Exporting a Bit Faster: The Long-Run Performance of Born Globals in Computing

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

Exporting a Bit Faster: The Long-Run Performance of Born Globals in Computing[*]

Shon Ferguson[†] and Magnus Henrekson[‡]

Research Institute of Industrial Economics (IFN),
Box 55665, SE-102 15, Stockholm, Sweden

August 9, 2018

Abstract: Policymakers in several countries have recently taken steps to promote the rapid export expansion of high-tech small- and medium-sized enterprises (SMEs). The goal of these policies has been to create successful export-intensive firms, which are often referred to as born globals. 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. 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 domestically-oriented computer firms. We find mixed 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 percent of the 250 largest computing employers in 2015 were born globals. Moreover, only 1.5 percent 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.

[†] Corresponding author. Research Institute of Industrial Economics (IFN), P.O. Box 55665, SE-102 15 Stockholm, Sweden. E-mail: shon.ferguson@ifn.se. Phone: +46-70-723 87 11.
[‡] Research Institute of Industrial Economics (IFN), P.O. Box 55665, SE-102 15 Stockholm, Sweden. E-mail: magnus.henrekson@ifn.se.

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-orientated product to expand. The goal of these policies has been to create successful export-intensive 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 the computing sector. 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 domestically-oriented peers in the long run. Many governments around the world actively support computing startups via business incubator programs (UBI Global, 2018), making this an important policy question.

Studies often identify born globals in the data based on export performance early in the firm's life, and this quantitative categorization is then used to perform long-run performance comparisons with non-born globals.[4] Such "ex post" identification of born globals suffers from spurious correlation, as it is unclear whether long-run outcomes are caused by the early

---

[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".

[4] 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 the age of the firm at which this export intensity criteria is met. In the literature, numerous definitions have been applied (see, e.g., Halldin, 2012; 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.

internationalization itself, or if both early internationalization and long-run success are both driven by the firms' innate features, which predate firms' export decision.[5]

The lack of detailed data on service exports in Sweden and many other 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. This is not the case for services and therefore other strategies have to be used if one wants to study service sector firms. As a result, the few existing empirical studies of born globals have focused on manufacturing, where detailed export data on the entire population of manufacturing firms is available (Halldin, 2012; Choquette et al., 2017; Ferguson et al., 2018).

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 has allowed for the emergence of so-called "micro-multinationals" in certain industries (Varian, 2010). By identifying potential born globals according to their industry characteristics we are able to avoid the problem of spurious correlation associated with many other studies that define born globals according to early startup performance. Moreover, since our identification of potential born globals does not require data on each firm's exports of services, we are also able to perform this analysis using Swedish data, where services export data would otherwise be inadequate to identify born globals based on export data. 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.

Our analysis is based on highly detailed firm-level register data covering all computing startups founded between 2007 and 2015 for Sweden, a small and open economy with a thriving computing sector. In the first part of the analysis we focus on the top-250 computing firms in Sweden according to employment in 2015, and show that only 15% of these firms fit the profile of born globals, while the remaining 85% are either foreign-owned affiliates, spinouts from existing Swedish firms, or other types of non-born global enterprises. 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.

In the second part of the analysis we compare the employment growth of the entire population of startup computer game and computer consulting firms in the Swedish data

---

[5] 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).

founded 2007–2015. We argue that the online nature of computer game distribution implies 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 value added, and it takes four years before they are significantly larger than computer consulting firms in terms of sales. We also find that only a small number of workers in the computing sector are employed by computer game firms. Our results thus suggest that promoting born globals may be a misguided policy since they are relatively small contributors to employment. Our results also indicate that foreign-owned affiliates, spinoffs and other domestically-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 strategic management and international business that studies the causes and consequences of born globals' export-intensive strategy (Knight and Cavusgil, 1996, 2004). [6] Research on born globals has mainly focused on documenting their characteristics and understand the underlying trends that give rise to these types of firms (Moen and Servais, 2002), and the study of born globals' performance is relatively new to the literature. Moreover, 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.

2. Growth in Services Exports

The growth of services 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 services 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 services exports are even more important after adjusting for the import content of exports in goods versus services. 38 percent of Swedish goods exports consist of imported inputs, which implies that the value added from exports of goods in 2016

---

[6] These studies found that born globals are typically innovation-intensive (Andersson and Wictor, 2003; Cavusgil and Knight, 2015), human capital-intensive (Knight, 2001; McDougall et al., 1994, 2003; Melén and Nordman, 2007; Kaur and Sandhu, 2013), and are characterized by a production process that is easily scalable (Kudina et al., 2008; Cannone and Ughetto, 2014).

equaled 18 percent of GDP $\left((1 - .38) \cdot 29.4 = 18.2\right)$.[7] In contrast, the import content of services exports is only 16 percent, which implies that the value added from exports of services from Sweden in 2016 equaled 12 percent of GDP $\left((1 - .16) \cdot 14.0 = 11.9\right)$. Thus, the contribution of service exports to Swedish GDP in 2016 was 40 percent 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 they 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 percent in all five countries. These facts highlight the importance of studying services exports.

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.

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.[8] We use annual data

---

[7] 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.

[8] 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 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

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). In a literature review, Bader and Mazzarol (2009) found 12 different definitions across 126 studies, where the most referenced definition was Oviatt and McDougall (1994). They defined born global firms as an extreme version of "international new ventures" that are international from inception and derive "significant competitive advantage from the sales from multiple countries".

With these qualitative definitions of born globals 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 define firms as born global according to five criteria: 1) they are not spinoffs of existing Swedish conglomerates, 2) they are not foreign-owned affiliates in their first year of operation, 3) they sell to consumers using a digitalized 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.

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

---

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 Rev. 2 is more detailed and allows us to identify computer game startups in the data.

startups by definition and are thus not established as a spinout of an existing firm.[9] Finally, 16 firms could not be categorized into any of these four groups. Overall, only 15 percent 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 spinoffs 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 modest size and growth advantage compared to domestic-oriented firms. This aspect will be studied more rigorously in the next section.

---

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

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.
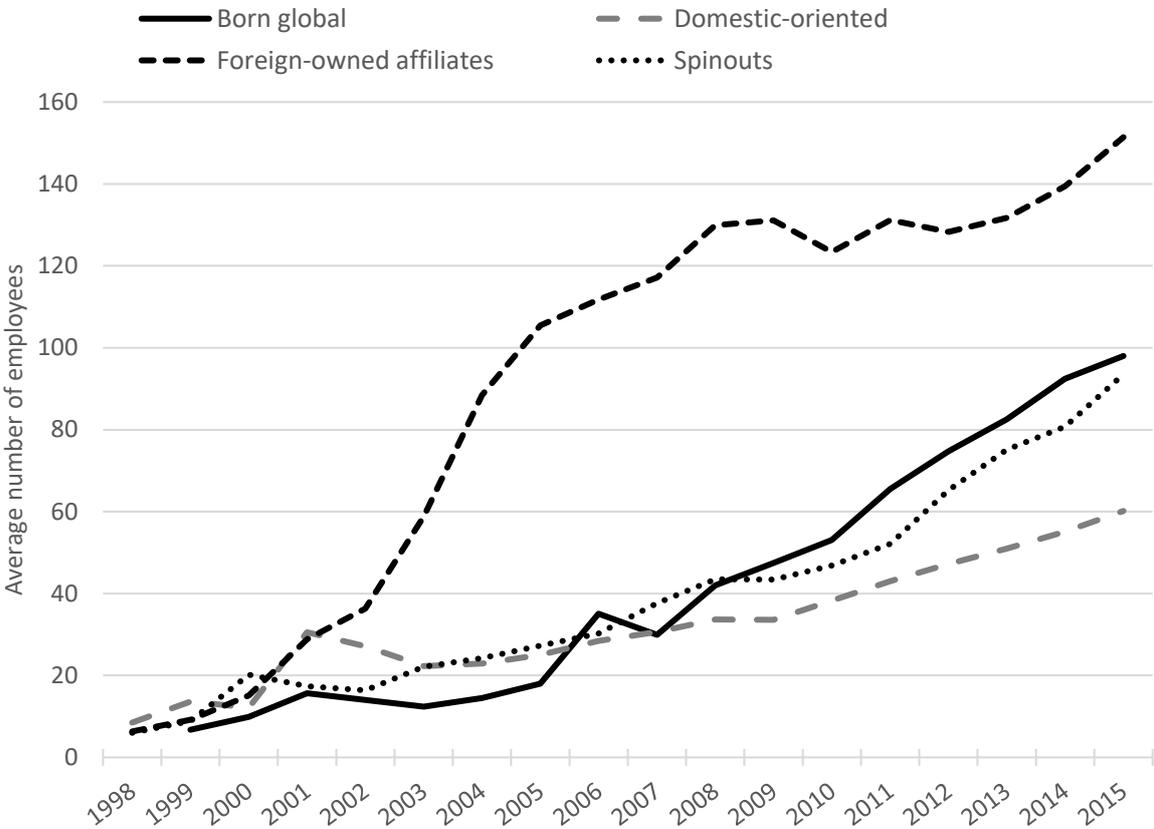
The breakdown of born globals by industry among the top-250 firms is given in *Table 2*. Computer game publishers among the top-250 2015 employers are few, but overwhelmingly belong to the born global category. Other software publishing firms are also few in number and split evenly between the born global 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 85 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.

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.

4. 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.
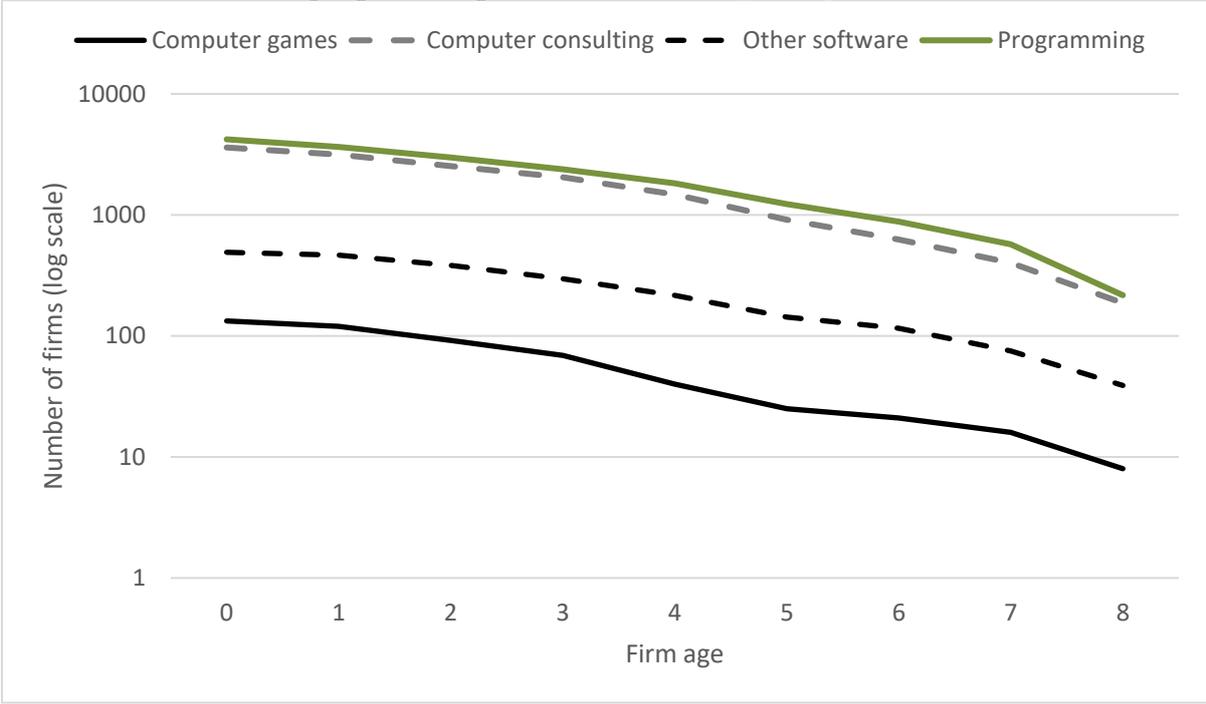
Table 3 Descriptive statistics, Swedish computer game, computer consulting, other software and programming firms founded 2007–2015.

| 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		0.11	0.13	0.43	0.35	0.35
Average labor costs (thousand SEK)		484	479	471	473	472

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

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 133 computer game startups, 3,606 computer consulting startups, 491 startups producing other software and 4,214 programming startups. 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 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.
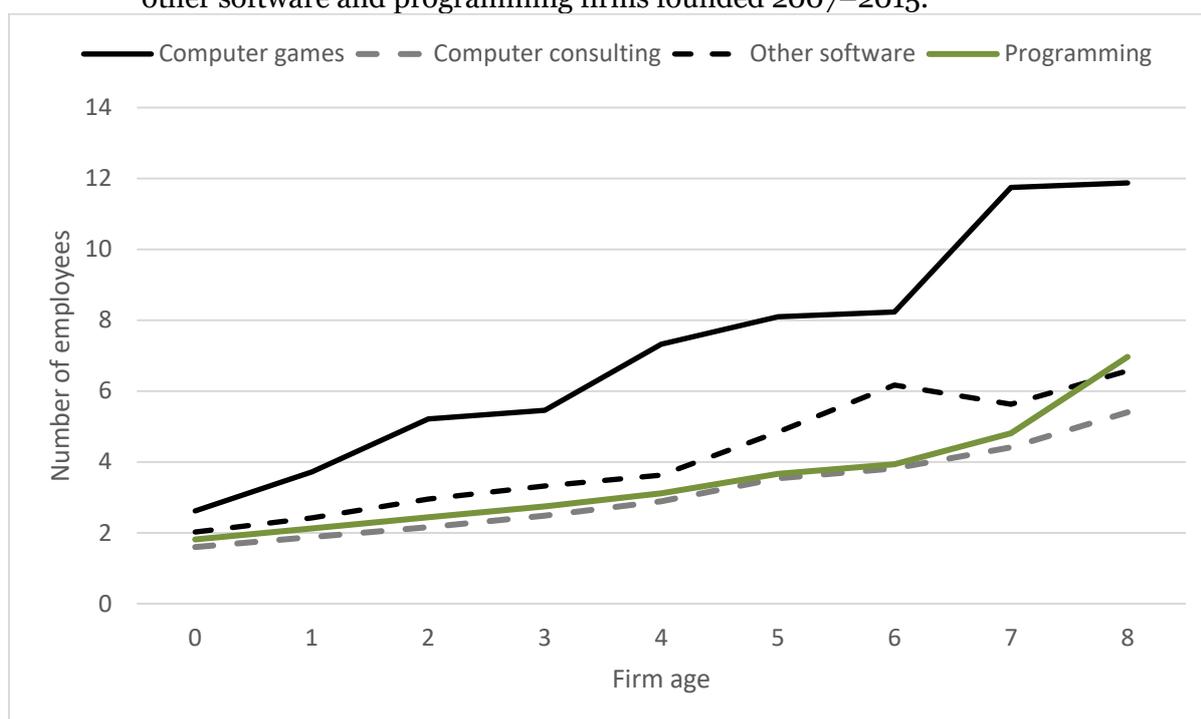

The average number of employees by firm age among born globals, computer consulting firms, other software firms and programming firms in the data is presented in *Figure 3*. The figure suggests that all types of firms start with approximately two employees on average upon founding. Computer game publishers grow faster in terms of employment, reaching about 12 employees for firms that reach the age of eight. Other software firms employ an average of six employees at the age of eight, while computer consulting firms and programming firms grow most slowly in terms of employment, with less than five employees on average at among the oldest firms in the analysis.

The average sales and value added among born globals, other exporters and non-exporting firms under our final sample are presented in *Figures 4* and *5*, respectively. 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.[10] The fact that younger startups are not present in the data for all years underscores the importance of controlling for calendar year in the regression analysis.

---

[10] Mojang's employment, sales and value added accrued to its corporate parent in 2014, which explains the temporary decline in average sales among three-year-old computer game publishers.

Figure 4 Average sales by firm age, Swedish computer game, computer consulting, other software and programming firms founded 2007–2015.
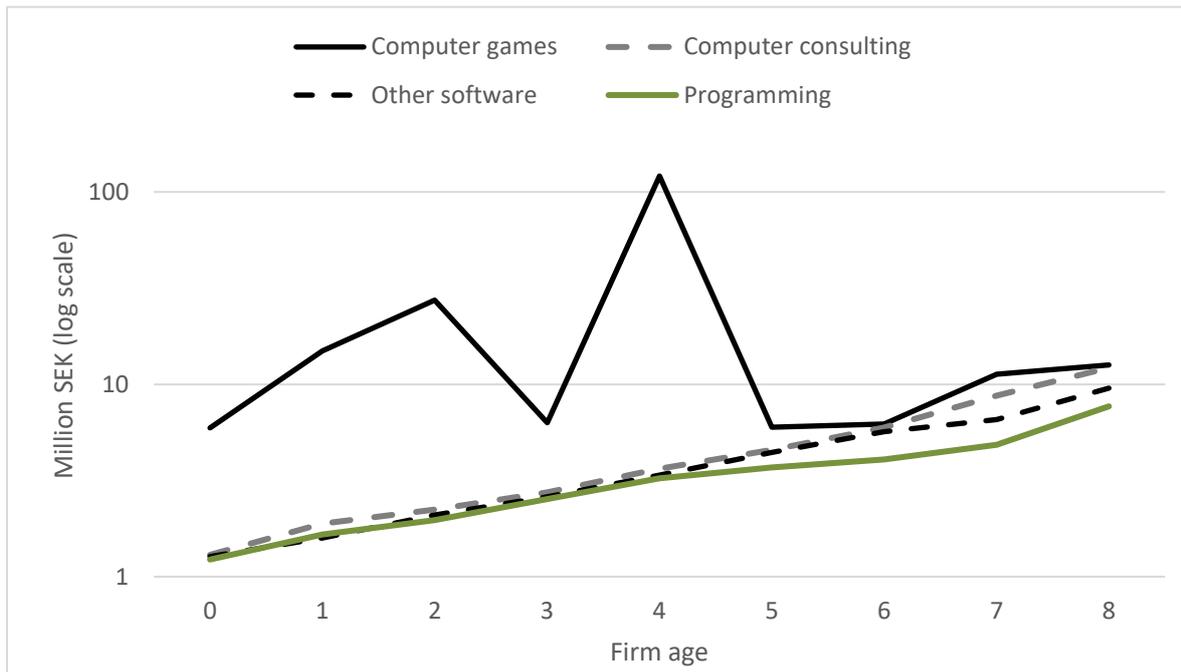
Note: USD 1 ≈ SEK 8.

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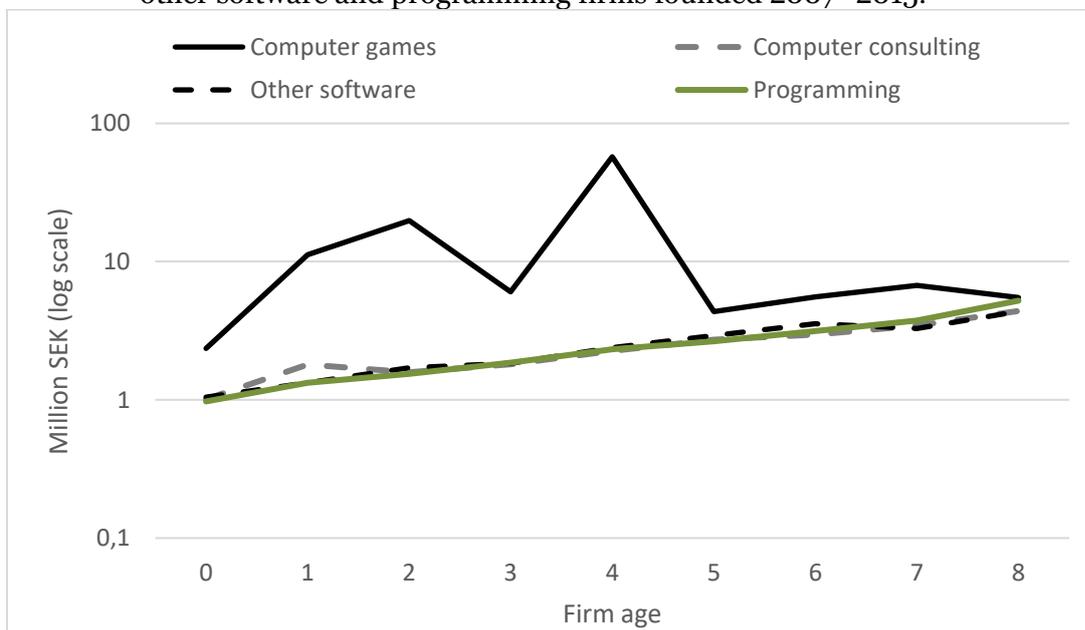
4.2 Empirical approach

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:

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

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, δ_t, which control for the impact of year-specific factors on firm size, such as the business cycle.

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. The null 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 percent 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 Regression results, computer game publishers versus computer consulting firms, age = 5

	Panel A: log(employees)					
	no restrictions	+ firm controls	+ remove foreign-owned	+ remove spinoffs	+ < 50 employees	+ < 20 employees
	(1)	(2)	(3)	(4)	(5)	(6)
Born Global$_i$	0.960***	1.188***	1.000***	0.860***	0.873***	0.881***
	(0.300)	(0.314)	(0.287)	(0.246)	(0.246)	(0.246)
N	969	873	803	767	726	724
R^2	0.040	0.055	0.045	0.036	0.040	0.040

	Panel B: log(sales)					
	no restrictions	+ firm controls	+ remove foreign-owned	+ remove spinoffs	+ < 50 employees	+ < 20 employees
Born Global$_i$	0.355	0.847**	0.935**	0.775**	0.805**	0.814**
	(0.434)	(0.431)	(0.375)	(0.349)	(0.365)	(0.365)
N	1,136	934	857	819	775	773
R^2	0.011	0.066	0.064	0.051	0.055	0.053

	Panel C: log(value added)					
	no restrictions	+ firm controls	+ remove foreign-owned	+ remove spinoffs	+ < 50 employees	+ < 20 employees
Born Global$_i$	0.458	1.117**	0.825*	0.540	0.551	0.558
	(0.546)	(0.504)	(0.499)	(0.455)	(0.459)	(0.460)
N	729	656	606	580	547	545
R^2	0.004	0.100	0.083	0.062	0.064	0.062

Notes: Calendar year fixed effects included in all specifications. Robust standard errors in parentheses.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

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 141 percent $((e^{0.881} - 1) \cdot 100 \approx 141)$ 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 126 percent $((e^{0.814} - 1) \cdot 100 \approx 126)$ 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 columns (2) and (3). Overall, the results of *Table 4* suggest that computer game startups have a size advantage relative to computer consulting startups in terms of employment, but not in terms of sales or 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 and spinouts are excluded from the sample in the even-numbered columns. 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 36 percent $((e^{0.308} - 1) \cdot 100 \approx 36)$ 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 39 percent $((e^{0.330} - 1) \cdot 100 \approx 39)$ 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 percent $((e^{0.098} - 1) \cdot 100 \approx 10)$ 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 (141 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 37 percent and 10 percent respectively. We find mixed evidence for a computing born global size premium in terms of sales or value added.

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$_i$	0.287***	0.308***	0.155	0.174	0.228	0.330**
	(0.0934)	(0.102)	(0.157)	(0.172)	(0.144)	(0.147)
Sample restrictions	None	All	None	All	None	All
N	1,104	809	1,291	866	831	610
R^2	0.025	0.031	0.010	0.059	0.005	0.081

Notes: Same sample restrictions as column (5) in *Table 4*. 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$_i$	0.0909**	0.0980**	−0.0573	0.0570	0.00648	0.0739
	(0.0431)	(0.0462)	(0.0760)	(0.0818)	(0.0703)	(0.0738)
Sample restrictions	None	All	None	All	None	All
N	2,176	1,611	2,610	1,737	1,657	1,229
R^2	0.014	0.020	0.006	0.067	0.001	0.084

Notes: Column (2) uses same sample restrictions as column (6) in *Table 4*. Calendar year fixed effects included in all specifications. Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Our results differ from studies of manufacturing born globals by Halldin (2012) and Choquette et al. (2017), which find larger size premia in terms of sales than in terms of employment. Ferguson et al (2018) find no size premia 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. (2018) 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.
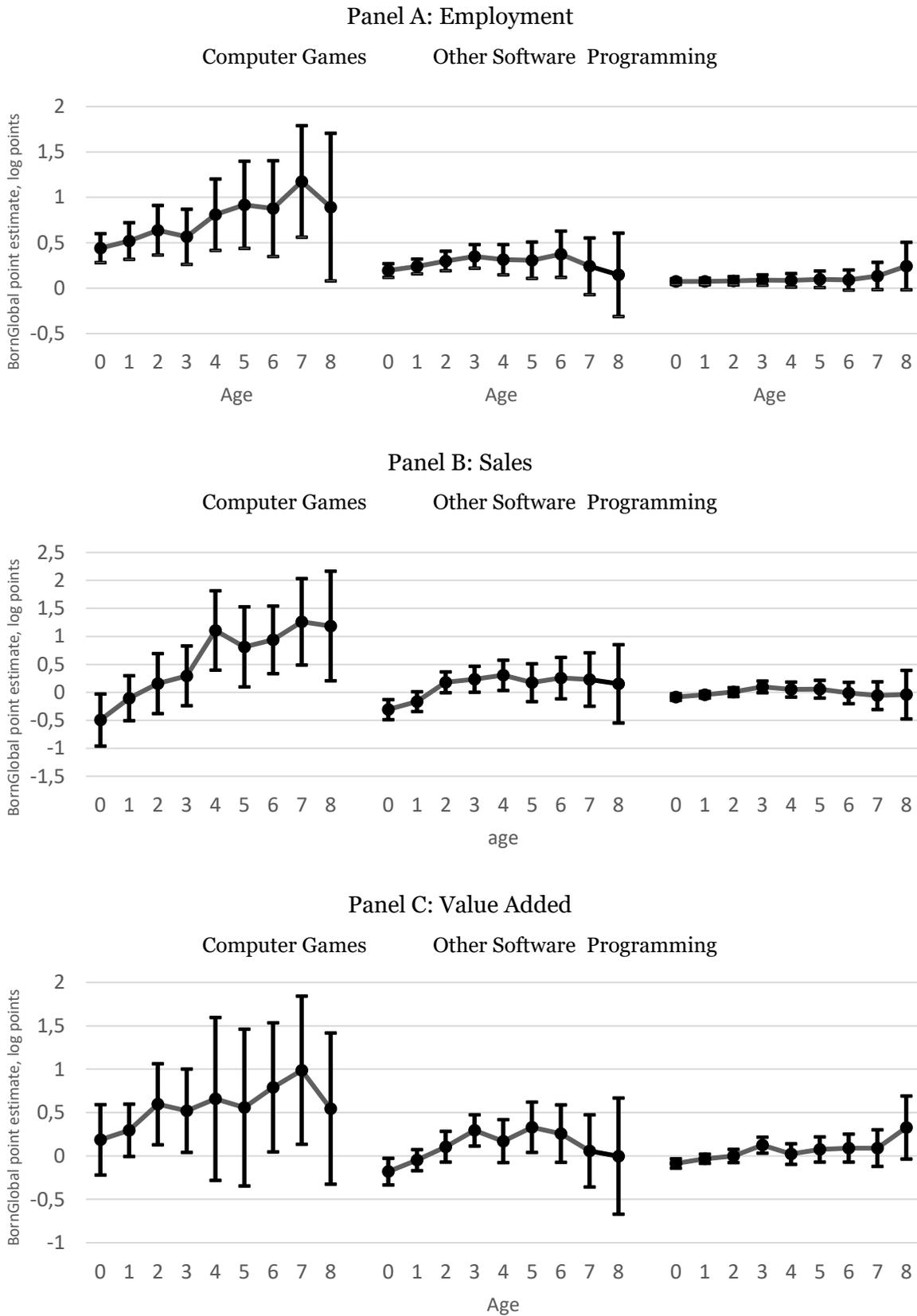
In *Figure 6* we present the results of the regression analysis by firm age. The results are based on regression equation (1), and each column illustrates the point estimate for the *BornGlobal$_i$* indicator variable and the corresponding 95 percent confidence interval within

each firm age cohort. The first column illustrates the regression results when the dependent variable is logged employment the year the firm is founded (age = 0). 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 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, from a 55 percent premium upon founding (($e^{0.440} - 1$) $\cdot$ 100 $\approx$ 55), to a 224 percent premium at the age of seven (($e^{1.175} - 1$) $\cdot$ 100 $\approx$ 224). Other software firms are characterized by a positive size premium until they reach the age of seven, whereupon their size premium diminishes. The employment advantage of programming firms is statistically significant until the firms reach the age of six.

Panel B 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 experience sales growth over time, but their size advantage is only statistically significant in their third and fourth year of operation among the firms we study. 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 Difference in employment, sales and value added by firm age, computer game publishers, other software publishers and programming firms versus computer consulting firms

Panel A: Employment

Computer Games   Other Software Programming

Panel B: Sales

Computer Games   Other Software Programming

Panel C: Value Added

Computer Games   Other Software Programming

Panel C 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 to a statistically significant size advantage only in terms of value added only at the age of three.

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. We find the largest size and growth advantage among computer game publishers, which arguably 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. 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 percent of the 250 largest employers in computing were identified as born globals. Moreover, a mere 1.5 percent 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.

References

Andersson, S., and I. Wictor (2003). Innovative internationalisation in new firms: born globals–the Swedish case. *Journal of International Entrepreneurship 1*(3), 249–275.

Bader, T., and T. Mazzarol (2009). Defining the born global firm: a review of the literature. Presented at the 23rd Australian and New Zealand Academy of Management Conference, Melbourne, CD ROM.

Bernard, A. B., and J. B. Jensen (1999). Exceptional exporter performance: cause, effect, or both? *Journal of International Economics 47*(1), 1–25.

Bernard, A. B., and J. Wagner (1997). Exports and success in German manufacturing. *Weltwirtschaftliches Archiv 133*(1), 134–157.

Bilkey, W. J., and G. Tesar (1977). The export behavior of smaller-sized Wisconsin manufacturing firms. *Journal of International Business Studies 8*(1), 93–98.

Cannone, G., and E. Ughetto (2014). Born globals: a cross-country survey on high-tech start-ups. *International Business Review 23*(1), 272–283.

Cavusgil, S. T. 1980. On the internationalization process of firms. *European research*, 8: 273–281.

Cavusgil, S. T., and G. Knight (2015). The born global firm: An entrepreneurial and capabilities perspective on early and rapid internationalization. *Journal of International Business Studies 46*(1), 3–16.

Choquette, E. M., Rask, D. Sala och P. Schröder (2017). Born globals – is there fire behind the smoke? *International Business Review* 26(3), 448–460.

Ferguson, S., M. Henrekson, and L. Johannesson (2018). Getting the facts right on born globals. IFN Working Paper No. 1210. Stockholm: Research Institute of Industrial Economics.

Gabrielsson, M., and V. M. Kirpalani (2004). Born globals: how to reach new business space rapidly. *International Business Review 13*(5), 555–571.

Growth Analysis (2016). Hänt i världen våren 2016 – born globals: internationellt snabbvaxande företag. Technical report, SN: Svar direkt 2016 2016:04: Dnr: 2016/039. Stockholm and Östersund: Tillväxtverket/Growth Analysis.

Halldin, T. (2012). Born global firms–do they perform differently? Working Paper in Economics and Institutions of Innovation, No. 269. Stockholm: CESIS-Centre of Excellence for Science and Innovation Studies, Royal Institute of Technology.

Johanson, J., and J. E. Vahlne (1977). The internationalization process of the firm-a model of knowledge development and increasing foreign market commitments. *Journal of International Business Studies 8*(1), 23–32.

Kaur, S., and M. S. Sandhu (2013). Internationalisation of born global firms: Evidence from Malaysia. *Journal of the Asia Pacific Economy* 19(1), 101–136.

Knight, G. A. (2001). Entrepreneurship and strategy in the international SME. *Journal of International Management 7*(3), 155–171.

Knight, G. A. (2015). Born global firms: evolution of a contemporary phenomenon. In S. Zou, H. Xu, and L. H. Shi, eds., *Entrepreneurship in International Marketing – Advances in International Marketing*, *Vol. 25* (pp. 3–19). London: Emerald.

Knight, G. A., and S. T. Cavusgil (1996). The born global firm: a challenge to traditional internationalization theory. In S. T. Cavusgil and T. K. Madsen, eds., *Advances in International Marketing, Vol. 8* (pp. 127–137). Greenwich, CT: JAI Press.

Knight, G. A., and S. T. Cavusgil (2004). Innovation, organizational capabilities, and the born global firm. *Journal of International Business Studies 35*(2), 124–141.

Kudina, A., G. S. Yip, and H. G. Barkema (2008). Born global. *Business Strategy Review 19*(4), 38–44.

Mayer, T., and G. I. P. Ottaviano (2008). The happy few: the internationalisation of European firms. *Intereconomics 43*(3), 135–148.

McDougall, P. P., B. M. Oviatt, and R. C. Shrader (2003). A comparison of international and domestic new ventures. *Journal of International Entrepreneurship 1*(1), 59–82.

McDougall, P. P., S. Shane, and B. M. Oviatt (1994). Explaining the formation of international new ventures: the limits of theories from international business research. *Journal of Business Venturing 9*(6), 469–487.

Melén, S., and E. R. Nordman (2007). The value of human capital for the networks of born globals. *International Journal of Globalisation and Small Business 2*(2), 205–219.

Moen, Ø., and P. Servais (2002). Born global or gradual global? Examining the export behavior of small and medium-sized enterprises. *Journal of International Marketing 10*(3), 49–72.

Oviatt, B. M., and P. P. McDougall (1994). Toward a theory of international new ventures. *Journal of International Business Studies 25*(1), 45–64.

Rennie, M. W. (1993). Born global. *McKinsey Quarterly* (4), 45–53.

UBI Global (2018). *World Benchmark 17/18 Report*. Stockholm: UBI Global.

Varian, H. R. (2010). Computer mediated transactions. *American Economic Review* 100(2), 1–10.

Wagner, J. (2002). The causal effects of exports on firm size and labor productivity: first evidence from a matching approach. *Economics Letters 77*(2), 287–292.

Zander, I., P. McDougall-Covin, and E. L. Rose (2015). Born globals and international business: Evolution of a field of research. *Journal of International Business Studies* 46(1), 27–35.