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**The Entrepreneurship-Philanthropy Nexus:
Implication for internationalization ¹**

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The Entrepreneurship-Philanthropy Nexus: Implication for internationalization

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Abstract

This paper examines how Sweden and the United States have been impacted by philanthropic activities, commercialization of university-based knowledge and international entrepreneurship. The analysis comprises a detailed case study of Swedish and U.S. universities, as well as a statistical analysis of the impact of philanthropy on economic growth. The results show that the United States has prompted a university system based on competition and variety, with an emphasis on philanthropy, promoting knowledge creation. International entrepreneurship has been an important mechanism by which this knowledge is globalized leading to increased economic growth. Conversely, Swedish universities were characterized by less commercialized R&D and weak links to the commercial sector, rooted traditionally in dependence on tax-financed and homogenous university structure. The Swedish model has begun to change with important implications for development in smaller domestic markets. The analysis has important implications for knowledge creation as a source of economic growth through international entrepreneurship taking advantage of globalization, especially for smaller countries.

Keywords: Philanthropy, entrepreneurship, growth

JEL classification code: O3, M13, M14

1. Introduction

In this paper we focus on an often-neglected link between the academic and commercial sectors that distinguish the U.S. from Europe by examining the roles played by philanthropic private funding in knowledge creation and the role of international entrepreneurship in global commercialization—what Acs and Phillips (2002) call the entrepreneurship-philanthropy nexus. Philanthropy, as opposed to charitable donations to the poor and needy, is designed to augment knowledge in either existing or new organizations (Acs and Dana, 2001). It is in this context that philanthropy may have an impact on growth - by contributing to the accumulation of knowledge (America, 1995; Sachs, 2000) that can serve as a basis for entrepreneurship internationally. Several of the most distinguished U.S. universities were initially financed by philanthropic donations from wealthy entrepreneurs. Institutions such as universities of Chicago and Duke, Harvard, Johns Hopkins and Stanford are a few examples.

Philanthropy can generate knowledge accumulation in several unique ways. *First*, philanthropic donations increase the amount of resources available for research (Barro, and Sala-i-Martin, 1998). *Second*, government grants and similar sources of funding may be more risk-averse than donations coming from wealthy individuals. Government grants can be restricted by different regulations, forcing a major part of funding to go into mainstream areas of research. Hence, private donations are likely to fund a greater variety and even a greater portion of knowledge creating activities (Pfeffer and Salancik 1978, Letts, Ryan and Grossman, 1997). The U.S. government has long recognized the importance of philanthropy in this respect. Already in 1965 the Treasury Department described philanthropy as being “...*uniquely qualified to initiate thought and action, experiment with new and untried ventures, dissent from prevailing attitudes, and act quickly and flexibly* (emphasis added)” (Toepler and Feldman 2003). *Third*, a donation from wealthy entrepreneurs could also influence the culture and attitudes of knowledge producing entities. In particular, the links to

the private sector and willingness to engage in unrestricted, if not global, commercial activities could distinguish between private (entrepreneurially-initiated) and governmental initiated knowledge centers. Traditionally, philanthropically funded knowledge creating projects have been open to all, including international scholars, while government funded projects have been restrictive. Thus philanthropic-initiated projects have contributed more to internationalization of entrepreneurship than government supported initiatives. These observations resonate with the arguments of path dependence (Rosenberg 2003). Rosenberg (2003) claims that there is a “path-dependence” in the culture and attitudes of knowledge-intensive environments that can be traced back to the founder of universities and other knowledge centers² That have resulted in increased entrepreneurship, knowledge and wealth creation domestically and internationally.

Although these are the three main ways necessary for philanthropy to influence the links between the academic research community and economic growth, they are not sufficient. To close the process we also need agents that can exploit the knowledge created, such as the entrepreneur. Envision a cycle where successful entrepreneurs donate to knowledge creating entities, which is eventually exploited by entrepreneurs, leading to the creation of new fortunes that can again be invested in knowledge creating entities. When philanthropy is combined with entrepreneurship, the two become a potent force in explaining the long run dominance of the American Economy. This system is today in the process of being exported globally as knowledge, entrepreneurship and economic growth are all becoming internationalized (Acs and Yeung, 1999a and 1999b).

Sweden Versus the United States. The reason why we have chosen to compare Sweden and the United States is because these countries represent different traditions and institutional set-ups (Braunerhjelm and Thulin (2003) and Karlsson and Acs, 2002). Sweden can be viewed as the extreme outcome of Bismarck’s vision of the welfare state, thereby capturing a

political paradigm that influences all European countries. The Swedish university structure is characterized by a centralized and politically organized system. No other country has invested as much in R&D as Sweden. Yet, relatively little seems to show up in terms of new technologies, goods and services, or the establishment of new high-technology industries (Karlsson and Acs, 2002). The U.S. on the other hand has put more emphasis on competition, variety and market-governed processes when handling the university sector. The resulting environment has been highly conducive for technological entrepreneurship. In fact, the origin of most of the last decade's global technological renaissance can be found in the United States.

Complementary Methodologies. To understand how philanthropy and entrepreneurship may fuel economic growth, we use two complementary methodologies: case studies in addition to statistical analysis. Case studies will be used to compare Swedish and U.S. universities qualitatively. We concentrate the analysis to the natural science and technological departments and institutions at the universities. The case studies will explore the extent to which philanthropy is positively associated with commercialization of university-based research through better links with the commercial sector and will also examine whether philanthropy has helped to preserve, if not cultivate, a more entrepreneurial culture within the universities.

The qualitative analysis of case studies will be complimented with a statistical analysis of the impact of donations on growth. As far as we know, philanthropy has never been included as a variable in growth estimations. Based on U.S. data, we will undertake a time series analysis stretching over a 30-year period. For Sweden, we will present an analysis on cross-sectional data covering Swedish regions in one given year. The purpose is to isolate the effect of philanthropy on growth as we control for other factors (company based R&D, investments, taxes, entrepreneurship, etc.).

Finally, we push the frontier by examining the global implication of the entrepreneurship-philanthropy nexus. We see globalization as a Schumpeterian evolutionary process on a global scale. The internationalization theory assumes that indigenous firms usually have advantage over outsiders. Foreign entrants need to possess unique superior capabilities to overcome indigenous firms' home court advantage. These are information-based capabilities in technology, production marketing and management, which are often referred to as intangibles. The entrepreneurship-philanthropy nexus suggests that philanthropy plays an important role in knowledge creation and that international entrepreneurship is an important vehicle for increasing economic growth rate and wealth creation in the global economy (Acs and Phillips, 2002).

Following this introduction, Section two discusses endogenous growth theory and examines the extent to which these theories have gained empirical support. Section three discusses the role of philanthropic donations in creation of knowledge. Sections four and five contain the case studies for the U. S. and Sweden. While section six presents a comparison of the commercial activities in Swedish and U.S. universities. Section seven presents the statistical analysis and Section eight discusses the implication for internationalization. The final section presents the conclusions, where we find philanthropy-based knowledge creation can stimulate, if not lead to, commercialization of knowledge broadly through international entrepreneurship with important lessons for small countries such as Sweden.

2. The Determinants of Economic Growth

This section starts by examining the determinants of economic growth as they might relate to the creation of new knowledge by philanthropy. The seminal contributions of Solow (1956, 1957) made it clear that after accounting for the contributions provided by additional labor and capital there remained a sizeable part of growth to be explained.³ Solow attributed that

unexplained part of growth to technical progress and knowledge enhancing processes in general. The effect became known as Solow's "technical residual".

The insight that knowledge was crucial in propelling growth was far from new; Already Alfred Marshall (1879) had already claimed: "knowledge is the most prominent engine of growth".⁴ Still, it took almost a century before knowledge was included into the standard theoretical growth models (Romer 1986, Lucas 1988).

As evident from Figures 1 and 2 knowledge alone does not explain the differences in growth between Sweden and the U.S. The U.S. has invested considerably less in knowledge than Sweden, measured as total expenditures on research and development (R&D) in relation to GDP (Figure 1). Still, it is clear that U.S. has outperformed Sweden in economic growth (Figure 2). After paralleling the U.S. between 1960 and 1975, Sweden started to fall behind. This difference has become more pronounced in the 1980s and the 1990s. It means that 100 USD in 1960 would be worth almost 400 USD by 2001 in the U.S., but only 250 in Sweden.

One reason could be more sizeable outlays on R&D in the U.S. in absolute terms. A more likely explanation is that a number of other factors also influence growth, including demographic factors (age structure), legal institutions, structure of financial markets, and, more recently, entrepreneurial activity. Sweden and the U.S. differ considerably with respect to these factors. Sweden is a much less entrepreneurial country and much less effort has been made by internationally-oriented firms through, for example, the so called "born Globals" to commercialize the wealth of knowledge generated by the Swedish universities globally. Another variable, where we detect large differences between the two countries, is philanthropy, which may constitute the link between university-based knowledge, commercialization through international entrepreneurship and incremental growth rates leading to added employment and wealth creation.

3. Philanthropic Donations and knowledge

This section starts with a brief comparison of the structure, depth, and objectives of Swedish and U.S. philanthropy. With respect to foundations engaged in philanthropic activities, Sweden hosts approximately 14,000 foundations with a total endowment of USD 24 billion (year 2000). Total donations amount to about 500 million to 700 million USD. In the U.S. 60,000 foundations exist, holding estimated assets of 450 billion USD. These foundations donate about 27 billion USD a year (2002). However, total donations are valued close to 240 billion USD in the U.S. Most of the difference between total donations and foundations' contribution is made up by private individuals, who account for approximately 76 percent of donations in the U.S. (Figure 3). Although in Sweden, as in most other European countries, individuals play a minor role in total donations, the exclusion of their contribution leads to a clear bias ⁵. Table 1 summarizes and compares information about the extent and directions of donations in Sweden and the U.S.

Over the years, philanthropy has assisted in financing and promoting education and research at the universities. Within the U.S., universities differ in the degree in which they are impacted by philanthropy. U.S. universities have different traditional relationships with the commercial sector that are a function of a variety of influences, including the university's founding history and the role played by philanthropists in setting the course for the universities.

Swedish universities are not unlike their U.S. counterparts, but their relationships with the commercial sector and benefits from philanthropic contributions differ in general and there are differences between universities in particular. Swedish universities have historically relied on public research funding more than U.S. universities. Still, for several of the institutions we studied, there have been involvements by philanthropists, or at least private initiatives, to start the universities. However, private involvement largely withered away

between the late nineteenth century and early 1990s, particularly after the Second World War. Interestingly, there has been a resurgence of philanthropic contributions aimed towards Swedish universities during the last decade or so. During this time period, Swedish universities received an increase in private funding in the range of 50–100 percent. Conversely, during the surge in private funding, governmental funding has flattened out, decreased or expanded at a significantly lower rate. The Swedish universities are thus becoming more dependent on private funding.

The two systems have their own different strengths and weaknesses. During the nineteenth century, when the modern university system was developed, philanthropists had a large influence on U.S. universities. During the twentieth century, the influence of philanthropists gradually diminished and today most universities are run by well educated “wage earner collectives” – such as academics and professional university administrative staffs (Glaeser 2002). Still, the evolutionary process in the U.S. university system seems to have encouraged variety and competition (See for example Jencks and Riesman 2002). Although the Swedish model guaranteed a funding system independent from the private sector long ago, but resulted in the prevalence of “governmental” culture and homogeneity developed in Swedish universities.

The U.S. invests considerably larger sums in university education. In relation to GDP, the U.S. share is about twice as large when compared to the average for the EU countries, and 25 percent larger than in Sweden including private and public expenditures (Aghion et al, 2003). If we focus the analysis on public funding of research in universities and technical colleges, Figure 2 reveals that there has been a decline in both Sweden and the U.S., albeit more pronounced in Sweden. Unfortunately for the Swedish system, the decline in public funding has not been counteracted by larger inflows of private funding, except for a period for briefly during the latter part of the 1990s.⁶

By comparing universities embedded in different traditions and exposed to different financial systems and opportunities, we examine whether there are differences in the diffusion of knowledge-related growth variables to the private sector. This will be done in a two-step fashion. We will first compare universities originating by philanthropic donations with universities based on tax funding in the country and then we will compare the universities across their respective countries.

4. U.S. universities

The two universities chosen for this study are likely to be representative of the typical U.S. university: Cincinnati University (CU) and Case Western Reserve University (CWRU). While CU is a public university CWRU, is a private university and they are both located in Ohio. The choice of Ohio, as shown in Braunerhjelm and Carlsson (1999), is similar to Sweden in many respects: size, industry-structure, size-distribution of firms, etc. We include Stanford University as a control since it is a unique model of the entrepreneurial university.

Stanford University. In terms of economic impact perhaps no university can claim a greater economic impact in the last quarter of the twentieth century. Stanford is in fact the model to which all other communities aspire. The University has a technology transfer staff of almost 25 full time individuals, almost ten times the effort of either Cincinnati University or Case Western Reserve University. The University had 252 invention disclosures in 2000, filed for 240 patents, received 98 patents, and had licensing income of \$34,603,000.

Knowledge and Wealth Creation. What role has knowledge creation at Stanford played in creating economic growth in the region and beyond? Stanford built a community of scholars and a world-class network. Its graduates have been responsible for the founding of many of the greatest high-tech companies in the world. The list includes Hewlett Packard

1939 (William Hewlett and David Packard), Silicon Graphics 1982 (James Clark and six others), Cisco Systems 1984 (Leonard Bosack and Sandra Lerner), Excite 1993 (Ben Lutch, Ryan McIntyre, Graham Spencer, Mark Van Haren) and many others. Today Silicon Valley is the home of 33 of the 100 largest high-tech firms launched since 1965 including Oracle, Sun Microsystems, Netscape, 3Com, Cisco Systems, Intel, National Semiconductor, Fairchild Semiconductor Seagate, Excite and Yahoo. Silicon Valley also has one of the highest shares of small high-technology firms with fewer than 20 employees – 55.9 percent – and one of the highest shares of locally-owned high tech firms – 65.9 percent – of any American city. These entrepreneurial firms can easily propel to international markets because of the innovative nature of products and services.

The commercialization of knowledge plays a major role in both domestic and international growth through international entrepreneurship. Consider for example, that many university-based inventions, with or without patents, can be exploited by foreign firms first (e.g., The global success of Honda is attributed to its use of Stanford' improvements in internal combustion engines in its early days). International commercialization provides much larger income from the intellectual property/knowledge. But, the impact is much broader than higher license fees.

The Stanford Formula. Why has Stanford achieved such prominence? There seem to be two chief explanations: First the size of the original endowment of eleven million dollars and 8,000 acres of land in the Valley, which gave Stanford University its initial financial edge. Today the endowment of Stanford is fifty percent greater than that of the whole University of California system. Second, the vision of Leland Stanford was that “practical education” should be pursued, a vision that is proved every day more than 100 years later.

On November 11, 1885, Stanford dedicated the founding grant at his country house. The document, accepted by the 24 members of the firsts board of trustees, defined the scope,

responsibility and organization of the University, which stands as the University's constitution:

....to qualify students for personal success and direct usefulness in life: and promote the public welfare by exercising an influence on behalf of humanity and civilization, teaching and blessings of liberty regulated by law, and inculcating love and reverence for the great principles of government as derived from the inalienable rights of man to live, liberty and the pursuit of happiness.

The size of the initial endowment was considerable. In 1898, after the death of her husband, Mrs. Stanford sold her railroad holdings and turned over \$11 million to the university trustees plus some of the original buildings. In one century, Stanford grew into one of the best universities in the United States, if not the world. In 2002, the University had 13,317 full time equivalent students, the fourth-largest endowment of \$7,612,767,540, a total research budget of \$806 million, ranked second only to Johns Hopkins University, and an operating budget of \$1,598,577.556.

The consolidated budget for operations includes all non-capital revenues and expenses. For 2002–03 the largest source of revenues was from sponsored research support (36 percent), endowment income (18 percent), students' income (15 percent), other income (13 percent), health care services (8 percent), expendable gifts (6 percent) and other investment income (4 percent). Government funding, except for research, is tiny.

The impressive endowment income of the University is born out of the annual giving to Stanford. In 2002, annual giving more than half a billion dollars (i.e., totaled \$454,769,463.00), second only to Harvard University. The distribution of total giving was 26 percent from alumni, 4 percent from parents, 40 percent from other individuals, 18 percent from foundations, 7 percent from foundations and 4 percent from other sources – all with philanthropic intentions. There was a 150 percent increase in donations to Stanford between

1993 and 2002. These funds were almost evenly split between gifts to current operations and capital purposes making a very significant contribution of \$215,010,501.00 to current operations. Figure 3 illustrates Stanford's revenues distributed on private and public sources per student during 1992 to 2000.

Case Western Reserve University. To ensure the economic impact of its research activities CWRU maintains a large staff dedicated to technology transfer. Over the last decade, a staff of five full time professionals has operated the office. In 2000 the office received 54 invention disclosures, filed for, and was granted, 38 patents. It executed 23 patents and 5 licenses. This created an income of \$1,244,576 from licenses. Legal fees accounted for \$632,906. The number of start-up companies out of CWRU only averages about one a year. Of course this does not account for companies that are started without the help of the University. Over the decade of the 1990 we can see that the efforts of CWRU have resulted in doubling of the licensing fee income from \$613,000 to over \$1,244,576; and the number of patents issued tripling from 6 to 23.

In 1967 a federation of the two institutions (Western Reserve University and Case Institute of Technology) was created and named Case Western Reserve University. The new entity became one of the leading universities of the country. In 2001 CWRU had full time enrollment of 8,226 graduate and undergraduate students, an endowment of \$1,434 million, an annual giving of around \$1 billion dollars, and a budget of \$464 million. CWRU ranks in the top 25 universities in the United States in terms of endowment.

In 2002 the University relied on endowment income of \$55.4 million (12 percent of its operating revenue). Tuition and fees accounted for \$149 million (32 percent), research for \$143.9 million (31 percent), gifts and grants for \$30.6 million (6 percent) and recovery of indirect costs for \$48.5 million (10 percent). State appropriations accounted for \$5.4 million

(1 percent) and auxiliaries made up the rest. While data going back on the endowment is not easily available, figures over the last ten years tell an interesting story. CWRU's total giving in 2002 from alumni, parents, individuals, foundations, corporations, religious organizations and other organizations was \$100,130, 987. The purpose of these gifts is divided between \$65,083,179 for current operations and \$27,005,143 for capital purposes with \$8,042,665 for deferred giving. The distribution between private and public sources of revenue per student is shown in Figure 3.

University of Cincinnati. University of Cincinnati is a large urban university today with 25,340 full time equivalent students, an endowment of \$824, 469,231 and expenditures of \$597,977,711. The University has 2,366 full time faculty, 1,938 part-time faculties, and a total employment of 13, 410. Each year UC graduates 5,000 students. The revenues of UC are different from CWRU. UC relies on 25 percent of its revenues from tuition and fees, 30 percent from state assistance, 15 percent from federal grants and contracts, 5 percent from endowment income, 4.5 percent from private gifts and the rest from auxiliary income. UC's research budget in 2000 was \$172,085,000 . This kept it in the top 50 research universities in the country. The university's federal grants account for 30 percent of its revenues, which amounts to half of the total value of both CWRU's and Stanford's federal grants. Similar to CWRU, UC receives a large share of its Federal Funds for the Medical School. UC also has a technology transfer office. As compared to CWRU, UC does not leave as large a footprint in terms of economic impact as CWRU. This might be traced in part to UC's much larger teaching mission and in part traced to its smaller endowment.

It was the munificent bequest of Charles McMicken to the city of Cincinnati, which finally laid the foundation for the University of Cincinnati. In his last will and testament in 1855, Charles McMicken bequeathed \$900,000 to the City of Cincinnati for McMicken

College. Pursuant to the Municipal University Act passed by the Ohio legislature, City Council in December 1870, elected a Board of Directors for the University of Cincinnati. The College of Engineering started with the appointment of a professor of civil engineering in 1874 culminating in the establishment of the College of Engineering in 1900. In 1968 UC became a “municipally-sponsored, state-affiliated institution” and in 1977 one of Ohio’s state universities.

Annual giving received by UC in 1993 amounted to \$32,788,400 from all sources. Annual giving has increased steadily over the years and grew especially rapidly during the past few years reaching \$131,474,697 in 2002. The largest share of that, 54 percent, came from individuals that are not alumni. While fluctuating over the years, alumni giving averaged about \$15 million or about 20 percent of total giving. In most years, corporations have been the largest source of giving at UC, averaging more than 30 percent of all giving. The purpose of these funds, however, differ from that of CWRU. While at CWRU the largest part of funds was for current operations, at the UC the largest part is for capital purposes.

The total endowment of UC in 2000 was \$909,268,000 topping \$1 billion in August. During the 1990, UC ranked close to the fortieth largest university in terms of the market value of its endowment (in the same ranking, CWRU placed twenty-fourth and Stanford University placed fifth). In Ohio it ranked third in total endowment behind CWRU and Ohio State University. Figure 3 illustrate revenues distributed on private and public sources per student. To sum up the U. S. situation, universities are important outlets in funneling private funds and play a crucial role in creating incremental social and financial wealth. The total endowment of U. S. universities is astonishing on a global scale. Furthermore, the universities allow international entrepreneurship to flourish thereby using knowledge created in the universities to create commercial opportunities leading to new wealth creation globally.

5. Swedish Universities

In selecting Swedish universities for the analysis, there is less risk of picking unrepresentative cases. Sweden's population is smaller and the universities we have chosen in the Gothenburg and Stockholm regions are large enough to represent the entire Swedish university sector. To make the Swedish cases comparable to the U.S. universities, we have included not only the Gothenburg and Stockholm universities, but also engineering and medical schools. Hence, in addition to Gothenburg University we also examine Chalmers University of Technology as well as Stockholm University, the Royal Institute of Technology, the Karolinska Institute (specialized in medicine and biotechnology) and the Stockholm School of Economics, albeit to a lesser extent, in Stockholm Region.⁷

An institutional difference between Swedish and U.S. universities makes it difficult to compare commercialization of academic knowledge. The basic reason is that the Swedish system gives the individual – not the university – the proprietary rights to research results, even though research is funded by the universities. In the U.S. the Bayh-Dole Act of 1989 implied that universities have the proprietary rights to developing commercial opportunities based on academic research.⁸ Hence, the data from available sources will only allow us to paint a partial picture since we will be missing much of the commercial activities undertaken without involving universities.

It was not until the 1990s that there was a shift in political attitudes regarding the role that Swedish universities should play in the commercialization process. Universities' roles were redefined to include active participation in the commercializing knowledge, in addition to the academic research and teaching, which had been their previous dominant focus. During the liberal government in 1991 to 94, new support institutions were outlined to enable a closer cooperation between the universities and the business sector. Resources were earmarked for

seven bridging institutions and eleven holding companies were established in 1994 and 1995 specifically aimed at promoting commercialization. They came into action a few years later.

Universities in the Stockholm Region. In 2001, the Stockholm University had about 2,200 employees involved in teaching and research, among those about half were associated with Natural Sciences. The same year the number of students exceeded 34,000, where approximately 3,000 belonged to the natural sciences. The University's revenues came close to 2.5 billion Swedish kronor.

The basis of the Stockholm University was a small-scale education in natural sciences that started in 1878. In 1904, the College became an official degree granting institution and a few years later Stockholm College graduated its first PhD student. But it was not until 1960 before Stockholm College formally became a state university and four years later the Faculty of Social Sciences was added. In 1970 the University moved to Frescati, just outside Stockholm. Today it consists of 80 institutions, within four faculties: Humanities, Law, Social Sciences and Natural Sciences.⁹

The Stockholm University has always been heavily dependent on governmental financing. Per student revenues have slightly increased in real terms over the last decade, excluding the last few years (Figure 6).¹⁰ The amount of funding coming from private sources has increased approximately 150 percent since the mid 1980s, albeit from very low levels (Figure 7). Despite that impressive increase, the private share only accounts for about 6 percent of total revenues.

The Karolinska Institute. KI was founded in 1810 on the initiative of King Charles the XIIIth after the defeat in the Finnish War of 1808–09 against Russia. At that time, one third of the wounded died in field hospitals. The Army surgeons' medical knowledge was evidently

insufficient. Among the founders of KI was Jöns Jacob Berzelius. His outstanding research in chemistry laid the foundations of the university's natural scientific orientation. In 1861 there were 8 professors and 133 students. In the same year the Institute gained a status formally equal to that of a university.

Early confirmation of the standing of KI in the natural scientific field came in 1895. In that year Alfred Nobel appointed the Institute to decide who was to be awarded the Nobel Prize in Physiology or Medicine. This work has since afforded the Institute a broad contact network within the medical scientific community.

KI has expanded a number of times over the years, where new and complementary fields have been added to the Institute's traditional area. Research at KI is mainly conducted at 28 departments in the Stockholm region, all belonging to the medical field, including surgical sciences, genomics, molecular biology, bioinformatics, neurosciences, and much more (See www.ki.se for detailed descriptions). The staff involved in teaching and research was 1,772 in 2001, and the number of students about 6,900 in 2001. Total revenues reached somewhat more than 3 billion Swedish kronor.

Figure 4 illustrates a decreasing trend in real governmental funding since the early 1990s. In 2001 the governmental funding per student was lower than in 1990. In the latter part of the 1990s KI became increasingly dependent on private funding (Figure 7). In relation to the number of students, governmental funding decreased by 40 percent between 1990 and 2000/2001, whereas private sources increased by 48 percent.

The Royal Institute of Technology. The origin of the Royal Institute of Technology in Stockholm (KTH) goes back to 1827, when the *Technological Institute* began to offer education in technological subjects with a strong professional orientation. Its education program was meant to be “popular as well as practical”, as the industrialization process of the

modern Swedish society was then getting under way, which called for a school that could meet the ever-increasing demand for engineers. Thus the educational focus of the new institute was set on applied technology and not its scientific foundations.

The approach was highly controversial. When viewing the early history of KTH, this clash between industrial and academic perspectives was in fact seen as a constant element of concern, as the desire to give scientific authority to the subject of technology collided with society's demand for a practical approach to engineering in all its aspects. When the School of Mining was incorporated in KTH in 1867 the four established main branches of study became those of Mining Science, Mechanical Engineering, Chemical Technology & Engineering and Civil Engineering. Other subject areas have then been constantly added – Building Architecture in 1877, Electrical Engineering in 1901, Naval Architecture in 1912, Surveying and Engineering Physics in 1932, Computer Science in 1983, and Industrial Economics in 1990. One activity, designated as high priority for the next few years, will be the establishment and development of Information Technology research at KTH in the Kista Science Park just outside Stockholm.

In 2001, teaching staff and researchers amounted to almost 2,000, while the number of registered students was 13,700. Overall revenues were close to 2.5 billion Swedish kronor, and in absolute terms there has been an increase in real revenues. However, also here it is notable that the private share has increased while the share of governmental funding has decreased (Figures 8 and 1). To summarize, in the Stockholm region universities have been predominantly financed through governmental means, which seems to be a difference as compared to Gothenburg.

Gothenburg University. We will look at two entities in the Gothenburg region: Gothenburg University and Chalmers University of Technology. Commencing with the Gothenburg

University, the municipality board concluded in 1887 that a college was needed in Gothenburg and seven professors were installed in 1891. Yet, the initiative came from the private side and during the first 10 years of its existence, the University was completely dependent upon donations from wealthy Gothenburg families (Ekman, Röhss), but also donors from other countries were involved (for instance Carnegie). Fifteen years after its establishment, the college was declared a state university, with the same status and position as the two already existing state universities in Uppsala and Lund.

However, it took until 1954 before Gothenburg University was formally founded through the amalgamation of this College with the Medical College, which had been established in 1949. Later on the Faculty of Deontology (founded in 1967) and the School of Economics and Commercial Law (founded in 1923) were incorporated into the University. Recently Gothenburg University has decided to take part in the establishing of an “IT-university”. Today it is the second largest university in Sweden (See www.gu.se for more information. In 2001, the number of employees amounted to 2,556, about 45 percent belonging to natural sciences. The number of students exceeds 33,500, the overall majority was in the social sciences, and total revenue was roughly 3.5 billion Swedish kronor. There has been no increase in governmental funding since 1990 (Figure 6), and also private funding have remained roughly constant in the last decade (Figure 7). Currently the private funding is twice as large as compared to Stockholm University.

Chalmers University of Technology. Chalmers is the only higher education establishment in Sweden that is named after an individual. It has its origins in the “Industrial School”, which opened in Gothenburg on 5 November 1829 under the name *Chalmersska Slöjdskolan* [Chalmers School of Arts and Crafts] – entirely funded with the funds bequeathed by William Chalmers (1748–1811), director of the Swedish East India Company.

The school grew steadily and from 1836 it received a certain amount of governmental support and gradually began to become incorporated in the national education system. After 57 years in the state sector, Chalmers University returned to its roots on the first of July 1994, when it ceased to be a state-owned institution and became an independent foundation. The new statutes, which replaced the previous ordinance, gave Chalmers greater freedom of action and more scope for exploring new paths. Presently they have about 9,400 students, of which 20 percent are involved in research. Overall, an impressive 40 percent of Swedish engineers and architects have a background from Chalmers.

Chalmers is organized around 10 so called sections, all related to natural sciences, where the teaching staff exceeds 1,500 (2001). Total revenues amounted to just below 2 billion Swedish kronor in 2001, roughly 50 percent is devoted to research. Adjacent to Chalmers is also a science park, hosting research departments and a number of other institutions. Looking at Chalmers' revenues, a minor increase in governmental funding is revealed since the mid 1980s (Figure 6). Most striking is that a strong increase has occurred in private funding since mid 1980s (Figure 7). Between 1995 and 2000 private funding per student increased by about 500 percent and by 2001, private research funding exceeded governmental funding.

To sum up, the Swedish universities have been creating knowledge both historically and recently. However, the universities have not been allowed to commercialize and therefore not play a major role in economic growth in part because of the relatively small role played by philanthropy in funding them. While for both the U. S. and Swedish universities commercialization and international entrepreneurship were important, Sweden's smaller domestic market makes international entrepreneurship even more important in Sweden than in U.S. Swedish multinational must commercialize internationally to succeed because of the much smaller economic base from which they operate. This, suggests that the Swedish

growth can be enhanced even more by commercializing knowledge internationally beyond Sweden through international entrepreneurship.

6. A Comparison of U.S. and Swedish universities

The volume of private sector donations to universities has increased in both Sweden and the U.S. yet we find not only considerable differences between countries, but also between universities within the respective country. Stanford and Case Western Reserve Universities, both private and originated by in private donations, outperformed the other universities considered in the present study in terms of received donations (per student, see Table 2). Two aspects are particularly noteworthy: First, as Table 2 reveals, Stanford and Case Western Reserve Universities clearly outperform the other universities. Stockholm University is the least successful in obtaining donations, followed by Gothenburg University. If we compare the two Swedish state universities with the University of Cincinnati, which is also state-owned and about the same size as that of the Swedish universities, it is clear that the Swedish universities only manage to capture a fraction of potential donations compared to their U.S. counterparts. The smaller, and more specialized medical and technological universities fare much better even though they do not reach similar levels as the private U.S. universities.

Second, a major part of donation revenues stem from philanthropic acts by individuals in the U. S. In fact, it is the major source of donation revenue at Stanford University and the second most important donor category at Case Western Reserve University. For the Swedish universities a similar distribution on donors does not exist. However, as evident in Table 4, the volume of aggregate private donations has increased markedly during the 1990s, corporations accounting for the major part of donations, even though the levels are much lower as compared to the U.S. universities. As a result, a range of interesting questions comes

to mind: How have the Swedish academic institutions succeeded in bridging academic research and commercialization? Have Swedish academic institutions had extraordinary success at doing so like Stanford University, or are the Swedish institutions more comparable to Cincinnati University?

It is difficult to answer these questions for a variety of reasons – there is a scarcity of data, individual researchers have proprietary rights to their own discoveries, and a relatively short period has passed since the academic community was assigned this new role. Therefore, even though we can only capture a part of the evolution at this point in time, we have enough evidence to discern the overall motion.

We note that the political decision to set up holding companies has been enforced in all the Swedish academic institutes we examined, however, little is known about their performance.¹¹ The holding company of Stockholm University had, by the end of 2001, ownership stakes in six companies. Some of the universities we examined have also embarked on joint ventures, primarily with other universities (see below).

The Karolinska Institute, specializing in pharmaceutical and biotechnology related education and research have had more intimate links with the commercial sectors. They have initiated a number of start-up and investment facilities and companies. Karolinska Holding AB (KIHAB) had by 2002 five subsidiary companies. Among those subsidiaries Karolinska Innovations AB (KIAB) has invested in 48 firms by 2002. KIHAB has also, jointly with one of the major Swedish pension funds (Alecta), set up the Karolinska Investment Fund (KIF), which has invested in 12 firms. In addition, the Karolinska Institute has set up an incubator activity in Novum Research Park just south of Stockholm, and of course also plays a key role in the emerging biotechnology science park around KI itself, located in north Stockholm. In addition, KI also has close links with Uppsala, another strong Swedish biotechnology cluster.

Turning to the Royal Institute of Technology, their holding company (KTH Holding) initiated their activities in 1994. By the end of 2002 KTH holding had six subsidiary companies and 13 limited investments (less than five percent) in other ventures. Together with the holding company of Stockholm University, they have engaged in an incubator activity, which contains about 40–50 firms. KTH has also set up investment funds together with other actors in order to propel commercialization. Similar to KI's role in Stockholm's biotechnology cluster, the Royal Institute of Technology is a major player in the ICT (information and communication technology) industrial park located in Kista. Kista already houses business companies, research institutes and an academic presence.

At the Gothenburg University, the objective of the holding company was to promote and increase attention and legitimacy to new firms emanating from the university, thereby facilitating commercialization. By 2001 the holding company was involved in 12 firms, most stemming from medical research undertaken at the University. Three of these companies are providing support and advice to researchers. Just as Stockholm University had embarked on a joint venture with the Royal Institute of Technology, Gothenburg University has joint ownership with Chalmers (Chalmers Licensing AB), but also with university holding companies in Lund, Stockholm and Uppsala.

Chalmers Technology University is an independent foundation and is therefore not subject to the same regulations as the other academic institutions. Chalmers has started a number of companies to speed up and facilitate commercialization. We have already mentioned Chalmers Licensing AB, which primarily works with researchers at Chalmers. Since its start in 1996, 117 projects have been evaluated, nearly a third of them have led to applications for patent and some 10–15 have been commercialized, implying that the rights to the patents have been sold. Yet, the revenues from these sales have so far been meager.

Chalmers Innovation has, since its take-off in May 1999, become involved in 36 firms, of which twenty percent were during 2002. The number of employees in those firms is 190, total invested venture capital about 556 million Swedish kronor, and the major part of investments were undertaken during the first two years of the foundations life. These investments have resulted in applications for 51 patents, all of them granted or presently subject to evaluation.

Chalmersinvest AB is a holding company but it differs from the other university-holding companies due to Chalmers' legal status as a foundation. In particular, they are free to invest also in ventures started outside of Chalmers. Chalmersinvest has invested in 16 start-ups between 1992 and 2002. Among those, about half can be traced to Chalmers, four to Gothenburg University, and the remaining four from various places, including large private firms and governmental institutions.

Based on the relatively scattered evidence presented above, the overall impression is that the Gothenburg region seems to be more involved in the commercialization than the Stockholm region. In particular, Chalmers has actively been pursuing the strategy of commercializing knowledge during the last decade, as has Gothenburg University. Still, this assessment should not be taken as conclusive. The apparently stronger performance of Gothenburg University, as compared to Stockholm University, could be attributed to the fact the medical school is incorporated in Gothenburg University, whereas KI is the separate university institution in Stockholm responsible for medical/biotechnological research and education. Because we only have a few years of observation and due to the lack of a systematic collection of data we must be cautious in interpretation of results¹². They are likely to strengthen over time.

Table 5 presents a comparison of granted patents in U.S. universities and The Royal School of Technology (KTH), the only Swedish university where we have access to such

data. Obviously, Stanford outperforms all other universities in the present analysis, and private CWRU seems to fare considerably better than state owned CU. However, KTH seems to match CWRU quite well, and is doing better than CU. During 1993 to 2002, KTH has applied for 260 patents of which 109 have been approved. That reveals a strong innovative capacity. Still, there is quite a gap between commercialization outcomes in Swedish and U.S. universities.

Even though these case studies suggest that philanthropy has been important in promoting knowledge that could subsequently be transformed into global entrepreneurial activities in terms of increased production, employment and economic growth, they do not alone support the conclusions of knowledge creation leads to increased macroeconomic activity. This is the topic of the next section.

7. Donations and Growth – A Statistical Analysis

To answer the question of whether philanthropy contributes to economic growth, we undertake statistical analyses on two levels: First, we will study if there is a relationship between regional growth in Sweden and the presence of private foundations set up by philanthropists. Second, using U.S. data, we will examine whether we can trace any impact of philanthropy on growth over time. We start with a cross-sectional study.

Regional growth and philanthropy in Sweden. In Figure 6 we have plotted regional growth (vertical axis) in counties between the years 2000 and 2001, whereas the horizontal axis captures the per capita assets of private foundations. A clear positive relationship can be discerned by these two variables; but this is far from proving that such a relationship exists. This certainly suggests that further investigation is worthwhile.

We conduct a statistical analysis on this relationship, including other variables likely to influence regional growth. Our dependent variable – regional growth between 2000 and

2001 – is based on the definitions of Sweden Statistics.¹³ To explain this change, in addition to assets of private foundation per capita, we insert the following explanatory variables; share of firms with no employments in relation to the total number of firms (proxy for entrepreneurs), private R&D-expenditure, county taxes, share of population with higher education levels, and specialization in industry (see Table 6). All explanatory variables, except average income, which is expected to capture a region’s level of initial prosperity, are lagged two years. Note that the limited amount of observations prevented us from inserting all explanatory variables into the regressions simultaneously; instead we inserted the explanatory variables stepwise.

The results in Table 7 suggest that donations, or per capita assets of foundations, yield a statistically significant impact on regional growth also after controlling for regional R&D and the share of entrepreneurs. The other explanatory variables fail to contribute to the explanation of differences in regional growth and are not shown here. Thus, even though we have to be cautious in our interpretation because of the scarcity of data, we conclude that the results suggest a positive impact of donations on regional growth.

Philanthropy and growth over time in the United States. The analysis of the relationship between growth and philanthropy at the national level in the U.S. stretches over a 30-year period. Hence, the robustness of the empirical analysis is considerably stronger, implying that interpretation of the results is more straightforward.

To explore statistically if philanthropic contributions contribute to long run economic growth, we begin with an ordinary Cobb-Douglas production function of the form:

$$(1) \quad Y = AK^\alpha L^{1-\alpha},$$

where Y is output, K is the contribution of capital, L is the contribution of labor, α is the capital's share in total output and A is a parameter that measures the level of productivity.

Taking the total differential of (1) gives us:

$$\begin{aligned}
 dY &= \left(\frac{\partial Y}{\partial A}\right)dA + \left(\frac{\partial Y}{\partial K}\right)dK + \left(\frac{\partial Y}{\partial L}\right)dL \\
 \Leftrightarrow dY &= (K^\alpha L^{1-\alpha})dA + (A\alpha K^{\alpha-1} L^{1-\alpha})dK + (AK^\alpha(1-\alpha)L^{-\alpha})dL \\
 \Leftrightarrow dY &= \left(\frac{Y}{A}\right)dA + \alpha\left(\frac{Y}{K}\right)dK + (1-\alpha)\left(\frac{Y}{L}\right)dL \\
 \Leftrightarrow \frac{dY}{Y} &= \left(\frac{dA}{A}\right) + \alpha\left(\frac{dK}{K}\right) + (1-\alpha)\left(\frac{dL}{L}\right) \\
 \Leftrightarrow \frac{dA}{A} &= \left(\frac{dY}{Y}\right) - \alpha\left(\frac{dK}{K}\right) - (1-\alpha)\left(\frac{dL}{L}\right),
 \end{aligned}$$

which can be approximated by the discrete time version:

$$(2) \quad \frac{\Delta A}{A} = \frac{\Delta Y}{Y} - \alpha \frac{\Delta K}{K} - (1-\alpha) \frac{\Delta L}{L}$$

We have collected data on the total stock of capital, the level of income, the share of capital, donations and private R&D. Labor is measured in the total number of workers excluding agricultural workers. Donations are the total contribution to donations for all purposes on an annual basis (see Table 8).

In accounting for growth where we subtract the contributions of capital and labour to growth to give us a rough measure of Solow's technical residual ($\Delta A/A$). In the next step,

OLS regression technique is implemented to estimate the impact of philanthropy on this residual.

$$(3) \quad \frac{\Delta A}{A} = \beta_0 + \beta_1 \frac{\Delta P}{P} + X\delta + \varepsilon$$

To control for other factors that might have an effect on our dependent variable, we include a number of control variables contained in vector X. We expect donations to positively influence growth after controlling for the other variables, so our hypothesis can be formulated as:

$$(4) \quad \begin{cases} H0: \text{Not } H1 \\ H1: \beta_1 > 0 \end{cases}$$

The results are shown in Table 9.

These results are preliminary as we need to refine the capital contribution and control for hours worked in the labor employment variable. There are real data limitations, because a limited amount of information on variables for a limited period of time could be collected. However, we have managed to collect data on philanthropic contribution in the U.S. for the 1929–1959. Although data for more recent years are available, we have not located them as of this writing, but our ambition is to extend the analysis to the period 1929–2000. Moreover, we would like to include other variables, both for knowledge (R&D and human capital) and entrepreneurship.

8. Implications for Internationalization

What are the implications of our analysis for internationalization? International Entrepreneurship is a new field of study (Etemad, 2002) where small and medium sized firms have begun to internationalize (Acs and Yeung, 1999b). Much has been written about the phenomenon of “born globals” (McDougall, 1989, McDougall and Oviatt, 2000; and McDougall, Shane and Oviatt, 1994. One interpretation of this phenomenon—“born globals”— suggested by Acs and Yeung (1999a) is that Globalization is a Schumpeterian evolutionary process on a global scale. It involves *learning and discovery* on the one hand, and some *selection mechanism* for broad exploitation on international scale on the other.

Foreign entrants to international markets, which are the home markets of indigenous firms (Etemad 2004), with home court advantage, need to possess unique superior capabilities to compete with indigenous firms. Firms are able to internationalize because of the superior competitive advantage of their intangibles. These are knowledge-based capabilities in marketing, production and management, which are often referred to as intangibles. Because they are information based, intangibles assets behave like public goods—they have intrinsic economies of scale and scope. Firms can leverage the value of their intangible assets by expanding their scale and scope of application. Due to well known transactions difficulties in arms length trade of information-based assets, firms often have to retain direct control in expanding the application of their intangible assets. In other words, firms internalize the markets for their intangibles assets. For example, Multinational enterprises are firms that expand the application of their intangibles internationally by retaining direct control of them. This is a prominent mechanism by which, these firms become multinational firms.

Internationalization implies that multinational firms manage to capture the overseas profit opportunities that their intangible assets create. The overseas profit opportunities exist because their intangibles allow them to overcome local indigenous firms home court

advantage and thus to capture at least a part of the local indigenous firms markets. Foreign firms are able to enter overseas markets and compete directly with local firms already in the market because of their intangibles. This is exactly what happens, for example, when an international retailer enters a local market and competes on its intangibles like brand name, marketing expertise, compute software etc.

In other words, firms are able to internationalize because of their superior competitive advantage (of their intangibles), which could, for example, be information-based capabilities in production, marketing and management. To the extent that local indigenous firms do not possess these intangibles, they are innovations from the perspective of local indigenous firms. Seen in this light, a firm's cross border expansion is an internationalized Schumpeterian evolution and it is an indispensable component of globalization (Acs, Morck and Yeung, 2001).

Our story—the entrepreneurship-philanthropy nexus—has three interesting implications for internationalization theory. First, intangible assets plays an important role in explaining why firms can internationalize more quickly than one would expect from existing theories of internationalization. Countries that have a rich tradition of philanthropy create more intangible assets and enable entrepreneurs to internationalize more quickly feeding the born global phenomenon. Countries that have more philanthropy and a larger knowledge base should have more born global firms than other countries. Second, smaller countries that have a large knowledge base, like Sweden, need to be more, not less, internationally-oriented to take advantage of a larger international market. In these countries the relationship between universities and international entrepreneurship should be strengthened to take advantage of globalization. Third, small countries like Sweden should further strengthen their philanthropic activities to create a more diverse knowledge base leading to a richer technological society to strengthen the basis for globalization of firms and their international sectors.

9. Conclusions

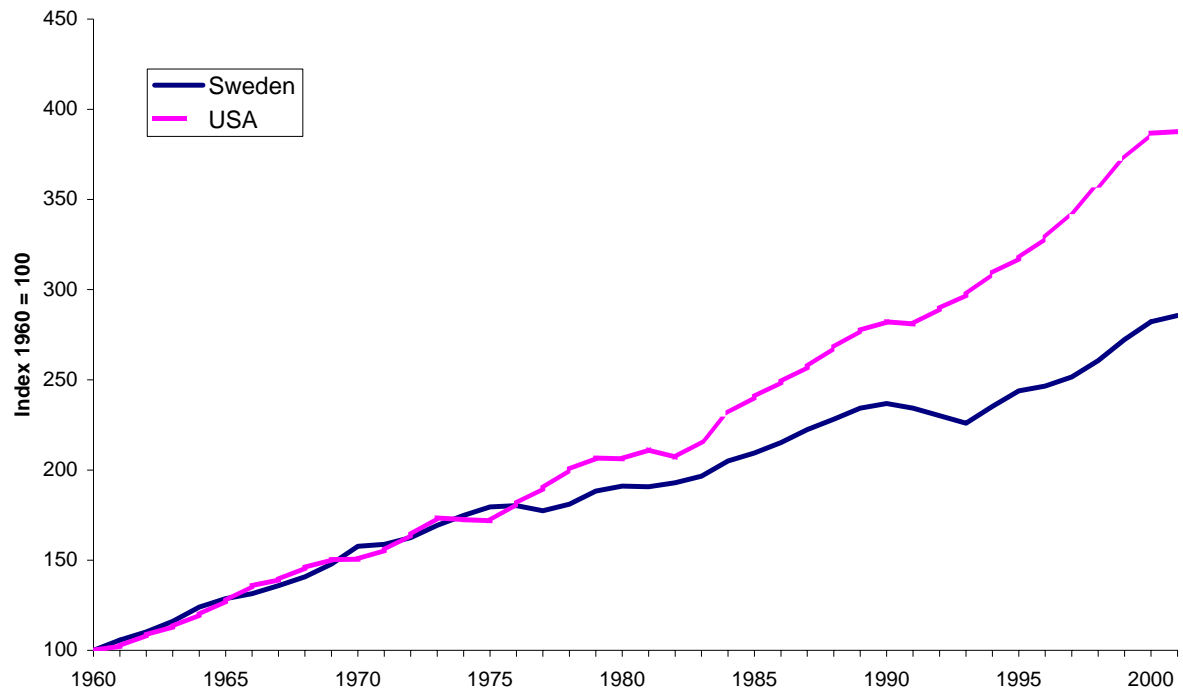
The results in general support our propositions that philanthropy increases the level of research funding to universities, adds to the level of diversity for which that funding can be used and can impact the culture of the institution. Because of this reconstitution, philanthropy may increase the level of technological opportunities available in and around the university. The increased opportunities may be exploited by entrepreneurs, both domestic and internationally leading to increased economic growth. These observations resonate very well with the case of the U. S. universities. We do not find any evidence that philanthropy does not support knowledge creation, entrepreneurship and economic growth.

Judging from the experience of all Swedish universities, private funding will become an increasingly important source of revenue. Whereas firm commissioned research has remained at about the same level in the last decades, philanthropic and untied research funding has increased in Swedish universities. There are reasons to believe that this trend will continue, particularly for high-tax societies such as Sweden, where traditional means of financing through taxes is under challenge because of structural factors and increased institutional competition. However, philanthropy is not likely to substitute for public funding, but rather it will complement other means of financing academic research.

The question we have posed concerns the effects of a higher share of philanthropic funding of academic research. Does this constitute a threat to free research? Or can we expect positive effects related to more diversity in research, increased resources and better links to the commercial sectors? Based on the comparison with U.S. universities and the statistical analysis on the impact of philanthropy of growth, we suggest that the positive effects are likely to outweigh potential negative effects. However, European universities must adopt strategies to manage and encourage philanthropy. Philanthropic financing is relatively new for most European universities and the inherent awkwardness in handling this source of

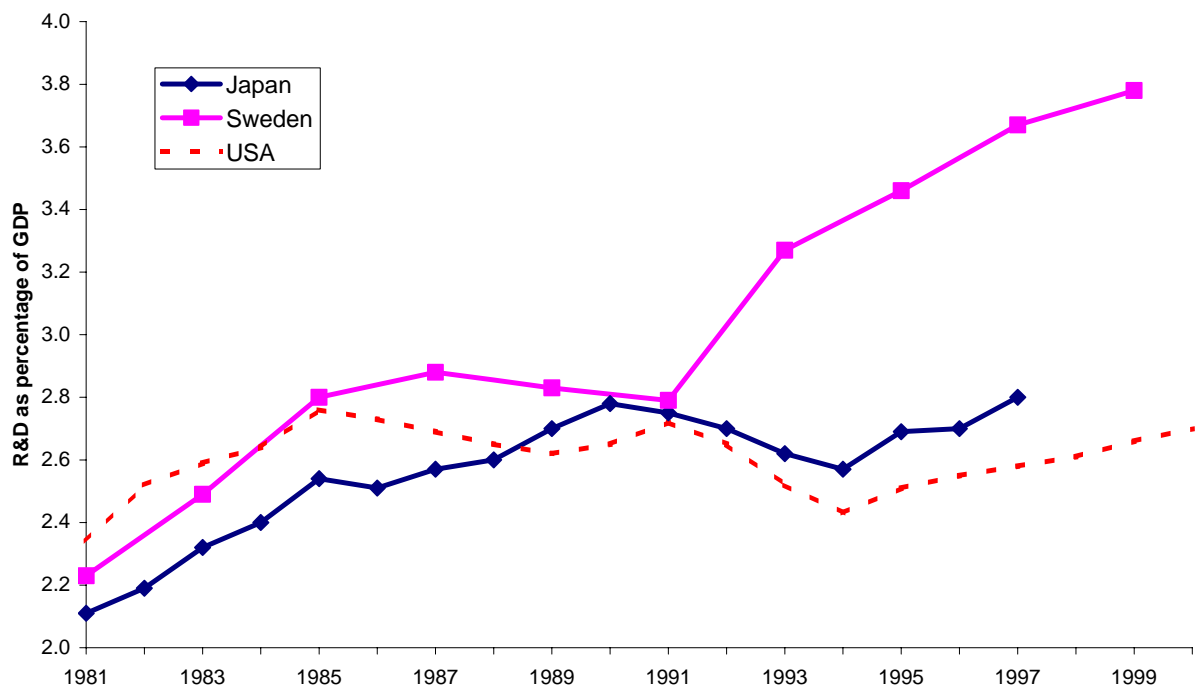
revenue may hamper a potentially important source of revenue. Much can be learned from the U.S.: extended philanthropic activity does not suffice. Entrepreneurs and incumbents alike must formulate pertinent policies to encourage exploitation of university-based knowledge.

Figure 1. Annual change in GDP, Sweden and the U.S., 1995 price level (1960=100)



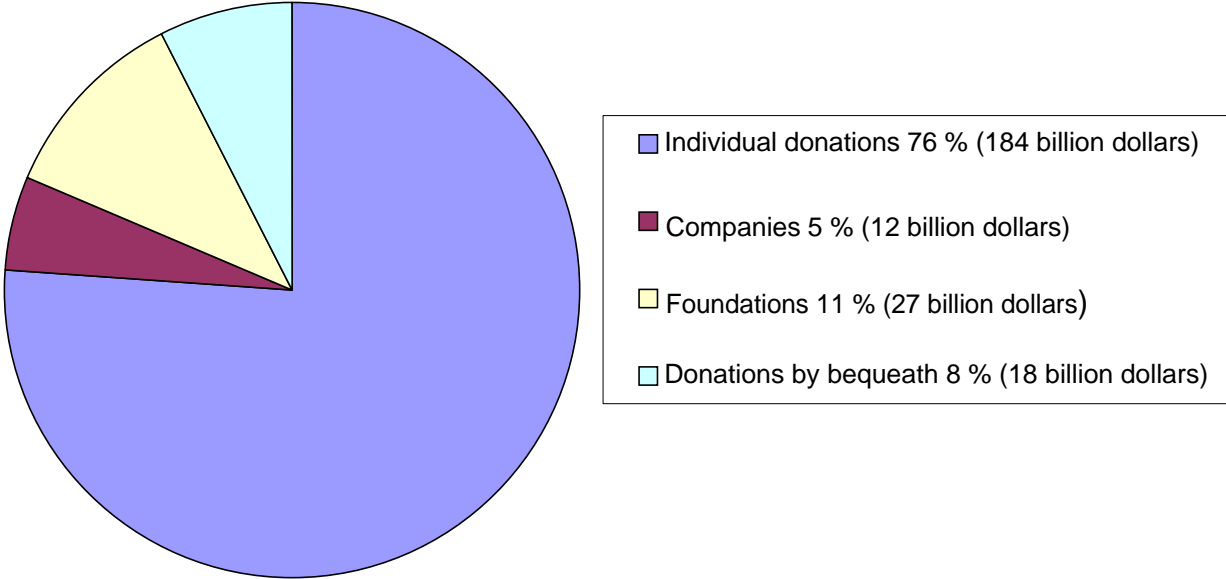
Source: OECD.

Figure 2. R&D-expenditures in relation to GDP, Japan, Sweden and the U.S.



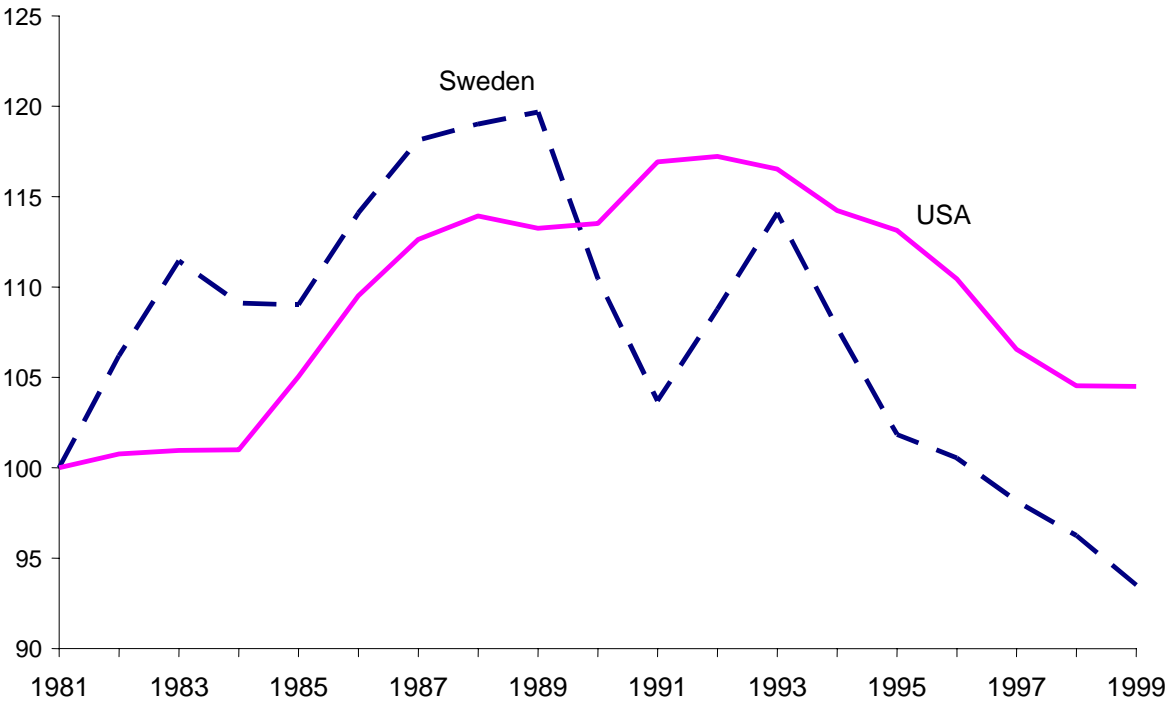
Source: OECD.

Figure 3. Volume of donation in the U.S., 2002, by source of funds, 240 billion dollars



Source : AAFRC Trust for Philanthropy/Giving USA (2003).

Figure 4. Public expenditure on research in American and Swedish universities and technical collages relative to GDP, 1981-1999, 1995 price level (1981=100)



Source: OECD Statistical Compendium.

Note: The numbers have been indexed to facilitate the comparison. In absolute numbers the expenditure in Sweden exceeds that of the U.S. The rise in Sweden 1993 is due to falling GDP.

Figure 5. Public and private income per student for three American Universities 1992-2000, 2001 price level

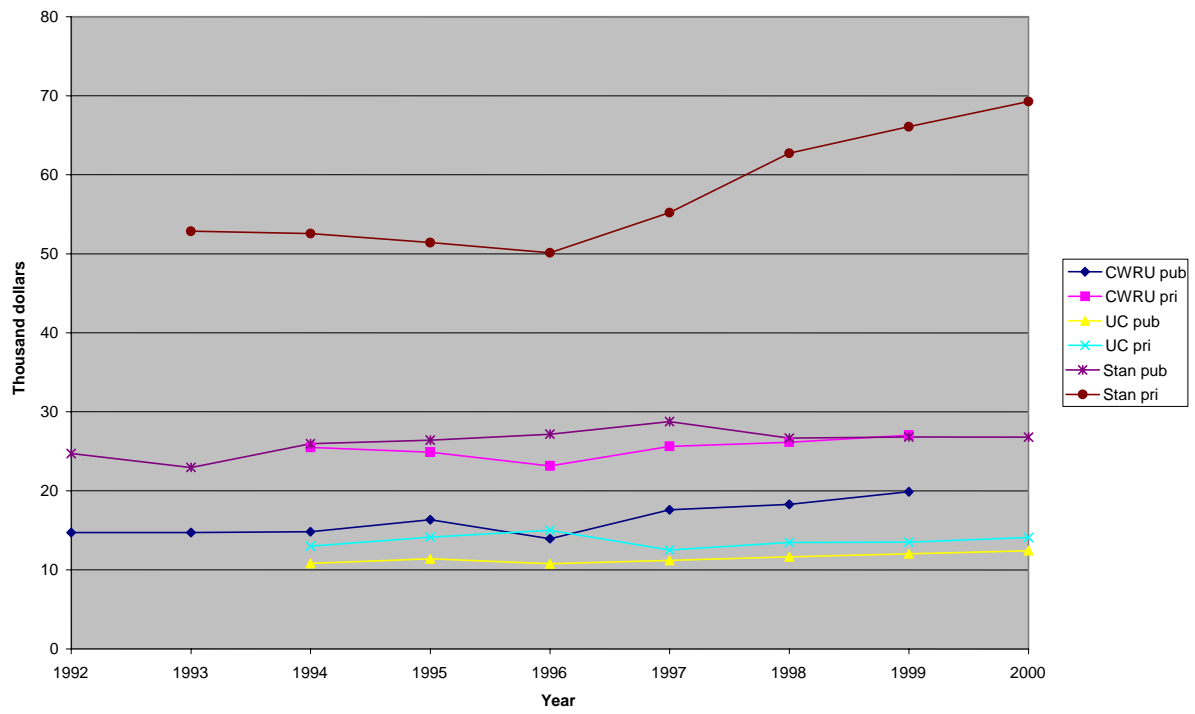
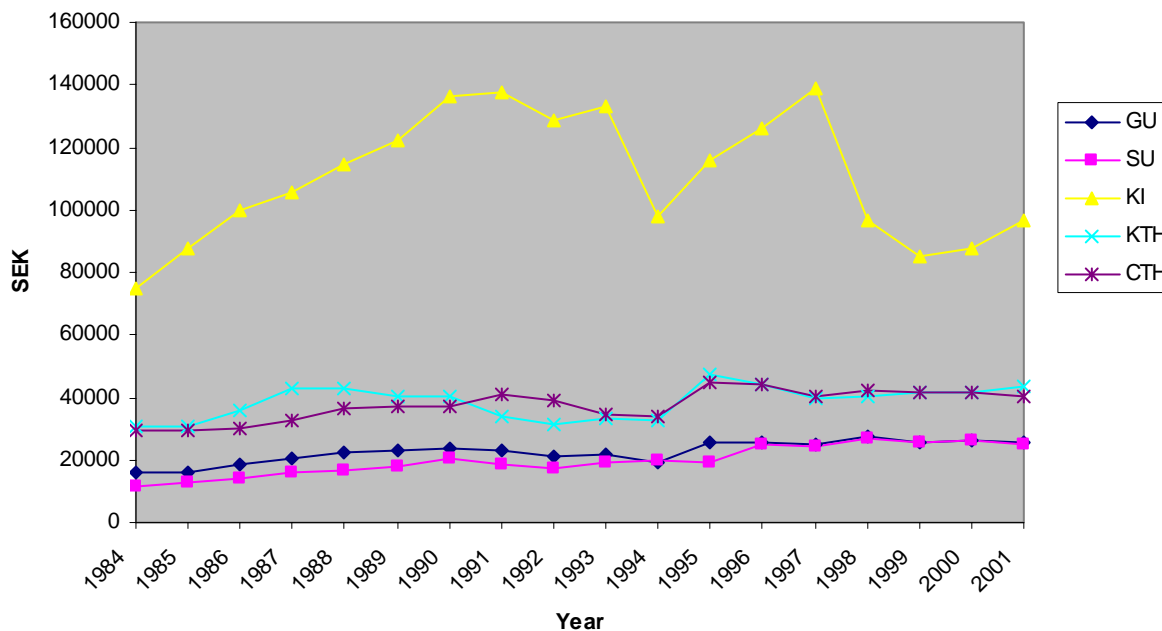


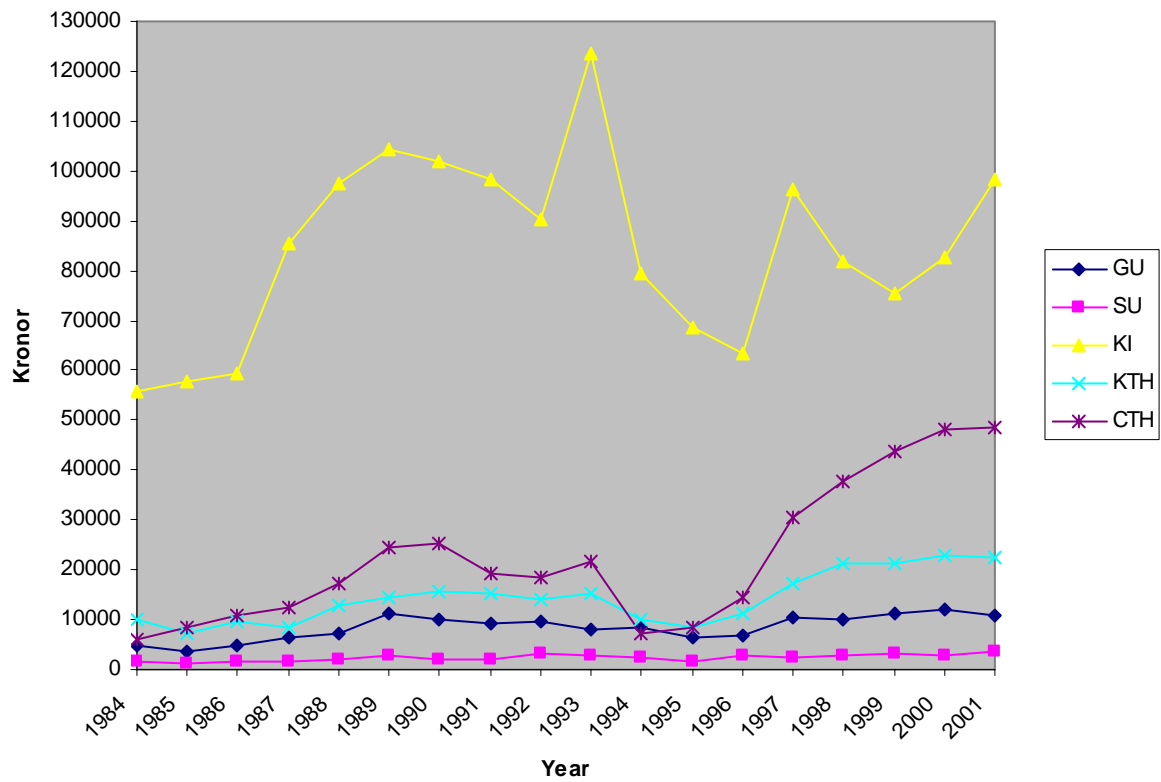
Figure 6. Government grants for research per student 1984-2001, 2001-price level



Source: National Agency for Higher Education, and SCB. Grants from other sources in the public sector (municipality, county council etc.) are not included.

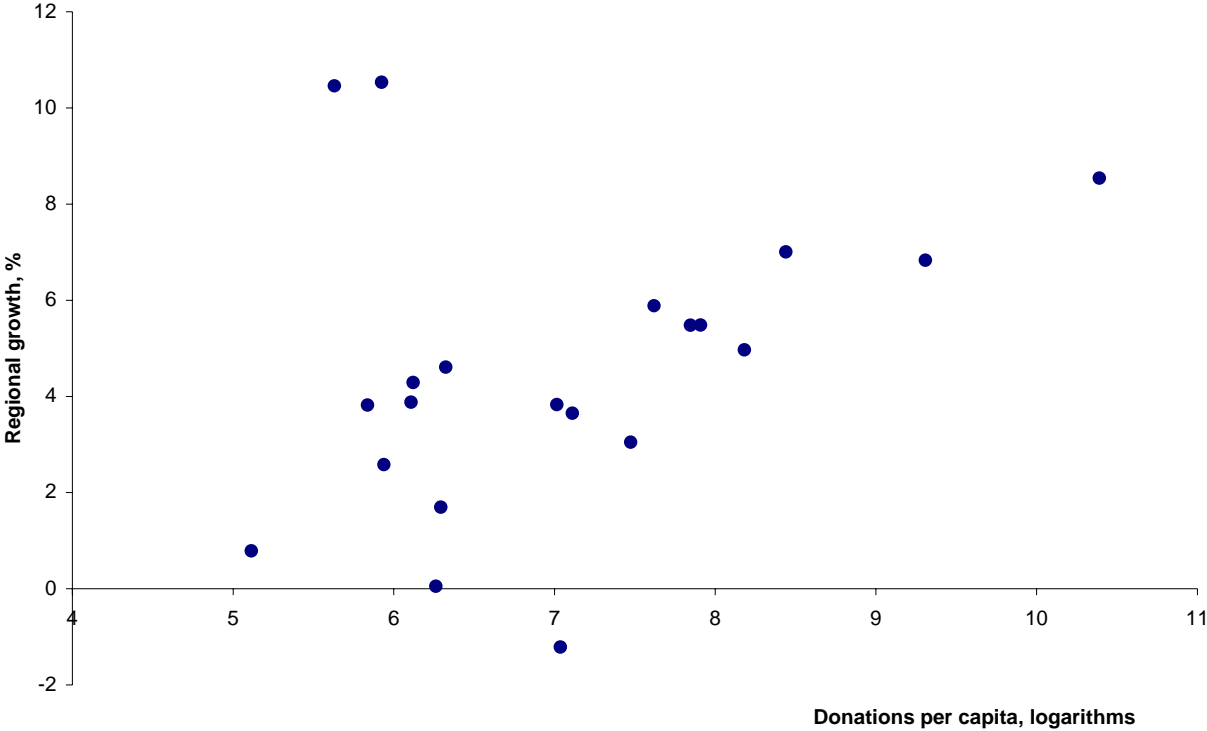
GU (Gothenburg University), SU (Stockholm University), KI (Karolinska Institutet), KTH (Royal Institute of Technology), CTH (Chalmers University of Technology).

Figure 7. Research grants from the private sector per student 1984-2001, 2001-price level



Source: National Agency for Higher Education and SCB. Concerns grants from Swedish companies (not commissioned research), Swedish non profit organizations, foreign companies and foreign non profit organizations.
 GU (Gothenburg University), SU (Stockholm University), KI (Karolinska Institutet), KTH (Royal Institute of Technology), CTH (Chalmers University of Technology).

Figure 8. The relation between regional growth and regional per capita assets of private foundations, Swedish regions, 2000–2001



Note: Donations is approximated with regional per capita assets of private foundations.

Table 1. Research and Development (R&D), volume of donations, its share devoted to research and education, and the source of donations in Sweden and the U.S., in percent, 2001

	Sweden	USA
R&D as share of GDP	4.3	2.8
The private sector share of total R&D*	72	68
Share of total university research financed by the government	78	65
Donations as share of GDP	0.3	2.4
Share of private donations spent on research and education	approx 25	approx 30

Source: OECD, Foundation Giving Trends, SCB, own calculations.

*Refer to 1999.

Table 2. Donations (USA)/private research grants (Sweden) to eight universities and academic institutions 1993–2001, per student, 1000 dollars, 2001 price level

Year/ Academic institution	Stanford University	Case Western Reserve University	University of Cincinnati	Gothenburg University	Stockholm university	Karolinska Institutet	Royal Institute of Technology	Chalmers University of Technology
1993	15.5	7.9	1.7	.9	.3	13.1	1.6	2.3
1994	18.7	9.5	2.0	.9	.3	8.4	1.1	.8
1995	19.3	7.4	2.2	.7	.2	7.2	.9	.9
1996	24.5	8.5	1.7	.7	.3	6.6	1.2	1.5
1997	23.8	8.4	1.9	1.1	.2	10.0	1.8	3.2
1998	23.4	9.7	2.8	1.0	.3	8.4	2.2	3.9
1999	23.5	8.5	1.9	1.1	.3	7.7	2.2	4.5
2000	41.7	12.1	2.9	1.2	.3	8.4	2.3	4.9
2001	33.1	19.6	3.7	1.1	.4	10.0	2.	5.0

Source: Own calculations based on information from HSV 1993–2001, SCB statistics on number of students 1990/91–2001/2002. Compilations by professor Zoltan Acs.

Table 3. Donations to American universities, by donors, 1993 and 2001, million dollars

	Case Western Reserve University		University of Cincinnati		Stanford University	
	1993	2001	1993	2001	1993	2001
Individuals (alumni, parents, other)	24	40	13	22	123	309
Foundations	23	40	9	8	34	101
Companies	14	90	15	53	39	41
Other	9	11	1	3	16	18
Total	71	181	38	86	212	469

Source: Voluntary Support of Education (2002), Council for Aid to Education, New York, NY

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Table 4. Total private donations to Swedish Universities and Colleges, 1994 and 2001, million dollars

	Gothenburg University	Stockholm University	Karolinska Institutet	Royal Institute of Technology	Chalmers University of Technology	Stockholm School of Economics
1994	22	9	38	17	19	5
2001	34	12	68	29	44	39

Source: National agency for higher education (1994, 2001), Stockholm School of Economics (Birgitta Stål) (2003).

Table 5. Number of granted patents 1993–2002 to Royal Institute of Technology (KTH), Stanford, UC and CWRU

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
KTH				21	7	17	15	15	19	15
Stanford	39	69	70	56	64	86	90	98		
UC	8	8	7	8	10	14	6	12		
CWRU	6	3	8	8	8	18	17	23		

Source: KTH.

Table 6. Regression results OLS. Dependent variable regional growth in Sweden, 2000–01

<i>Regressions</i>	1	2	3
Constant	−28.47* (−1.87)	−4.10 (−.15)	4.38 (.29)
Donation	.91 (1.63)	1.42** (2.01)	1.57*** (2.87)
Initial income level	−1.31 (−.30)	1.95 (.43)	1.81 (.41)
Entrepreneurs	.33 (1.32)	.12 (.39)	–
R&D	–	−.71 (−.79)	−.94 (−1.38)
R ²	.25	.17	.22
F-value	1.91	1.94	2.69
No. of obs.	20	18	18

Note: * refer to significance at the 10-percent level, ** refer to significance at the 5-percent level, and, *** refer to significance at the 1-percent level.

Table 7. Definition of variables

<i>Variable</i>	<i>Definition</i>	<i>Expected value</i>
Regional growth	Percentage change in labor income between 2000 and 2001*	Dependent variable
Donation	Assets of private foundations per capita in respective region, valued at book values, lagged one period (1999)	Positive, assumed to contribute to knowledge accumulation
Entrepreneurs	Share of self-employed out of total firms in the respective region, establishment data, 1999	Positive, expected to generate positive employment effects and to exploit new knowledge
R&D	Private R&D, number of private employees in the respective regions, 1999, logarithmic	Positive, expected to contribute to knowledge accumulation.
Initial income	Regional, average income, logarithm, 2000	Positive

Source: Statistics Sweden and Braunerhjelm & Skogh (2004).

*See Statistiscs Sweden (AM 56 SM 0301, p. 21) on the motivation regarding the definition of this variable.

Table 8. Definition of Variables

Variables	Definitions	Expected value
Growth of Gross National Product	Percentage change of annual Gross National Product between 1929-1959 in constant dollars. Source: U. S. Bureau of Economic Analysis.	Dependent variable
Stock of Produced Assets	Net stock of total assets and annual change to total stock of assets 1929-1959 in constant dollars. Source: U. S. Bureau of Economic Analysis.	The change in the capital stock is expected to have a positive effect of economic growth.
Labor's contribution	Total number of employees excluding agricultural workers 1929-1959. Source: U. S. Bureau of Labor Statistics.	The change in the number of workers is expected to have a positive effect on economic growth.
Annual private sector philanthropic giving.	Total dollar amount of giving by individuals as well as returns to foundations 1929-1959 in constant dollars. Source: U. S. Internal Revenue Service tax files as cited in Frank Dickinson, <i>The Changing Position of Philanthropy in the American Economy</i> , 1970, Table 2-1, p. 42.	Philanthropic contributions are expected to have a positive effect on economic growth because these contributions represent a reconstitution of capital to society and shift the production function.
Patents	Total number of patents granted to corporations annually 1929-1959. Source: U. S. Patent and Trademark Office. Series W 96-106. Patent Applications Filed and Patents Issued by Type and by Patentee: 1790-1970.	Patents are a measure of technological change and should be positively related to economic growth.

Table 9. Regression results OLS. Dependent variable is GDP growth in the United States 1929-1959 (t-statistics in parentheses).

Regressions	(1) Annual Changes	(2) Annual Changes	(3) (20 years lag)
Constant	-0.003 (-0.31)	-0.003 (-0.42)	0.081 (8.54)*
Total stock of Producer Assets	-0.061 (-0.48)	-0.068 (-0.52)	0.089 (0.70)
Civilian Employment	0.825 (4.97)*	0.813 (4.78)*	-0.24 (-1.17)
Total Private Philanthropy	0.507 (3.67)*	0.512 (3.65)*	-0.036 (-0.29)
Patents	-	-0.015 (-0.54)	-
Adjusted R ²	0.76	0.76	0.14
F	32.4	23.7	1.41
No. of Observations	29	29	29

Note: * significance at the 5-percent level.

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² See Rosenberg (2003). But there are also exceptions (Feldman and Desroschers, 2003).

³ See Barro (1997) or Gylfasson (1999) for a survey of the literature.

⁴ See also Hayek (1944), Knight (1921, 1944) and McKenzie (1959).

⁵ This is often neglected in comparisons between the U.S. and European countries. For instance, comparisons are limited to endowments of foundation per capita, meaning that a huge selection bias is introduced into these comparisons (e.g., see Schlüter, Then and Walkenhorts, 2001).

⁶ Still, public funds are the main source also in the U.S. academic research (Toepler and Feldman, 2003).

⁷ In the statistical comparisons we have mainly used data from Statistics Sweden since information directly from the universities seems to differ in their definitions of different variables.

⁸ Several studies claim that the Bayh-Dole Act is a major explanation to the success in turning academic research into commercial products (see Carlsson and Fridh (2002) for a survey).

⁹ For more information, see Frescati (www.su.se).

¹⁰ The National Agency for Higher Education changed their statements of account in the late 1980's. Hence, before 1988 the statements of account refers to university expenditure. From 1988 and onwards the numbers refers to university revenue. Our data reveal small differences between these two measures and we will use the term revenue.

¹¹ In a recent analysis of a Swedish university Braunerhjelm (2003) shows that the links to the commercial sectors are inadequate, centralistic and inefficient.

¹² One conclusion, after attempting to compile information on the Swedish universities involvement in the commercialization process, is that these routines must be strengthened. More systematic and organized documentation is required in order to evaluate the outcome of the measures taken so far to commercialize university research.

¹³ See [www.....](#)