IFN Working Paper No. 1224, 2018

# The Long-Run Performance of Born Globals in Computing: The Role of Digital Platforms

Shon Ferguson and Magnus Henrekson

Research Institute of Industrial Economics
P.O. Box 55665
SE-102 15 Stockholm, Sweden
info@ifn.se
www.ifn.se

Forthcoming in the *International Review of Entrepreneurship*

# The Long-Run Performance of Born Globals in Computing: The Role of Digital Platforms

Shon Ferguson* and Magnus Henrekson‡

October 23, 2019

*Abstract*: Using data on all Swedish computing startups founded 2007–2015, we find a systematic positive relationship between the propensity of a computing firm to reach customers globally via digital platforms and its long-run employment growth relative to domestic-oriented computer firms. We also find positive, yet weaker, evidence that born globals in computing grow faster in terms of sales or value added. Our analysis also indicates that very few computing firms fit the profile of born globals; only 15% of the 250 largest computing employers in 2015 were born globals. Moreover, only 1.5% of computing startups founded 2007–2015 were computer game publishers, which arguably have the highest propensity to be born global. Thus, although we find positive born global effects at the firm level, policymakers must be aware that encouraging more born globals need not necessarily lead to large benefits for the overall economy.

*JEL Codes*: F14, F23, L25, M13.

*Keywords*: Born globals, Computing industry, Exporting, Firm growth, Globalization, Job creation.

* Shon Ferguson. Research Institute of Industrial Economics (IFN), P.O. Box 55665, SE-102 15 Stockholm, Sweden. Tel:+46 8 665 4500. Email: Shon.Ferguson@ifn.se & Swedish University of Agricultural Sciences (SLU), P.O. Box 7070, SE-750 07 Uppsala, Sweden.
‡ Magnus Henrekson (corresponding author). Research Institute of Industrial Economics (IFN), P.O. Box 55665, SE-102 15 Stockholm, Sweden. E-mail: magnus.henrekson@ifn.se. Tel: :+46 8 665 4500.

We thank Victor Ahlqvist, Enrico Deiaco and Joacim Tåg for useful comments and suggestions on an earlier version of this study. Financial assistance from the Marianne and Marcus Wallenberg Foundation is gratefully acknowledged. We would also like to thank Karl-Adam Bonniers Stiftelse for stirring our interest in this topic and for financing an initial pilot study.

# 1. Introduction

The rising dominance of the service sector in general, and the computing sector in particular, marks one of the most significant economic transformations of our time. Policymakers have thus become interested in encouraging the proliferation of high-tech startups in order to promote economic growth and boost job creation. This has led many countries to adopt policies that assist high-tech small and medium-sized enterprises (SMEs) with an internationally oriented product to expand. The goal of these policies has been to create successful fast-internationalizing firms, which are often referred to as *born globals*.

Born globals are defined as startups that quickly and successfully engage in multiple foreign exports without first establishing a strong customer base in the domestic market.[1] The ability of these firms to circumvent a lengthier internationalization process has caught the attention of many governments.[2] For example, in 2016 the Swedish government published an export strategy that specifically emphasized the importance of encouraging born global firms. In the strategy document it is stated that: "There are many successful examples of Swedish companies that have been international from the start, but there could be even more of these so-called born globals."[3]

Many of the most prominent examples of born globals are found in computing. In Sweden, for example, the most prominent examples of born globals include Skype, Spotify and Mojang (developer of Minecraft). However, there is a dearth of empirical studies that take stock of the number and size of born globals in the computing sector and evaluate whether internationally oriented startups outperform their domestic-oriented peers in the long run. Many governments around the world actively support computing startups via business incubator programs (UBI Global 2018), making the choice of supporting domestically oriented versus internationally oriented startups with government subsidies an important policy question.

In this analysis, we exploit the fact that some computing services suffer less from export barriers than others, and thus firms that specialize in such digital products have a more natural inclination to quickly expand sales globally. We thus identify born globals in this study according to whether their line of business sells its product on a digital platform directly to customers. The ability to engage directly with customers via computer-mediated transactions

[1] The term born globals was first coined in a report by McKinsey (Rennie 1993) to describe enterprises that are able to quickly and successfully engage in foreign exports.
[2] Initiatives to promote born global firms currently exist in, inter alia, Japan, South Korea, China, the Netherlands, Brazil, and Canada (Growth Analysis 2016).
[3] Government Communication 2015/16:48, "Regeringens exportstrategi".

has allowed for the emergence of small and export-intensive firms in certain industries (Varian 2010). Selling a digital product online entails a fixed production cost, but the marginal cost of production is nearly zero, which allows firms to scale up quickly. Kudina et al. (2008) and Cannone and Ughetto (2014) find that born globals are typically characterized by a production process that is easily scalable. Rapid internationalization may provide a first-mover advantage for these firms (Bell et al. 2003), allow them to diversify risks (Almor 2011), provide the firm with a competitive edge (Oviatt and McDougall 1994) and provide positive learning effects (Andersson and Lööf 2009).[4]

Our analysis is based on highly detailed firm-level register data for Sweden, a small and open economy with a thriving computing sector. In the first part of the analysis we manually inspect the websites of the most successful computing firms in Sweden in order to inform us about the segments of the industry with the highest propensity to be born global. We thus focus on the top-250 computing firms in Sweden according to employment in 2015, the most recent year in our dataset. The data indicate that only 15% of these firms fit the profile of born globals according to the international nature of their product and distribution system, while the remaining 85% are either foreign-owned affiliates, spinouts from existing Swedish firms, or other types of computing startups with a domestic orientation. Among the top-250 firms, computer game publishers tend to fit the definition of born globals, while computer consulting firms overwhelmingly fit the definition of domestic-oriented firms. These results suggest that some segments of the computing industry are more likely to be born global than others. The notion that some industries have higher born global propensity than others is intuitive, and we are not the first in the literature to make this distinction. Kudina et al. (2008), for example, point out that high-tech companies are "particularly prone to the born-global effect".

In the second part of the analysis we compare the employment growth of the entire population of startup computer game and computer consulting startups in the Swedish data founded 2007–2015. We argue that the online nature of computer game distribution implies

[4] Our emphasis on technology-driven born globals differs from theories that focus on the favorable performance of born globals due to their adaptability as young firms (Autio et al. 2000; Johanson and Vahlne 1977; Figueira-de-Lemos et al. 2011; Casillas and Moreno-Menéndez 2014). Some authors argue that born global management strategies may lead to slower growth or exit due to increased risk (Bonaccorsi 1992; Knight and Cavusgil 2004; Luostarinen and Gabrielsson 2006), and that firms that are quick to expand internationally face a disadvantage of "foreignness" (Zaheer and Mosakowski 1997; Rugman and Verbeke 2007) and "newness" (Stinchcombe and March 1965; Zahra 2005; Sleuwaegen and Onkelinx 2014). Finally, Andersson and Wictor (2003), Oviatt and McDougall (2005), Sapienza et al. (2006) and Carr et al. (2010) posit that young firms are particularly constrained with respect to management competencies and other resources, which can make rapid internationalization risky.

that computer game makers have a higher propensity to become born globals compared to computer consulting firms. We find that employment among computer game startups outpaced employment growth at computer consulting firms. We also find that computer game firms are initially smaller than computer consulting firms in terms of sales, and it takes four years before they are significantly larger than computer consulting firms in terms of sales. In addition, we find that only a small number of workers in the computing sector are employed by computer game firms, so employment growth is higher in this sector, but the level of employment is relatively low in aggregate. Our results thus suggest that promoting born globals may not be the most effective policy since they are relatively small contributors to output and employment. Our results also indicate that foreign-owned affiliates, spinouts and domestic-oriented enterprises such as computer consulting firms play an important role among the top employers in the computing sector in Sweden.

We contribute to a small and growing literature in the fields of entrepreneurship economics and international business that study the causes and consequences of born globals' export-intensive strategy (Knight and Cavusgil 1996, 2004). Research on born globals has mainly focused on documenting their characteristics and understanding the underlying trends that give rise to these types of firms (Moen and Servais 2002).[5] Most analyses of born globals are based on surveys and case studies, which often focus on a highly selective group of successful born globals that may not be fully reflective of the behavior of born globals in general. Cavusgil and Knight (2015) and Zander et al. (2015) have thus called for a more rigorous approach to study born globals, namely using longitudinal data spanning all firms in order to obtain a proper control group of other startups.

Our study also contributes to a new literature on "born global industries" where all firms in a sector are born global. The literature includes studies on microelectronics (Aspelund et al., 2018) and offshore wind power (Lovdal and Aspelund, 2012), but the case of the computing industry has not been studied in this context.

By identifying potential born globals at the industry level according to the industry's propensity to be born global, we distinguish ourselves from the many studies that identify born globals in the data based on export performance early in the firm's life.[6] Such "ex post"

[5] These studies found that born globals are typically innovation-intensive (Andersson and Wictor 2003; Cavusgil and Knight 2015) and human capital-intensive (Knight 2001; McDougall et al. 1994, 2003; Melén and Nordman 2007; Kaur and Sandhu 2013).

[6] Studies using the quantitative definition include Kuivalainen et al. (2007), Hashai (2011), Sleuwaegen and Onkelinx (2014), Sui and Baum (2014), Choquette et al. (2017), Garcia-Garcia et al. (2017), Ferguson et al. (2019) and Braunerhjelm and Halldin (2019). The quantitative definition of born globals is usually defined along two dimensions: the degree of export intensity (exports as a share of total sales must exceed a certain value) and

identification of born globals suffers from spurious correlation, as it is unclear whether long-run outcomes are caused by the early internationalization itself, or if both early internationalization and long-run success are driven by the firms' innate features, which predate firms' export decisions.[7] Our approach to identifying born globals is in line with the most common *qualitative* definition of born globals in the literature, namely as "business organizations that, from or near their founding, *seek* superior international business performance from the application of knowledge-based resources to the sale of outputs in multiple countries" (Knight and Cavusgil, 2004, p.124).[8] It is thus the aspiration to sell products in international markets that defines born globals, not necessarily their future exporting success. We thus argue that the very nature of the computer game industry implies that all Swedish computer game startups since 2007 had the global market in mind upon founding. Knight and Liesch (2016) recently point out in a review of the born global literature that an ex post quantitative definition, such as the 25% three-year rule, is arbitrary. They also note that an export intensity threshold is highly sensitive to country size, making cross-country comparisons difficult.

Our identification of potential born globals using a highly detailed industry classification does not require data on each firm's exports of services. We apply this approach to the Swedish data, where services export data would otherwise be inadequate to identify born globals, and our methodology could be applied in any country where services export data on startups are lacking. The lack of detailed data on service exports in almost all countries has discouraged comprehensive empirical analyses of born globals in the service sector in general. Data on trade in goods is gathered by the customs authorities at the point when goods cross the national border. Firm-level data on trade in services must instead be collected via surveys, which often only cover larger firms. Other strategies therefore have to be used if one wants to study service exports among startups in the vast majority of countries.[9] As a result, the few existing empirical studies of born globals using firm-level register data have focused

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the age of the firm at which this export intensity criteria is met. In the literature, numerous definitions have been applied (see, e.g., Braunerhjelm and Halldin 2019; Gabrielsson and Kirpalani 2004; Oviatt and McDougall 1994; Rennie 1993), such as export activity within 2–10 years and a minimum export share of total sales ranging between 20 to 80 percent.

[7] It is a well-established empirical fact in the international economics literature that more productive firms tend to self-select into trade (Bernard and Wagner 1997; Bernard and Jensen 1999, Mayer and Ottaviano 2008).

[8] Cavusgil and Knight (2015, p.4) paraphrase their original definition as "entrepreneurial startups that, from or near their founding, *seek* to derive a substantial proportion of their revenue from the sale of products in international markets." Similarly, Oviatt and McDougal (1994, p.49) define International New Ventures as "a business organization that, from inception, *seeks* to derive significant comparative advantage from the sale of outputs in multiple countries."

[9] A notable exception is Germany, which collects services trade data for all firms with total annual transactions in excess of EUR 12,500.

on manufacturing, where detailed export data on the entire population of manufacturing firms are available (Choquette et al. 2017; Ferguson et al. 2019; Braunerhjelm and Halldin 2019). To the best of our knowledge, we are the first to study born globals in computing using firm-level register data, which cover the universe of firms in a particular country and sector. Given the rapid growth of service-based startups and trade in services, our study fills an important void in the literature.

The rest of the paper is organized as follows. An overview of the historic growth in service exports is described in Section 2. The incidence of born globals among the top-250 Swedish computing firms is given in Section 3. Data sources, descriptive statistics and our regression methodology are provided in Section 4. The regression results are presented and discussed in Section 5. Conclusions follow in Section 6.

## 2. Growth in Service Exports

The growth of service exports is a global phenomenon. *Table 1* presents exports of goods and services as a percentage of GDP in Sweden, Finland, Germany, the United Kingdom and the United States in the years 1998, 2007 (the year before the financial crisis) and 2016. The table shows that service exports have grown substantially as a share of GDP between 1998 and 2016; its share has roughly doubled during this period. In Sweden, roughly one third of exports consists of services, and service exports are even more important after adjusting for the import content of exports in goods versus services. 38% of Swedish goods exports consist of imported inputs, which implies that the value added from exports of goods in 2016 equaled 18% of GDP $\left((1-0.38)\cdot 29.4=18.2\right)$.[10] In contrast, the import content of service exports is only 16 percent, which implies that the value added from exports of services from Sweden in 2016 equaled 12% of GDP $\left((1-0.16)\cdot 14.0=11.9\right)$. Thus, the contribution of service exports to Swedish GDP in 2016 was 40% of the total contribution of exports.

Another striking observation that can be made is that goods exports dropped sharply in Sweden and Finland after the financial crisis, while goods exports have returned to pre-crisis levels in Germany, the United Kingdom and the United States. In contrast, the service exports share has increased by between 20 and 33% in all five countries. These facts highlight the importance of studying service exports.

[10] We use the measures of "Domestic value added share of gross exports" in agriculture, hunting, forestry, fishing and industry (NACE Rev. 1.1 1-41) and services (NACE Rev. 1.1 50-95) for 2014, the most recent estimate from the OECD Trade in Value Added (TiVA) database.

{Table 1 near here}

# 3. Born globals among the top-250 Swedish computing firms

We first identify the number of born global firms among the top-250 firms in the "Computer and related services" sector, based on their employment in 2015.[11] We use annual data covering the universe of Swedish firms between 1998 and 2015 from the IFN Corporate Database. This data, based on register data from Statistics Sweden, includes detailed accounting records collected from tax returns, including employment, sales and value added. The data also includes information on ownership that allows us to determine if the firm belongs to a Swedish company group or is an affiliate of a foreign-owned firm.

Born globals are characterized by an ability to overcome the initial barriers and risks that are associated with entry into foreign markets without first establishing a strong home market presence. In contrast, conventional firms build up a customer base in the domestic market and then gradually expand internationally under a more traditional internationalization process (Bilkey and Tesar 1977; Cavusgil 1980; Johanson and Vahlne 1977).

With the qualitative definitions of born globals of Oviatt and McDougall (1994) and Knight and Cavusgil (2004) in mind, we use the name of each firm among the 250 largest employers in order to find their website and determine whether it fits the profile of a born global firm in the context of computing. We identify firms as born global according to five criteria: 1) they are not spinouts of existing Swedish conglomerates, 2) they are not foreign-owned affiliates in their first year of operation, 3) they sell to consumers using an online distribution and payment system, 4) they have an English-language website, and 5) they sell a product with a clear international market (i.e., computer games, apps, cloud services). Among the top-250 employers in the computing sector in 2015 we find that 37 firms fit the profile of born globals.

While excluding spinouts and foreign-owned firms is intuitive, the latter three criteria for identifying born globals deserve more motivation. An online distribution and payment system reduces transaction costs for domestic and international customers alike. Knight and Cavusgil

[11] The "Computer and related services" sector corresponds to NACE Rev 1.1 division 72. We use NACE Rev 1.1 when studying the top-250 firms because it captures all computer-related activities. In contrast, computing activities in the more recently introduced NACE Rev 2 classification are spread across three divisions: "Publishing activities" (58), "Computer programming, consultancy and related activities" (62) and "Information service activities" (63), which all include several non-computer industries. Using the older industry classification allows us to identify the industry of firms upon founding as far back as 1998 in the data. We use the NACE Rev 2 industry classification and focus on startups founded from 2007 onward in the regression analysis in the next section because NACE Rev. 2 is more detailed and allows us to identify computer game startups in the data.

(2004) posit that the widespread diffusion of the internet makes internationalization a more viable and cost-effective option. Gabrielsson and Gabrielsson (2011) find that internet-based sales channels are more common for born globals that sell to consumers instead of firms. An English-language website is a must for firms targeting an international audience. In contrast, a Swedish-language website would be highly suggestive of a firm that is targeting Swedish customers only. Finally, selling a product with a clear international market (such as computer games) is crucial for selling to customers globally. A Swedish startup with a product or service tailored to the domestic market would clearly not be a born global.

Among the top-250 employers in 2015 are a large number of firms that do not fit the profile of born globals. 94 firms implement business software solutions for other firms. These firms are not as internationally oriented as the born globals, as they often install customized digital business solutions on-site and have a primarily Swedish customer base. Their websites are often exclusively in Swedish. Some of these firms may have an international presence, but all of these firms have a clear focus on the Swedish market. We thus define these businesses as domestic-oriented firms. Another 48 firms began in Sweden as foreign-owned affiliates and are therefore not classified as born globals. Finally, 55 firms began as spinouts from existing Swedish conglomerates, and are not classified as born globals. Born globals are startups by definition and are thus not established as a spinout of an existing firm.[12] Finally, 16 firms could not be categorized into any of these four groups. Overall, only 15% of the top-250 firms fit the profile of born globals.

The evolution of the average employment per calendar year for born globals, domestic-oriented firms, foreign-owned affiliates and spinouts among the 250 computing firms with the highest 2015 employment is illustrated in *Figure 1*. The majority of these firms were founded after 1998, and average employment was relatively low and similar across groups in the late 1990s. Employment among foreign-owned affiliates grew the fastest compared to other types of firms between 2000 and 2005, then grew at a slower pace between 2006 and 2015. Average employment growth among born globals was similar to spinouts during the 1998–2015 period, which was lower than foreign-owned firms but higher than domestic-oriented firms. Overall, *Figure 1* suggests that successful foreign-owned affiliates have contributed more to employment than successful born globals in recent years. These results also suggest that born globals had a considerable size and growth advantage compared to domestic-

[12] This is an important difference compared to many international new ventures that begin life as spinouts (Oviatt and McDougall 1994).

oriented firms between 2007 and 2015. This aspect will be studied more rigorously in the next section.

The breakdown of born globals by industry among the top-250 firms is given in *Table 2*. Computer game publishers among the top-250 2015 employers are few, but overwhelmingly belong to the born global category. Other software publishing firms are also few in number and split evenly between the born global and domestic-oriented category. 20 of the 37 born globals are classified as computer programming firms, although there are nearly twice as many computer programming firms that are domestic-oriented. Finally, very few computer consultancy firms fit our definition of computing born globals. While there are 45 computer consultancy firms among the top-250 2015 employers, only seven qualify as born globals. These results suggest that computer game publishers are the most likely to be born global, while computer consulting firms are more likely to be domestic-oriented and thereby well-suited to act as a control group. Other software publishing and computer programming firms share characteristics of both born globals and domestic-oriented firms.

{Figure 1 near here}
{Table 2 near here}

# 4. Regression methodology

The analysis of the top-250 computing firms revealed that certain categories of business have a higher predisposition to be born globals than others. We use this insight in our firm-level regression analysis by comparing the performance of computing startups according to their industry class. In this section we describe the firm-level data, provide some descriptive statistics and explain our regression methodology.

## 4.1 Data description

We use firm-level register data covering all computing startups founded 2007–2015 in the IFN Corporate Database. The analysis focuses on the following NACE Rev. 2 classes: "Publishing of computer games" (58.21), "Other software publishing" (58.29), "Computer programming activities" (62.01) and "Computer consultancy activities" (62.02). Firm accounting variables such as sales, value added and the number of employees, as well as capital (fixed assets) and labor costs, are derived directly from firms' tax returns.

Descriptive statistics are presented in *Table 3*, where we report the sample averages for the firm size measures under various sample restrictions. *Table 3* highlights the fact that newly created firms in computing tend to be small, with less than four employees on average in the

unrestricted sample. Removing foreign-owned firms and spinouts leaves the sample averages largely unchanged for the outcome variables and average labor costs, but removing spinouts increases the capital–value added ratio.

{Table 3 near here}

The number of firms included in the analysis for each age cohort using the full set of sample restrictions is illustrated in *Figure 2*. The analysis includes 134 computer game startups, 3,597 computer consulting startups, 490 startups producing other software and 4,211 programming startups. Note that computer game startups thus only make up 1.5% of all startups in the computing sector. The number of firms in the analysis decreases with firm age, which is due to a combination of exits and truncation due to the fact that we only observe firms until 2015, regardless of age. *Figure 2* suggests that exit rates are similar across the different types of computing businesses.

{Figure 2 near here}

{Figure 3 near here}

The average number of employees by firm age among born globals (i.e., firms in the computer games industry), computer consulting firms, other software firms and programming firms in the data is presented in *Figure 3*. The figure suggests that all types of firms start with approximately two employees on average upon founding. Computer game publishers grow faster in terms of employment, reaching about 13 employees for firms that reach the age of eight years. Other software and programming firms employ an average of between six and seven employees at the age of eight, while computer consulting firms grow most slowly in terms of employment, with just more than five employees on average at among the oldest firms in the analysis.

The average sales and value added among born globals (i.e., startups in the computer games industry), other exporters (other software and programming industries) and non-exporting firms (computer consulting) under our final sample are presented in *Figures 4* and *5*, respectively. Our final sample corresponds to the sample after imposing the same restrictions in column (6) of *Table 4* but includes firms of all ages. We find that computer game publishers initially grow faster than other types of startups in terms of sales and value added, but computer consulting firms nearly catch up by the time they are eight years old. The

decrease in sales and value added for computer game publishers older than four is caused primarily by Mojang, a highly successful computer game startup founded in 2011.[13] The fact that older startups are not present in the data for all years underscores the importance of controlling for calendar year in the regression analysis.

{Figure 4 near here}

{Figure 5 near here}

## 4.2 Empirical approach

We test whether five-year-old computer game publishers founded 2007–2015 are larger than computer consulting firms. We perform a cross-section regression analysis at the firm level using OLS, which takes the following form:

$$log\left(Size_{i,age=5}\right) = \alpha + \beta(BornGlobal_i) + \gamma\left(Controls_{i,age=1}\right) + \delta_t + \varepsilon_i, \quad (1)$$

where $Size_{i,age=5}$ is the size proxy for firm $i$ in the year where it turns five years old. We regress equation (1) separately using employees, sales and value added as measures of firm size. The main explanatory variable of interest is the born global indicator variable, $BornGlobal_i$, which equals one if firm $i$'s main activity is "Publishing of computer games" and takes a value of zero if its main activity is "Computer consultancy activities". $Controls_{i,age=1}$ denotes firm-level controls for capital intensity and labor costs per worker, both measured when the firm is one year old. Controlling for firm-level capital intensity and labor costs per worker ensures that our results are not being driven by more primitive underlying firm-level characteristics. We include a set of calendar year indicators, $\delta_t$, which control for the impact of year-specific factors on firm size, such as the business cycle.[14]

Since we log the firm size measures, a positive point estimate for the industry indicator variable indicates that computer game publishers are $\left(e^{\beta} - 1\right) \cdot 100$ percent larger in size compared to computer consulting firms. Logging removes the small fraction of observations with non-positive employment, sales or value added, and results in slightly different numbers of observations in the regressions depending on the outcome variable of interest. The null

[13] Mojang's accounting period was exceptionally long (18 months) in 2014–2015. In the analysis, we accrue 2/3 of their sales and value added to the 2014 accounting period, and 1/3 to the 2015 accounting period.

[14] The same regression model will also be used below to estimate any differences in the three outcome measures between computer consulting firms and other software publishers and programming firms, respectively.

hypothesis is that there is no size difference in terms of employment, sales or value added between the two industry types.

# 5. Regression results

Our estimations of the size premium of five-year-old computer game publishers compared to computer consulting firms are presented in *Table 4*.

Panels A, B and C in *Table 4* present the results using logged employees, sales and value added, respectively, as measures of firm size. In column (1) we estimate the size premium associated with born globals without any sample restrictions. In column (2) we control for firm-level capital intensity and labor costs per worker. In column (3) we have removed firms that are foreign-owned in order to ensure that our results are not driven by foreign-owned affiliates. We define firms as foreign-owned if they are formally owned by a foreign company group, or if their name includes the words "Sweden" (in English or Swedish) or the word "Europe". In column (4) we estimate the size premium of born globals after also removing spinouts. A firm is defined as a spinout if its employment is less than 50% of its company group's total employment upon inception, which removes firms belonging to larger company groups. In columns (5) and (6) we present the regression results after further restricting the sample to include only firms with less than 50 employees and 20 employees in their first year, respectively. We impose the employment restrictions in order to further ensure that our analysis is focused on true startups.

{Table 4 near here}

Panel A of *Table 4* presents the results for employment. In column (1), prior to adding firm-level controls and removing foreign-owned firms or spinouts, we find a large and statistically significant employment premium associated with computer game publishers. This employment premium persists after adding firm-level controls in column (2), removing foreign-owned firms in column (3), and removing spinouts from the analysis in column (4). The point estimate for $BornGlobal_i$ continues to be statistically significant and stable in magnitude when we also remove firms with unusually high employment in their first year in columns (5) and (6). The point estimate for $BornGlobal_i$ in column (6) implies that the number of employees among five-year-old computer game publishers is 154% ($(e^{0.933} - 1) \cdot 100 \approx 154$) higher than similarly aged computer consulting firms on average.

In Panel B we find a statistically significant size premium in terms of sales once firm-level controls are added, which is robust to applying the full set of sample restrictions. The point estimate in column (6) of Panel B suggests that sales among computer game publishers is 138% ($(e^{0.865} - 1) \cdot 100 \approx 138$) higher than computer consulting firms at the age of five. However, in Panel C we find evidence of a statistically significant size premium in terms of value added only in column (2). Overall, the results of *Table 4* suggest that computer game startups have a clear size advantage relative to computer consulting startups in terms of employment, but less clearly so in terms of value added.

In *Tables 5* and *6* we present the regression results when software firms and programming firms are defined as the born global group, respectively. In *Table 5*, the odd-numbered columns report the point estimates for the $BornGlobal_i$ indicator variable when no sample restrictions are applied, while firm-level controls are added and foreign-owned firms, spinouts, and firms with 20 employees or more at founding are excluded from the sample in the even-numbered columns (corresponding to the full set of restrictions used in column (6) of *Table 4*). We find that software firms are characterized by a statistically significant size difference in terms of employment, which is robust to excluding foreign-owned firms and spinouts. The point estimate in column (2) implies that the number of employees among five-year-old software publishers is 32% ($(e^{0.275} - 1) \cdot 100 \approx 32$) higher than similarly aged computer consulting firms on average. Software firms display no size advantage in terms of sales regardless of whether the full set of controls and restrictions are applied. Finally, we find a significant size advantage in terms of value added, which implies that value added of software publishers is 43% ($(e^{0.359} - 1) \cdot 100 \approx 43$) higher than similarly aged computer consulting firms on average at the age of five.

The results for programming firms in *Table 6* reveal a statistically significant size premium in terms of employment, but not in terms of sales or value added. The point estimate for $BornGlobal_i$ in column (2) implies that the number of employees among five-year-old programming firms is 10% ($(e^{0.092} - 1) \cdot 100 \approx 10$) higher than similarly aged computer consulting firms on average.

Overall, we find a systematic positive relationship between the propensity of a computing firm to be born global and its size premium relative to computer consulting firms at the age of five. Computer game firms, which arguably have the highest predisposition to become born globals, are characterized by the largest size premium in terms of employment (154 percent). Other software publishers and programming firms, which are less inclined to become born

globals compared to computer game publishers, have a correspondingly lower size premium in terms of employment at 32% and 10%, respectively. We find mixed evidence for a computing born global size premium in terms of sales or value added.

{Table 5 near here}

{Table 6 near here}

Our results differ from studies of manufacturing born globals by Braunerhjelm and Halldin (2019) and Choquette et al. (2017), which find larger size premia in terms of sales than in terms of employment. Ferguson et al. (2019) find no size premium in terms of employment and small and weakly significant size premia in terms of sales and value added among manufacturing firms. In the context of manufacturing, Ferguson et al. (2019) argue that the weakly positive result for sales and value added among manufacturing firms may be due to the presence of economies of scale in production, whereby export growth leads to higher output among born globals but does not result in a corresponding increase in employment in these firms. In the context of computing, however, many software and programming startups are characterized by low sales and value added in early years.

In *Figure 6* we present the results of the regression analysis by firm age. The results are based on regression equation (1), and each column illustrates the point estimate for the $BornGlobal_i$ indicator variable and the corresponding 95% confidence interval within each firm age cohort.[15] The first column illustrates the regression results when the dependent variable is logged employment the year the firm is founded (age = 0), the second column illustrates the results in the following year (age = 1), and so forth. We perform separate regressions for each age group in our data up to eight years after birth. We perform these regressions by firm age in order to confirm that our results for the cohort of five-year-old firms are robust to varying the time horizon of our analysis. The gradient of these point estimates over firms' lifespans is also informative regarding the relative growth in employment, sales and value added for born globals versus other exporting firms in the long run.

Panel A of *Figure 6* reports the regression results by firm age for computer game, other software and programming firms when firm-level employment is the dependent variable. We find that employment among computer game publishers is statistically significantly higher for all age cohorts, and the size premium for computer game publishers grows over their lifespan,

[15] The sample used in *Figure 6* imposes the same sample restrictions as column (6) of Table 4 for each age group.

from a 60% premium upon founding ($(e^{0.467} - 1) \cdot 100 \approx 60$), to a 243% premium at the age of seven ($(e^{1.234} - 1) \cdot 100 \approx 243$). Other software firms are characterized by a positive size premium until they reach the age of six, whereupon their size premium diminishes. The employment advantage of programming firms is statistically significant until the firms reach the age of six, but the effects are small.

Panel B of *Figure 6* reports the regression results by firm age when firm-level sales is the dependent variable. The results indicate that computer game, other software and programming firms are smaller than computer consulting firms in terms of sales at inception, but sales grow over their lifespans. Computer game publishers overtake computer consulting firms at the age of two, but their size advantage in terms of sales is not statistically significant until they reach the age of four. Other software firms display a negative size advantage until they are three years old, and no statistically significant size advantage in later years. Programming firms begin life with the smallest size disadvantage but their low subsequent sales growth entails that they do not overtake computer consulting firms at any point over the eight-year age horizon that we study.

{Figure 6 near here}

Panel C of *Figure 6* reports the regression results by firm age when value added is the outcome variable. Computer game publishers begin life at par with computer consulting firms in terms of value added, and then grow over their lifespan. However, we find evidence of a statistically significant difference in value added among computer game publishers only for firms aged two, three, six and seven. Other software firms begin life with significantly lower value added compared to computer consulting firms, and the low and erratic growth in value added implies that we find a statistically significant size advantage in terms of value added at age three and five among these firms. Finally, programming firms also begin life with a size disadvantage, and their low growth leads does not lead to a statistically significant size advantage in terms of value added.

# 6. Conclusion

Promoting the emergence and growth of born globals in the computing sector is seen in many circles as a desirable policy goal. We have analyzed whether computing startups within industries with a high propensity to be born globals are characterized by higher employment, sales and value added in the long run. We study this question using detailed firm-level data on

the universe of Swedish computing startups founded 2007–2015, which allows us to follow computing startups for a period of up to eight years.

Overall, our results suggest a systematic relationship between an industry's propensity to be born global and its long-run employment compared to our control group of computer consulting firms (which were shown in *Table 2* to be more often domestically oriented). We find the largest size and growth advantage among computer game publishers, which were shown in *Table 2* to have the strongest propensity to become born globals. However, a corresponding size advantage in terms of sales takes several years to materialize, and the long-run size premium in terms of value added is highly unstable (yet positive overall). Other software publishers and programming firms exhibit a modest size advantage over computer consulting firms in terms of employment, but not in terms of sales or value added. Finally, our results suggest that a born global export strategy is practiced by a small number of Swedish computing firms; only 15% of the 250 largest employers in computing were identified as born globals. Moreover, a mere 1.5% of all computing startups were computer game publishers, which arguably have the highest propensity to be born global. Policymakers must therefore be aware that encouraging more born globals need not necessarily lead to large benefits for the overall economy.

Our use of a qualitative definition of born globals that is independent of the firms' later performance may be seen by some as a limitation of the analysis, but we argue that it is useful in ensuring that the investigation does not only focus on successful exporters but also on those firms that seek to be global from the outset but do not succeed. A qualitative definition is potentially a useful approach to studying born globals using register data in industries where export data is lacking. Another potential weakness of the study is our definition of the entire set of computer game startups since 2007 as born global in their entirety. However, we argue that the digitalized distribution of computer game sales implies that all of these firms had the global market in mind upon founding, and this is therefore another example of a "born global industry". We hope that our study encourages future work on not only the methodological issues related to evaluating born globals' performance, but also the broader implications of born globals for aggregate employment.

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*Figure 1* Average employment per year among the 250 computing firms with highest employment in 2015: export-oriented firms, domestic-oriented firms, foreign-owned affiliates and spinouts.

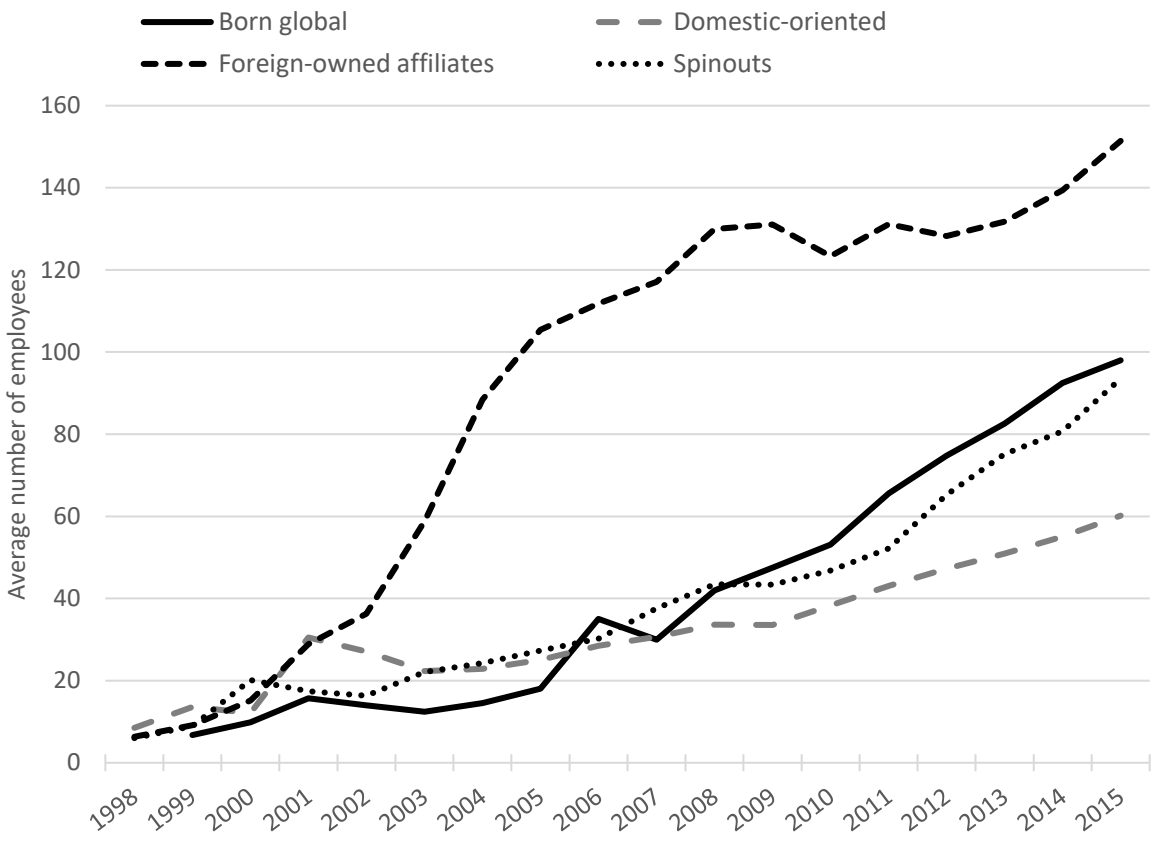


*Figure 2* Number of firms by firm age: Swedish computer game, computer consulting, other software and programming firms founded 2007–2015.

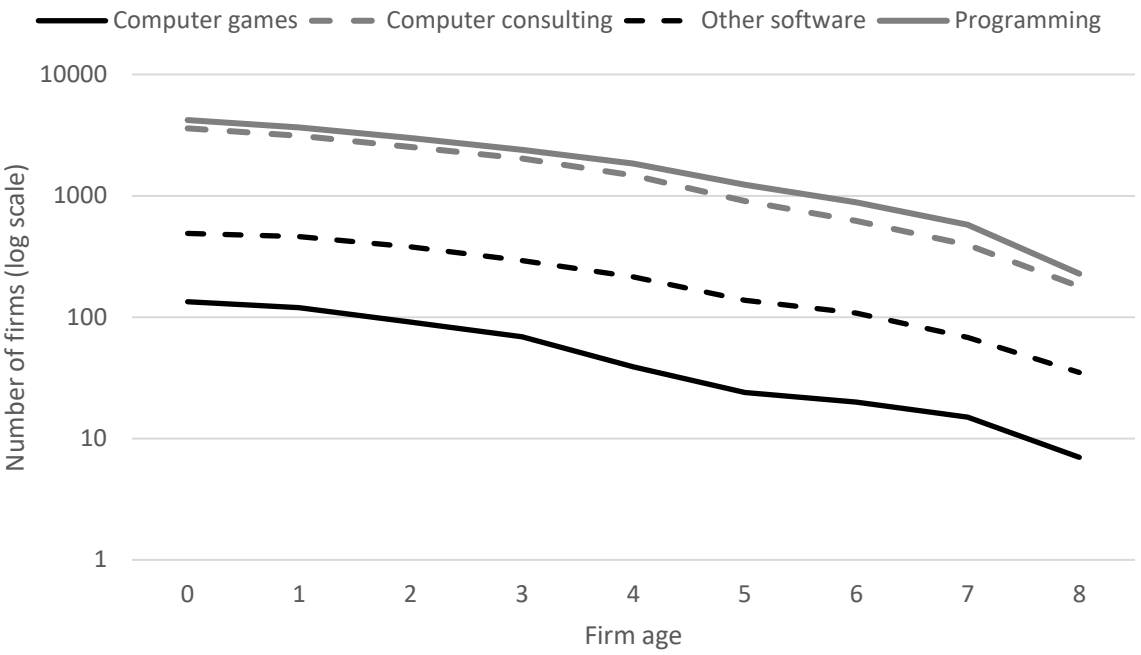


*Figure 3* Average employment by firm age: Swedish computer game, computer consulting, other software and programming firms founded 2007–2015.

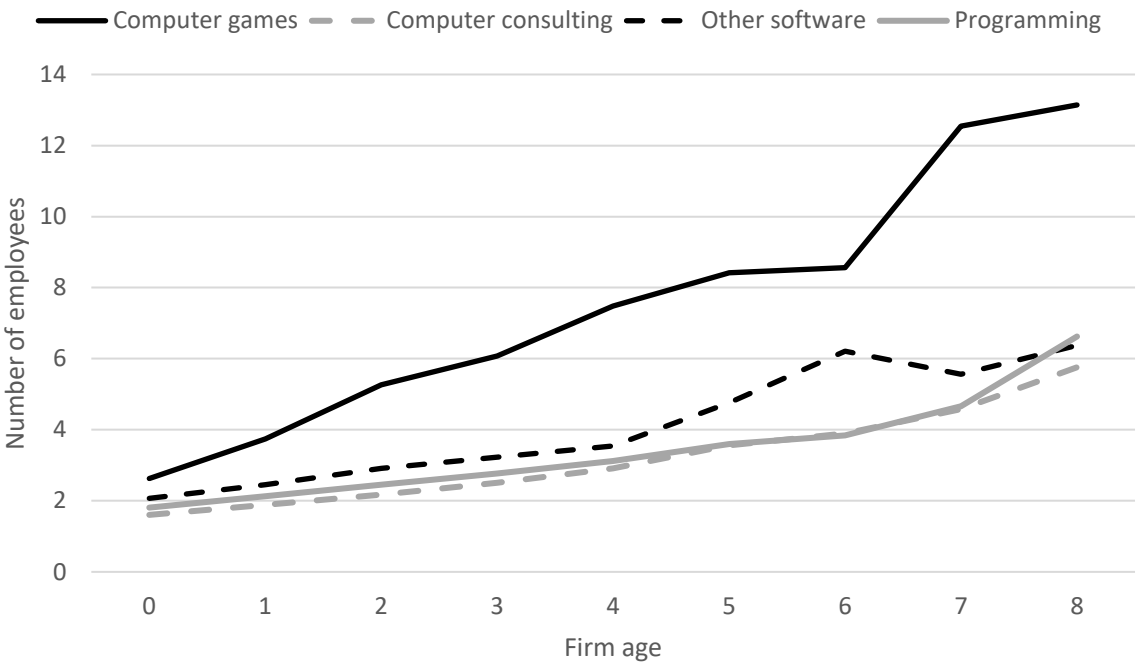
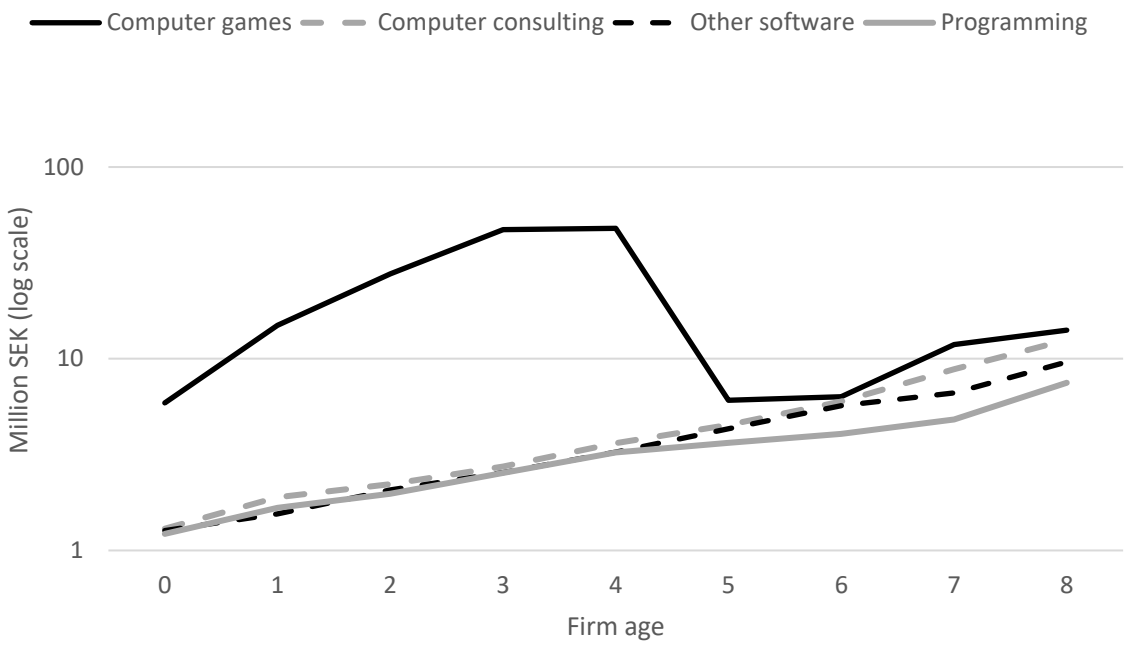


*Figure 4* Average sales by firm age: Swedish computer game, computer consulting, other software and programming firms founded 2007–2015.




*Note*: USD 1 ≈ SEK 8.

*Figure 5* Average value added by firm age: Swedish computer game, computer consulting, other software and programming firms founded 2007–2015.

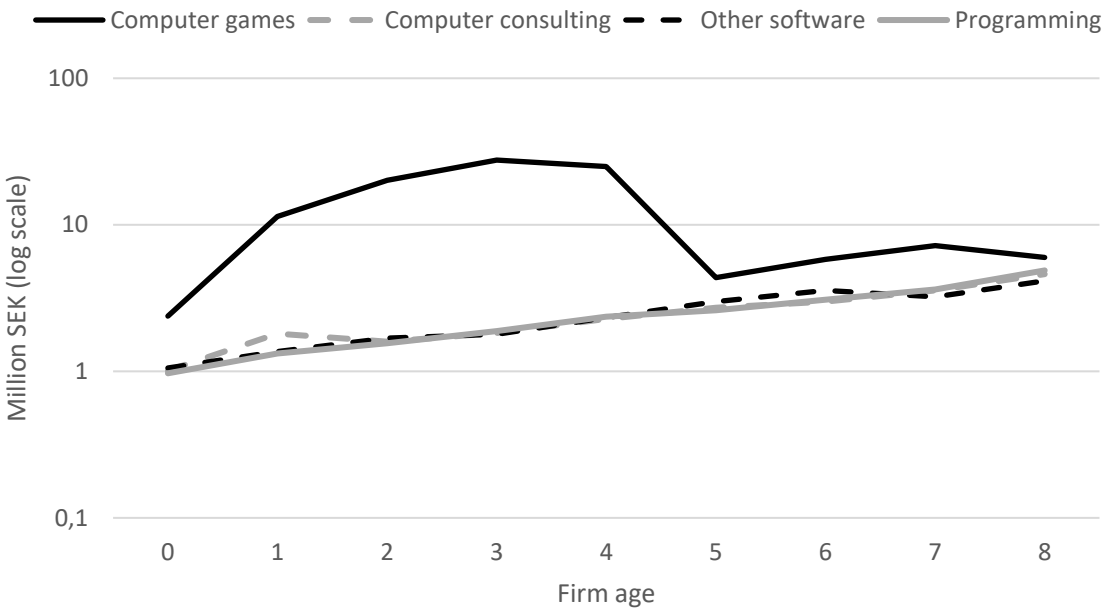


*Figure 6* Difference in employment, sales and value added by firm age: computer game publishers, other software publishers and programming firms versus computer consulting firms.

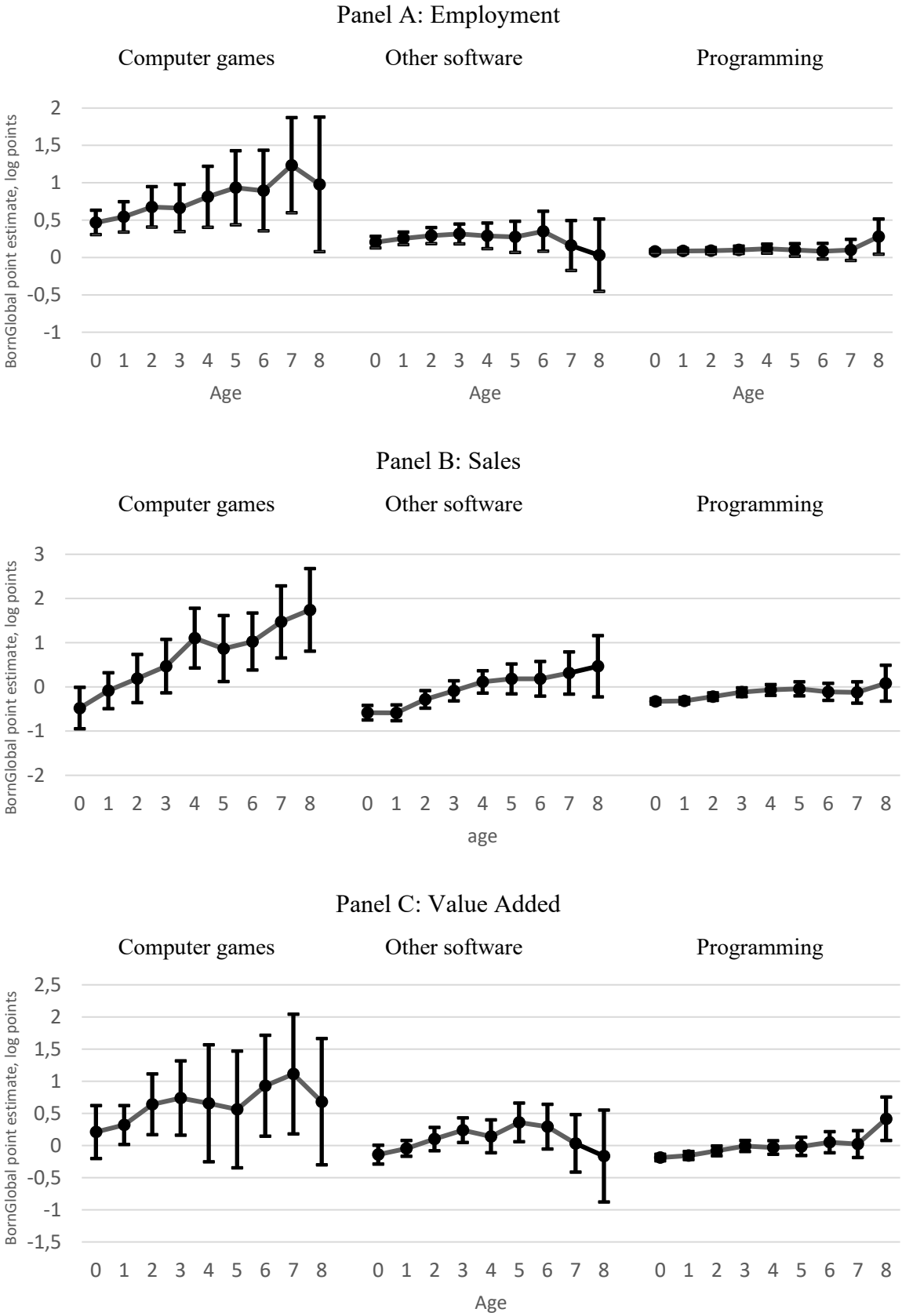


*Table 1* Exports of goods and services as a percentage of GDP in Sweden, Finland, Germany the United Kingdom and the United States, 1998, 2007 and 2016.

| | | 1998 | 2007 | 2016 |
|---|---|---|---|---|
| Sweden | Goods | 32.9 | 37.0 | 29.4 |
| | Services | 6.6 | 11.0 | 14.0 |
| | Total | 39.5 | 48.0 | 43.4 |
| Finland | Goods | 31.6 | 34.8 | 24.5 |
| | Services | 6.0 | 9.2 | 11.1 |
| | Total | 37.6 | 44.0 | 35.6 |
| Germany | Goods | 22.9 | 36.9 | 37.9 |
| | Services | 3.8 | 6.1 | 8.1 |
| | Total | 26.7 | 43.0 | 46.0 |
| United Kingdom | Goods | 16.6 | 14.5 | 15.4 |
| | Services | 7.1 | 10.4 | 12.9 |
| | Total | 23.7 | 24.9 | 28.3 |
| United States | Goods | 7.4 | 8.0 | 7.8 |
| | Services | 2.9 | 3.4 | 4.0 |
| | Total | 10.3 | 11.4 | 11.9 |

*Source*: OECD, authors' calculations.

*Table 2* Number of born global and domestic-oriented firms by industry class among the 250 computing firms with highest employment in 2015.

| NACE Rev. 2 class | Number of firms | |
|---|---|---|
| | Born global | Domestic-oriented |
| Publishing of computer games | 5 | 1 |
| Other software publishing | 3 | 3 |
| Computer programming activities | 20 | 38 |
| Computer consultancy activities | 7 | 38 |
| Data processing, hosting and related activities | 1 | 3 |
| Web portals | 1 | 4 |

*Notes*: Sample based on firms included in Figure 1. Includes only industry classes that report at least one born global firm. Domestic-oriented firms also found in four other industry classes.

*Table 3* Descriptive statistics, Swedish computer game, computer consulting, other software and programming firms founded 2007–2015.

| Variable (Averages) | No restriction | + add firm controls | + not foreign owned | + remove spinouts | + < 50 employees | + < 20 employees |
|---|---|---|---|---|---|---|
| Employees | 3.6 | 3.5 | 3.2 | 2.9 | 2.8 | 2.7 |
| Sales (million SEK) | 4.0 | 4.5 | 4.0 | 3.6 | 3.6 | 3.4 |
| Value added (million SEK) | 2.9 | 2.7 | 2.5 | 2.2 | 2.2 | 2.1 |
| Capital–value added ratio | | 0.10 | 0.12 | 0.43 | 0.36 | 0.36 |
| Average labor costs (thousand SEK) | | 486 | 480 | 472 | 474 | 474 |

*Notes*: Sample based on firms included in Tables 4–6. Sample restriction criteria use information for the year that the firm is founded.

*Table 4* Regression results, computer game publishers versus computer consulting firms, age = 5.

| Panel A: log(employees) | | | | | | |
|---|---|---|---|---|---|---|
| | No restriction | + firm controls | + remove foreign owned | + remove spinouts | + < 50 employees | + < 20 employees |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| *Born* | 1.012*** | 1.262*** | 1.066*** | 0.915*** | 0.926*** | 0.933*** |
| $Global_i$ | (0.307) | (0.319) | (0.294) | (0.252) | (0.253) | (0.252) |
| *N* | 949 | 853 | 786 | 751 | 714 | 712 |
| $R^2$ | 0.041 | 0.056 | 0.045 | 0.038 | 0.040 | 0.040 |

| Panel B: log(sales) | | | | | | |
|---|---|---|---|---|---|---|
| | No restriction | + firm controls | + remove foreign owned | + remove spinouts | + < 50 employees | + < 20 employees |
| *Born* | 0.284 | 0.771* | 0.989** | 0.828** | 0.857** | 0.865** |
| $Global_i$ | (0.439) | (0.449) | (0.389) | (0.364) | (0.381) | (0.381) |
| *N* | 1,121 | 918 | 843 | 806 | 766 | 764 |
| $R^2$ | 0.009 | 0.065 | 0.063 | 0.052 | 0.056 | 0.054 |

| Panel C: log(value added) | | | | | | |
|---|---|---|---|---|---|---|
| | No restriction | + firm controls | + remove foreign owned | + remove spinouts | + < 50 employees | + < 20 employees |
| *Born* | 0.463 | 1.114** | 0.823 | 0.544 | 0.553 | 0.560 |
| $Global_i$ | (0.545) | (0.505) | (0.500) | (0.457) | (0.460) | (0.462) |
| *N* | 717 | 643 | 593 | 567 | 538 | 536 |
| $R^2$ | 0.004 | 0.096 | 0.078 | 0.061 | 0.063 | 0.061 |

*Notes*: Capital intensity and average labor costs at age=1 and calendar year fixed effects included in all specifications. Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

*Table 5* Regression results, other software publishers versus computer consulting firms, age = 5.

| | log(employees) | | log(sales) | | log(value added) | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| $BornGlobal_i$ | 0.290*** | 0.275*** | 0.0899 | 0.135 | 0.257* | 0.359** |
| | (0.0976) | (0.106) | (0.164) | (0.177) | (0.150) | (0.153) |
| Sample restrictions | None | All | None | All | None | All |
| $N$ | 1,076 | 791 | 1,270 | 852 | 812 | 596 |
| $R^2$ | 0.024 | 0.025 | 0.006 | 0.060 | 0.006 | 0.081 |

*Notes*: Same sample restrictions as column (6) in *Table 4*. Capital intensity and average labor costs at age=1 and calendar year fixed effects included in all specifications. Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

*Table 6* Regression results, programming firms versus computer consulting firms, age = 5.

| | log(employees) | | log(sales) | | log(value added) | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| $BornGlobal_i$ | 0.0937** | 0.0924** | -0.0248 | 0.0794 | 0.0118 | 0.0751 |
| | (0.0431) | (0.0462) | (0.0758) | (0.0818) | (0.0705) | (0.0738) |
| Sample restrictions | None | All | None | All | None | All |
| $N$ | 2,171 | 1,603 | 2,611 | 1,731 | 1,658 | 1,222 |
| $R^2$ | 0.014 | 0.020 | 0.006 | 0.068 | 0.001 | 0.081 |

*Notes*: Column (2) uses same sample restrictions as column (6) in *Table 4*. Capital intensity and average labor costs at age=1 and calendar year fixed effects included in all specifications. Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.