ln (cit. rate) of local areas				−0.0214**	−0.0220**	−0.0217**
				(0.00885)	(0.00902)	(0.00903)
Ln (cit. rate) of neighbouring areas				0.0204	0.00409	0.00498
				(0.0167)	(0.0147)	(0.0147)
Neighbourhood fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	Yes	No	Yes	Yes
Sample	All	All	Urban areas	All	All	Urban areas
Observations	43,386	43,381	41,717	43,386	43,381	41,717
R^2	0.966	0.970	0.970	0.966	0.970	0.970

Note: Robust standard errors are clustered at the neighbourhood (RegSo) level.
***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

5. MAIN RESULTS: HEIs AND LOCAL ECONOMIC DEVELOPMENT

5.1. Baseline results

Table 2 presents the results of our investigation into the relationship between HEI research capacity and local economic development, measured by income per capita. We assess this relationship from two perspectives: research intensity (publication rates) and research impact (citation rates), focusing on both local areas and neighbouring regions.

In columns (1) to (3), we use the logged publication rate to measure the research intensity of HEIs. Column (1) shows the baseline regression, controlling for neighbourhood and year fixed effects but without additional socio-economic controls. The results indicate a negative, albeit statistically insignificant, relationship between local publication rates and income per capita. In contrast, publication rates in neighbouring areas show a positive but also statistically insignificant correlation with local income. These results suggest that while HEI research activity might have some influence on local economies, the effect is not strong enough to reach statistical significance without further controls.

Column (2) introduces socio-economic control variables, but the insignificance of both local and neighbouring publication rates persists. This suggests that even after accounting for additional factors, HEI research intensity does not have a meaningful impact on income levels. In column (3), we narrow the analysis to urban areas, where HEIs are predominantly located. However, the results remain consistent, with no significant relationship detected between local or neighbouring research intensity and income levels.

In columns (4) to (6), we shift our focus to research impact, using logged citation rates as the explanatory variable. Here, we observe a significant negative relationship between local research impact and income per capita across all specifications. These results suggest that areas with higher research impact, as measured by citations, experience lower income levels. This finding holds even after controlling for socio-economic factors and limiting the sample to urban areas. Citation rates in neighbouring areas, such as publication rates, remain statistically insignificant and show no substantive correlation with local income.

Overall, our results indicate that HEI research capacity – whether measured by intensity or impact – is not positively linked to local economic development in Sweden. In fact, the significant negative relationship between research impact and local income levels raises questions about the mechanisms through which HEI research affects local economies.

To verify our findings in Table 2, we conduct a series of robustness checks. One concern is that economic activities driven by research capacity might occur near city boundaries, where there is more space for production facilities or new offices. Our neighbourhood-level analysis may not fully capture these activities. To address this, we reanalyse the data at the metropolitan level, as shown in Table A1 in Appendix A in the supplemental data online.[4] The results remain consistent with our baseline in Table 2, indicating no significant positive relationship between HEI research capacity and regional income, even when considering economic activity beyond neighbourhood boundaries.

Another potential issue is that focusing solely on the current year may overlook longer term effects of knowledge accumulation, as economic activities may be influenced by knowledge developed over multiple years. To account for this, we introduce one-, two- and three-year time lags in our analysis (see Tables A2–A4 in Appendix A in the supplemental data online). The results are consistent with our baseline in Table 2, although the significance level of the negative relationship between research impact and income varies slightly across different lags.

Additionally, we replace the outcome variable with income relative to national and regional averages, as well as employment rates (see Tables A5–A7 in Appendix A in the supplemental data online). Once again, our results are consistent with the baseline, showing no significant impact of research capacity on employment rates.

Furthermore, using the ratio of publications or citations to the number of HEI researchers as a proxy for research intensity or impact may introduce measurement errors. To address this, we use student enrolment to measure HEI size in Table A8 and local population as a broader index for density in Table A9, both in Appendix A in the supplemental data online. The findings from these tables remain consistent with those in Table 2.

Finally, we examine whether our significant and insignificant coefficients are influenced by the geographical level of fixed effects or standard error clustering. In Tables A10 and A11 in Appendix A in the supplemental data online, we cluster standard errors at the county level and apply fixed effects at the county level. Our results remain robust across these specifications.

5.2. Heterogeneous effects

As discussed above, Sweden's current higher education system, influenced by the 1977 reform, is polarised into old and new HEIs. Old Swedish HEIs such as Uppsala and Lund have deep historical roots and a strong focus on research. New HEIs, created after the 1977 reforms, aim to enhance local education and economic condition, thereby addressing regional inequalities. Does the difference in research capacity between old and new HEIs affect local development?

To answer this question, we examine the heterogeneous effects of our baseline analysis by considering the new and old HEIs' research capabilities separately. Panels A and B in Table 3 correspond to the results of the old and new HEIs on local development, respectively. Panel A shows that old prestigious universities in Sweden have no significant impact on local economic development from both dimensions of research density and impact.

Table 3. Higher education institution (HEI) research capacity and income level in Sweden, new versus old HEIs.

	Income per capita (logged)					
(A) 'Old' HEIs	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Ln (pub. rate) of local areas	−0.0584	−0.0747	−0.0741			
	(0.0733)	(0.0695)	(0.0695)			
Ln (pub. rate) of neighbouring areas	0.0334	0.0233	0.0242			
	(0.0433)	(0.0358)	(0.0357)			
Ln (cit. rate) of local areas				−0.0248	−0.0301	−0.0298
				(0.0286)	(0.0272)	(0.0272)
Ln (cit. rate) of neighbouring areas				0.00410	0.00111	0.00147
				(0.0183)	(0.0143)	(0.0142)
R^2	0.966	0.970	0.970	0.966	0.970	0.970
(B) 'New' HEIs	**(7)**	**(8)**	**(9)**	**(10)**	**(11)**	**(12)**
Ln (pub. rate) of local areas	−0.0481	−0.0532	−0.0522			
	(0.0326)	(0.0330)	(0.0331)			
Ln (pub. rate) of neighbouring areas	0.0205	0.00428	0.00517			
	(0.0168)	(0.0148)	(0.0148)			
Ln (cit. rate) of local areas				−0.0214**	−0.0220**	−0.0217**
				(0.00885)	(0.00902)	(0.00903)
Ln (cit. rate) of neighbouring areas				0.0204	0.00409	0.00498
				(0.0167)	(0.0147)	(0.0147)
R^2	0.966	0.970	0.970	0.966	0.970	0.970
Neighbourhood fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	Yes	No	Yes	Yes
Sample	All	All	Urban areas	All	All	Urban areas
Observations	43,386	43,381	41,717	43,386	43,381	41,717

Note: Robust standard errors are clustered at the neighbourhood (RegSo) level.
***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

Especially when we compare and analyse the baseline results in Table 2, we find the negative economic influence of local research impact has largely been muted. In contrast, the results of panel B elaborate that our findings about the negative impact of local research impact on the economy are mainly driven by the newly built universities. Our results suggest that the establishment of new HEIs has not met policy expectations. New HEIs, rather than contribute to reduce the income gap in Sweden, have further increased spatial inequality.

These results may be affected by the fact that not all HEIs are comprehensive; each HEI may have its own strengths in particular disciplines. For instance, Stockholm University is renowned for its social sciences but offers fewer departments and courses in the natural sciences. In this case, HEIs may publish extensively (or receive numerous citations) in social science, which may have a lower impact on local development than excellence in engineering, for example. To understand the disparities caused by different disciplines, we manually collected data on the number of publications and citations at the disciplinary level for each HEI from Scopus. Figure 3 presents the effect of research capacity across various academic disciplines at both local and neighbouring areas on the income level. Our results show that there are some differences in the economic impact of different disciplines on neighbouring regions. For example, the coefficient of research intensity in material science is negative, while the influence of chemistry is more positive (Figure 3B). However, none of the coefficients is significant. In contrast, the impact of local research capacity on economic development is more consistent across disciplines, which indicates that our findings about the negative correlation between local research impact and local development are led by the disciplinary characteristics of HEIs (Figure 3C).

An important aspect of this analysis is the alignment between universities' research activities and the local or regional industrial structure. To capture this alignment, we have developed an HEI–local industry match index, which measures the degree of correspondence between universities' research strengths and the specialisation of local industries. The index is constructed using employment data classified according to NACE Rev. 2 industry categories at the RegSo level. Local industry specialisation is quantified using the location quotient (LQ), which reflects the concentration of industry employment relative to the national average. The HEI–local industry match index is then derived by weighting university research strengths in each region according to the LQ of local industries, creating a measure that reflects the degree of alignment between university research and regional industrial needs.

To examine potential heterogeneity in these effects, we divided the regions into quartiles based on the HEI–local industry match index. Table A12 in Appendix A in the supplemental data online presents the results of the quartile regression analysis, showing the influence of local and neighbouring universities' research capacity on regional income levels across different quartiles. These results reveal a significant negative relationship between the research capacity of local universities and income levels in the lower middle 25% of regions (column 2). This suggests that in areas with a moderate alignment between university research activities and local industry specialisation, local research may actually hinder economic outcomes. This could be due to a mismatch between the type of research conducted and the specific needs of local industries, potentially leading to inefficiencies or a failure to capitalise on regional growth opportunities.

However, for regions in the other quartiles, we also do not find a significant positive relationship between research capacity and local economic performance.

6. MECHANISMS

Having established a robust association between local income per capita and HEIs' research capacity, we now explore the mechanisms through which HEIs may hinder higher economic achievements.

6.1. HEIs and human capital

First and foremost, HEIs act as hubs for producing human capital. Skilled workers are generally deemed more productive than their less skilled counterparts. Human capital is influenced by the geographical location and proximity of HEIs. Areas with HEI access not only increase the opportunities for local teenagers to pursue higher education but also tend to retain graduates as part of the local workforce (Valero & Van Reenen, 2019). Thus, one potential reason for the failure of HEIs to effectively contribute to the economy may relate to difficulties in retaining human capital locally.

To examine this mechanism, we first add measures of human capital to our baseline regression to see how it might influence local income levels and the coefficients of HEIs' local and neighbouring research capacities. Table 4 considers the relationship between HEI research capacity, human capital and income per capita levels. Panel A replicates the baseline regressions with the inclusion of human capital. Across all specifications, there is a consistently strong and positive relationship between the proportion of higher education graduates and income per capita. This finding aligns with existing literature (e.g., Gennaioli et al., 2014; Sianesi & Reenen, 2003), which emphasises the role of human capital in driving economic growth.

We must highlight that this relationship represents a correlation rather than causation. While higher education qualifications are positively associated with income, higher income areas may also attract more qualified individuals, and more qualified individuals tend to earn higher incomes (Glaeser & Maré, 2001; Moretti, 2012). This endogenous relationship suggests that the observed positive coefficient reflects the interaction between education and income, rather than a one-way causal effect.

Notably, after accounting for human capital in the analysis, the significantly negative coefficients of research capacity are completely eliminated. This suggests that

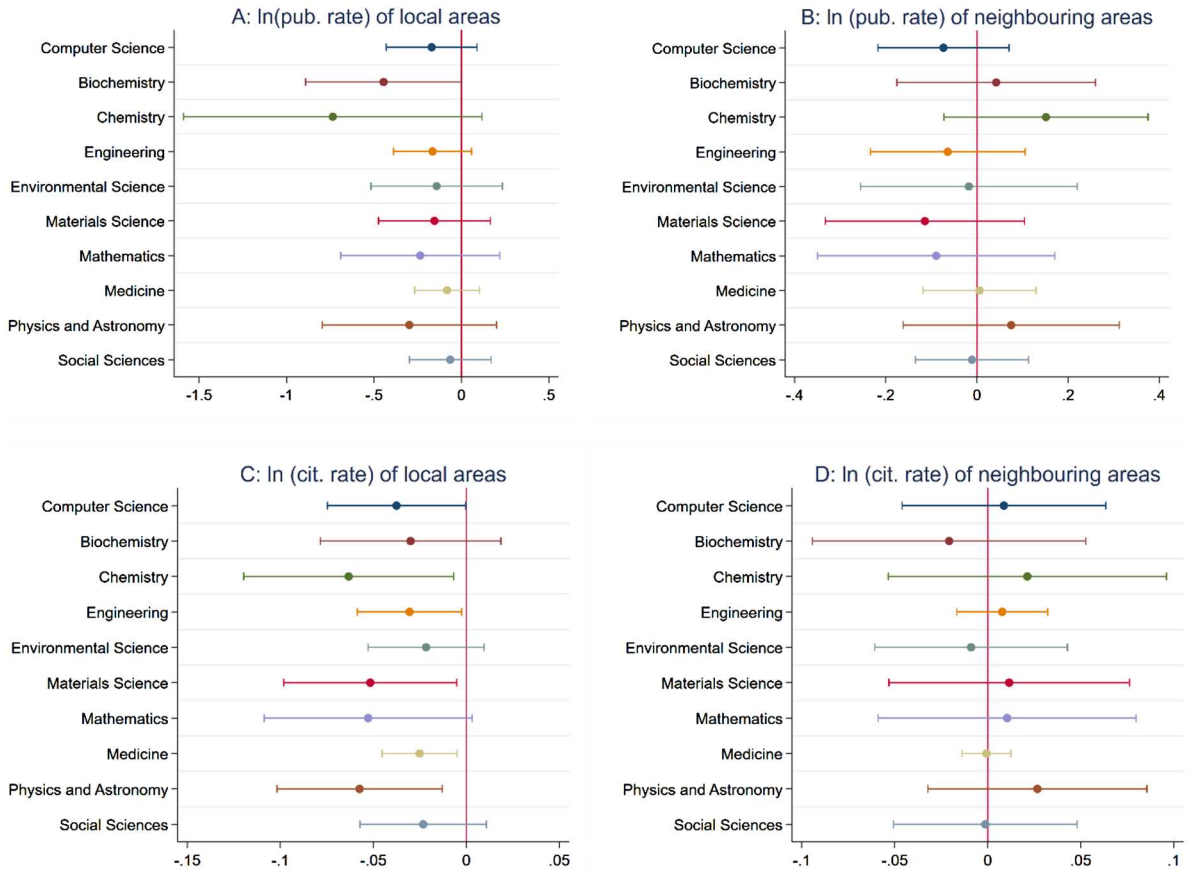

Figure 3. Higher education institution (HEI) research capacity and income level in Sweden, heterogeneous effect: different subjects.

the earlier results were likely influenced by the omission of human capital as a confounding factor. Once human capital is accounted for, the direct effect of HEI research capacity on income appears negligible, reinforcing the critical role of human capital in driving local economic performance.

By regressing human capital on research capacity variables, panel B establishes a direct link between HEI research capacities and human capital. In columns (7) and (10), we examine the raw correlation between research capacity and human capital with neighbourhood and year fixed effects as controls. We further refine our estimates by including socio-economic covariates in both columns (8) and (11). In our most comprehensive analysis, the urban area sample regressions (columns 9 and 1)), we find that both HEIs' research intensity and impact have a significantly negative correlation with the human capital level of the localities and surrounding areas. This indicates that HEIs' research capabilities do not enhance the human capital of the local and surrounding areas, but conversely, may lead to the loss of human capital. This phenomenon may be due to resource allocation and brain drain. Specifically, HEIs that focus heavily on research may allocate significant resources towards research activities, potentially at the expense of teaching or community engagement. This could limit the development of human capital if less attention is paid to the educational needs and professional training of the broader student body. Furthermore, HEIs with strong research capabilities may attract talented individuals from local areas, who then often move away after graduation to seek better opportunities elsewhere (Eriksson & Rodríguez-Pose, 2017). This migration can result in a net loss of human capital in the local area, as the most skilled or educated individuals leave.

6.2. HEIs and innovation

A second channel through which HEIs may affect economic performance is innovation. Research has shown that HEIs can boost local innovation at county or state levels in the United States (Andrews, 2023; Jaffe, 1989). Therefore, one reason that may undermine how HEIs' research capabilities trigger local development is the obstruction of HEIs' channels for local innovation capabilities.

The most common measure of local innovative performance is the number of patents. We thus use the number of patents as the proxy for local innovation. Similar to the analysis of human capital, we first add the patent variable to our baseline analysis in panel A of Table 5 to observe its correlations with local income levels. Our estimations show a clear positive correlation between patent levels and local income levels. The coefficient of patents is significant under any analysis condition. Importantly, the research impact of HEIs still exhibits an inverse correlation with the economic impact

Table 4. Higher education institution (HEI) research capacity and human capital in Sweden.

(A)	Income per capita (logged)					
	(1)	(2)	(3)	(4)	(5)	(6)
Ln (pub. rate) of local areas	−0.0215	−0.0274	−0.0260			
	(0.0322)	(0.0324)	(0.0324)			
Ln (pub. rate) of neighbouring areas	0.0290*	0.0156	0.0169			
	(0.0154)	(0.0146)	(0.0146)			
Ln (cit. rate) of local areas				−0.0132	−0.0141	−0.0137
				(0.00928)	(0.00907)	(0.00910)
Ln (cit. rate) of neighbouring areas				0.0292*	0.0156	0.0170
				(0.0154)	(0.0146)	(0.0146)
Proportion with HEI degree (%)	0.00558***	0.00445***	0.00452***	0.00557***	0.00444***	0.00451***
	(0.000589)	(0.000502)	(0.000508)	(0.000589)	(0.000503)	(0.000509)
R^2	0.969	0.971	0.972	0.969	0.971	0.972
(B)	**Proportion with HEI degree (%)**					
	(7)	(8)	(9)	(10)	(11)	(12)
Ln (pub. rate) of local areas	−4.706*	−5.695**	−5.736**			
	(2.402)	(2.378)	(2.376)			
Ln (pub. rate) of neighbouring areas	−1.464	−2.289**	−2.363**			
	(1.049)	(0.954)	(0.954)			
Ln (cit. rate) of local areas				−1.450***	−1.733***	−1.743***
				(0.524)	(0.514)	(0.514)
Ln (cit. rate) of neighbouring areas				−1.507	−2.344**	−2.419**
				(1.044)	(0.950)	(0.949)
R^2	0.988	0.989	0.989	0.988	0.989	0.989
Neighbourhood fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	Yes	No	Yes	Yes
Sample	All	All	Urban areas	All	All	Urban areas
Observations	43,380	43,377	41,713	43,380	43,377	41,713

Note: Robust standard errors are clustered at the neighbourhood (RegSo) level.
***$p < 0.01$, **$p < 0.05$, * $p < 0.1$.

Table 5. Higher education institutions (HEI) research capacity and innovation in Sweden.

(A)	Income per capita (logged)					
	(1)	(2)	(3)	(4)	(5)	(6)
Ln (pub. rate) of local areas	−0.0488	−0.0534	−0.0525			
	(0.0327)	(0.0331)	(0.0331)			
Ln (pub. rate) of neighbouring areas	0.0194	0.00371	0.00461			
	(0.0168)	(0.0148)	(0.0148)			
Ln (cit. rate) of local areas				−0.0216**	−0.0221**	−0.0218**
				(0.00883)	(0.00901)	(0.00902)
Ln (cit. rate) of neighbouring areas				0.0193	0.00351	0.00442
				(0.0167)	(0.0147)	(0.0147)
Patent (logged)	0.00204***	0.00120**	0.00121**	0.00206***	0.00122**	0.00123**
	(0.000596)	(0.000517)	(0.000521)	(0.000596)	(0.000516)	(0.000520)
R^2	0.966	0.970	0.970	0.966	0.970	0.970
(B)	**Patent (logged)**					
	(7)	(8)	(9)	(10)	(11)	(12)
Ln (pub. rate) of local areas	0.337	0.217	0.209			
	(0.312)	(0.307)	(0.307)			
Ln (pub. rate) of neighbouring areas	0.529***	0.471***	0.460***			
	(0.160)	(0.161)	(0.161)			
Ln (cit. rate) of local areas				0.134*	0.0990	0.0970
				(0.0759)	(0.0766)	(0.0765)
Ln (cit. rate) of neighbouring areas				0.531***	0.471***	0.460***
				(0.160)	(0.161)	(0.161)
R^2	0.723	0.725	0.724	0.723	0.725	0.724
Neighbourhood fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	Yes	No	Yes	Yes
Sample	All	All	Urban areas	All	All	Urban areas
Observations	43,420	43,381	41,717	43,420	43,381	41,717

Note: Robust standard errors are clustered at the neighbourhood (RegSo) level.
***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

of the location even when controlling for the level of local patents. Hence, the influence of research impact on the local economy is primarily driven by the mechanism of human capital rather than innovation. Panel B then characterises the correlation between research capacity and innovation. The coefficients of research intensity and impact in the places where HEIs are located are always not significant, which goes against expectations and suggests that research capacity does little to promote local innovation. In contrast, HEIs' research capacity has significantly improved innovation in the surrounding areas, both in terms of the intensity and impact of research. The evidence demonstrates that the research capabilities of HEIs have distinct local knowledge spillover effects at the neighbourhood level. To sum up, our findings show that the research emanating from HEIs may not have the expected impact on innovation in the immediate neighbourhood of the research institution. However, it may act as a catalyst for innovation in surrounding areas.

HEIs can facilitate the trickle-down of innovations to local economies through two different approaches. The first approach involves direct impact: HEI researchers themselves can commercialise their research and then generate and improve local innovation. The second approach entails collaboration between HEIs and local firms, facilitating the dissemination of research innovations at the local level through university–industry collaborations. We attempt to empirically differentiate these two distinct paths of HEIs' innovation.

To improve our approach for capturing knowledge transfer between universities and industry, we refine our data processing to establish a more precise link between patents and academic publications. Given the limitations in the OECD REGPAT and Scopus datasets – particularly relating to the lack of detailed information on patent applicants and publication authors – we incorporate additional data sources to better track knowledge flows. Specifically, we use the patent-to-paper citation database referenced in Marx and Fuegi (2022), which allows us to

Table 6. higher education institution (HEI) research capacity and innovation in Sweden, cited HEIs' research-owned patents versus industry-owned patents.

(A)	**Cited HEIs' research-owned patents (logged)**			
	(1)	**(2)**	**(3)**	**(4)**
Ln (pub. rate) of local areas	0.561**	0.556**		
	(0.224)	(0.223)		
Ln (pub. rate) of neighbouring areas	0.707***	0.700***		
	(0.124)	(0.124)		
Ln (cit. rate) of local areas			0.170***	0.169***
			(0.0547)	(0.0546)
Ln (cit. rate) of neighbouring areas			0.713***	0.705***
			(0.123)	(0.123)
R^2	0.582	0.582	0.582	0.583
(B)	**Cited industry-owned patents (logged)**			
	(5)	**(6)**	**(7)**	**(8)**
Ln (pub. rate) of local areas	−0.0862***	−0.0894***		
	(0.0116)	(0.0119)		
Ln (pub. rate) of neighbouring areas	−0.0735***	−0.0779***		
	(0.0260)	(0.0261)		
Ln (cit. rate) of local areas			−0.0285***	−0.0294***
			(0.00315)	(0.00318)
Ln (cit. rate) of neighbouring areas			−0.0742***	−0.0787***
			(0.0260)	(0.0260)
R^2	0.395	0.396	0.395	0.396
Neighbourhood fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
Sample	All	Urban areas	All	Urban areas
Observations	43,381	41,717	43,381	41,717

Note: Robust standard errors are clustered at the neighbourhood (RegSo) level.
***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

identify patents that cite academic publications. Using patent IDs, we matched the complete set of Swedish patents in the OECD REGPAT database with this citation database. Of the initial 80,081 patents in the OECD REGPAT dataset for Sweden, 14,064 (17.56%) contained citations to academic articles. This subset provides a clearer picture of knowledge transfer, as patents citing academic work are more likely to be directly influenced by research outputs from HEIs.

We further enrich the analysis by classifying the cited patents into two distinct categories. First, using author affiliation information from the patent-to-paper citation database, we identify whether the cited publications originated from universities. Next, we check the geographical location of both the HEI and the patent applicant, using the OECD REGPAT dataset to determine the region of the patent applicant. If both the HEI and the patent applicant are located within the same geographical region, we classify these as 'Cited HEIs' research-owned patents', representing direct innovation activities by HEI researchers. If the cited university and the patent applicant are from different regions, we classify the patents as 'Cited industry-owned patents'.

By refining our classification in this way, we aim to distinguish between direct HEI-led innovation and broader industry-driven patenting activities that cite academic work.

Table 6 presents the effects of HEIs' research capacity on cited HEIs' research-owned patents and industry-owned patents in panels A and B, respectively. According to the findings in panel A, there is a significantly positive relationship between HEI research capability and HEI-owned innovation in both local and adjacent areas. This evidence supports the idea that when HEIs endeavour to transfer research outputs into innovation themselves, research capacity remains an effective channel for promoting local innovation. However, in panel B, we found that HEIs' research ability has a significantly negative correlation with the improvement of cited industry-owned patents, which implies that HEIs' research excellence offers no tangible benefits to local firms' innovation.

Integrating the above findings, our results point to an inadequate communication between HEIs and local firms as the primary cause of the innovation dilemma in HEIs' research capacity. In Sweden, the integration of new HEI knowledge at the local level is impeded by a significant mismatch between the type of knowledge produced and the needs of local businesses. Additionally, ineffective university–industry collaboration systems may also hinder this process, or both factors may concurrently affect it. On one side, HEIs' recent drive for research excellence – aimed at increasing public funding and boosting global rankings – has led researchers to prioritise research that does not necessarily align with local economic realities. On the other side, despite traditionally strong university–industry ties, the actual mechanisms facilitating these connections may not be as effective as expected. This discrepancy, along with varying incentives and goals between HEI researchers and business professionals, limit the potential for university research to contribute to local economic level. Consequently, the new knowledge generated by HEIs is not as easily absorbed by local firms as theories predict (Acs et al., 1994; Piergiovanni & Santarelli, 2001; Zucker et al., 2007).

7. CONCLUSIONS

Investment in HEIs' research capacity is often touted as a universal solution for local economic development. Many countries globally have increased their public R&D investments not only to achieve higher innovation levels but also to revitalise the economic landscape of regions through new knowledge generated by HEIs. This paper presents the first systematic evidence of the relationship between the research capacity of HEIs and local economies at the neighbourhood level in Sweden. The results indicate that although Swedish HEIs' research capacities – boosted by strong government support – have increased significantly and become comparable with some of the world's top institutions, their impact on the local economy has been limited. Our findings reveal no substantial link between HEIs' research intensity and neighbourhood income levels. In some cases, we even observe a negative relationship between HEI research and local income. The heterogeneity analysis suggests that this negative impact is particularly associated with the establishment of new HEIs following the decentralisation reform, highlighting that increased research capacity does not automatically translate into positive economic outcomes.

The dissociation between HEIs' research capacities and local economic performance in Sweden prompts an investigation into two key channels – human capital and innovation – through which HEIs could potentially influence economic level. When integrating human capital measures into our baseline analysis, we find a persistently positive correlation with local income levels within the Swedish context. Notably, when human capital is accounted for, the detrimental effects of HEI research capacities on economic indicators are mitigated. The mitigation of the negative effects of research capacity when controlling for human capital suggests that a focus on talent retention and development is essential. At the same time, prioritising research over teaching and community engagement may inadvertently contribute to a 'brain drain,' as local graduates leave to seek better opportunities elsewhere.

Furthermore, the limited capacity of many local economic sectors in Sweden to assimilate the type of knowledge produced by HEIs further complicates matters. Our findings indicate that, given the Swedish legal framework allowing HEI researchers to retain IP ownership, pursuing independent university research remains an effective strategy for enhancing regional research capacity. However, transforming knowledge and innovation into tangible economic outcomes presents significant challenges. University–industry linkages are less effective than anticipated. This shortfall may

be a consequence of insufficient proactive engagement by both HEIs and firms. Primarily, a notable discrepancy and mismatch exist between university research outputs and the needs of local businesses. Despite increased research funding preserving the advanced nature of university research in Sweden, this focus on research intensity could occasionally deter industry collaboration (Maietta et al., 2017). Firms are more likely to collaborate with HEIs on projects that closely align with their immediate market needs (D'Este & Iammarino, 2010; Johnston & Huggins, 2017; Laursen et al., 2011). Without robust collaboration from project inception, forming partnerships mid-project becomes increasingly challenging. Additionally, Swedish HEIs often lack proactive initiatives to establish links and communication channels with local firms, with many institutions adopting a relatively passive stance. The absence of career progression and financial incentives for researchers to engage with local businesses further exacerbates this issue. Consequently, HEIs' third mission – contributing to the local economic and social ecosystem – is often overshadowed by their research objectives.

Given the egalitarian treatment of all HEIs within the Swedish higher education system, many institutions have similarly prioritised research excellence. However, the findings of this study suggest that this approach may not be the most effective for fostering economic dynamism. To address this, we propose several strategic recommendations.

First, HEIs should be encouraged to maintain a more balanced allocation of resources between research and teaching. This would help retain local talent and create a more supportive environment for human capital development within the region.

Second, the mechanisms to foster robust partnerships between industry and HEIs should be strengthened. This can be achieved through policies that incentivise collaborative projects from their inception and through funding platforms or networks that enhance communication and ongoing dialogue. These efforts will align university research with the immediate needs of local businesses and contribute to bridge the gap between academic research and the practical demands of the local economy that is in evidence across Sweden today.

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DATA AVAILABILITY STATEMENT

The data are available from the authors upon request.

DISCLOSURE STATEMENT

No potential conflict of interest was reported by the authors.

NOTES

1. Data for Figure 1 were collected from the OECD Main Science and Technology Indicators (MSTI).
2. For a more detailed introduction to RegSo, see Statistics Sweden, https://www.scb.se/en/services/open-data-api/open-geodata/regso–regional-statistical-areas/.
3. Polygons of urban areas/localities can be achieved via https://www.scb.se/en/services/open-data-api/open-geodata/localities/. We do not conduct our spatial analysis at this urban dimension because this urban area/locality level only depicts the geographical distribution of residents, but no other socio-economic indicators are available.
4. We define metropolitan areas using the functional urban area standard. According to this standard, Sweden has 12 metropolitan areas.

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