Linking Entrepreneurship and Economic Growth in Sweden, 1850–2000

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Abstract

Entrepreneurship has gained increasing support from governments in recent decades. Entrepreneurship is considered to generate new jobs, innovations, and economic growth. In current research, a causal link between entrepreneurial activity and economic growth is maintained, where variations in entrepreneurship precede variations in economic output. Various models identify a positive effect entrepreneurship on economic development in advanced, innovation-driven economies in the most recent decades – a time when several Western countries transformed from 'managed' to 'entrepreneurial' economies.

Self-employment is one of the most common indicators of entrepreneurship in both policy and research. The present study analyzes the relationship between growth in self-employment and economic growth in Sweden between 1850 and 2000. For the entire period (1851–2000), variations in self-employment had a significant, instantaneous positive correlation with GDP growth. Using Granger causality tests, the results in this study show that variations in self-employment did not granger-cause GDP growth. We discovered a structural break in GDP growth as early as in the year of 1948, which gives two different periods: 1851–1948 and 1949–2000.

Between 1851 and 1948, Granger causality between self-employment and GDP in either (Granger) direction could not be established. For the other segment (1949–2000), GDP growth granger-caused self-employment growth, but not the other way around. Granger causality tests in the frequency domain show that for the period 1949–2000, but for no other periods, variations in self-employment lagged with GDP growth. Consequently, GDP growth preceded self-employment growth, but self-employment growth did not precede GDP growth.

Given that self-employment is a suitable indicator for entrepreneurship, the empirical results in this study are, in several respects, in disagreement with dominating assumptions in mainstream entrepreneurship research.

Contents

1. Introduction[1]

How does entrepreneurship change over time and how is it important? Entrepreneurship encloses several analytical meanings and constructive conceptual definitions of entrepreneurship are often problematic to operationalize. In addition, comprehensive, long series on entrepreneurship are rare. Even if empirical research claims that entrepreneurship has increased in most developed economies during the past decades (Carree et al. 2007), it is often difficult to determine whether entrepreneurship increases or decreases over longer periods. An established perception, which can be traced back to the early 18th century, is that entrepreneurship is a key determinant for economic transformation, innovation, economic growth, and employment creation. In recent decades, the relationship between entrepreneurship and economic growth has received vast academic and political attention. Yet, while the common, spontaneous answer is that entrepreneurship generates new jobs and innovations, it is often challenging to establish whether entrepreneurship has any impact.

Self-employment has been one of the most commonly used indicators of entrepreneurship in contemporary research. In the present study, our aim is to analyze the causal relationship between growth in self-employment and economic growth in Sweden over one hundred and fifty years (1850 to 2000). The dominating theoretical paradigm in entrepreneurship research maintains a positive, causal relationship between entrepreneurial activity and economic growth. Innovative, growing firms are perceived to be embedded within the total number of new start-ups (Acs 2006, Bosma et al. 2008). Thus, entrepreneurship drives economic growth and this link, it is claimed, has been empirically verified across a wide spectrum, from the enterprise, the industry, the region, and the country (Thurik and Wennekers 2004).

In contemporary research, 'historical' models. and 'stages of economic development' models, respectively, have evolved. The models are closely

[1] This study has received support from Riksbankens Jubileumsfond, and is part of the research project Entrepreneurship, Innovation, and the Demography of Firms and Industries in Sweden over Two Centuries (P12-1122:1).

related. Models that are 'historical' maintain a more manifest and positive causal link from entrepreneurship on macroeconomic growth from around the 1970s and 1980s in many Western economies. Thus, a historical, structural shift has occurred (e.g., Audretsch and Thurik 1997, 2001). In 'stages of economic development'-models, there is a similar relationship. As – or if – countries become more economically advanced, there is an increase in the positive significance of entrepreneurship for economic growth. In low-income economies, entrepreneurship may even have negative effects (e.g., Acs and Szerb 2009, Wennekers et al. 2010).

From past research, the following can be established. Most available data on entrepreneurship (or on self-employment) generally covers, at best, the period from the 1970s. This makes it difficult to study the relationship between entrepreneurship and economic change in the long term. Furthermore, the causal relationship between entrepreneurship and economic growth is ambiguous; several earlier analyses are often cross-sectional or have consisted of rather short panels. Even though empirical research has confirmed several recent theoretical models in research, a number of individual countries deviate from the established assumptions.

Recent theory and empirical research generally claim that entrepreneurship drives economic growth, particularly during the most recent decades, while this may not have been the case in earlier periods. In this study, we set out from these assumptions. The specific aim is to study the relationship between variation in entrepreneurship and economic growth in Sweden over 150 years, and to test whether the case of Sweden is line with (or deviates from) established theory and past research. Although self-employment may not be an ideal or even appropriate indicator of entrepreneurship, a long observation period has several advantages. Long series may reveal patterns and relationships that cannot be detected with short observation periods, and they are ideal for testing previous assumptions, hypotheses and theories, as well as for generating new hypotheses.[2] To the best of our knowledge, neither the present empirical data nor the long-term relationship between self-employment and economic growth in Sweden has previously been studied in this context.[3] Furthermore, the methodology

[2] An additional advantage of using the case of Sweden is that, as opposed to several other European or Western countries, Sweden has not been directly affected by catastrophes, severe civil conflict, wars, or foreign occupation that may interrupt or infer statistical reporting and statistical series over the past two hundred years.

[3] Stenkula (2012) uses the same dataset in a study of tax effects on self-employment in Sweden between 1947 and 2000.

used in this study has only recently been developed and has, as far as we know, not previously been used in analyses of entrepreneurship and economic growth in the long term.

The study is organized in the following manner. Section 2 gives a background and outlines theory and empirical research in past research. Section 3 is an empirical account of the development of self-employment in Sweden 1850–2000. Section 4 describes the methodology in the study, whereas section 5 reports the empirical results. Section 6 concludes the study and discusses the results.

Using Granger causality tests (Granger 1969) – i.e., testing the effect of one time series on another time series – our results show that variations in self-employment did not granger-cause growth in GDP. We discover a structural break in GDP growth as early as in the year of 1948, which gives two different periods, or segments: 1851-1948 and 1949-2000. More specifically, between 1851 and 1948, there was no Granger causality between self-employment and GDP in either (Granger) causal direction. For the other segment (1949–2000), GDP growth granger-caused self-employment growth, but not the other way around. Granger causality tests in the frequency domain furthermore show that for the segment of 1949–2000 (but for no other period), variations in self-employment lagged with GDP growth in the medium and long term. Thus, GDP growth preceded self-employment growth, but self-employment growth did not precede, or 'cause', GDP growth.

2. Background, theory, and previous research

Since the early 18th century, entrepreneurship and entrepreneurs have been perceived as essential driving forces for economic transformation, innovation, economic growth, productivity, and employment creation. As an academic discipline, entrepreneurship seemed to wither away during the post-war years.[4] The situation changed considerably during the final decades of the last century, and entrepreneurship started to seriously expand as a research field both internationally (Acs and Audretsch 2005) and in Sweden (Gratzer 2013). Entrepreneurship transformed from the 'ugly duckling', existing in the academic periphery, to a white swan (Johannisson 2010). Today, entrepreneurship is a multidisciplinary field, revealing a diversity of significant contributions from sociology, philosophy, psychology, anthropology, and economics.

One way of classifying the multitude of economic theories that have evolved since the days of Richard Cantillon is to divide them according to the *function* of entrepreneurship (Henrekson and Stenkula 2007). We can distinguish theories that focus on the entrepreneur as an innovator (Schumpeter 1911), and theories that emphasize the entrepreneur as an arbitrator (Kirzner 1973). A third school views the entrepreneur as a risk-taker and decision-maker (Knight 1921). A fourth function is the entrepreneur as a coordinator (Say 1816).

Newer contributions to entrepreneurship often represent variants or analytical refinements of these functions, and several theorists have chosen a more or less eclectic approach in the attempt to combine the various functions of entrepreneurship (see, for instance, Baumol 1993, Casson 1982 and Shane 2003). Frequently, diametrically conflicting theories are mixed – one example is the definition of entrepreneurship used by the Organisation for Economic Co-operation and Development (OECD).[5] An eclectic defini-

[4] Entrepreneurship disappears from the economic mainstream literature, most likely due to the growing dominance of the neoclassical school. As is known, this theory is based on homo economicus with perfect information that acts on perfect markets. In a world in which all expectations are satisfied, there is no active role for entrepreneurship.

[5] "1) *Entrepreneurs* are those persons (business owners) who seek to generate value, through the creation or expansion of economic activity, by identifying and exploiting

tion represents a blend of the entrepreneurial functions which Cantillon, Schumpeter, Knight and Kirzner regard as the quintessential features of entrepreneurship. In such definitions, the fact that diametrically opposing and often incompatible perspectives are mixed is seldom discussed.

For instance, Schumpeter regarded the entrepreneur as an agent, or as a group of agents (networks, or organizations such as firms, authorities, etc.) that introduced innovations. In his early works, innovation is defined as something historically new and important. In Schumpeter's late works, this 'new' is of less historical importance (e.g., the introduction of a new brand). Schumpeter's entrepreneurs create disequilibria, while Kirzner's entrepreneurs are arbitrators that establish market equilibrium. The perspective of Knight is that all small business owners are entrepreneurs. In disagreement with Knight, the Schumpeterian entrepreneur is not a risk taker or owner. In his late works, Schumpeter defines the entrepreneur as an economic function while Kirzner personalizes the entrepreneurs into individuals. These individuals are endowed with the ability to identify opportunities that others cannot. Entrepreneurship in the Kirznerian sense does not require innovation (Kirzner 1999).

The intellectual borrowing of concepts and theories from various schools of thought has been both beneficial and problematic. The definition of entrepreneurship is one of the most difficult and problematical aspects of the theory. While it has contributed to improve and advance research in entrepreneurship, it has also created the potential for a cacophony of concepts, theories and empirical results (Landström and Lohrke 2010).

Parallel to the revival of entrepreneurship as an academic discipline, entrepreneurship became a significant agenda in economic policy discussions amongst all political parties and decision makers at local, regional, national and international levels (Lundström and Sundin 2008). From around the 1980s, a large number of suggestions for improving the conditions for entrepreneurship were introduced in economic policy programs in organizations such as the European Union (EU), the World Bank, and the International Monetary Fund. In the EU, the Lisbon-strategy became a key, binding document for promoting entrepreneurship. Participation in the European framework made it more or less compulsory to implement decision processes and programs at the national level. As an example, this

new products, processes or markets. 2) *Entrepreneurial activity* is the enterprising human action in pursuit of the generation of value, through the creation or expansion of economic activity, by identifying and exploiting new products. 3) *Entrepreneurship* is the phenomenon associated with entrepreneurial activity." OECD (2011).

lead to an implementation of a Swedish national strategy for the years 2007–2013, contributing to create competitive regions and individuals. Several 'keys' have been identified in order to fulfill the objectives in this strategy. One of these keys is entrepreneurship (Swedish Government 2007).

The present economic and financial crisis has further reinforced the interest in entrepreneurship as a means of economic recovery. A 'vulnerability motive', widely used to legitimize small business policy in the early 1990s, is equally important today: "Therefore, new and young firms act as 'life jackets' as they help pull countries out of economic recession." (Nordic Entrepreneurship Monitor 2010). International and national organizations have increasingly put more effort into improving conditions and removing real or perceived obstacles to entrepreneurship. These aspirations have often been restrained by limited and imprecise information on how entrepreneurship is measured – as well as by imperfect knowledge of the factors affecting entrepreneurship (Ahmad and Hoffman 2008, Lunati et al. 2010).

2.1 Measuring entrepreneurship

The development of measures of entrepreneurship is a balance between what is theoretically desirable and what is possible in practice. In this limited space, it would be impossible to account for all methods and measurements that have been developed for evaluating the effects of economic policy. The most common and widespread measurement of entrepreneurship has been stocks or rates measures of the number of (new) small and medium enterprises (SMEs) and/or individuals who are self-employed. Other measures have been growth in existing and surviving firms, or peoples' attitudes towards entrepreneurship. There is substantial agreement that this 'mainstream view' only captures certain parts, dimensions or aspects of the concept 'entrepreneurship'; the continual attention given to the problem in the international works of the OECD and the EU, as well as the constant renewal of methods of measurements in international projects such as the Global Entrepreneurship Monitor (GEM), bear witness to this constant process. Most empirical research on the relationship between entrepreneurship and economic development has used self-employment or business ownership data (or variations thereof) as indicators of entrepre-

neurship.[6] In recent times, a substantial body of research has come to employ data from large projects that have produced harmonized series over entrepreneurship, most notably Compendia (COMParative Entrepreneurship Data for International Analysis), and GEM. These databases must nowadays be considered to be the dominating sources for country-specific or cross-country analyses of entrepreneurship research.

In short, Compendia encloses harmonized OECD data on business ownership for a large number of countries from the 1970s and onwards. Compendia includes owner-managers of both unincorporated (e.g., sole proprietorships) and incorporated businesses (so-called OMIBs) and excludes unpaid family workers. Due to substantial heterogeneity between countries' statistical reporting and definitions of business ownership – as well as significant differences in reporting and classifications over time, even for individual countries – various methods of calculations have been used in order to produce the harmonized data sets (Van Stel 2003).[7] GEM has produced substantially shorter cross-country time series (starting in 1999). GEM is survey-based and essentially produces data on attitudes

[6] Some studies have utilized data directly from statistical producers such as the OECD (e.g., Blanchflower, 2000), while others have produced own series from various sources (e.g., Gartner and Shane, 1995).

[7] It has been noted that the method of harmonizing international data can be somewhat simplistic and that it may produce incorrect figures. Even for individual countries, various data sources on self-employment over time can differ substantially. For instance, in Compendia, a so-called 'raise factor' is employed for Sweden in estimating the share of OMIBs in the total stock of business owners prior to 1987, assuming a constant share of OMIBs between 1972 and 1987 (Van Stel, 2003). Bjuggren et al. (2010) show that various databases on self-employment – in Sweden the Labor Force Survey (LFS) and the so-called RAMS (a labor market database) – report a significant discrepancy in the reported number of self-employed individuals. RAMS is based on registers and covers the entire Swedish population. LFS asks the participants in the survey about their employment situation – among other things whether they are (or if they consider themselves to be) self-employed. LFS is the very source of the self-employment data reported by OECD, and thereby constitutes the basis for Compendia's data on Sweden. Bjuggren et al. identify a huge leap in the reported number of self-employed in 1987 due to the inclusion of OMIBs. For that reason, it becomes problematic to analyze long-term changes in self-employment. It also makes it difficult to analyze the actual or 'true' level of self-employment. Their analysis shows that this type of data is tainted with apparent fallacies. It is often used in international comparisons such as in cross-country studies on self-employment and entrepreneurship. There is more seldom any discussion or awareness of changes in statistical reporting over time, or of the heterogeneity in the statistics in and between countries.

towards entrepreneurship, nascent entrepreneurship and on TEA (Total Entrepreneurial Activity).[8]

Both Compendia and the GEM database have been extensively used in earlier research on the relationship between entrepreneurship and economic growth. The considerable advantage of such data and definitions is that entrepreneurship is relatively 'simple' to measure, while they may not capture transformation, innovation, and renewal among established firms, or do not necessarily represent indicators of a dynamic economy (see, as an example, Congregado et al. 2012). The function of entrepreneurship has been extensively discussed over the decades, and we can therefore differenttiate between various concepts and definitions that emanate from different theories. These definitions often have different scopes and are operationalized via different indicators. This forces us to consider the validity of definitions, as well as what consequences that choice of theory and definitions may have for conclusions in research and policy.

2.2 The 'mainstream' view of entrepreneurship and economic growth

The dominating theoretical paradigm in contemporary entrepreneurship research assumes a link from the individual level, through the firm, up to the macro level. Entrepreneurship is viewed as an endogenous component of economic growth. From a discourse perspective, this theory creates the conception that new venturing activity is system-changing *per se*, thus carrying transformation capacity in the economy. In that respect, potentially growing and innovative firms are perceived as embedded within the total number of start-ups; therefore, while it is acknowledged that most new firms are not innovative and will not grow and create new jobs, a smaller share of them will. For that reason, if entrepreneurship increases – for instance measured as new-firm formation – so will the number of those firms that are 'entrepreneurial' and that qualitatively contribute to economic change (Wennekers and Thurik 1999, Carree and Thurik 2010).

In this mainstream view, the (causal) link between entrepreneurial activity and macroeconomic development is considered as dependent on both time – that is, on 'history' – and on the level of economic development. First, an established notion is that modern capitalist economies shifted from

[8] For instance, TEA is defined as that percentage of a country's population aged between 18-64 that is either actively involved in starting a new business or is an owner/manager of a business less than 42 months old (e.g., Bosma and Levie, 2010).

'managed' to 'entrepreneurial' economies in the 1970s and 1980s (see, in particular, Audretsch and Thurik 1997, 2000, 2001). Major global changes in both supply and demand conditions are identified as causes for this transition.[9] Different from the previous era of the 'managed' economy, entrepreneurship has today become increasingly important for economic growth and renewal. This historical view principally maintains that entrepreneurship has played different roles over time: while entrepreneurship may have varied counter-cyclically to economic growth in the 'managed' post-war economy, it has become an important engine for economic growth during the past three to four decades in the economies that have transformed from managed to entrepreneurial economies.[10]

Second, 'stages of economic development'-models represent closely related theory. These models represent various relationships between entrepreneurship and the level of economic development across countries. The models, often presenting cross-sectional associations rather than causal relationships, assume that entrepreneurship varies with the level of economic development. Within the framework of the GEM-project, an S-shaped model founded in Porter's typology of factor-, efficiency-, and innovation-driven economies has evolved (Acs and Szerb 2009, Bosma et al. 2008).[11] Related lines of thought are found in a U-shaped stage model in

[9] Traditional industries, such as manufacturing and construction, have declined; innovation and knowledge have become more important; new technologies have increased the possibility for flexibility and decentralization and have thus increased the importance of small scale economic activity. For instance, from past research, Carree and Thurik (2010) identify seven partly interrelated causes: 1) 'Creative destruction'; small firms gradually grew in importance, particularly in new industries such as software and biotechnology; 2) Scale economies diminished in importance due to technological change; 3) Political change; deregulations and privatizations have increased the number of small businesses; 4) Large firms have progressively come to focus on their core competencies, leaving room for smaller businesses; 5) Increasing incomes and wealth has increased the demand for variety, something which small firms can provide; 6) Self-employment has received increasing positive recognition and is more valued as occupational choice, and, 7) Employment in the services sector has increased, and normally such businesses are relatively smaller. For a critical view of the notion of the entrepreneurial economy, see Parker, R. (2001).

[10] From a slightly different angle, sociologists have suggested that the observed increase in self-employment from the 1970s in developed economies may be a structural response to declining opportunities for good jobs in the industrial sector rather than, as in earlier times, a cyclical response to unemployment (Steinmetz and Wright 1989, Bögenhold and Staber 1991).

[11] Factor-driven (low level of development) economies have low levels of 'genuine' entrepreneurship. For countries transiting into the efficiency-driven stage, and into the innovation driven stage of development (advanced economies), entrepreneurship rises in an S-shaped pattern.

which entrepreneurship is high in low-income countries, lower in middle-income countries (where economies of scale increase), and high in advanced economies (Wennekers et al. 2010). Even if the causal directions may be imprecise, these models overall propose a minor or even negative impact of entrepreneurship on economic growth for low-income or newly industrialized economies while there may be positive effects on economic growth in developed and advanced economies. As countries move from one stage to another, the level of – as well as the nature of – entrepreneurship is affected: the positive influence of entrepreneurship on economic development increases; in advanced, innovation-driven (Western) economies – 'entrepreneurial economies' – entrepreneurship is a driving force for economic growth. In sum, theory in mainstream entrepreneurship maintains that entrepreneurship drives economic growth. Yet, the theory suggests that this relationship may be conditional on, or valid for, particular periods or specific stages of economic development.

2.3 Previous empirical research

A substantial body of research seeking to investigate the relationship between entrepreneurship and economic development has emerged. Research on variations in entrepreneurship – and in self-employment – has received attention from economists, sociologists as well as economic historians.[12] Recent empirical research on the link between economic growth and entrepreneurship can essentially be divided into two closely related groups. One investigates the relationship between the rates and levels of entrepreneurship and the level of economic development between countries. Another group has studied the relationship between relative *change* in entrepreneurship over time and macroeconomic change, such as economic growth or productivity growth. There is no substantial difference between these two groups. Both cross-country panel analyses as well as 'pure' cross-sectional investigations have been common, and the majority of past studies covers the development from the 1970s and onwards.

[12] Sociologists and economists have regularly used time-series data, studying the relationship between self-employment and unemployment, between self-employment and changes in social security, or self-employment and taxes (see for instance Blau 1987, Bruce and Mohsin 2006, Fölster 2002, Steinmetz and Wright 1989, Staber and Bögenhold 1993, Stenkula 2012).

Starting with the group of 'level'-studies, Carree et al. (2002, 2007) investigated whether there is a long-term equilibrium relationship between the number of business owners, and the stage of economic development – and whether deviations from an equilibrium rate of business ownership leads to – or 'causes' – lower GDP levels. Their cross-country analyses of 23 OECD countries in 1972–1996 (Carree et al. 2002) and 1972–2004 (Carree et al. 2007) showed a U- or L-shaped equilibrium rate. A business ownership rate below the equilibrium level impedes economic growth while levels above equilibrium do not seem to lead to lower levels of GDP (Carree et al. 2007).[13] This U-shaped relationship was also confirmed in a study by Wennekers et al. (2005). Wennekers et al. asked if the level of nascent entrepreneurship is affected by the level of economic development. GEM data over 36 countries was used in a cross-sectional study (year of 2002) and a 'natural rate' of entrepreneurship is, in some measure, affected by the level of economic development. Since their study is cross-sectional, they found no effect of cyclical variables on nascent entrepreneurship.

The other group of empirical studies focuses on the relationship between changes in entrepreneurial activity and economic change over time. Generally, it has been found that changes in entrepreneurial activity affect economic growth or constitute an indicator of business cycle fluctuations. In a cross-sectional study, closely related to that of Wennekers et al. (2005), above, Van Stel et al. (2005) investigated the effect of TEA on average GDP growth in the medium term (1999–2003) in 36 countries. They found an impact of entrepreneurial activity on average GDP growth, but that this impact was conditional on the level of economic development: the impact increased with the level of per capita income and the stage of development.

The effect of entrepreneurial activity on economic growth is also claimed to have both direct and indirect effects over time. In a widely cited study, Fritsch and Mueller (2004) studied regional employment creation from new venture formation (entries). Fritsch and Mueller found direct employment effects, and lagged 'indirect' positive supply-side employment effects in the longer term: first a direct positive effect of new firms entering, creating new jobs; thereafter – with some lag – a negative effect from exits (due to infant

[13] A U-shape would predict a future increase of the equilibrium rate. An L-shape would predict a bottoming out. Countries that deviate from equilibrium, such as the Scandinavian countries or, as an example, Italy, suggesting that "demographic, cultural and institutional factors may be at play" (Carree et al. 2007:288). In their earlier study, Carree et al. (2002) find that a level of business ownership above the equilibrium level may result in negative GDP levels.

mortality and selection) and, finally, a positive supply-side effect on employment growth.[14]

Following these results, Carree and Thurik (2008) tested whether direct and indirect supply-side effects are at hand also at the aggregate level, employing a panel of 21 OECD countries (Compendia) over 15 years. They measured the lagged relative effects of net change in business ownership on employment growth, GDP growth and labor productivity growth. Significant results particularly concerning employment growth were discovered: a direct positive effect, a negative effect with a peak in the third and fourth year and a positive effect for the subsequent six years. For GDP growth, they identified a strong immediate positive impact. The following two 'stages' could be detected, but were not statistically significant. To some extent, their analysis shows that the effect of entrepreneurship on economic change occur with a lag.

Furthermore, using an OECD panel for 1972–2007 (Compendia) over 22 countries, as well as a shorter panel based on GEM over nascent entrepreneurship, Koellinger and Thurik (2012) found that changes in business ownership were leading the global business cycle. A positive impulse from business ownership was typically followed by a recovery of the world economy. This causal relationship was not apparent on a country-to-country basis, and only a smaller share of the economies in the study – seven out of 22 countries – confirmed the causal assumption that entrepreneurship affects economic change.[15] Comparing self-employment in the USA and in Spain 1987–2008, Congregado et al. (2012) also found divergent patterns: for Spain, business cycle output variations significantly affect future rates of entrepreneurship, while this could not be detected for self-employment in the USA. Similar to Koellinger and Thurik's (2012) investigation are the studies by Hartog et al. (2010) and Thessensohn and Thurik (2012). Both studies tested for two-way relationships, or for lag effects. Hartog et al.'s (2010) study of business ownership (Compendia) in 21 OECD countries 1981–2006 concluded that increases in entrepreneurship cause economic

[14] The direct employment effect came from the new jobs created by entrants during the first years from entry. The indirect, supply-side effect was negative in the following period. Yet, in the longer run, the supply-side effect was more positive for job creation than the direct effect.

[15] Koellinger and Thurik (2012) claim that their analysis cannot be replicated on an individual country due to country-specific shocks, and their study shows considerable country heterogeneity in the 'causal' relationship between entrepreneurship and the cycle.

growth.[16] Thessensohn and Thurik (2012) obtained similar results when employing GEM data over 22 countries. They found support for pre-cyclicality: periods of recovery as well as economic growth are anticipated by a rise in entrepreneurial activity.

Most past research has used cross-country panels when specifically addressing the causal relationship between entrepreneurship and economic growth. One of few exceptions is Parker et al. (2012). Their study showed no straightforward relationship between entrepreneurship and economic change. Parker et al. used quarterly time-series data for the UK 1978–2010, exploring if the rate of self-employment varies – and whether it is leading or lagging – with output and unemployment. For the entire 1978–2010 period, a pro-cyclical relationship between self-employment and output and unemployment was discovered, showing significant causal relationships running from self-employment variations to output and unemployment variations, but not the other way around. Distinct sub-periods could also be identified. Parker et al. (2012) found apparent structural breaks in these causal relationships. The four distinct sub-periods identified displayed different cyclical relationships. Between 1978 and 1993, the causality was running *from* output cycles *to* self-employment cycles. For the most recent period, 1993–2010, they discovered a procyclical, bi-directional causality: the cycles in self-employment were both causing and being caused by cycles in output and unemployment. Therefore, to some extent, the study by Parker et al. confirms the theory of a transition from a managed to an entrepreneurial economy.

To summarize, past empirical research suggests that changes in entrepreneurial activity drive economic change in subsequent periods positively, even though there is also evidence of a reversed or bi-directional causal relationship between economic change and entrepreneurship. Past empirical evidence has also found that this causal relationship may be conditional on the level of economic development, in which the impact of entrepreneurial activity on economic growth increases with the level of per capita income and the stage of development.

It should be noted that other research has shown weaker, or even opposite relationships where, e.g., high levels of entrepreneurship and particularly self-employment have a negative relationship with economic development. In particular, it seems that time series analyses over individual countries reveal

[16] This was conditional on the existing number of business owners in the economy (decreasing marginal returns to entrepreneurship) and conditional on entry shocks – if entrepreneurship increases intensely, it may have a negative effect on GDP.

inconsistent results that do not correspond to recent cross-country panel studies (see Audretsch et al. 2006).[17]

[17] For instance, Shane (1996) finds that macroeconomic growth had a negative relationship with the rate of entrepreneurship in the USA 1899–1988. Lindh and Ohlsson (1998) analyzed time-series data on self-employment in Sweden 1920–1990. Regressing GDP growth rates on self-employment, they found a negative relationship. With time lags, there were no significant effects at all. Blanchflower (2000) came to similar results in a study of 23 OECD countries 1966-1996. Contrary to several other studies, Blanchflower's analysis even revealed an opposite pattern: increases in the proportion of self-employment produced lower and not higher GDP.

3. The growth, decline and rise of self-employment in Sweden, 1850–2000

In an international context, past studies have identified a sharp decline followed by a subsequent revival of self-employment in several developed economies from the end of World War II. From here – and with some exceptions – self-employment rates fell sharply in several countries, while the trend was reversed from the 1970/80s and onwards (Blau 1987, Bögenhold and Staber 1991). Prior to World War II, it is possible to identify an even longer continuous fall in self-employment, which to a great extent can be explained by the constantly decreasing share of the agricultural sector from the onset of the industrialization (Wennekers et al. 2010).

Data on non-incorporated self-employment in Sweden for the period 1850-2000 (Edvinsson 2005a) shows that the development in Sweden (Figure 1) fits quite well with the international picture. In particular, self-employment in the entire economy fell sharply from the 1940s, mainly due the sharp decline in self-employment activity in the agricultural sector.[18] Non-agricultural self-employment (self-employment excl. agriculture, Figure 1) shows nearly similar patterns as total self-employment, particularly as concerns the most recent decades.[19]

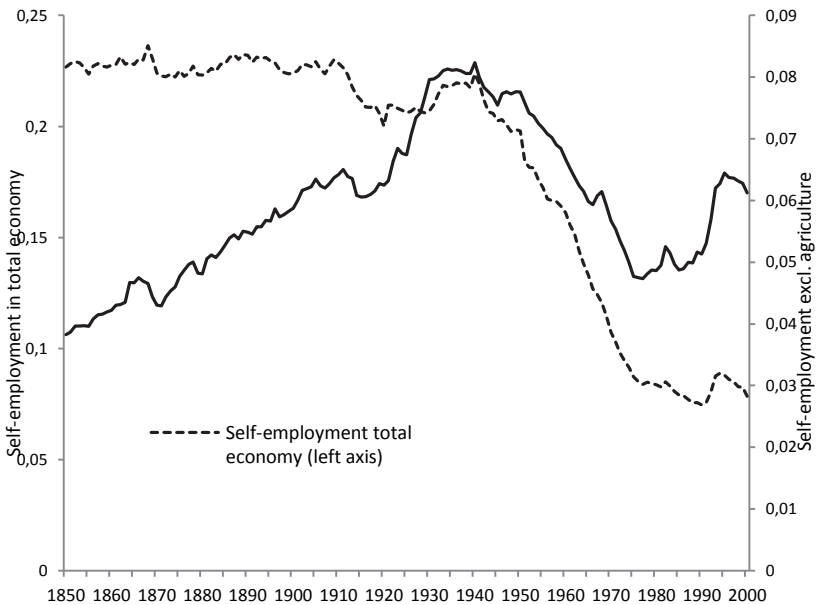
From 1850 up to 1940, the share of self-employed individuals doubled. Two distinct periods can be identified between these years: first, a larger fall

[18] The self-employment ratio is calculated as the share of self-employed individuals in relation to the total workforce. The self-employment ratio in the entire Swedish economy (self-employment total economy, including all sectors) remained quite stable until the end of the first decade of the 20th century, representing around a quarter of the total workforce. From around 1913/14, a negative trend is detectable. The years of World War I (1914–18) as well as the entire 1920s showed a relatively lower self-employment ratio in the total economy as compared to earlier periods. In the following decade, self-employment rose, peaking in the early 1940s. The rate then fell steeply up until the early 1970s. From the mid-1970s, this sharp fall came somewhat to a halt, even if the negative trend continued into the early 1990s. From that point in time, self-employment rose. A peak was reached in the mid-1990s and then, self-employment in the total economy diminished until the last year of observation (year 2000).

[19] Since agricultural self-employment diminishes rapidly from WWII, the series of self-employment in the total economy increasingly covary over time with the series of non-agricultural self-employment.

during the years preceding World War I as well as during the war; second, a fast increase in the interwar years. Here, the self-employment rates in the non-agricultural sector grew throughout the entire interwar-period (while self-employment in agriculture fell throughout the entire 1920s). Non-agricultural self-employment peaked in the early 1940s, and fell during World War II. With some variation, it basically continued to diminish during the following three to four decades. This tendency was halted from the latter half of the 1970s, since when self-employment has, on average, grown. In particular, it rose extensively from the 1990s.

Figure 1. Self-employment ratio in Sweden, 1850-2000. Self-employment in the total economy (left axis) and non-agricultural self-employment (right axis).



Source: Edvinsson (2005a), own calculations.

Although there are indications of a slight reversal from the second half of the decade, it can be established that at the end of the century, the rate of self-employment was higher than it had been for nearly forty years. Previous research has observed that variations in self-employment appear to be the inverse of the general macroeconomic development – periods of macroeconomic instability, slow growth, or high unemployment appear to correspond to rising levels of self-employment (Lindh and Ohlsson 1998,

Blanchflower 2000, Parker and Robson 2004).[20] From a visual inspection of Figure 1, this observation seems to be rather apparent.[21]

[20] Still, others have claimed diametrically opposed patterns, where self-employment and general business activity decrease during economic downturns (e.g., Shane 1996, 2011).
[21] Non-agricultural self-employment in Sweden rose throughout the interwar period. In contrast, the Swedish postwar-period exhibited a very long stage of high macroeconomic growth, a time during which self-employment fell sharply. The years from the early 1970s were characterized by slower economic growth and by crises. The stronger take-off in the early 1990s also corresponds to the onset of the economic depression. When the economy recovered in the second half of the last decade of the century, self-employment apparently fell again. For a description of the Swedish economy, see Schön (2010).

4. Methodology

In the present study, time series data on self-employment (SE) and Gross Domestic Product (GDP) for the period 1850–2000 is derived from Edvinsson (2005a). This data is quite comparable with other, but shorter, series on self-employment that have been used in previous research on self-employment in Sweden (Lindh and Ohlsson 1996, 1998), since they are both based on more or less the same material. Edvinsson's (2005a) series differ as compared to one of the dominating databases (Compendia) since other methods for calculation and definitions have been used.[22] In the domain of entrepreneurship research, Edvinsson's data has previously been used by Stenkula (2012) for the period 1947–2000. In line with past research, non-agricultural self-employment is used throughout the entire analysis.

We intend to analyze the relationship between the growth rate of the Gross Domestic Product (GGDP) and the growth rate of self-employment (GSE). Not only will the instantaneous correlation between GGDP and GSE be in focus in the analysis; we also aim at making correlations using 'historical' or lagged data. For this, and in line with past studies in entrepreneurship (e.g., Carree and Thurik 2008), Granger causality tests will be employed.

Granger causality (Granger 1969) is about the effect of one time series on another time series. A 'simple' correlation indicates a co-movement between two variables, but Granger causality relates to the concept of incremental predictive power of one time series in order to predict another time series. A stationary variable (Y) is said to 'granger cause' another stationary variable, X, if 'historical' data of the former variable (Y) improves the prediction of X that is beyond the information included in the 'historical' data of X. Therefore, the concept of Granger causality has two principles. First, the 'cause' occurs prior to the effect. Second, the effect of the this cause is unique.

[22] It can be noted that preliminary analyses show that the ratios derived from Edvinsson and Compendia seem to correlate rather well as regards fluctuations over time. This comparison is possible for 1972–2000.

Granger causality cannot provide any definitive conclusions regarding causal relationships in any 'true' sense – it rather provides 'predictive causality'. However, Granger causality is generally considered to demonstrate the probability of causation (or of no causation) more powerfully than simple correlation (Geweke 1984). Furthermore, for our study, this methodology will improve the possibility of testing previous assumptions and empirical results on the relationship between variations in entrepreneurship and economic growth.

Our study employs a vector autoregressive (VAR) model to implement Granger causality tests. One important factor will be taken into consideration in the analysis, namely the possibility of structural breaks in the relationship between entrepreneurship and economic growth as suggested by previous studies (e.g., Audretsch and Thurik 1997, 2001; Carre and Thurik 2010). This is principally due to the rather long time series that are used in the study. The relationship between the two growth rates series GGDP and GSE could vary according to changes in the economic structure over time. Ignoring structural breaks could lead to misleading conclusions of the relationship between GGDP and GSE, and the first task is therefore to identify possible structural breaks in the time series data.

4.1 Structural breaks

We start with a simple regression model without any lags where the dependent variable is the growth rate of GDP (GGDP) and the independent variable is the growth rate of self-employment (GSE).

$$GGDP_t = \alpha + \beta^* GSE_t + u_t \qquad (1)$$

The identified breaks according to (1) are considered later in the VAR model. The parameter stability tests will be carried out for a diagnostics check, testing whether such break(s) is (are) reasonable.

In detecting structural breaks, a prior condition is that the time series under investigation should be stationary. This will be done using the Augmented Dickey-Fuller (ADF) unit-root test, based on generalized least squares proposed by Elliott et al. (1996) which offers greater power for non-zero and trended deterministic components for both series of growth rates. We expect both series to be stationary, which is the actual reason why the rates, and not the levels of, GDP and SE are in focus.

After estimating (1) based on our full sample period (1851–2000), a standard CUSUM test, a diagnostics test for the stability of parameters, is implemented. Once there is a sign of significant shifts in parameters in (1), the multiple-breakpoints approach, developed by Bai and Perron (2003) to date structural breaks, is employed. The idea is to divide the sample period into several (m+1) corresponding segments. The parameters in the separate segments can then differ. For our investigation, (1) is transferred to

$$GGDP_t = \alpha_i + \beta_i^* GSE_t + u_t \, (i=1,2,\ldots,m+1) \qquad (2)$$

where the subscripts i constitute a segment index which is up to m+1 corresponding to m breaks. The *rss*, residual sum of squares, can be defined as the sum of individual *rss* (i), the *rss* in the ith segment, accordingly:

$$rss\,(i_1,\ldots, i_{m+1}) = \sum_{i=1}^{m+1} rss\,(i) \qquad (3)$$

The date (year) of breaks can then be identified by

$$(i_1,\ldots, i_m) = \text{argmin}_{(i1,\ldots, im)} rss\,(i_1,\ldots, i_{m+1}) \qquad (4)$$

This dating approach is according to the assumption that the number of breaks, m, is known. Since there exists no prior knowledge of m, we shall first determine the value of m. To determine a reasonable m, we specify different models with different possible m; for instance, we set m = 0, 1, 2, …, M. M will be determined based on the associated model that minimizes BIC.

4.1 Granger causality tests

As noted above, the present study does not only focus on the instantaneous correlation between GGDP and GSE, provided in (2), but also on correlations using historical information – more specifically, how current GGDP and GSE are correlated with past values of GSE and GGDP, respectively.

This is exactly the idea of Granger causality (Granger 1969), which tests whether additional historical information, the lags of a variable, would improve the predictive power of another variable. The procedure will provide additional information on the relationship between GGDP and GSE.

Granger causality can be tested via a VAR model. Our VAR model is formulated on each segment according to the identified structural break(s):

$$GGDP_t=\alpha_{i1}+\sum_{j=1}^{k}\beta_{ij}GGDP_{t-j}+\sum_{j=1}^{k}\gamma_{ij}GSE_{t-j}+u_{GDPt} \qquad (5)$$

$$GSE_t=\alpha_{i2}+\sum_{j=1}^{k}\theta_{ij}GGDP_{t-j}+\sum_{j=1}^{k}\delta_{ij}GSE_{t-j}+u_{SEt}$$

This system contains total k lags of GGDP and GSE. k is determined according to a general lag selection principle of VAR (the lowest AIC or SIC). The null hypotheses of the non-Granger causality test for the growth of GDP as the target variable are $\sum_{j=1}^{k}\gamma_j=0$, and, for the growth of self-employment, as the target variable H_0: $\sum_{j=1}^{k}\theta_j=0$. These hypotheses can be tested by the F-statistics that follows the F-distribution with the degrees of freedom of k and T-k.

Note that the Granger causality tests are implemented in each segment according to the identified structural break(s). Since the identification is based on an instantaneous relationship, (1), diagnostics tests for the stability of the parameter, the CUSUM tests, for each equation in each segment according to (5) will be implemented.

4.3 Granger causality in the frequency domain

The Granger causality in the time domain, discussed above, relates to the notion of incremental predictive power with 'historical' information of one time series to predict another time series. However, this procedure cannot handle causality at different frequencies, for instance causality at the typical business cycle frequency, the long-run causality at a low frequency, or the short-run causality at a high frequency, etc.

Therefore, while Granger causality is a measure for the entire relationship between two time series, Granger causality in the frequency domain makes it possible to establish whether predictive power is concentrated at quickly or slowly fluctuating components. In essence, Granger causality is calculated for each individual frequency component separately, meaning that for each frequency, the power as well as the direction of the Granger causality can differ.

Granger (1969), Geweke (1982) and Hosoya (1991) develop a method for Granger causality tests in the frequency domain. Breitung and Candelon (2006) largely simplify the testing procedure and we adopt their methodology in our study. We demonstrate the testing hypotheses based on the bivariate VAR model of GGDP and GSE (5). According to Breitung and Candelon (2006), the null of no causality of GGDP by GSE can be tested by the linear restrictions

$$\begin{aligned} &\gamma_1 \cos(\omega) + \gamma_2 \cos(2\omega) + \cdots + \gamma_k \cos(k\omega) = 0 \\ &\gamma_1 \sin(\omega) + \gamma_2 \sin(2\omega) + \cdots + \gamma_k \sin(k\omega) = 0 \end{aligned} \qquad (6)$$

where ω is frequency in (0,π). k is the number of lags, which can be determined according to AIC or BIC. It should be noted that in order to capture the feature associated with Granger causality in the frequency domain, k needs to be at least 3. Similarly, the null of no causality of GSE by GGDP can be tested by the linear restrictions

$$\begin{aligned} &\theta_1 \cos(\omega) + \theta_2 \cos(2\omega) + \cdots + \theta_k \cos(k\omega) = 0 \\ &\theta_1 \sin(\omega) + \theta_2 \sin(2\omega) + \cdots + \theta_k \sin(k\omega) = 0. \end{aligned} \qquad (7)$$

Breitung and Candelon (2006) further point out that the Wald testing statistics of (6) and (7) approximately follow the F-distribution, with degrees of freedom of 2 and T-2k. The non-Granger causality can be rejected if the estimated statistic is larger than the critical value. In order to establish an overview of the frequency ω in (0,π), the whole set of the Wald statistics with various ω in (0,π) as well as the critical value at 5% significant level are plotted. The non-Granger causality hypothesis can be rejected if the Wald statistics curve lies above the critical value.

5. Entrepreneurship and economic growth, economic growth and entrepreneurship

In this section, we analyze self-employment growth (GSE) and GDP growth (GGDP) in Sweden between 1851 and 2000, calculated from the levels of corresponding variables in Edvinsson (2005a). The two growth rates series are plotted in Figure 2.

5.1 Unit-root tests

The results of the unit-root test, the generalized-least-squared ADF, are reported in Table 1. The nulls of non-stationarity cannot be rejected for the levels of self-employment (SE) and GDP, respectively, but the nulls for the growth rates, GSE and GGDP, can be rejected. We conclude that both GDP and SE are $I(1)$ processes.

Table 1. Unit-root test.

	N of lags	tau	p-value
GSE	2	-4.99654	7.599e-007
GGDP	3	-3.21379	0.00128
SE	9†	-2.11255	0.5382
GDP	10†	-0.23212	0.9924

The numbers of lags are optimally determined, given the maximum lags of 4 for the growth rates and 12 for the levels, respectively. †: the time trend is included.

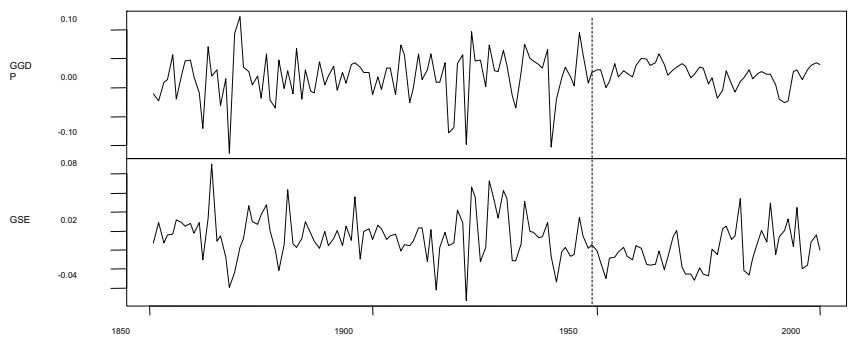
5.2 Structural breaks and the relationship between GSE and GGDP

In order to identify structural breaks, we estimate (1) for the whole sample period, 1851–2000, by implementing OLS. The result is reported in the first

column of Table 2. Both α and β are significant and the positive slope β=0.3886 indicates that a 0.39 percentage point increase in GDP is associated with a 1 percentage point positive growth rate in self-employment. However, and crucial, the parameters are not stable according to the CUSUM test. Then, we assume that the number of breaks could be 0, 1, 2, 3, 4, and 5. The associated BICs are presented in Figure 3. Both 'no break' and 'one break' minimize the BIC. Since the above analysis is based on 'no break' and fails to pass the CUSUM test, we accept one break point, m=1. The date (year) of the break is determined by the approach by minimizing the RSSs developed in Bai and Perron (2003).

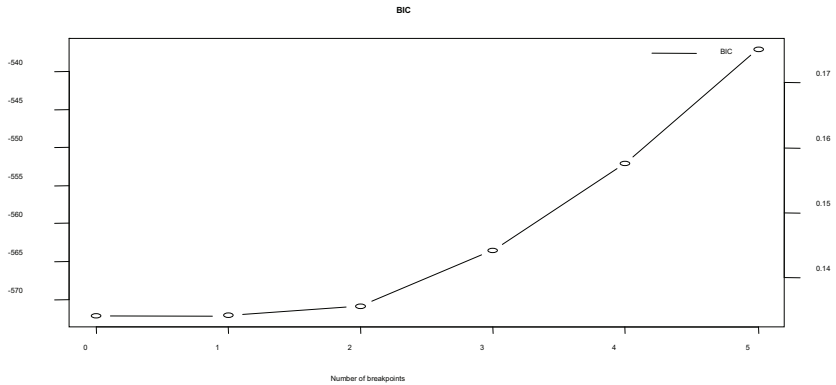
The year of 1948 is identified in the empirical data as the date (year) of the break, and a dashed vertical line indicating this year is added in Figure 2. As can be observed in the figure, the pattern of GGDP clearly changes from 1949, indicating a smoother, less volatile pattern as compared to the period 1851–1948.

Figure 2. Growth of self-employment (GSE) and GDP (GGDP).



The vertical dashed line indicates the time point of the break (1948).

Figure 3. BIC and number of breaks.



The lowest point of the BIC curve corresponds to 1 break.

By taking this structural break into consideration, the model (1) is extended by including two dummy variables, D1 and D2, corresponding to two segments (1851–1948, 1949–2000), and by replacing GSE in (1) by D1*GSE and D2*GSE to capture differences in slopes.

$$GGDP_t = \alpha_1 * D1 + \alpha_2 * D2 + \beta_1 * (D1 * GSE_t) + \beta_2 * (D2 * GSE_t) + u_t \quad (8)$$

The result is reported in the last two columns of Table 2. First of all, it can be observed that the model (8) now passes the CUSUM test, thus indicating stable parameters. In comparison with the single segment model (1), (8) fits the data much better which is indicated by an increased R-squared (0.07 and 0.16, respectively) and by the highly significant *F*-statistics. It can be further noted that the problem of heteroskedasticity has not been improved and, for that reason, robust standard errors are used.

More importantly, several significant changes in the parameters can be identified in the extended model. The intercept in the period 1851–1948 is insignificant, while the slope is highly significant. This indicates a signifycant and instantaneous correlation between GSE and GGDP.

Table 2. Regression results: Growth of GDP as the dependent variable.

	1851–2000	1851–1948	1949–2000
Intercept	0.0161*** (0.0036)†	0.0076 (0.0051)†	0.2249*** (0.0036)†
Growth of SE	0.3886*** (0.1510)†	0.7099*** (0.1782)†	-0.2060 (0.1321)†
R^2	0.07	0.16	
F	6.6193** (0.011)	28.498*** (1.45e-14)	
$X^2_{SC}(4)$	0.3948 (0.812)	1.0793 (0.898)	
X^2_H	9.7428*** (0. 0018)	42.828*** (0.000)	
X^2_{FF}	2.1205 (0.1237)	1.246 (0.291)	
CUSUM	2.5680** (0.0112)	1.03757 (0.3012)	

The standard errors of coefficients are in parentheses. †: The robust standard error

*** indicates significance at 1%, ** at 5%, and * at 10%.

$X^2_{SC}(4)$, X^2_H, and X^2_{FF} indicate the diagnostic tests of Breusch-Godfrey's serial correlation test up to a lag of 4, Breusch-Pagan's heteroskedasticity test and Ramsey's RESET function form test, respectively. P-values are given in parentheses.

CUSUM denotes the CUSUM test for the stability of parameters.

However, such a significant correlation disappears in the period of 1949–2000: although the intercept turns out to be significant, the slope in that segment is no longer significant. The significance of the changes is tested and reported in Table 3, showing that changes in coefficients are all significant according to the *F*-statistics for the null hypothesis of $\lambda_i = \lambda$. This result serves as additional evidence of the identified structural break in 1948. What can explain this structural break in 1948 in Swedish GDP growth in our analysis? This coincides with a long period of high economic growth and a new, active (Keynesian) economic policy in Sweden. In several

instances, the post-war years can be described as a turning point from a fiscal and monetary policy perspective. Erik Lundberg (1983) described the immediate post-war years as an economic-political 'system crisis'. Several economists, among these Gunnar Myrdal, were pessimistic about the post-war development. The Social Democratic government developed an extensive program for various socializations and regulations. These plans were extensively contested and, in the end, abandoned.

According to Lundberg, this system crisis in principle ended in 1948. Already in the 1930s did Sweden start with new stabilization policy measures, most notably a price-stability objective and, in particular after the War, an active (Keynesian) fiscal policy. This Swedish stabilization policy paradigm was basically kept intact up until the early 1990s (Jonung 2000). Past empirical research gives evidence of a long, stable period of growth during the post-war period (see, as an example, Krantz and Nilsson 1975, Schön 2010).

The shifts between economic recessions and expansions were substantially sharper during the second half of the 19th century as compared to later decades. From the mid-1900s and on, fewer recessions in the Swedish economy can be distinguished: with the period 1952-1953 being an exception (a small recession), the years from 1941 to 1976 can be seen as a long phase of expansion with an average annual GDP growth rate of approximately 4 percent (Edvinsson 2005b).

Table 3. Stability of parameters across different segments: the case of growth of GDP.

	1949–2000	
	Intercept	Slope
1851–1948	5.781** (0.02)	17.050*** (6.1e-05)

p-values are given in parentheses.

*** indicates significance at 1%, ** at 5%, and * at 10%.

5.3 Granger causality tests for GGDP and GSE

Since the two series of GGDP and GSE are stationary, a Granger causality test can be implemented in the VAR model (5) and the result is reported in

Table 4. The first column presents the result for the whole sample (1851-2000), while the second and third columns report the results in the two segments (extended model). Particular attention is given to the CUSUM tests (Table 4 and Figure 4). For the equation in which the dependent variable is represented by GGDP, there are no problems for all specifications of segments.

However, for the equation in which GSE is the dependent variable, the model for the whole sample period cannot pass the CUSUM test. Once more, as previously identified, this would indicate the presence of a structural break in the data. On the other hand, the estimates with a structural break (1851–1948; 1949–2000) can pass the CUSUM tests – consequently, the result of Granger causality tests implemented individually in each segment is reliable. Note that the number of observations in each segment becomes rather small – 99 and 52, respectively – and therefore, the bootstrap standard errors are adopted in order to increase the precision.

The results are reported in Table 4. Attention is paid to the last two columns representing two segments with the break at 1948, since they are reliable in the sense of no specification errors of unstable parameters.

First of all, concerning the Granger causality tests, it turns out that the null of non-causality can only be rejected by GGDP to GSE in the second segment, 1949–2000. This means that GGDP granger-causes GSE only after 1949 (i.e. 1949–2000) but not in the 1851–1948 period. Hence, GSE is correlated with historical GGDP in the period of 1949–2000, but not 1851–1948. On the other hand, our results also show that GSE does not (Granger)-cause GGDP in either segment. This indicates no correlation between GSE with historical GGDP in the entire sample period (1851–2000).

Table 4. VAR and no causality tests for growth rates.

	1851–2000	1851– 1948	1949–2000
Granger causality GSE → GGDP	3.1203** (0.029)†	1.5002 (0.207)†	1.2103 (0.205)†
Granger causality GGDP → GSE	3.4169* (0.086)†	0.3598 (0.705)†	4.356*** (0.006)†
Instantaneous	14.1402*** (0.0002)	11.5458*** (0.0007)	1.7888 (0.1811)
CUSUM equ. GGDP	Stable	Stable	Stable
CUSUM equ. GSE	Not stable	Stable	Stable
$X^2_{SC}(4)$	7.9216 (0.4412)	4.0151 (0.8558)	6.8857 (0.549)
k ††	2		

†: Bootstrap standard error. ††: The optimal lag for the whole sample is determined by the AIC. $X^2_{SC}(4)$ indicates the diagnostic tests of Breusch-Godfrey's serial correlation test up to a lag of 4. *** indicates significance at 1%, ** at 5%, and * at 10%.

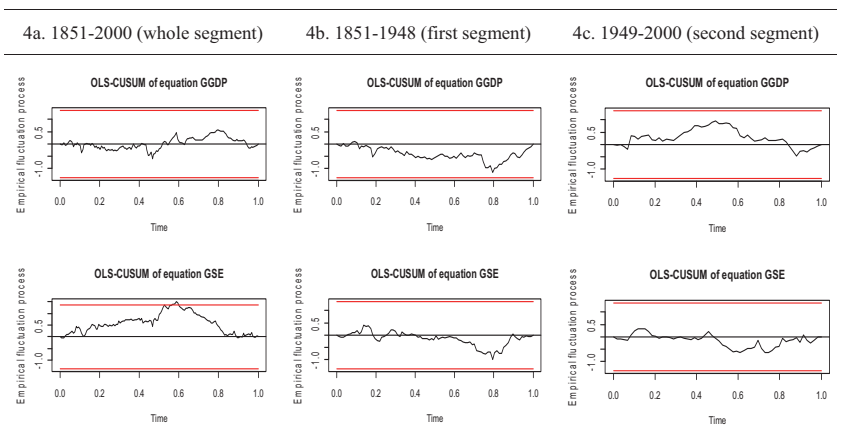
Second, focusing on instantaneous correlations, such an instantaneous correlation between GGDP and GSE can only be identified up until 1948 (i.e., 1851–1948). This instantaneous correlation disappeared after 1949. Intuitively, it can be imagined that both GGDP and GSE are affected by some common economic factors and common shocks. Instantaneous correlation implies that both GGDP and GSE would be affected simultaneously. The correlation therefore provides a picture of the relative magnitudes from common factors and shocks on GGDP and GSE. Consequently, these results are interpreted as, up until 1948, GGDP and GSE are simultaneously affected by common economic factors, such as economic policy, structural change, etc.

Granger causality characterizes the significance of correlations between the historical values of one variable and another variable. In this case, GGDP (Granger)-causes GSE after 1949; thus GSE correlates with past GGDP. When using the notion of common factors and shocks in the interpretation of this significant correlation, this would first affect GGDP and take a while to have an impact on GSE.

Putting these two correlations together, we can establish the following. In the sample period of 1851 to 1948, there is an instantaneous correlation,

but no Granger causality in either direction. Hence, GDP growth and self-employment growth would simultaneously be affected by common factors. In the sample period of 1949–2000, we are able to identify that GGDP (Grange)-causes GSE, but not in the other direction. In this period, there is no instantaneous correlation. This means that GSE is only correlated with historical GGDP. More specifically, GGDP did not react to fluctuations in entrepreneurship – rather, GGDP were always ahead of changes in entrepreneurship.

Figure 4a-c. Stability tests for the growth VAR model.

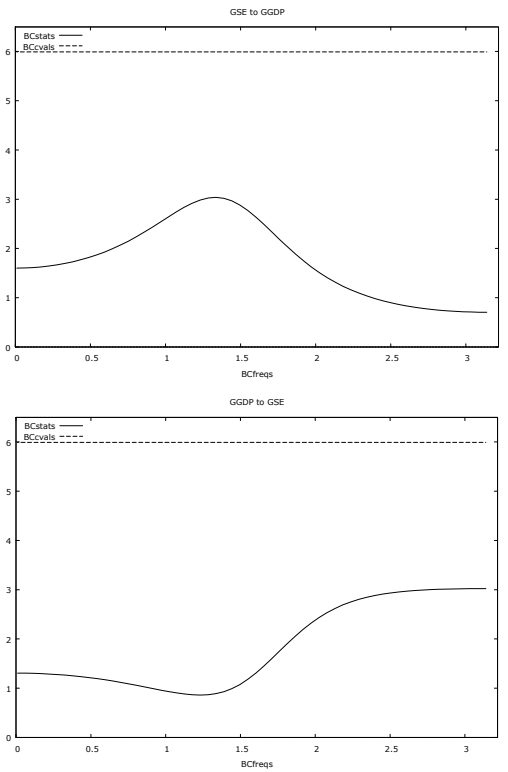


Statistics of the CUSUM tests are plotted with symmetric bands. The statistics being outside of bands leads to the rejection of the stablility of the coefficients. The left-hand panel indicates the whole sample. The middle panel refects the segment of 1851 to 1948. The right-hand panel shows the segment of 1949 to 2000.

The above analysis has established a delay for self-employment growth. A Granger causality test in the frequency identifies the length of this delay. Even though we know that Granger causality can only be identified for GGDP to GSE in the second segment (as found above), we test two segments and all directions; the tests can serve as a confirmation of our previous results. The number of lags, k, used in the tests, are three for both segments. The results are presented in Figures 5 and 6, and the curves in the figures represent the Wald statistics of testing the null hypotheses specified in (6) and (7) with different frequencies ω in (0,π).

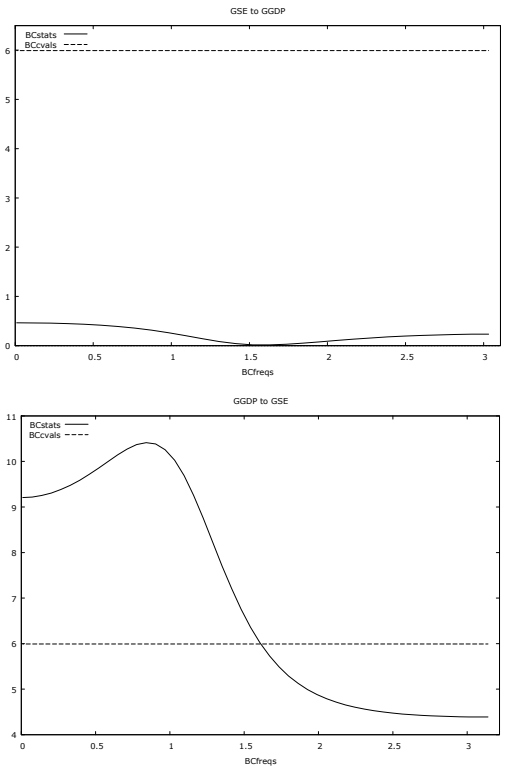
Figure 5 represents the segment of 1851–1948 (GSE to GGDP, and GGDP to GSE, respectively), and Figure 6 represents the segment of 1949-2000 (GSE to GGDP, and GGDP to GSE, respectively). The critical value of 5.99 is plotted as dashed lines; if a part of the curve (associated with the frequency ω) is located above the dashed line, the non-Granger causality can be rejected at the corresponding frequency ω.

Figure 5. The segment of 1851 to 1948: GSE to GGDP (left panel), GGDP to GSE (right panel).



The dashed lines represent 5% critical value. The curves represent statistics of Breitung and Candelon tests associated with different frequencies ω.

Figure 6. The segment of 1949 to 2000: GSE to GGDP (left panel), GGDP to GSE (right panel).



The dashed lines represent a 5% critical value. The curves represent statistics of Breitung and Candelon tests associated with different frequencies ω.

In the first segment, 1851 to 1948 (Figure 5), no parts of the curves are located above the dashed line. This indicates that non-Granger causality cannot be rejected at any frequency. This is consistent with the findings in the previous section: GGDP and GSE responded to common shocks simultaneously. In the second segment, 1949 to 2000 (Figure 6), however, the results differ. The left-hand panel indicates the non-Granger causality test GSE to GGDP, and it can be observed that no part of the curve is located above the dashed line. Therefore, the hypothesis that GSE does not Granger-cause GGDP cannot be rejected at any possible ω.

On the other hand, in the right-hand panel of Figure 6, the Wald curve is situated above the dashed line when ω is less than 1.6, which approximately matches a four-year period. The null of non-Granger causality can therefore be rejected beyond four years, but not for shorter frequencies.

6. Concluding remarks

In this study, our aim has been to investigate the relationship between changes in entrepreneurship – measured as self-employment – and economic growth over a very long period. We could identify a correlation between self-employment growth and GDP growth in the long term, 1851–2000. However, this correlation appears to have changed after World War II, more specifically in 1948. Between 1851 and 1948, we could not establish any Granger causality between self-employment growth and GDP growth in either direction. Here, GDP growth and self-employment growth appear to have responded simultaneously to common factors and shocks. Yet, from 1949 and onwards, GDP growth Granger-caused self-employment growth, but not the other way around. We found a delay for self-employment growth. Between 1949 and 2000, GDP growth would first react to these common factors and economic factors, and self-employment growth would respond with a delay.

Recent theory and research results in the mainstream of entrepreneurship research suggest that entrepreneurship has become a driving force for economic growth among advanced economies in the two to three past decades. Thus, entrepreneurship drives and precedes economic growth and this link is found to be empirically verified across a wide spectrum (Thurik and Wennekers 2004). The relationship is not purely straightforward – and it is not considered to be unaffected by time or history, nor by a country's level of development. 'Historical' models (e.g., Audretsch and Thurik 1997, 2001) maintain a more manifest and positive causal link from entrepreneurship starting around the 1970s and/or 1980s amongst advanced economies. Around these decades, a historical, structural shift supposedly occurred. In 'stages of economic development'-models, a similar association is maintained: there may be a minor or even negative impact of entrepreneurship in low-income economies while increases in entrepreneurship have more positive effects in advanced, innovation-driven economies. Thus, when countries become more economically advanced, the significance of entrepreneurship for economic growth increases (Bosma et al. 2008, Wennekers et al. 2010).

From this, it could be expected that changes in entrepreneurship would display a positive, causal relationship with economic growth in Sweden during approximately the final two decades of the last century (or perhaps even earlier) – but that this causal relationship would be either weaker, missing – or even reversed – for earlier periods.

In the present study, no relationship in line with these theories was discovered for Sweden, a country ranked as an advanced, innovation-driven economy (e.g., Acs and Szerb 2009, 2012). Our study rather shows that, 'historically' – that is, up to the late 1940s – there was an instantaneous relationship between self-employment growth and GDP growth, affected by common factors and shocks, but neither a negative nor a 'causal' relationship (in a Granger-sense).

Our results reveal that this immediate relationship disappeared from 1949. From that year, variations in self-employment lagged with GDP growth (or with common shocks or common factors) in the medium or long term – not the other way around. Thus, we have not been able to establish that economic growth reacts to fluctuations in entrepreneurship; rather, for the past several decades, changes in GDP were always ahead of changes in entrepreneurship. This relationship could be detected as far back as the late 1940s. Accordingly, no shift or structural break in which changes in entrepreneurship would precede economic growth could thus be discovered for the most recent decades of the 20th century.

As a consequence, in this study, the case of Sweden does not correspond to recent established models and assumptions. Furthermore, it is interesting to note that the structural break discovered in the present study coincides with earlier empirical observations: the immediate post-war years have been viewed as a turning point and the onset of a long stabilization policy paradigm (Jonung 2000, Lundberg 1983).

Given these results, and within the framework of the theoretical mainstream that maintains a causal relationship going from entrepreneurship to economic growth, it could be asked whether Sweden is an exception to the rule. It may of course be so. Nonetheless, empirical research that has used large samples and country panels also gives evidence of substantial country heterogeneity when testing the causal relationship between entrepreneurship and economic change. In fact, there are rather few countries that actually do display the hypothesized relationships proposed by mainstream models. Several countries deviate from the average. At the global level, increases in entrepreneurship are an early indicator for a recovery from economic recessions. At the national level, entrepreneurship seems to react to

unemployment fluctuations rather than causing them (Koellinger and Thurik 2012, see also Congregado et al. 2012).

The results in the present study are in line with these observations: we found no support for the assumption that changes in entrepreneurship precede macroeconomic change. Rather, it was the other way around. Therefore, Sweden does not seem to be an exception from the rule.

Given our results, it could be asked if entrepreneurship has been properly measured in the study. Self-employment is one of the most commonly used (and most available) indicators for entrepreneurship in both research and policy. It may, however, be an inappropriate one. The definition of entrepreneurship is probably one of the most problematical and difficult aspects in the entrepreneurship literature. Therefore, self-employment may perhaps – at best – be able to measure some characteristics of entrepreneurship, but it cannot capture all aspects of the phenomenon.

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