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Destructive entrepreneurship in the small business sector: bankruptcy fraud in Sweden, 1830–2010

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Abstract Entrepreneurship will not always productive: Baumol (1990, 1993) distinguishes between productive, unproductive, and destructive entrepreneurial activities, and in the last two cases, new values are not created. Setting of from the notion of destructive entrepreneurship and the bankruptcy institute as framework for the empirical analysis, we use long aggregate series on bankruptcies and bankruptcy frauds in Sweden, 1830–2010. We operationalize destructive entrepreneurship with bankruptcy frauds. The bankruptcy institute is not a pure cleansing mechanism; assets can be redistributed by criminal procedure. Thus, a form of destructive entrepreneurship can be conducted within this system. We link bankruptcy frauds to the selection mechanism—the aggregate bankruptcy volume—over time. We cannot establish any direct linkages between the bankruptcy volume and institutional changes. However, and in line with research on bankruptcy diffusion and diffusion of economic crimes, we find that bankruptcy frauds have significant, positive impacts on the bankruptcy volume. Therefore, our results indicate that increases in bankruptcy frauds, destructive entrepreneurship, would affect the economic system.

Keywords Bankruptcy · Bankruptcy fraud · Destructive entrepreneurship · Sweden

JEL classification E3 · C22 · G33 · K4 · L26

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1 Introduction

Entrepreneurship is commonly associated with innovation and the increase of welfare (Schumpeter 1911, 1939, 1949). However, in his seminal works, Baumol (1990, 1993) distinguishes between three types of entrepreneurship: productive, unproductive, and destructive. In the last two cases, entrepreneurial activity results in redistribution of wealth, and new values are not created; entrepreneurship will therefore have a negative effect on society. This fact has been more neglected; furthermore, the distinction between unproductive and destructive entrepreneurship has been tenuous and therefore often ignored (Desai et al. 2013). One fundamental problem has been to operationalize and to distinguish the three concepts of entrepreneurship; since productive, unproductive, and destructive entrepreneurship come in many forms, no universal approach or definition exists. Another problem has been to study the effects of the different forms of entrepreneurship (e.g., Bjørnskov and Foss 2008).

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In the literature, *destructive* entrepreneurship has been defined as illegal entrepreneurial activities such as organized crime and economic crime (e.g., Collins et al. 2016). In the present article, we explicitly attend to the notion of destructive entrepreneurship and operationalize it by using comprehensive, aggregate series on bankruptcy fraud in Sweden. The framework of the bankruptcy institute presents an opportunity to elaborate on the Baumolian framework: while the bankruptcy institute can be regarded as a cleansing or selection mechanism that sorts out inefficient firms from the market (e.g., Miller 1991), it can also be regarded as a financial institution that can be used by entrepreneurs for distributing assets in unintended and sometimes unwanted directions. First, it can be employed as a tool for rent-seeking and thus for unproductive entrepreneurship: firms themselves can, strategically, file for bankruptcy and evade payment of debts. The bankruptcy costs are thereby externalized to creditors, suppliers, and taxpayers (Akerlof et al. 1993; Delaney 1992; Stiglitz 2001). Second, economic crimes—destructive entrepreneurship—are committed within the bankruptcy institute. Bankruptcy frauds are typically committed before bankruptcy proceedings are initiated; here, an insolvent firm has illicitly withdrawn or concealed assets from creditors and the state (Gottschalk 2010; McCullough 1997). In the case of bankruptcy fraud, offenders have committed either dishonesty or carelessness towards creditors, favoritism towards creditors, or accounting fraud. Thus, a firm has illegally exploited an economic opportunity in order to gain some form of financial or business advantage. Just as in "strategic" bankruptcies, all or some of the bankruptcy costs are externalized (Friedrichs 2010).

The dynamics of bankruptcies and bankruptcy frauds should be viewed through the lens of the small business sector: the lion's share of all bankruptcies and business exits each year relates to small businesses (e.g., Lundberg 1999; van Praag and Versloot 2007). For example, around 80,000 firms went bankrupt in Sweden between 1994 and 2001; of these, nearly 90% had 0–1 employees (Statistics Sweden database), and this is also illustrative for historical times (Gratzer 1998; Box 2005, 2008; Statistics Sweden 1923). In a similar way, most economic crimes and frauds are committed by small-scale entrepreneurs (Croall 1989; Korsell 2015; Sutton and Wild 1985), and the "victims" of these types of crimes are typically *other* business organizations (e.g., Alvesalo and Virta 2010; Wheeler and Rothman 1982).

Setting out from Baumol's (1990, 1993) notion of destructive entrepreneurship and its potential effects, we empirically operationalize the concept and ask whether there is a relationship between bankruptcy frauds and the selection mechanism—in the present case, the bankruptcy volume. Indeed, changes and variations in the bankruptcy volume could be conceived to reflect a Schumpeterian process of productive entrepreneurship, disbanding outdated structures and contributing to renewal and new-firm formation (Schumpeter 1911). But a complementary view is that bankruptcies also may be disruptive and costly to a wide array of stakeholders such as investors, creditors, suppliers, and society (e.g., Carter and Auken 2006). Alongside the Baumolian framework on how the allocation of entrepreneurship affects the economic system, this observation has several similarities with recently developed models on interlinkages between firms and bankruptcy diffusion: bankruptcies would have potential "domino effects," and a bankruptcy may spillover to other firms, creating a vicious bankruptcy cycle (Gatti et al. 2006, 2009). Furthermore, as noted, bankruptcy *frauds* are characteristically integrated in the bankruptcy institute; interlinkages and networks in the economy therefore represent comparable sources of bankruptcy fraud diffusion. Analogous to the effects of bankruptcies and "strategic bankruptcies" and as regularly observed in the criminology literature, crimes and frauds committed by business organizations have potential to proliferate and to lead to the failure of creditors and suppliers—commonly other firms (Alvesalo and Virta 2010; Croall 2004).

Following these strands of literature, we take on an explorative approach in the present article and strive to assess the extent to which bankruptcy frauds could be linked to changes in the bankruptcy volume. This research problem also has relevance for policy-makers: governments identify economic crime as a threat against general welfare and, in extension, against democracy. Furthermore, the incentive structure on the market becomes distorted: businesses that use the bankruptcy institute for strategic and even criminal purposes may drive serious firms out of business (Höjer 2006; Swedish Economic Crime Authority 2017).

We employ comprehensive series on all bankruptcies and bankruptcy frauds in Sweden during nearly 200 years (1830–2010). Clearly, several factors will affect the probability for businesses to exit. Past empirical research has linked variations in the bankruptcy rate,

as well as variations in the rate of (economic) crimes, to the business cycle (e.g., Levy and Bar-Niv 1987; Krüger 2011; Detotto and Otranto 2012). In line with these findings, we take these potential linkages into consideration. Our methodological contribution is that we make use of and combine several contemporary and historical sources, including archival materials, that are not readily available in any public statistical databases; this approach thus shows how longer economic analyses of changes in entrepreneurship are possible to conduct. Furthermore, the autoregressive distributed lag (ARDL) model, developed by Pesaran et al. (2001), is employed in the analysis. Recently, the ARDL model has been applied to the relationship between crimes and economic variables (Narayan and Smyth 2004; Mauro and Carmeci 2007; Habibullah and Baharom 2009; Detotto and Pulina 2013). The article's contribution to the entrepreneurship literature is that we present new empirical results and approaches for the study of bankruptcy and on the relationship between bankruptcies and bankruptcy frauds. Furthermore, we contribute by showing how the concept of destructive entrepreneurship can be operationalized and used for an empirical assessment at the macro-level across time (Desai et al. 2013).

2 Background

2.1 Destructive entrepreneurship

Since the early 1980s, policy and research have mainly focused on the "good" side of entrepreneurship. However, since the early 1990s, more research has attempted trying to shed light on entrepreneurship's "dark sides." This discussion has drawn attention to the negative aspects, seldom mentioned in the literature. Baumol (1990, 1993) claims that the current understanding of various forms of entrepreneurship remains incomplete, almost always focusing on Schumpetarian productive entrepreneurship. Baumol emphasizes that the difference between productive, unproductive and destructive entrepreneurship, and unproductive and destructive entrepreneurship plays important roles in many, if not most, economies. According to Schumpeter (1911), entrepreneurship fulfills a central function in the development of an economy: economic development, and thus *productive entrepreneurship*, takes place through the introduction of innovations.

Baumol (1990, 1993) argues that his own expansion of the Schumpetarian model, which focuses on the *allocation* of entrepreneurship, can enhance our understanding significantly. Baumol shows that not only the supply but also the very type of entrepreneurship are determined by formal and informal institutions. In his theory, the supply of entrepreneurial talent varies less than the allocation entrepreneurship: individuals will put their talent to use in activities that are either productive, unproductive, or destructive. At least one of the prime determinants of entrepreneurial behavior at any particular time and place is the prevailing rules of the game that govern the payoff of one entrepreneurial activity relative to another: the relative returns, and thus the allocation of these activities, are determined by the rules of the game (see also Douhan and Henrekson 2010; Henrekson and Stenkula 2016). Weak and unstable formal institutions, including informal institutions such as norms and societal values, might foster *unproductive entrepreneurship*. According to Baumol (1990, 2010), unproductive entrepreneurship may take many forms; rent-seeking via litigation, corporate takeovers, or tax evasion constitutes the main contemporary threat to productive entrepreneurship. Other examples include "smart" speculative financial transactions (Lindbeck 1988) or so-called convenience bankruptcies and strategic bankruptcies. These are not a criminal act per se, but may often work against the interest of creditors and the public (Akerlof et al. 1993).[1]

Baumol (1990) does not go into detail on *destructive entrepreneurship*, or on how the concept can be operationalized. Since there is no consensus on what activities that exactly can be classified as unproductive and destructive entrepreneurship, the boundary between these two categories is unclear (see for example Antony et al. 2017). However, according to scholars, examples of destructive entrepreneurship are found in the field of economic crime and organized crime (Collins et al. 2016; Douhan and Henrekson 2010). The phenomenon of organized crime is mostly associated with activities such as the production and distribution of illegal drugs,

[1] For instance in Sweden, a "convenience bankruptcy" is carried out in order to favor the actual debtor. The bankruptcy trustee can hire the company's deputy to lead the business operations during the reconstruction period. The company's employees may be dismissed; according to Swedish law, their redundancy payments during the continued operation will be paid by the State (in Swedish: *Lönegaranti*). Unsecured claims rarely receive any dividends at all, which makes debt restructuring effective (*Lag om företagsrekonstruktion*, Proposition 1995/96:5).

racketeering, and blackmail. We often refer to this as Mafia activities; a Mafia can achieve significant market positions by selling protection, illegal gambling, or by engaging in human trafficking or in drug- and weapons-related activities. Other examples of destructive entrepreneurship in the field of organized crime are the piracy in the Malacca Sea outside the coast of Somalia; the emergence of system of state corruption in Russia (Dawisha 2014), or the smuggling of migrants to Europe (European Union 2006), or the use of the bankruptcy system for criminal purposes (Croall 2001, 2004).

Baumol's (1990) theory has received considerable attention; nonetheless, past work elaborating on this theory, though significantly contributing to research progress, has generally been more theoretical and conceptual (see Acs et al. 2013; Desai et al. 2013). These models generally assume, alike Baumol (1990), that the supply of entrepreneurs is less varying than the allocation of entrepreneurship: destructive entrepreneurship has a negative effect on society and is therefore rent-destroying; unproductive entrepreneurship is rent-seeking, and productive entrepreneurship is rent-creating. Recently, Antony et al. (2017) have presented a model of endogenous growth, driven by productive entrepreneurs with an endogenous degree of rent-seeking (unproductive entrepreneurship). Another recent study is Elert and Henrekson (2016), who introduce the concept of "evasive entrepreneurship"—a profit-driven business activity aimed at circumventing the existing institutional framework by using innovations to exploit contradictions in that very framework (inconsistencies in regulation, lack of judicial precedence, lack of judicial resources).

The difficulties in operationalizing Baumol's (1990) theory, as well the problems of measuring the effects from productive, unproductive, and destructive entrepreneurship, are generally acknowledged; as stated by e.g., Bjørnskov and Foss (2008), it is theoretically and empirically important to distinguish both the supply and the allocation of entrepreneurship—however, available data seldom allow for a complete empirical distinction. In their own attempt, Bjørnskov and Foss (2008) use business start-ups as an indicator for both the supply and the allocation of entrepreneurship. They admit that this captures only fragments of the allocation concept; furthermore, it does not inform of the degree to which entrepreneurship is productive, unproductive, or destructive. Earlier efforts to operationalize the Baumolian framework include both micro-oriented studies that utilize either experimental, interview, or survey data (Collins et al. 2016; Sauka 2008; Sauka and Welter 2007; Urbig et al. 2012) and macro-oriented research using aggregate and/or cross-country data (Ashby 2015; Bjørnskov and Foss 2008; Sobel 2008). Albeit using different data, methodologies, approaches, and different spatial and temporal dimensions, past empirical work therefore commonly empirically operationalizes fragments of the Baumolian framework. For instance, Urbig et al. (2012) experimentally examine the association between individuals' entrepreneurial intent and their benevolent/selfish behavior. Individuals who perceive themselves as being good in doing business invest in more destructive entrepreneurship. As another example, Sobel (2008) focuses on entrepreneurial productivity (e.g., venture capital investments, patents, self-employment) relative to "unproductive" political and legal entrepreneurship (lobbying, lawsuits) at the state level in the USA. Sobel finds a relationship between having good institutions and net entrepreneurial productivity across states.

In sum, earlier efforts show that universal measurements are difficult, if not impossible, to generate (e.g., Bjørnskov and Foss 2008): some studies focus on how the institutional framework affects the allocation of entrepreneurship, focusing on unproductive entrepreneurship and its effects (but leaves out destructive entrepreneurship; e.g., Sobel 2008); others focus on the allocation of entrepreneurship, but not on the effects (e.g., Collins et al. 2016). Empirical operationalizations of the different concepts of entrepreneurship are therefore moderately few, and Desai et al. (2013) identify a number of key areas for further research on destructive entrepreneurship: while the literature on the allocation and determinants of entrepreneurship is expanding, the specific dynamics, causes, and effects of destructive entrepreneurship remain ignored. Furthermore, it is necessary to gain more knowledge on how destructive entrepreneurship can be a process as well as an outcome. Finally, further elaborations on temporal dimensions are necessary. Along the lines of these suggestions, utilizing the framework of the bankruptcy institute, we strive to contribute to the literature by empirically operationalizing destructive entrepreneurship and attempt to measure the potential effects of destructive entrepreneurship—bankruptcy frauds—over a very long observation period. We focus on the relation between bankruptcy frauds and bankruptcies and we make use of several different historical and contemporary sources in

order to construct these long series. Alike earlier attempts, we are confined to employ specific indicators that partially are able to capture the phenomenon of destructive entrepreneurship and its potential effects.

2.2 Diffusion of economic crime and bankruptcy fraud

Will variations in bankruptcy frauds—destructive entrepreneurship—affect the selection mechanism, here defined as the aggregate bankruptcy volume? It is highly plausible; empirical studies have provided evidence of diffusion of personal bankruptcies to stakeholders (Miller 2015; Mikhed and Scholnick 2014; Scholnick 2014), and a theoretical explanation for bankruptcy diffusion in the corporate sector is provided by Gatti et al. (2006, 2009), building a model on the credit interlinkages. In their model, macro-economic business cycles can be outcomes of a complicated interaction between firms and banks with heterogeneous conditions. The corporate sector consists of "downstream firms" and "upstream firms"; upstream firms supply intermediate inputs to the downstream firms, which are pure borrowers. Upstream firms are lenders, supplying trade credit to downstream firms, but they are also borrowers from banks. Banks are pure lenders to both down- and upstream firms. The activities of upstream firms are principally determined by the production of downstream firms, and a shock would affect their credit relationship. If the shock is substantial, borrowers may not be able to fulfill debt commitments: the default of one firm will cause the default of another, and the number of links between firms implies a likelihood of bankruptcy diffusion (Gatti et al. 2009; for a related approach, see Allen and Gale 2000).

In a similar spirit, a growing field of research on the aggregate relationship between crimes, economic crimes, and economic variables shows that crimes have a crowding-out effect on the economy (Carboni and Detotto 2016; Detotto and Pulina 2013); furthermore, criminologists assert that networks and ties between firms can be a major source for fraud diffusion. A crime or fraud committed by a business may ruin other businesses such as suppliers and creditors; changes in the rate of fraudulent bankruptcies would therefore diffuse to other business organizations (Alvesalo and Virta 2010; Baker and Faulkner 2003; Croall 2004; Wheeler and Rothman 1982).

One conclusion from past research on credit interlinkages in the corporate sector and research on crime and the economy is that it is plausible that (economic) crimes would have substantial effects on the economic system. By assuming that bankruptcy fraud could be used as an empirical indicator for destructive entrepreneurship—a crime committed within the framework of a "legal" business—and, furthermore, that destructive entrepreneurship may vary over time (Baumol 1990), our *overall* hypothesis is that there is a positive relationship between bankruptcy frauds and the bankruptcy volume.

3 Bankruptcies and bankruptcy frauds, 1830–2010

It is reasonable to assume that the rates of bankruptcies and bankruptcy frauds are dependent on the institutional framework. Thus, one main determining factor of entrepreneurial behavior is the prevailing rules of the game (Baumol 1993; Douhan and Henrekson 2010; Henrekson and Stenkula 2016). A macro-policy factor which would influence the number of bankruptcies is changes in bankruptcy legislation. In this article, it is above all the laws regulating bankruptcy and bankruptcy fraud that are of interest—for instance, in an empirical study, Liu and Wilson (2002), e.g., study corporate failure rates, macro-economic determinants, and changes in the UK insolvency legislation, 1961–1998. They find an effect from the 1987 Insolvency Act, diminishing the failure rates. However, the impact from the act did not persist in the long term and they conclude that the apparent effect of that one-time change leveled off over time. Institutional change is thus a complicated process that is difficult to measure quantitatively: changes in the volume of bankruptcies and crime rates can be outcomes of changes in formal rules, informal restrictions, and the effectiveness of third-party enforcement. In addition, institutions commonly change gradually (e.g., North 1990).

3.1 The institutional framework

When an individual or a business applies for credit or borrows money, some kind of written or oral agreement is fulfilled. If there is no repayment, the debtor breaks a contract—something considered fundamental in every economy. The bankruptcy institute has several functions: forcing the closing of non-viable firms; avoiding fraud and unfair distribution of assets; coordinating creditors; and resolving disputes between debtors and creditors. Thus, it forces the payment of debts and may help to restore debtors. This institute—the "insolvency

regime"—thus tries to balance several objectives, among them the weight given to the debtors, creditors, the management, and to other stakeholders. Different judicial systems across the world further complicates balancing different incentives; furthermore, the bankruptcy procedure is dependent on the efficiency of the judicial system to enforce rights and objectives, or at least to serve as a credible threat (Claessens and Klapper 2005; Gratzer 2008; LoPucki 1982).

Can the institutional framework explain the changes in the volumes of bankruptcies and bankruptcy frauds? One complicating factor is that punishable bankruptcy frauds periodically have been regulated in both the Bankruptcy code, in the Penal code, and in the Commercial code. In Sweden, these three codes have overlapped in a complicated manner and cannot be described separately. From a principal focus on the distribution of assets, insolvency law is today viewed as an important part of national growth through the rules of reconstruction (equivalent to Ch.11 in the USA), rules for saving capital, and for securing job opportunities. Insolvency law in Sweden has developed from a creditor-debtor focus to a stakeholder perspective (Danell 2007).

In Sweden, a first separation of punishable and non-punishable bankruptcies was introduced in the mid-1600s (for a comprehensive overview, see Tuula 2001). During the long period of observation, the penalty for bankruptcy fraud in Sweden has varied, but the definition of this particular offense has remained essentially intact, pertaining to carelessness and/or dishonesty towards creditors. In Sweden, penalty for carelessness towards creditors was introduced in the Bankruptcy code of 1818. Over time, several factors served to gradually depersonalize the belief of the causes of bankruptcy: the emergence and proliferation of joint-stock companies as economic organizational form from 1848; changes in the credit market; and the recognition of business cycles. A more varied picture of the reasons for economic failure slowly emerged and many countries, among them Sweden, established modern bankruptcy laws in the mid-nineteenth century. Consequently, bankruptcy was increasingly perceived as an economic failure rather than a moral one (Mann 2002).

In the new Bankruptcy code of 1862—replacing the code from 1818—carelessness towards creditors (fraud) was introduced, and in the Penal code of 1864, the penalty regulations in Chapter 23 were entered under the heading "on debtors in bankruptcy that are fraudulent or careless." From 1921, both these crimes were put under public prosecution. After a reform of the Penal code in 1942, five special debtor's crimes—bankruptcy frauds—were included: dishonesty to creditors; grave such dishonesty; carelessness towards creditors; favoritism to creditors; and bookkeeping crimes. All regulations on debtor's crimes were transferred to the Penal Code, without any factual changes. The Bankruptcy code from 1862 was succeeded by a new code in 1921, effective from 1922. Neither of these two codes was radical in the sense that it could be expected that the volume of bankruptcy filings would be affected by these legal changes: in several respects, parts of former laws remained or were modified in the new laws, and the reforms mainly concerned procedural matters (Tuula 2001). Thus, the code from 1862 did not result in any distinct break with the previous legal development (pre-1860s), and the reasons for the new code in 1921 were that it had become obsolete Again, focus was mainly on procedure and on lowering the administrative costs. A reform in the early 1970s, furthermore, had the goal to simplify voluntary agreements among parties, something that theoretically would depress the bankruptcy rate. In 1987, the legal framework that is effective today was introduced. In this bankruptcy code, effective from 1988, the Bankruptcy code of 1921 has remained practically unchanged; several rules and regulations from the code of 1921 were transferred to the new code (Mellqvist and Welamson 2017; Swedish Government 2010). One major change in the law on corporate reconstruction (corresponding to the US Ch.11) became effective from 1996, with the purpose of lowering the bankruptcy rate and saving insolvent firms. One decade after this most recent major reform, it was established that it did not have the intended effects: in relation to all bankruptcy filings, very few businesses applied for reconstruction (Karlsson-Tuula 2006, 2011).

3.2 The empirical picture

Figure 1 reports the volume of all registered bankruptcies and registered bankruptcy frauds in Sweden, 1830–2010. As can be observed in Fig. 1, Sweden has had a very varied development in the bankruptcy volume (registered bankruptcies). A periodization of the bankruptcy development during the entire observation period shows a low and quite stable bankruptcy level between 1830 and the late 1850s. A phase with relatively higher levels commences approximately in the 1860s and ends in the early 1920s. During this phase, the trend increases

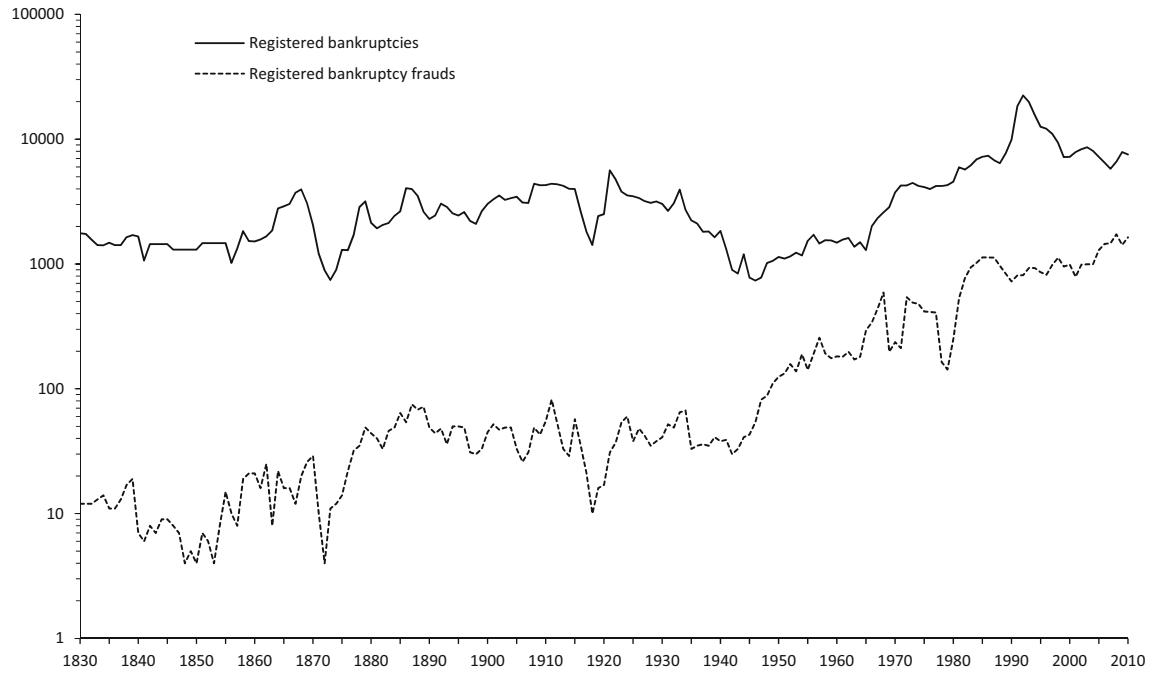

Fig. 1 Registered bankruptcies and registered bankruptcy frauds in Sweden, 1830–2010. Log scale

positively and has higher variation than before. The lowest observed value (1873) can probably be explained by an economic boom, and the highest observed value, in 1868, corresponds to a severe recession that resulted in Sweden's last famine. The bankruptcy peaks in 1921, 1933, and in the early 1990s are most likely caused by the three most severe economic crises during the twentieth century.

From 1933, there is a fall in the bankruptcy trend up to end of World War II (1939–1945). Overall, the entire period after the war (1946–2010) witnesses a significant increase in the bankruptcy volume—from 778 bankruptcies in 1946, to a nearly ten times higher level in 2010. In historical perspective, the relatively low and stable bankruptcy volume between the 1940s and the mid-1960s is remarkable. Reasonable explanations are the heavily administrated and regulated economy during the war, the economically prosperous post-war period, and a delayed and pooled demand for Swedish exports. From the mid-1960s, the volume increases considerably and the period *c.*1985 to 2010 records the highest bankruptcy frequencies. The general increase in the early 1990s and the bankruptcy peak in 1992 coincide with government failures: a crisis in the financial and real estate markets raged in full due to credit market deregulations and unemployment soared (Lönnborg et al. 2003).

Figure 1 also reports registered bankruptcy frauds. The development of bankruptcy frauds is somewhat different from the bankruptcy volume. With variation, the level of bankruptcy frauds is historically low up to the 1870s/1880s. From here to the mid-1940s, the level increases, and the fraud volume takes off from the late 1940s/early 1950s—particularly from the 1950s (as noted, the bankruptcy volume takes off some 20 years later). One factor that complicates the picture in the post-war period is the strong fluctuations in the 1960s and 1970s; however, the fraud trend is positively rising in a linear manner from the 1960s. From visual inspection of Fig. 1, it can be noted that some periods of peaks and troughs in bankruptcy frauds appear to correspond to the general macro-economic development: for example, the level is reduced during the two World Wars (1914–1918; 1939–1945); similarly, frauds increase distinctively in the speculative years of the 1980s. They fall in the early 1990s but increase again in the following economic recovery. In 2001, there is a fall in the fraud volume, coinciding with the "Dot.com" crisis.

Our overall assessment of the changes in the volume of bankruptcies and bankruptcy frauds, between 1830 and 2010, is that it could be questioned if major changes in the formal institutional framework have had observable effects. Scholars have noted that recent reforms have not resulted in any noticeable changes in the

bankruptcy rate (Karlsson-Tuula 2006, 2011). This observation is partially reflected in the data of the present article; from visual assessment of the development of the bankruptcy volume—and the bankruptcy fraud volume—it is generally difficult to discern any direct or immediate relationship with major institutional reforms across time. The volume of bankruptcy frauds takes off distinctly from the early 1950s, i.e., around a decade after the reform of the Penal code in 1942 (and appears to occasionally vary with the macro-economic development). Furthermore, legal changes and reforms on insolvency—the early 1860s, early 1920s, early 1970s, late 1980s, and mid-1990s—do not directly appear to correspond to changes in the aggregate bankruptcy volume. For instance, neither the reform in the early 1970s nor the reform in the mid-1990s did not distinctly appear to affect the bankruptcy trend. More importantly and as shown in the formal analysis (Sect. 5), we are not able to identify structural breaks in the bankruptcy series that would correspond to these institutional reforms.

4 Research framework

With economic crime and in both national and international contexts, we here mean crime occurring in economic activities in or in relation to an essentially legal business (Swedish Government 2008; definitional problems and conflicts are well-documented in academic literature, see Larsson 2001). In our study, bankruptcy frauds relates to all individuals sentenced for this offense; regardless of data source, bankruptcy fraud is consistently measured throughout the period of observation in the sense that the view of crime and dishonesty towards creditors has not changed substantially over time.[2] This offense is detected after a firm has filed for bankruptcy, and it has thus occurred prior, or in direct relation, to the bankruptcy event.

Generally, economic crimes have not been systematically studied by historians; organized analyses of the extent to which economic crimes were noticed by authorities during the nineteenth century in Sweden are still lacking. Furthermore, Swedish printed historical statistics are largely restricted to traditional criminality—that is, violence and theft crimes—and it is generally difficult to identify economic or corporate crimes (Lindström 2004; von Hofer 2011). Crimes against creditors, bankruptcy frauds, are relatively few, equivalent to 2–3% of the total of *all* economic crime. Like all types of statistics, it is generally problematic to apprehend "true" rate of the variable of interest. This is also the case for bankruptcy frauds; like all crime statistics, only detected, reported, and/or convicted frauds appear in the statistics (Ahlberg 1999; Korsell 2015). In general, empirical case studies and cross-sectional investigations on bankruptcy frauds in both Sweden and internationally show that the bankruptcy fraud rate may vary between 30 and 90% of all registered bankruptcies (Kedner 1975; Langli 2001; Liebl 1988; Magnusson 1999; Weyand 1997). According to a recent investigation by the Swedish Enforcement Authority (2010), notifications for or suspicion of crime were made in 35% of all registered bankruptcies in 2010. In sum, this means that the exact numbers remain unknown. The main reason for why we, in spite of this, choose bankruptcy frauds as a proxy for destructive entrepreneurship is that other longitudinal, unbroken series on other types of business-related crimes in Swedish statistics are lacking.

Another challenge for all longitudinal studies is that the object of study transforms over time. Between 1830 and 2010, the composition of the total stock of bankruptcies has changed: in the beginning of the period of investigation, and different from today, bankruptcies consisted predominantly of individual persons' bankruptcies (as well as of a smaller part of bankruptcies related to inheritance of estate).[3] At that time, the organization of business was mainly conducted within the framework of the family or the household. Modern forms of organization of business commenced in 1848 with the introduction of the joint-stock company, but only very large businesses, such as mines or railroad

[2] The following sources and databases have been used for constructing the series on bankruptcies and bankruptcy frauds. Statistics Sweden: Bidrag till Sveriges officiella statistik (BISOS), Rättsväsendet: *Sammandrag af justitie-statsministerns underdåniga embetsberättelser för åren 1830 till och med 1856*, and *Utdrag ur Hans Exc. Herr justitie-statsministerns underd. Brottmålsberättelse för åren 1857 och 1858* (af O. Carlheim-Gyllensköld) I: 141–150; III:223–235; *Statistisk tidskrift*, 1860–1913 (including supplements); *Statistisk tidskrift*, 1952–1984 (Stockholm: Norstedt); *Sveriges officiella statistik* (1870–1913); *Statistisk årsbok för Sverige* (1914–2010); *Rättsstatistisk årsbok*, 1975–1984 (Stockholm/Örebro: SCB förlag). In addition, statistical databases from both Statistics Sweden and BRÅ (The Swedish National Council for Crime Prevention) have been used; BRÅ, *Kriminalstatistik: elektroniska databaser över anmälda-, handlagda- och lagförda brott*.

[3] In this type of bankruptcies, the heirs to an estate refrained from inheritance in order to avoid debts to creditors.

firms, initially transformed to joint-stock companies. It would take several decades until business forms such as the joint-stock company, trading companies, or sole proprietorships would spread to trades dominated by small firms. However, the absolute majority of the bankruptcies in our data concern small business failures. This is also true in a historical setting: in early twentieth century Sweden, more than 80% of all the registered bankruptcies were personal bankruptcies, consisting of individuals in small-scale businesses and trades: master craftsmen, journeymen, tradesmen, and traveling salesmen (Statistics Sweden 1923). Over the course of time, the composition of bankruptcies transformed, dominated by formal business firms—in particular by small joint-stock companies. In a relative sense, joint-stock companies are today over-represented in the Swedish bankruptcy statistics, while personal bankruptcies amount to around 6–7% per year of the total bankruptcy rate.

4.1 Data and variables

A critical evaluation of the sources and data used in this article gives the following: historical and contemporary statistics on *bankruptcies* are generally reliable across time. Records and databases on economic property, transactions, and financial behavior are well-documented, since it lies in the interests of both the government, the public, and the market (however, one problem with collecting historical statistics on bankruptcies has to do with the organization of the Swedish judiciary).[4] Data on criminal behavior and economic crimes, and thus registered *bankruptcy frauds*, are relatively more uncertain (a fact well-known in the criminology literature): only detected, reported, and/or convicted bankruptcy frauds are made visible. Overall, there is no straightforward way to estimate the "actual" rate (e.g., Korsell 2015). Social scientists are generally guided by and are forced to employ official statistics. Activities that fall outside the purview of government accounting—such as "shadow economy" activities—when using indicators on GDP, trade, and investment (which we normally accept as "objective") are not included and often problematic to approximate (Fleming et al. 2000). From the various sources, we have constructed three longitudinal series of non-interrupted data: (i) annual series on all registered bankruptcies; (ii) series on court convicted offenses on bankruptcy, i.e., bankruptcy frauds, and (iii) series on the difference between total bankruptcies and fraudulent bankruptcies. The latter variable is the dependent variable. The reason for this approach is the following. For any calendar year, the total number of bankruptcies will always entail a certain number of bankruptcy frauds—that is, each bankruptcy fraud is also a bankruptcy event, thus counted twice in the statistics. The average share of bankruptcy frauds in relation to all registered bankruptcies for the whole observation period is 5.2%, but is varying between 0.27 (in the year of 1853) and 26.2% (in 2008). This implies that some bankruptcy also is bankruptcy fraud events; this is the motivation for using the *net* bankruptcy volume as dependent variable.

Furthermore, we employ an indicator for the business cycle (growth rate of the gross domestic product; Schön and Krantz 2015). Since long, economists have assumed that firm behavior such as the frequency of establishing and closing down firms systematically covaries with the macro-economic development (Birch 1987; Koellinger and Thurik 2012). In an upturn, business exits and bankruptcies are claimed to decrease and vice versa. Overall, the empirical literature provides evidence of the relation between exit rates and bankruptcy volume and the business cycle at both the micro-level (e.g., Everett and Watson 1998; Bhattacharjee et al. 2009) and the macro-level (Levy and Bar-Niv 1987; Balcaen and Ooghe 2006; Hol 2007). It would be surprising if crime rates were immune to the business cycle (Cook and Zarkin 1985). Empirical studies have found that the effect of real economic activity is different between different types of crimes. Property crimes, violence crimes, and sex crimes are countercyclical, while the reverse is true for economic crimes due to increasing opportunity during economic expansions (Bushway et al. 2012; Krüger 2011; Povel et al. 2007); for example, Detotto and Otranto (2012) have recently found that economic crimes, including bankruptcy frauds, display

[4] Until 1849, there were six different district and municipal courts on the countryside and in the towns where bankruptcies could be filed. During the 1800s, bankruptcies could be filed in several courts (including academic courts; universities had their own jurisdictions). Earlier, court statistics on bankruptcies were not published annually; yearly figures must therefore be collected in different court archives—a time-consuming task. We have no precise knowledge of the accuracy of authorities when registering cases. From 1822, the provincial governor's reports are printed every 5 years. From 1856 to 1860 through 1901 to 1905, the reports were sent to Statistics Sweden. Even today, we can encounter different information on the number of bankruptcies in public statistics (Gratzer and Tuula 2007).

a sensitivity to macro-economic conditions. Overall, we could expect a negative relationship between changes in bankruptcies and changes in economic growth: bankruptcies increase during economic downturns and recessions and are reduced during economic upturns.

Therefore, and following past research results, bankruptcy crimes should reveal a positive relationship. As noted, we use GDP growth between 1830 and 2010 (Schön and Krantz 2015) as an indicator for the business cycle. Indeed, indicators such as the unemployment rate could be more suitable for this task; however, such long series are not available. According to Okun's law (Okun 1962; Baily and Okun 1965) and the "difference version" (Knotek 1975), there is a stable, negative relation between GDP growth and changes in the unemployment rate (Ball et al. 2014).

5 Analysis

We employ data on GDP growth, *GGDP*, along with the three variants of our bankruptcy data: the total registered number of bankruptcies, *RB*; the total number of registered bankruptcy frauds, *BF*; and finally the net series obtained by subtracting the bankruptcy fraud series from the total registered bankruptcy series. For simplicity's sake, we call this third series "bankruptcies," *B*. Our main exploration aims at identifying the long-run relationship, and we regress GDP growth and bankruptcy frauds on bankruptcies. Following the discussion in Sect. 4.1, we also carry out two additional regressions: the long-run relation between GDP growth and bankruptcies (dependent) and the relation between GDP growth and bankruptcy frauds (dependent), respectively. These results, which essentially build on the same methodology as the main analysis (see Sect. 5.1), are discussed in the end of the present section (see also Appendix). In short, these results show that we fail to establish long-run relationships between the variables.

5.1 Methodology

Our analysis focuses on the logarithm of Bankruptcies, ln*B*. Thus, we analyze the relationship between ln*B* and *GGDP*. More importantly, following the main hypothesis in the article, we explore whether there is any spillover or diffusion effect from bankruptcy frauds, ln*BF*, on ln*B* in the long run. Hence, we introduce ln*BF* as additional independent variable in our regression model. The long-run relation is as follows[5]

$$\ln B = \mu_{\mathrm{GGDP}} GGDP + \mu_{\mathrm{BF}} \ln BF + v \tag{1}$$

where μ_{GGDP} and μ_{BF} are the long-run coefficients. μ_{GGDP} refers to impacts from 1% age point change in *GGDP* on *B* ($\mu_{\mathrm{GGDP}} * 100\%$). At the same time, 1% change in *BF* would lead μ_{BF} % changes in bankruptcies *B* in the long run. The ARDL model has been widely used in economic studies, including crime and economic growth (e.g., Narayan and Smyth 2004; Detotto and Pulina 2013), and the regression is based on this model:

$$\begin{aligned}\ln B_t = {} & \alpha_0 + \textstyle\sum_{i=1}^{p} \theta_i \ln B_{t-i} + \sum_{i=0}^{q1} \theta_i^{\mathrm{GGDP}} GGDP_{t-i} \\ & + \textstyle\sum_{i=0}^{q2} \theta_i^{BF} \ln BF_{t-\mathrm{i}} + u_t \end{aligned} \tag{2}$$

The least squares estimation can be applied here, and the determination of p, $q1$, and $q2$ can rely on Akaike and/or Schwarz information criteria. At the same time, the determination should also take autocorrelation of u into consideration. In general, we need to increase p, $q1$, and $q2$ if autocorrelation appears. Note that if any of the involved variable(s) is (are) non-stationary, the distribution of estimates from Eq. (2) would not be Gaussian. Thus, conventional t and F tests may not be valid when $I(1)$ process is involved. In such a situation, it is important that the relation of Eq. (1) is a cointegration relation (Pesaran et al. 2001). The existence of cointegration can be identified by the bounds test. According to Hassler and Wolters (2006), we may reparameterize Eq. (2) into

$$\begin{aligned}\Delta \ln B_t = {} & \alpha_0 + \alpha_1 \ln B_{t-1} + \alpha_2 GGDP_{t-1} \\ & + \alpha_3 \ln BF_{t-1} + \textstyle\sum_{i=1}^{p-1} \beta_i \Delta \ln B_{t-i} \\ & + \textstyle\sum_{i=0}^{q1-1} \beta_i^{GGDP} \Delta GGDP_{t-i} \\ & + \textstyle\sum_{i=0}^{q2-1} \beta_i^{BF} \Delta \ln BF_{t-i} + u_t \end{aligned} \tag{3}$$

where

$$\begin{gathered} \alpha_1 = \textstyle\sum_{i=1}^{p} \theta_i - 1 \\ \alpha_2 = \textstyle\sum_{i=0}^{q1} \theta_i^{GGDP} \\ \alpha_3 = \textstyle\sum_{i=0}^{q2} \theta_i^{BF} \\ \beta_{\mathrm{i}} = -\textstyle\sum_{m=i+1}^{p} \theta_m \\ \beta_0^{GGDP} = \theta_0^{GGDP} \text{ and } \beta_i^{GGDP} = -\textstyle\sum_{m=i+1}^{q1} \theta_m^{GGDP}, \text{ for } i > 0 \\ \beta_0^{BF} = \theta_0^{BF} \text{ and } \beta_i^{BF} = -\textstyle\sum_{m=i+1}^{q2} \theta_m^{BF}, \text{ for } i > 0. \end{gathered}$$

[5] We disregard the time trend in Eq. (3), since *BF* is trended.

The null hypothesis of bounds test is

$$\alpha_1 = \alpha_2 = \alpha_3 = 0.$$

corresponding to no cointegration. Since distributions of estimated coefficients are non-Gaussian, the standard F test is not valid. The bounds test affirms rejecting the null when the F statistic exceeds the upper bound provided in Pesaran et al. (2001). Besides autocorrelation, we also carry out other diagnostic tests: heteroscedasticity, autoregressive conditional heteroscedasticity (ARCH), and RESET. For coefficients stability, we carry out the Ramsey's RESET, cumulative sum of the recursive residual (CUSUM), and cumulative sum of the recursive residual squares (CUSUMSQ). These diagnostic tests are designed for making the regression results reliable. Note that dummy variable(s) would help to overcome specification errors due to possible structural breaks. However, as clarified by Pesaran et al. (2001), this procedure would not have any sensible and meaningful interpretation for the equilibrium condition. In addition, the ARDL model with the bounds test approach is robust to the degrees of integrations of involved variables. Specifically, the regression result would be valid no matter if *GGDP* and ln*BF* are pure *I*(1) or *I*(0) process. Furthermore, the regression is also valid when *GGDP* and ln*BF* are cointegrated. With optimally selected p, $q1$, and $q2$, the ARDL model can also take care of possible endogeneities of *GGDP* and ln*BF*.

Equation (3) can be further renormalized in the form of ARDL-ECM:

$$\begin{aligned}\Delta \ln B_t = {} & \alpha_0 + \alpha_1 (B_{t-1} - \mu_{GGDP} GGDP_{t-1} - \mu_{BF} BF_{t-1}) \\ & + \sum_{i=1}^{p-1} \beta_i \Delta \ln B_{t-i} + \sum_{i=0}^{q1-1} \beta_i^{GGDP} \Delta GGDP_{t-i} \\ & + \sum_{i=0}^{q2-1} \beta_i^{BF} \Delta \ln BF_{t-i} + u_t \end{aligned} \quad (4)$$

where the long-run coefficients $\mu_{\mathrm{GGDP}} \equiv -\frac{\alpha_2}{\alpha_1}$ and $\mu_{\mathrm{BF}} \equiv -\frac{\alpha_3}{\alpha_1}$. α_1 measure the short-run adjustment speed of bankruptcies according to disequilibrium.

5.2 Results

Table 1 provides descriptive statistics, and Table 2 reports the statistics of unit-root tests. We consider the augmented Dickey-Fuller (ADF) test (Dickey and Fuller 1979) based on the asymptotic critical values from MacKinnon (1991) and MacKinnon (1996), the Phillips-Perron (PP) test (Phillips and Perron 1988), Elliot, Rothenberg, and Stock (ERS) test (Elliott et al. 1996), and Kwiatkowski, Phillips, Schmidt, and Shin (KPSS) test (Kwiatkowski et al. 1992).

Table 1 Descriptive statistics

	Mean	Standard deviation
ln*RB*	7.888	0.707
ln*BF*	4.220	1.617
ln*B*	7.832	0.690
GGDP	1.786	3.357

The ADF, PP, and ERS tests have the null of nonstationarity, but the KPSS has the null of stationarity. We also carry out a unit-root test with structural breaks in the intercept and time trend along the line of Vogelsang and Perron (1998), Zivot and Andrews (1992), and Banerjee et al. (1992), which endogenously determine break dates from data by using the F statistic for the break coefficients. Furthermore, and following Perron (1989), we consider two types of break dynamics: the innovational outlier and the additive outlier models, respectively. The innovational outlier model assumes that the break takes place gradually, while the additive outlier model considers the break to take place immediately.

We start with the growth series: ADF, PP, and ERS clearly reject the null of unit root for GDP growth, *GGDP*, growth of registered bankruptcies ($\Delta \ln RB$), and the growth of bankruptcies, $\Delta \ln B$. At the same time, KPSS cannot reject the null of stationarity for all growth rates at 5%. We can conclude that all growth rates are *I*(0). For ln*RB* and ln*B*, ADF, PP, and ERS cannot reject the null of unit root at 5%. At the same time, KPSS rejects the null of stationarity at 5% for both variables. We also check the unit root with break, for ln*RB*, we find that with the assumption of innovational outlier, the unit-root null can be rejected at 5% and the estimated break year is 1933 (coinciding with the deep recession of the early 1930s). The unit-root test in sub-samples divided with the break year, 1933, shows that ln*RB* is not stationary in the second sub-sample period. On the other hand, with the additive outlier assumption, the unit root can only be rejected at 10%.

Overall, ln*RB* is not stationary and thus *I*(1) process. Concerning ln*B*, the unit-root null cannot be rejected at 5% for both outliers. Consequently,

Table 2 Statistics of unit-root tests and break year

	ln*RB* †	Δ ln*RB*	ln*BF* †	ln*B* †	Δln*B*	*GGDP*
ADF	− 2.90	− 10.77***	− 3.89**	− 2.90	− 11.00***	− 12.17***
PP	− 2.63	− 10.52***	− 3.74**	− 2.67	− 10.79***	− 12.64***
ERS	5.85*	0.29***	5.22**	5.71*	0.29***	0.34***
KPSS	0.17**	0.06	0.24***	0.15**	0.05	0.41*
ADF with innovational outlier	− 5.30**		− 5.82***	− 5.08*		
Break year	1933††		1911†††	1933		
ADF with additive outlier	− 4.40*		− 5.62***	− 4.24		
Break year	1941		1916†††	1941		

* $p < 0.1$

** $p < 0.05$

*** $p < 0.01$

† Unit-root test with the intercept and time trend

†† Non-stationarity cannot be rejected the unit-root tests in the second subsample period

††† Stationarity cannot be reject by KPSS in both subsample periods

ln*B* is not stationary and is thus *I*(1) process. The unit-root tests for bankruptcy frauds, ln*BF*, show some inconsistencies: ADF, PP, and ERS reject the null of unit root at 5%. However, KPSS also rejects the null of stationarity at 1%; therefore, we further carry out the unit-root tests with a break. According to both approaches, the null of unit root with break can be rejected at 5%. With an innovation outlier, the break year is 1933 but with the additive outlier the break year is 1941. The unit-root tests are carried out in all corresponding sub-sample periods. ln*BF* is stationary in all sub-samples; thus, bankruptcy frauds is trend stationary.

The results of the bounds test and the estimation of the ARDL-ECM model, Eq. (4), are reported in the first column of Table 3 (full sample, without outlier dummies). The result shows that the optimal lags are all 1 based on AIC. We fail to pass the heteroscedasticity test. In solving this, the standardized residuals and identify outliers which have standard deviations more extreme than 3 (or − 3) is predicted. Four outliers are discovered: the years 1919, 1921, 1945, and 1991; alike the break year of 1933, these years all coincide with substantial economic, political, and social changes, but no break year is directly associated with changes in the legal frameworks related to insolvency in general or to bankruptcy fraud. Dummy variables are set up to capture the identified outliers; the dummies are treated as exogenous variables when the ARDL model is re-estimated. The result is reported in the second column of Table 3 (full sample with outliers dummies); note that the null of homoscedasticity is not rejected.

The Pesaran, Shin, and Smith bounds test shows that we may reject the null of no level relationship at 1%; we conclude there is a long-run linear relationship between bankruptcies, per capita GDP growth, and bankruptcy frauds. Both long-run coefficients are significant. The coefficient for GDP growth is significant at the 5% level, and the one for bankruptcy frauds is significant at 1%. The GDP growth coefficient indicates a negative impact from GDP growth; essentially, accelerated GDP growth leads to lower bankruptcies. The coefficient is about − 0.12, implying that one percentage point increased output growth would lead to about a 12% decrease in the bankruptcy volume (note that growth is already in the unit of percentage). At the same time, the coefficient for bankruptcy frauds is positive at a value of 0.31. This suggests that a 1% increase in bankruptcy frauds—destructive entrepreneurship—would lead to a 0.31% increase in bankruptcies. The result in Table 3 (second column) also shows that the adjustment coefficient α_1 is approximately − 0.11, suggesting that bankruptcies would adjust to remove the disequilibrium. The speed is about one tenth of the gap per year—in other words, it would take about 10 years to eliminate the disequilibrium. The main implication from this is that

Table 3 Bankruptcies and GDP growth. Full sample with and without outlier dummies and sub-samples (1833–1933; 1934–2010)

	Full sample		Sub-samples	
	Without outliers dummies	With outliers dummies	1833–1933	1934–2010
$\ln(B)(-1)$	−0.0898***	−0.1068***	−0.2914***	−0.1701***
Long-run coefficient				
$GGDP(-1)$	−0.2181**	−0.1200**	−0.0303*	−0.1814**
$\ln(BF)(-1)$	0.3333***	0.3097***	0.4522***	0.5677***
Short-run coefficient				
$\Delta(\ln(B)(-1))$	0.1691**	0.2254***	0.2914**	0.2634***
$\Delta(GGDP)$	−0.0178***	−0.0135***	−0.0064*	−0.0188***
$\Delta(GGDP)(-1)$				0.0205***
$\Delta(GGDP)(-2)$				0.0250****
$\Delta(GGDP)(-3)$				0.0160***
$\Delta(\ln(BF))$	0.1132***	0.0756**	0.1662***	−0.0084
Constant	0.6144***	0.7213***	0.8174***	0.8375***
d1919		0.5604***	0.5327***	
d1921		0.7043***	0.7403***	
d1945		−0.5876***		−0.6189***
d1991		0.5655***		0.5904***
R^2/adj R^2	0.20/0.17	0.37/0.35	0.37/0.33	0.54/0.50
AIC/SIC	−0.50/−0.37	−0.73/−0.52	−0.62/−0.44	−0.89/−0.53
F_{PSS}	6.57[aaa]	8.01[aaa]	4.05[aa]	5.33[aaa]
χ^2_{heter}	14.43**	13.97	5.67	6.89
χ^2_{auto}	1.30	1.53	2.88	4.35
RESET	3.88	3.86	2.57*	0.82
ARCH	0.73	0.82	0.10	1.63
CUSUM	Stable	Stable	Stable	Stable
CUSUMSQ	Stable	Stable	Stable	Stable

F_{PSS} reports the PSS's F statistics for the bounds test. [aaa] indicates the rejection of the null of no cointegration hypothesis at 1%. Dummy variables = d(year). χ^2_{heter}, χ^2_{auto} (4), $RESET$(2) and $ARCH$(2), $CUSUM$ and $CUSUMSQ$ provide the diagnostic statistics for Breusch-Pagan's heteroscedasticity, the Breusch-Godfrey's LM serial correlation with 4 lags, the Ramsey's RESET function form with 2 lags, ARCH with 2 lags, CUSUM and CUSUMSQ stability of parameters

*$p < 0.1$

**$p < 0.05$

***$p < 0.01$

bankruptcies actively respond to any disequilibrium caused by either GDP growth and/or bankruptcy frauds. Furthermore, all short-run coefficients are significant, indicating that there are Granger causalities from GDP growth and bankruptcy frauds to bankruptcies.[6]

We also carry out a robustness test by dividing the sample period into two sub-sample periods.[7] The break year is determined according to the following criteria: first, the number of observations in sub-sample periods should roughly be similar. Second, since we identify a

[6] We do not carry out the full version of Granger causality test since our long-run residuals from Eq. (1) are not estimated independently.

[7] An alternative way to carry out the out-sample forecasting. Since we are interested in possible breaks caused by possible institutional change and economic events, we decide to adopt the sub-sampling approach.

cointegration relation, the least squares estimates now follow standard distributions; thus, the approach developed in Bai and Perron (1998) to identify structural break(s) can be applied. However, as pointed out by Pesaran et al. (2001), ARDL model is not suitable for capturing structural changes with dummies; therefore, we re-estimate Eq. (3) and carry out the bounds tests for all sub-samples again. The chosen break year is 1933/1934,[8] and results are reported in the two columns farthest to the right in Table 3 (sub-samples: 1833–1933 and 1934–2010, respectively).

It can firstly be noted that there is a change in lag structures: in the second sub-sample period, the optimal lag for GDP growth, $q1$, is 4, according to AIC. Second, the explanation power is, somehow, changed. While the estimation in the first sub-sample has not improved in comparison with that in the whole sample, the estimation in second sub-sample has improved in terms of R squares, adjusted R squares, AIC, and SIC. Third, by keeping the outlier dummies, we do not identify specification errors in both sub-sample periods (RESET test is significant at 10% in the first sub-sample). Notably, the impact from GDP growth becomes insignificant in the first period, indicating that GDP growth might have no profound effects on the bankruptcy volume prior to the 1930s, while it becomes crucial after 1934 in our analysis. Similar to the whole sample, it can be observed that accelerated growth rates would lead to lower bankruptcies. The diffusion effect from bankruptcy frauds remains robust and is significant in both sub-samples. The magnitudes of these effects are larger in both sub-samples, 0.45 and 0.57, respectively, in comparison with 0.31 in the whole sample estimation; furthermore, if we compare the two sub-sample periods, the diffusion effect seems to be enhanced. We also note that bankruptcies are more sensitive to the disequilibria in the sub-samples (− 0.29 and − 0.17, respectively) in comparison with − 0.11 for the whole sample estimation; however, that sensitivity is weakened in the second period. As for the short-run coefficients, in the first period, only bankruptcy frauds Granger-cause bankruptcies in the first period. At the same time, GDP growth loses prediction power. In the second period, the opposite is true: GDP growth Granger-cause bankruptcies, while bankruptcy frauds lose power to predict bankruptcies.

We also shortly summarize the two complementary analyses (details are found in the Appendix). First, we study the impacts of GDP growth on registered bankruptcies, and we identify the same break years as in the main analysis. The model suffers from specification errors. More importantly, GDP growth—the business cycle—reveals no impact on registered bankruptcies (*RB*). At the same time, we identify the same break year for carrying out the robustness test: GDP growth is non-significant in both sub-sample periods. GDP growth Granger-causes registered bankruptcies in both the whole and the second sub-sampler periods but not in the first sub-sample period. The result is robust: there are no significant impacts of GDP growth on bankruptcies in all sub-sample periods. Furthermore, we analyze the relationship between GDP growth and bankruptcy frauds. Since bankruptcy fraud is trend stationary, we employ the OLS method and find no evidence of that GDP growth would have any impact on bankruptcy frauds. By applying the Bai and Perror (Bai and Perron 1998) approach, we find structural breaks in the years 1875 and 1915, which do not correspond to any known major changes in insolvency legislation.

Our main analysis (Table 3) between the bankruptcy volume, economic variation, and bankruptcy frauds shows a similar pattern: we cannot directly link structural breaks in the bankruptcy trend to institutional changes over time in Sweden. Rather, as revealed, a break occurs in the early 1930s; from this period, both macro-economic variation and bankruptcy frauds appear to have more profound impacts on the bankruptcy volume in comparison to the previous period (pre-1933). In applying a long period of investigation, we can establish that there is a long-run relation between bankruptcies and bankruptcy frauds, and that the impact from bankruptcy frauds on the bankruptcy volume has increased over time. Thus, our results support the notion in the literature that destructive entrepreneurship may have effects on the economic system (e.g., Desai et al. 2013; Douhan and Henrekson 2010).

6 Conclusions and discussion

The bankruptcy institute is a mechanism for both selection and for the regulation of credit relationships (Claessens and Klapper 2005; Miller 1991; Schumpeter

[8] When two breaks are allowed, the Bai and Perron approach identifies 1991 as an additional structural break. But the sub-sample period 1991–2010 is too short. Narayan (2005) provides critical values of bounds tests for small size of samples; however, the minimum size requires 30 observations—thus, we decide to use one break only.

1911). Within this system, entrepreneurial activities may be both productive, unproductive, and destructive (e.g., Akerlof et al. 1993; Croall 2001, 2004). In the present study, we have empirically operationalized destructive entrepreneurship (Baumol 1990, 1993) as bankruptcy frauds at the aggregate level across 180 years in Sweden. Past research has identified criminal activities as one form of destructive entrepreneurship (e.g., Douhan and Henrekson 2010). Obviously, bankruptcy fraud is one of several potential indicators that could be used. In practice, however, and since there are no universal definitions, comprehensive measures are often very difficult to construct. Thus, we are often confined to utilize data that measures fragments the supply and allocation of entrepreneurship (e.g., Bjørnskov and Foss 2008).

Baumol shows that not only destructive entrepreneurship has many different faces across historical periods, economies, and activities but also destructive entrepreneurship may also vary over time due to changes in the institutional environment. In this study, we have found no direct support for the hypothesis that the allocation across productive and destructive entrepreneurship is determined by institutions and institutional change. Specifically, our methodological strategy could not identify any particular years or periods that would coincide with major changes in the formal institutional framework for neither bankruptcy nor bankruptcy fraud. Yet, it seems unreasonable to conclude that this would be the case: past studies show that cross-country variations in bankruptcies can be explained by the legal framework (Claessens and Klapper 2005; Liu and Wilson 2002). However, the present study, as well as other results (Karlsson-Tuula 2006, 2011), has not been able to link distinct institutional changes to any profound variations the bankruptcy volume in Sweden. Future research and other data would be able to investigate these linkages more in detail.

The essential definition of bankruptcy fraud in Sweden has principally remained intact: fraud or carelessness towards creditors. The majority of bankruptcy frauds and bankruptcies concern small business activity—in our time as well as historically. Presently, we can only speculate on the causes of this increase. More importantly, and in line with past research, we have made an effort to link bankruptcy frauds to variables that reflect economic behavior—in our case: the aggregate bankruptcy volume. In line with recent suggestions, we have focused on key issues relate to the dynamics, causes, and effects of destructive entrepreneurship, applying a distinct temporal empirical dimension (see Desai et al. 2013). What we have shown, at the aggregate level, is that destructive entrepreneurship not only varies over time but also may have effects on economic agents and thus on the selection mechanism. We were unable to establish any apparent linkages between the bankruptcy fraud volume and the business cycle. Hence, opposed to past results (e.g., Krüger 2011; Detotto and Otranto 2012), we found no support for the case of Sweden; similarly, we could not directly link changes in the overall bankruptcy volume to macro-economic variation (see Appendix). Several studies have attempted to assess the link between bankruptcies and the business cycle (Levy and Bar-niv 1987; Hol 2007). However, efforts to link variations in bankruptcies to the cycle might have to control for or consider the fact that the total number of bankruptcies will always consist of bankruptcy frauds.

However, when using the net bankruptcy rate, a negative relationship between bankruptcies and the cycle could be verified. More importantly, in the main analysis, our results show that the net bankruptcy volume varied positively with bankruptcy frauds: periods of 'boosts in the fraud volume were significantly related to increases in the aggregate bankruptcy volume. Our interpretation of this result is that increases in bankruptcy frauds would have diffusion or spillover effects. If fraudulent bankruptcies increase, the bankruptcy risk for firms that have claims on or other types of relationships with the former may increase. Several strands of literature maintain that both business failures in general and economic crimes and frauds have propensity to diffuse to other agents—which often are other economic organizations (Baker and Faulkner 2003; Croall 2004; Gatti et al. 2006, 2009; Miller 2015; Mikhed and Scholnick 2014; Wheeler and Rothman 1982). We have established that bankruptcy frauds have varied over longer periods—and that this particular type of destructive entrepreneurship generally has increased. The analysis furthermore indicates that the impact from bankruptcy fraud has magnified over time. Again, while it is theoretically and empirically desirable to separate and distinguish the three concepts of entrepreneurship, it is often difficult to accomplish this empirically in. Admittedly, our own definition of the concept is not an ideal one. These empirical findings are in line with the literatures on diffusion and the Baumolian framework (Acs et al. 2013; Baumol 1990; Desai et al. 2013), indicating that destructive entrepreneurship is rent-destroying and that it would have effects on the economic system.

Our empirical results raise several questions. Our findings point to that changes in destructive entrepreneurial behavior—variations in bankruptcy frauds—would affect the selection mechanism. As noted in passing, research that uses aggregate bankruptcy data in attempting to capture the effect from economic cycles might have to consider that bankruptcy frauds are integrated in the statistical data. More importantly, and turning to the core question in our article, future analyses of our data could utilize other analytical methods, such as Poisson or negative binomial regression models. Additionally, we may have measurement errors in the present study: we only observe reported bankruptcy frauds, and changes in frauds would lead to changes in both reported and unreported frauds. The long-run relation can also be studied by using the dynamic ordinal least squares (DOLS) method which takes leads and lags into consideration. Finally, an asymmetric impact could provide evidence for a rejection of spuriousness; non-linear impacts with a non-linear ARDL (NARDL) model could be a fruitful way—using the same dataset and the NARDL framework, Box et al. (2018) confirm the results of the present study.

Future empirical research on the linkages between bankruptcies and frauds—both analyses of our own our data and other datasets on bankruptcies—should focus in detail on, and attempt to measure, specific changes in policies and actions taken by governments and authorities; the period of analysis does not have to be as extended as in the present article. We mean that this could make progress for analyses of the effects of various forms of destructive entrepreneurship. Future studies should elaborate more on temporal dimensions and how changes in the institutional framework would affect bankruptcies—both at the macro- and micro-levels. Furthermore, and as shown by this study, future empirical research should also further attempt to study the interlinkages between firms and agents in the economic system as well as within the bankruptcy institute (e.g., Gatti et al. 2006, 2009): the extent to which both bankruptcies and bankruptcy frauds may diffuse is relevant for both researchers, policy-makers, and practitioners.

Appendix

Analysis 1

The aim is to identify a long-run relationship between *GGDP* and *RB*. Since ln*RB* is *I*(1) process, we employ the ARDL bounds test approach. The estimation model is specified as:

$$\begin{aligned}\Delta \ln RB_t = {} & \alpha_0 + \delta t + \alpha_1 \ln RB_{t-1} + \alpha_2 GGDP_{t-1} \\ & + \textstyle\sum_{i=1}^{p} \beta_i \Delta \ln RB_{t-\mathrm{i}} \\ & + \textstyle\sum_{j=0}^{q} \theta_j \Delta GGDP_{t-j} + u_t \end{aligned} \tag{A1}$$

A time trend is added in the model, since lnlö*RB* is trended but GDP growth is not. Similarly, (A1) can be further rewritten in the ARDL-ECM format:

$$\begin{aligned}\Delta \ln RB_t = {} & \alpha_0 + \alpha_1 \left(\ln RB_{t-1} - \mu GGDP_{t-1} - \delta^* t\right) \\ & + \textstyle\sum_{i=1}^{p} \beta_{\mathrm{i}} \Delta \ln RB_{t-i} \\ & + \textstyle\sum_{j=0}^{q} \theta_{\mathrm{j}} \Delta GGDP_{t-j} + u_t \end{aligned} \tag{A2}$$

where the long-run coefficient is given by $\mu \equiv -\frac{\alpha_2}{\alpha_1}$ and represents the extent to which changes in *GGDP* would have an impact on *RB*. The interpretation of μ is the following: a one percentage point change in *GGDP* will lead to total change of $\mu * 100\%$ in *RB*. Results are reported in the first two columns in Table 4 (full sample: without outlier dummies and with outlier dummies, respectively). When no outlier dummy is considered, the model suffers non-stable variance of residuals and ARCH component. We apply the same rule in the main text to identify outliers, and identify the same outliers. Now, the CUSUMSQ test shows no sign of instability of residuals' variance, but the ARCH component remains. Non-counteraction null can be rejected at 5%; however, the long-run coefficient is no longer significant at 5%. Thus, *GGDP* would not have any significant impact on *RB*. Following the established approach in the main text, we divide the sample into two sub-samples (sub-samples: 1833–1933 and 1934–2010, respectively). For the first period, and despite the introduction of dummies, the model still suffers non-stable variance of residuals. The estimation in the second period suffers from ARCH specification error and non-stable coefficients. Overall, this procedure does not improve the estimations.

Analysis 2

The aim is to identify a long-run relationship between *GGDP* and bankruptcy frauds, *BF*. Since ln*BF* is trend-stationary, the least squares estimation and

Table 4 Registered bankruptcies and GDP growth. Full sample with and without outlier dummies, and sub-samples (1833–1933; 1934–2010)

	Full sample		Sub-samples	
	Without outliers dummies	With outliers dummies	1833–1933	1934–2010
ln(*RB*)(− 1)	− 0.0802***	− 0.0808***	− 0.1910***	− 0.1834***
Long-run coefficient:				
GGDP(− 1)	− 0.2226**	− 0.1204*	− 0.0419*	− 0.1204*
Trend	0.0109***	0.0009***	0.0103***	0.0009***
Short-run coefficient:				
Δ(ln(*RB*)(− 1))	0.2369**	0.2858***	0.3910**	0.3230***
Δ(*GGDP*)	− 0.0166***	− 0.0122***	− 0.0067*	− 0.0141***
Δ(*GGDP*)(− 1)				0.1733***
Δ(*GGDP*)(− 2)				0.0207***
Δ(*GGDP*)(− 3)				0.0131***
Constant	0.5915***	0.6490***	1.6412***	0.6279***
d1919		0.5611***	0.4380**	
d1921		0.6983***	0.6703	
d1945		− 0.6118***		− 0.6546***
d1991		0.5420***		0.5597***
R^2/adj R^2	0.17/0.14	0.37/0.34	0.37/0.34	0.58/0.51
AIC/SIC	− 0.55/− 0.45	− 0.79/− 0.61	− 0.64/− 0.46	− 1.23/− 0.89
F_{PSS}	5.99[aa]	6.43[aa]	5.85[aa]	8.53[aaa]
χ^2_{heter}	17.73***	15.10*	8.20	7.12
χ^2_{auto}	1.30	2.75	3.90	2.91
RESET	1.64	2.07	2.97*	0.17
ARCH	6.46**	6.14**	1.05	0.53**
CUSUM	Stable	Stable	Stable	Not stable
CUSUMSQ	Not stable	Stable	Not stable	Stable

F_{PSS} reports the PSS's F statistics for the bounds test. [aaa] indicates the rejection of the null of no cointegration hypothesis at 1%. Dummy variables = d(year). χ^2_{heter}, χ^2_{auto} (4), *RESET*(2) and *ARCH*(2), *CUSUM* and *CUSUMSQ* provide the diagnostic statistics for Breusch-Pagan's heteroscedasticity, the Breusch-Godfrey's LM serial correlation with 4 lags, the Ramsey's RESET function form with 2 lags, ARCH with 2 lags, CUSUM and CUSUMSQ stability of parameters

*$p < 0.1$

**$p < 0.05$

***$p < 0.01$

associated tests are valid if we estimate the ARDL model in levels:

$$\ln BF_t = \alpha_0 + \delta t + \sum_{i=1}^{p} \theta_i \ln BF_{t-i} + \sum_{i=0}^{q} \theta_i^{GGDP} GGDP_{t-i} + u_t \quad \text{(A3)}$$

The ARDL specification for overcoming possible autocorrelation is employed, and two models are considered: with and without breaks. Breaks are estimated according to Bai and Perron (1998), and no outlier is detected. The results are reported in Table 5.

The results show that bankruptcy frauds (*BF*) are highly persistent. However, the impacts from *GGDP* are insignificant. Furthermore, the models suffer many specification errors. Introducing breaks improves nothing in terms of these specification errors. In sum, we are

Table 5 GDP growth and bankruptcy frauds

	No break†	With breaks†		
		1831–1875	1876–1915	1916–2010
ln(*BF*)(− 1)	0.8840***	0.5646***	0.5261***	0.7026***
GGDP	− 0.0014	− 0.0068	− 0.0127	0.0120
Trend	0.0050***	0. 0051	− 0.0004	0.0149***
Constant	0.2612***	0.9291***	1.8638***	− 0.4156**
R^2/adj R^2	0.96/0.96	0.96/0.96		
AIC/SIC	0.70/0.77	0.61/0.83		
χ^2_{heter}	6.56***	19.45***		
χ^2_{auto}	5.12	3.95		
RESET	6.47*	6.75		
ARCH	13.30***	9.19***		
CUSUM	Stable	Stable		
CUSUMSQ	Not stable	Not stable		

χ^2_{heter}, χ^2_{auto} (4), *RESET*(2) and *ARCH*(2), *CUSUM* and *CUSUMSQ* provide the diagnostic statistics for the tests of Breusch-Pagan's heteroscedasticity, the Breusch-Godfrey's LM serial correlation with 4 lags, the Ramsey's RESET function form with 2 lags, ARCH with 2 lags, CUSUM and CUSUMSQ stability of parameters

†Using HAC robust standard errors

*$p < 0.1$

**$p < 0.05$

***$p < 0.01$

not able to identify any reliable and significant relationship between bankruptcy frauds, the indicator for destructive entrepreneurship, and GDP growth. The results are not consistent with, e.g., Detotto and Otranto (2012) that find that economic crimes are sensitive to macro-economic conditions. However, the trend of *BF* in Sweden 1830–2010 has an increasing tendency, while *GGDP* has not. Therefore, bankruptcy frauds may have other driving factors.

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