Post-crisis firm survival, business model changes, and learning: evidence from the Italian manufacturing industry

Post-crisis firm survival, business model changes and learning. Evidence from the Italian manufacturing industry.

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Abstract

Company survival after recessions depends on the entrepreneurial ability of decision makers to react to the crisis and learn how to make the best use of chances. The aim of this paper is to shed light on the relationship between post-crisis firm survival, learning and firm's entrepreneurial behavior measured by business model changes. Specifically, we test if firm survival after the 2009 recession has been affected by changes in the business model occurred in the period of recovery between the two recessions (2004-08), and if these changes are the result of deliberate reactions to the 2003 recession – i.e. learning hypothesis. The analysis of 67,241 Italian manufacturing firms suggests that business model changes have affected post-crisis firm survival by lowering the probability of default. However, the adoption of these default-reducing business model changes did not result to be significantly more frequent in firms that performed poorly during the 2003 crisis, thus providing weak support to the role of entrepreneurial learning in reducing defaults.

Keywords: Firm survival, Business model, Firm performance, Learning, Entrepreneurship, Crisis, Family firm.

JEL codes: L25, L26, L60

1 Introduction

Economic recessions are recurring events in the world economy and they affect the competitive landscape profoundly (Srinivasan et al., 2011). Because of their cyclicality, they have two major implications for the firm behavior. On the one hand, firms must adapt and renew their strategic behavior to cope with permanent changes in the industry dynamics caused by recessions. This may take place through a significant reconfiguration of the business model. The literature on corporate entrepreneurship has recognized the change of the business model as a distinctive expression of the entrepreneurial behavior, especially when the limited organizational size does not permit the adoption of complex managerial strategies (Kuratko et al., 2015; Kuratko and Audretsch, 2013; Basu and Wadhwa, 2013; Chindooroy et al., 2007). On the other hand, as firms are likely to experience several crises during their life, changes in the business model can be non-randomly fostered and shaped by previous experiences of recession, as firms are expected to learn how to cope with recurring shocks.

In a recent literature review, George and Bock (2011) stress that the dynamics of business models represent a potentially rich source of information about how firm characteristics and strategies interact and adapt to environmental changes (Casadesus-Masanell and Ricart, 2010). Zott and Amit (2007, 2008) and Teece (2010) argue that understanding business models, and especially how they interact with other elements, is one of the most promising avenues for explaining the firm's competitive structure. Business model innovations have been identified as the actions of modifying the firm's activity system to create value (Morris et al., 2005), exploit new opportunities (Cucculelli and Bettinelli, 2015) and carry out strategic entrepreneurship initiatives (George and Bock, 2011; Schneider and Spieth, 2013. In this sense, the business model construct builds upon the value chain concept and the notions of value systems, strategic positioning (Porter, 1985, 1996), strategic network (Jarillo, 1995) and transaction costs (Williamson, 1981).

By using the business model change as a proxy for corporate entrepreneurial reaction to recessions, this paper investigates whether post-crisis firm survival is affected by changes in companies' business model, and identifies a set of default-reducing strategies that increase the chance for firms to survive future economic downturns. Then, the paper tests whether these strategies have been implemented by those companies that performed poorly in a previous recession, i.e. whether these changes are an outcome of a deliberate learning process driven by the experience the company had with a previous crisis, or the result of a pure random adoption.

The empirical analysis has been carried out on a sample of 67,241 Italian manufacturing firms, mostly SMEs, whose financial data are available for the period 2002-2012. As business model changes may either occur randomly or be the result of previous crisis experience, we adopt a two-step estimation technique to investigate whether post-crisis survival was affected by changes in companies' business model, and whether business model changes were induced by previous poor performances (learning hypothesis). We identify business model changes through the modification of a set of measures that proxies for the renewal

process observed in the company. More specifically, we use the following indicators of the organizational structure: (i) the degree of vertical integration (computed as value added on sales); (ii) the intensity of investments in intangible assets (computed as R&D and advertising on total assets); and (iii) the complexity of the external services network (computed as external services on total sales).

By way of preview, in line with the idea that strategic entrepreneurship initiatives represent a valid way to ensure long-term performance (Grewal and Tansuhaj, 2001; George and Bock, 2011; Kuratko et al., 2015; Kuratko and Audretsch, 2013), we find that business model changes positively affect post-crisis firm survival. More specifically, we find that company default probability declines with reduced vertical integration, less complex business models and increased investment in intangible assets, which we classify as crisis-resistant business model changes or strategies. When it comes to learning, instead, we find that companies hit by the first recession (poor performers in 2003) in general did not adopt crisis-resistant business model changes, except in the case of complexity. Moreover, for those few who implemented them, the adoption has been only marginally affected by previous crisis experience, thus providing limited support to the learning hypothesis. Finally, splitting the sample by districtual affiliation and family ownership provides further evidence on the issue. If being in a districtual area does not help firms to adopt a default-reducing strategy, family ownership does help when the change of the business model involves intangible investments. This evidence supports the conclusion that some degree of isomorphism in company behavior may be present both in industrial districts and family businesses, as they tend to replicate existing courses of actions (Liberman and Asaba, 2006; Carroll and Hannan, 1995). This result is also consistent with the issue of renewing competencies in districtual firms, and the long-term perspective and entrepreneurial orientation of family-owned companies (Thomsen, 1999; Zahra et al., 2004; Eddleston et al., 2012).

In providing this evidence, the paper contributes to different fields of the current literature. First, by analyzing business model innovation and its impact on firm survival in a very large sample of Italian manufacturing firms, we contribute to the literature on business model in small- and medium-sized enterprises. The analysis of business model innovation should be of the outmost importance in the aftermath of an economic downturn, when strategic reconfiguration is crucial for firm survival, especially in small- and medium-sized firms. Italy represents the ideal environment to carry out this study, as the industrial structure is mainly composed by SMEs, and innovation is often carried out by firms with medium size (Minetti et al., 2015). Second, we add to the literature on organizational learning, by investigating whether companies characterized by a negative performance during a recession selected strategies associated with a lower ex-post default probability in a subsequent economic downturn. In this sense, we find that previous crisis experience promotes the adoption of crisis-resistant behavior only when a measure of complexity is considered in the empirical analysis. Hence, we only partially confirm the organizational learning hypothesis. Third, as business model innovation has been largely defined as a strategic entrepreneurship initiative (Kuratko and Audretsch, 2013; Kuratko et al., 2015), this paper contributes to

the growing literature on corporate entrepreneurship and its impact on firm performance (Corbett et al., 2013; Kuratko and Audretsch, 2013; Cucculelli and Bettinelli, 2015; Kuratko et al., 2015). More specifically, our finding that increasing investments in intangibles have positive effects on firm survival confirms that innovation is at the center of corporate entrepreneurship activities. Finally, we contribute to the understanding of the role of external sociocultural, economic, and market conditions in the pursuit of corporate entrepreneurship strategies, by analyzing the effects of economic crises and organizational learning in specific contexts as family-owned firms and industrial districts.

The remainder of the paper is organized as follows. Section 2 reviews the current literature on business model changes, post-crisis firm survival and organizational learning within the crisis framework. Section 3 describes the dataset, the variables and the econometric approach used to perform the empirical analysis. Section 4 presents the estimation results and Section 5 concludes.

2 Background literature and hypotheses development

Our research is primarily related to two strands of the business and economic literature. First, the literature on firms' reaction to crisis in terms of business model change and its impact of firm survival. Second, the research on organizational learning after a recession, and the role played by both family ownership and districtual affiliation.

2.1 *Firms' reaction to crisis: business model changes and firm survival*

The literature on firms' reaction to crisis is dominated by financial research and, more precisely, by studies that evaluate the effects of different ownership and governance models on firm's performance during the economic recession (Leung and Horwitz, 2010; Liu et al., 2012). Conversely, there are not so many papers investigating the firms' reaction to crisis by adopting the lens and paradigms of business analysis and entrepreneurial studies (Smith and Elliott, 2007; Latham, 2009; Marsen, 2014).

The literature on innovation is more revealing: reactive strategies towards the crisis can be particularly visible within the decision-making of innovation processes. Archibugi et al. (2013) propose two contrasting hypotheses on the relation between innovation and business cycles. According to the cyclical hypothesis, companies' investments in innovation increase in periods of prosperity and decline during economic crises, due to the low profit margins and the overall pessimistic view in times of downturns (Freeman et al., 1982)[1]. On the other hand, Mensch (1979) claimes that innovations tend to be rather counter-cyclical, as most of the enterprises tend to "play safe" in periods of economic expansion by exploiting the existing rents, and are forced to innovate only when the value of such rents falls, as during economic recessions.

[1] This view is also confirmed by the theoretical research on the demand impact on innovation (Geroski and Walters, 1995): the rising demand during economic booms provides more fertile ground for the product absorption than during recessions. Moreover, as firms have only limited periods of advantage over their competitors (Schumpeter, 1939), during which they reap their returns to investments, it is safer for them to come up with such activities when the economy is growing.

Hence, the existing theoretical literature suggests heterogeneous, or even contrasting, responses towards the crisis. The ability of the company to renew and reshape its competitive profile can benefit from difficult times, as firms may be induced to get rid of non-profitable techniques and products ("pit stop" view and "cleansing effect" of recession, Caballero and Hammour, 1996). On the other hand, firm renewal may be stopped by a strategic timing effect that leads firms to introduce new procedures only when the market recovers, and not when it declines (Stiglitz, 1993; Barlevy, 2004).

A second research area considers firms' reaction to crisis in terms of business model changes. Although business model research is gaining increasing attention, a unique definition of business model does not exist. A recent literature review concludes that business models are a holistic way of describing how companies operate, seeking to explain value creation, value delivery to customers and value capture by the company (Zott et al., 2011; Cucculelli and Bettinelli, 2015). In the context of small and medium enterprises, business models are also defined as 'the design of organizational structures to enact a commercial opportunity' (George and Bock, 2011:99). A change in firms' business model, therefore, determines a change in the way companies act and it generally occurs with the specific aim to gain competitiveness. As Kuratko and Audretsch (2013) point out, there are two possible reference points to be considered when a business model change occurs: (i) how much the firm is transforming itself relative to where it was before, and (ii) how much the firm is transforming itself relative to industry standards. Although certain business model changes may not be innovative to the industry, they may be new for the business itself involving simultaneous opportunity-seeking and advantage-seeking behaviours (Ireland et al., 2003).

It is generally recognized that business models can be both enabling and limiting elements for the company's growth (Amit and Zott, 2001; Morris et al., 2005). Indeed, there is evidence that business models enable a firm's success when they are dynamic: a recent literature review reveals 'an increasing consensus that business model innovation is key to firm performance' (Zott et al., 2011: 1033). However, there may be some barriers to business model improvement: firm's assets and processes may be subject to inertia, and managers may fail to recognize the latent value of business model changes (Bouchikhi and Kimberly, 2003; Chesbrough, 2010). The empirical evidence shows that business models are intertwined with strategy, firm performance and competitiveness (Acs and Amoròs, 2008; Zott and Amit, 2008), and supports the existence of a potential persistency in firms' organizational structure. For example, by measuring business model adjustments through changes in firm's products and markets, Andries and Debackere (2007) found that business model changes increase firm survival in the case of new companies operating in capital intensive and high-velocity industries, while they are not significant for those firms working in more stable industry sectors.

The empirical research also views business model adjustments as a way to exploit new opportunities and to adapt to the firm's life-cycle changes (Franke et al., 2008; George and Bock, 2011; Markides, 2013). In this sense, business model innovation can be seen as a vehicle for firm rejuvenation (Demil and Lecocq, 2010; Ireland et al., 2001; Johnson et al., 2008; Sosna et al., 2010). It represents a way to innovate and to

ensure both firm survival (Perlow et al., 2002; Thoma, 2009) and long-term performance (George and Bock, 2011; Grewal and Tansuhaj, 2001), especially in contexts where competition, risk and uncertainty are high, as in times of economic downturns.

Hence, we test the following hypothesis:

Hypothesis 1: Business model changes affect post-crisis firm survival.

2.2 *Learning from crisis*

Since Cyert and March (1963)'s seminal work, the economic literature has considered organizational learning a key strategic capability in explaining firm success, as it allows a continuous adaptation to the rapidly changing market conditions (Bapuji and Crossan, 2004; Kandemir and Hult, 2005). As shown by the extensive empirical research, companies are more likely to modify their behavior when they underperform with respect to competitors or expected and desired results. However, decision makers' propensity to change may be also correlated with slack resources, thus making the probability to observe business model changes dependent on both bad and good performances.

Recent research addresses the benefits of organizational learning in several business areas: organizational performance (Azadegan and Dooley, 2010), market orientation (Santos-Vijande et al., 2005; Stein and Smith, 2009), service quality (Tucker et al., 2007), innovation (Akgun et al., 2006; Weerawardena et al., 2006), and human resource performance (Bhatnagar, 2007). After the recent economic crisis, many economists have also started to investigate the role of organizational learning within the crisis reaction framework, by examining whether those companies that experienced previous crises survived better to the last economic downturn. Desai (2014) analyzes whether and how public reporting of details about recent failures affect companies' organizational learning in terms of new failures experience. Herbane (2014) investigates whether organizations have learned thanks to the introduction of crisis management planning and whether new information sources, such as SMEs networks and forums, have been important in shaping the learning process. Cucculelli and Bettinelli (2016) analyzes how organizational learning and firm internal factors, such as CEO's origin, tenure and turnover, affect the firm's reactions to the economic recession. Overall, these empirical studies claimed that former negative events and experiences affect companies' management actions and decision-making process. Hence, firms facing economic shocks should be more likely to adopt reactive strategies in subsequent crisis frameworks as an outcome of the learning process.

The ability of learning from previous crisis may also depend on companies' specific characteristics, and in particular by firms' ownership structure and industrial localization. The literature on family businesses has extensively highlighted the peculiarities of family owned firms: long-term orientation (Miller and Le Breton-Miller, 2005), family social capital (Arregle et al., 2007), survival and reputation concerns (Miller et al., 2008). All these features are likely to induce family companies to adapt to the changes in the economic environment by learning from previous experiences. In a similar way, firms located in industrial districts

(IDs, i.e. areas with a high predominance of micro- and small businesses that build their competitiveness on a system of inter-firm relationships) should be more inclined to adapt their behavior to the changing market conditions. This should happen because of their imitative and herding behavior, and the optimal information sharing that characterizes the districtual areas (Dei Ottati, 1995; Baffigi, 2000). In industrial district, tacit knowledge and values are created over long periods of time and transmitted into the wider community to facilitate low-cost coordination, efficiency, and to regulate competition. Although during economic recessions firms operating in industrial districts may lose their renewal potential (Menzel and Fornahl, 2009), they may be more able to survive and learning from crisis experiences, due to their ability to imitate better performing companies.

Given this theoretical background we test the following two complementary hypotheses:

Hypothesis 2 (Learning Hypothesis): The adoption of default-reducing strategies depends on previous crisis experience.

Hypothesis 3: The ability of the firm to learn from a crisis is associated with firm ownership and districtual affiliation.

3 Empirical analysis

3.1 *Data*

The empirical analysis has been carried out on a sample of Italian firms drawn from the BvD-AIDA database[2]. BvD-AIDA collects annual accounts from Italian companies and contains information on a wide set of economic and financial variables, such as sales, costs and number of employees, value added, tangible and intangible assets, start-up year, sector of activity, legal status and ownership type. By relying on firms' ATECO 2007 code[3], we only considered in the sample Italian manufacturing firms, i.e. firms belonging to section "C" (divisions from 10 to 32), operating in the period 2002-2012.

A total of 67,241 small- and medium-sized companies have been included in the final sample. They represent a very large share of the universe of Italian manufacturing industry: in comparison with the National Census of Economic Activities for the year 2011, sample firms represent 16.2 percent of all the Italian manufacturing firms (including sole proprietorships) and 51.1 percent of companies with compulsory

[2] BvD-AIDA is an authoritative and reliable source of information on Italian companies. Information is drawn from official data recorded at the Italian Registry of Companies and from financial statements filed at the Italian Chambers of Commerce. BvD-AIDA provides information on more than 500000 joint stock, public and private limited share companies, and limited liability companies (Spa and Srl) that furnish data on a compulsory basis. The information provided includes credit reports, company profiles, and summary financial statements (balance sheet, profit and loss accounts, and ratios) updated every year.

[3] ATECO is the classification of economic activity used by the Italian Institute of Statistics (ISTAT). It is the translation of the NACE code (*Nomenclature statistique des activités économiques dans la Communauté européenne*) developed by the European Union from the International Standard Industrial Classification (ISIC) rev 3.1.

obligation to deposit their financial statement. When split by firm size, the incidence of the sample on the total number of firms with compulsory financial statement deposit is 47.8 percent for firms with less than 50 employees and 92.9 percent for companies with more than 50 employees (see Table A.1 in the Appendix). Given these numbers, we are confident that our sample is well suited for the analysis of the Italian manufacturing industry.

3.2 *Variable definitions*

In Table 1 we report the complete list of the dependent and independent variables employed in the empirical analysis, the associated descriptive statistics and definitions. Here we provide a detailed description of their measurement.

Table 1

3.2.1 *Firm survival*

BvD-AIDA provides up-to-date information about companies' legal status by identifying year by year 'Active', 'Into Liquidation' and 'Inactive' firms. We rely on this categorization for the purpose of detecting those companies that did not survive after the economic recession. More specifically, we built a dummy variable *Default*, which is equal to one if the firm results to be 'Into Liquidation' or 'Inactive' in 2013, and 0 otherwise, i.e. if the company is 'Active' in the same year.

As reported in Table 1, the incidence of failed companies in our sample is rather low, as only 5 percent of the sample firms result to be in default in 2013[4].

3.2.2 *Business model change*

Business model innovation has been largely identified as a way to carry out strategic entrepreneurship initiatives (George and Bock, 2011; Schneider and Spieth, 2013; Cucculelli and Bettinelli, 2015). With respect to SMEs, business model changes have been also defined as those actions aimed at modifying the firm's existing activity system to enact and exploit new opportunities (Cucculelli and Bettinelli, 2015). Morris et al. (2005) argue that the business model construct builds upon the value chain concept, the notions of value system and strategic position (Porter, 1985, 1996), the strategic network theory (Jarillo, 1995) and transaction cost economics (Williamson, 1981). Consistently with this view, as the current literature does not provide a unique operational definition of business model, in this paper we identify business model innovation through a set of accounting measures proxying for the innovation and strategic positioning processes observed within the company. More specifically, we use the following indicators of the organizational structure: (i) the degree of vertical integration (computed as value added on sales), which

[4] These figures are in line with the average Italian death rate computed by Eurostat (2015).

accounts for transaction costs strategies and value chain positioning; (ii) the intensity of investments in intangible assets (computed as R&D and advertising on total assets), which measures firm's propensity to innovate; and (iii) the complexity of the external services network (computed as external services on total sales), which accounts for the firm's positioning in a strategic network.

Kuratko and Audretsch (2013) point out that there are two possible reference points to be considered when a business model change occurs: (i) how much the firm is transforming itself relative to where it was before and (ii) how much the firm is transforming itself relative to industry standards. As we follow the first approach, business model changes between 2003 and 2008 are identified by a variation in our indicators outside the range plus/minus 10 percent[5]. In particular, starting from our three business model measures (*Vertical Integration*, *Intangibles*, *Complexity*), we built the following dummy variables: *Increased Vertical Integration*, a dummy variable equal to one if value added on total sales increased more than 10 percent between 2003 and 2008, and zero otherwise; *Reduced Vertical Integration*, a dummy variable equal to one if value added on total sales reduced more than 10 percent between 2003 and 2008, and zero otherwise; *Increased Intangibles*, a dummy variable equal to one if investments in intangibles (scaled by total assets) increased more than 10 percent between 2003 and 2008, and zero otherwise; *Reduced Intangibles*, a dummy variable equal to one if investments in intangibles (scaled by total assets) reduced more than 10 percent between 2003 and 2008, and zero otherwise; *Increased Complexity*, a dummy variable equal to one if external services on total sales increased more than 10 percent between 2003 and 2008, and zero otherwise; *Reduced Complexity*, a dummy variable equal to one if external services on total sales reduced more than 10 percent between 2003 and 2008, and zero otherwise.

3.2.3 *Family ownership*

In order to correctly identify family owned firms, we rely on the 'Global Ultimate Owner' (GUO) indicator provided by BvD-AIDA[6]. Despite only partially coherent with the many definitions employed in the empirical literature on family businesses, the procedure of using the GUO indicator is now a standard approach for all those empirical studies that employ data from BvD sources. More specifically, companies with a GUO equal to 'one or more named individuals or families' are classified as family firms.

3.2.4 *Districtual affiliation*

[5] A plus/minus 10 percent deviation from the initial value has been chosen because it permits a balanced division of the sample between firms that changed their business model and firms that did not.

[6] To define a (Global) Ultimate Owner, BvD analyzes the shareholding structure of each company looking for the shareholder with the highest direct or total percentage of ownership. If this shareholder is independent, it is defined as the Ultimate Owner of the subject company. If the highest shareholder is not independent (as in the case of controlling companies), the same process is repeated until BvD finds a Global Ultimate Owner. Shareholders information is gathered from several sources, including annual reports or privately written communications addressed by the company to BvD.

Companies' districtual affiliation is determined by matching information on firm localization provided by BvD-AIDA and the industrial district (ID) classification developed by the Italian Central Institute of Statistics (ISTAT). The identification of IDs is based on a multiple-stage algorithm developed by Sforzi (2001): in the first step, by grounding on census information about daily commuting movements of employees, the algorithm identifies the 'Local Labor Systems' (LLSs); then, in the second step, the identified LLSs are differentiated on the basis of their economic characteristics. Only LLS with (i) high presence of small and medium sized firms and (ii) high degree of industry specialization are classified as 'Industrial Districts" (Istat, 2005). On the basis of 2001 population census and 2001 economic activities census, ISTAT identified 156 IDs in Italy: 42 in the North East, 39 in the North West, 49 in the Centre, and 26 in the South of Italy.

Following this classification, we build the dummy variable District, which is equal to one if the firm belongs to an industrial district, and zero otherwise. In our sample, as reported in Table 1, 43.4 percent of firms belong to IDs, whereas 56.6 percent are categorized as non-districtual businesses.

3.2.5 *Poor Performers in 2003*

To test the learning hypothesis (Hypothesis n.2), we evaluate whether the adoption of default-reducing strategies (i.e. business models positively related to firm survival) has been significantly affected by companies' past performance, and in particular by the relative performance registered in 2003 after the economic downturn.

In this study, relative performance is measured using the following definition of adjusted-ROS:

$$Adj(ROS)_{ijts} = ROS_{ijts} - Median(ROS)_{jts} \qquad (1)$$

that is the difference between firm i's ROS and the median ROS of its competitors at the same 3-digit sector, province and size class. Then, building on this indicator, we compute the dummy variable *Poor Performance*, which is equal to one if firm i's individual ROS was lower than the median ROS of its industry sector in 2003 (i.e. if $Adj(ROS)_{ijts} < 0$), and zero otherwise (i.e. if $Adj(ROS)_{ijts} > 0$).

3.3 *Econometric specification*

As business model changes may either occur randomly or be the result of previous crisis experience, we adopt a two-step estimation technique to investigate whether post-crisis firm survival was affected by changes in companies' business model, and whether business model changes were induced by previous poor performances.

More specifically, in the second stage we estimate the following equation:

$$Pr(Default_i) = \alpha_0 + \gamma_1\left(\Delta\widehat{BM}_i\right) + \gamma_2 Z_i + u_i \quad (2)$$

where the dependent variable $Default_i$ is a dummy variable equal to one if firm i is no longer active in 2013, and zero otherwise; Z_i is a set of firm specific control; u_i is the error term; and $\Delta\widehat{BM}_i$ are the predicted probabilities obtained from the estimation of the first-step equation[7]:

$$Pr(\Delta BM)_i = \alpha_1 + \beta_1(Poor\ Performance_i) + \beta_2(Family\ Firm_i) + \beta_3(District_i) + \beta_4 X_i + v_i \quad (3)$$

where the dependent variable ΔBM denotes, alternatively, one of the business model measures described in Section 4.2.2 (i.e. Increased Vertical Integration; Reduced Vertical Integration; Increased Intangibles; Reduced Intangibles; Increased Complexity; Reduced Complexity); $Poor\ Performance_i$ is a dummy variable equal to one if firm i experienced a negative relative performance in 2003, and zero otherwise; $Family\ Firm_i$ is a dummy variable equal to one if the company is owned by a family, and zero otherwise; $District_i$ is a dummy variable equal to one if firm i belongs to an industrial district, and zero otherwise; X_i is a set of firm specific control; and v_i is the error term. The variable $Poor\ Performance_i$ has been then interacted with variables $Family\ Firm_i$ and $District_i$ to evaluate the influence of these two variables on the learning mechanism. Correlation coefficients for all the variables included in the empirical analysis are reported in Table 2.

4 Results

4.1 *Preliminary descriptive evidence*

Table 3 reports some preliminary results about the relationship between business model changes and firm survival. Our three indicators of business model change (Increased/Reduced Vertical Integration; Increased/Reduced Intangibles; Increased/Reduced Complexity) are computed for the period 2003-2008, whereas the default probability is calculated in 2013, after the economic recession[8].

Starting from Vertical Integration, only 19.1 percent of sample firms reduced the amount of value added on total sales, whereas more than 50 percent (56.7 percent) of companies increased their Vertical Integration index; about 24 percent did not change the ratio between value added and total sales. The default probability characterizing this last group of firms is the lowest (0.057 percent), suggesting that not to change firm's vertical integration appears to be the best strategy for ensuring firm survival after a crisis. Conversely, reducing vertical integration appears to be associated with the highest default probability. Regarding companies' investments in intangible assets, the most common strategy between 2003 and 2008 was to reduce the share of intangibles: 37.9 percent of firms are associated with an increased Intangibles indicator, whereas about 54 percent of companies reduced the amount of intangible assets. Interestingly, only 7.9 percent of companies did not change their investment in intangibles policy. When the default

[7] As the correspondent increasing and reducing strategies of business model changes are significantly correlated, Equation (3) has been estimated through a bivariate probit model for each business model proxy, i.e. Increased/Reduced Vertical Integration, Increased/Reduced Intangibles, Increased/Reduced Complexity.

[8] We assume that business model changes produce medium-term effects in terms of firm performance and survival.

probability is adopted as a measure of effectiveness of the business model change, the lowest default ratio is observed for the group of firms that reduced the share of intangibles on total assets, thus making this the best strategy. Finally, when the complexity indicator as a measure of business model is analyzed, it results that the shares of firms that increased, reduced, or did not change the amount of external services are very similar: 32.5 percent of companies show an increased Complexity, 33.5 percent are associated with an unchanged Complexity index, and 34 percent of firms are characterized by a reduced ratio of external services on total sales. Also the default probability is almost similar across the possible strategies, suggesting that, apparently, there is not an optimal behavior.

Overall, the above descriptive evidence indicates that the most effective strategy for reducing the default probability in 2013 mainly involved (i) an unchanged vertical integration, and (ii) a reduction of investment in intangibles. In the following section, these findings are tested through a multivariate approach, which accounts for additional variables that may affect the relationship between business model changes and firm survival.

Table 3

4.2 *Estimation results*

In this section we present the empirical results obtained from the estimation of the two-step model described above (Section 3.3). In particular, we first report the findings related to the impact of business model changes on post-crisis firm survival (Hypothesis 1) by identifying the default reducing strategies. Then, we move to the learning hypothesis results, by showing whether crisis-resistant business model changes have been adopted as a consequence of previous crisis experience (Hypothesis 2). Finally, we delve into the role of districtual affiliation and family ownership within the learning process (Hypothesis 3).

4.2.1 *Business model changes and firm survival*

Table 4 reports the estimated coefficients of the second-step estimation equation (Equation (2)), which investigates the impact of business model changes on post-crisis firm survival. Starting with our first measure of business model, that is Vertical Integration, as indicated in columns (1) and (2) of Table 4, Increased Vertical Integration is positively associated with the default probability, whereas Reduced Vertical Integration results to be related with a higher survival rate. The estimated coefficients are respectively 0.205*** and -0.185***, both statistically significant at the 99 percent level. Taken together, these findings do not reject the hypothesis that firms adopting less integrated business models in 2008 were less likely to default after the crisis in 2013.

Moving to our second proxy of business model, i.e. the share of intangible assets, estimation results indicate that post-crisis default reduces when the intensity of intangibles increases (Increased Intangibles, column (3)) and grows when intangible investments decreases (Reduced Intangibles, column (4)). Both the

estimated coefficients, -1.540*** and 2.791***, are statistically very significant. Overall, these findings suggest that companies increasing intangible investments between 2003 and 2008 are associated with a lower ex-post default probability after the economic recession. Finally, with regard to the last two indicators of business model changes, i.e. Increased Complexity and Reduced Complexity, estimation results reported in columns (5) and (6) show that less complex business models help firm survival. The estimated coefficients are, respectively, 0.263*** for the Increased Complexity variable, and -0.344*** for the Reduced Complexity indicator.

Summing up, the evidence described above confirm our Hypothesis 1, as business model changes significantly affect post-crisis firm survival. More specifically, our findings indicate that default probability declines with reduced vertical integration, less complex business models and increased investment in intangible assets. Therefore, Reduced Vertical Integration, Increased Intangibles and Reduced Complexity may be classified as crisis-resistant (or good) strategies[9].

Table 4

4.2.2 *Organizational learning and the adoption of default-reducing strategies*

Table 5 presents the estimation results of Equation (3), which tests the learning hypothesis (Hypothesis 2). Columns (1) to (6) summarize the impact of poor performance on the probability of adopting more (less) integrated business model, more (less) intense intangible investments, and more (less) complex value network.

If business model changes occurred as a consequence of the 2003 economic crisis, the learning hypothesis implies a positive coefficient in the relation between the Poor Performance dummy and crisis-resistant strategies, i.e. those strategies associated with a lower default probability. From the estimation results presented in the previous section, we know that these strategies are: (i) reducing vertical integration (column (2)); (ii) increasing intangible investments (column (3)); and (iii) decreasing network system complexity (column (6)). By the sign of the coefficients related to these strategic options, learning seems very unlikely to occur. As reported in columns (2) and (3), for both the Reduced Vertical Integration and Increased Intangibles indicators, the estimated coefficients are negative and statistically significant (respectively, -0.387*** and -0.037***). This evidence does not support our hypothesis, suggesting that poor performers actually adopted those strategies that proved to be less effective in reducing the probability of default. Conversely, poor performers seem to have selected the good strategy in the case of changes of business model aimed at reducing the complexity of the business network, as the estimated

[9] It is worth noting that the indication coming out from these estimates goes in the opposite direction of what we got from our previous preliminary analysis (Table 3). In the multivariate regression we account for several firm-specific characteristics, such as the size, profitability, industrial sector and geographical localization, which significantly affect post-crisis firm survival.

coefficient of the Poor Performance dummy is positive and statistically significant (0.179***) when related to the Reduced Complexity index.

Overall, these findings indicate that learning have had a limited impact on reshaping the firm strategic approach, except in the case of network complexity. Therefore, as the adoption of default reducing strategies only marginally depends on previous crisis experience, Hypothesis 2 is only partially confirmed.

Table 5

Table 6 reports the estimation results related to the impact of family ownership and districtual affiliation on companies' learning ability. A positive sign of the interaction terms between these two variables (Family Firm and District) and the Poor Performance dummy indicates a positive contribution to the selection of default-reducing strategies. Conversely, a negative or null estimated coefficient suggests an adverse or null influence of the two factors. As shown in the table, the impact of family ownership and districtual affiliation is not significant in the case of Reduced Vertical Integration (column (2)), and negative and statistically significant in the case of Reduced Complexity (column (6)). This means that companies belonging to these two groups have not diverged from the average firm decision in the case of vertical integration, but have negatively affected the selection of the good strategy in the case of complexity. In this last case, inertia in the strategic behavior, together with a likely lack of competencies or risk aversion have probably motivated the no-change strategy chosen by districtual and family firms. Conversely, and contrary to the general pattern of strategic response to crisis, family businesses have positively contributed to the adoption of intangible-driven strategies (Increased Intangibles, column (3)), probably thanks to their long-term orientation and reputation concerns (Thomsen, 1999; Bjuggren and Sund, 2014).

Table 6

5 Concluding remarks

SMEs have been strongly hit by the global financial crisis. These firms are particularly vulnerable during economic and financial recessions because of many reasons, among which are the difficulty to downsize, the lower extent of diversification in economic activities, a weaker financial structure, and the strong dependence on external credit as a main financing option. While large companies' reactions to crises are largely based on "managerial" solutions (such as actions targeted to efficiency improvements, strategic turnarounds, international expansion via new branches or FDI, mergers and acquisitions and more complex financing models), small firms usually respond to difficult economic conditions through entrepreneurial reactions, such as business model innovation.

The paper analyses the role of learning from crisis on the entrepreneurial ability of a company to adapt to a new competitive landscape through the adoption of a new or renewed business model. By investigating

the impact of changes occurred in business models on the company default probability, the paper contributes to the debate concerning the impact of external events in shaping the firms' entrepreneurial strategy and the organizational learning from past experiences.

The paper identifies business model changes by using a set of measures of the business structure of the company, such as the degree of vertical integration, the intensity of investments in intangible assets and the complexity of the external services network. We find that the probability of default estimated in 2013 increases with the complexity of the business model adopted in 2008, as measured by the firm vertical integration and the complexity of network of external services, whereas it declines with the intensity of investment in intangible assets. Furthermore, we do not find evidence of a significant learning process driven by the crisis: conditional on having adopted a new business model in 2008, poor performers have not selected - on average - business models associated with a lower default probability, the only exception being those aimed at reducing the organizational complexity. Besides, neither being in a districtual area nor having a family ownership correlate with a more intense (learning) ability to adopt default-reducing business models. However, family firms are more likely than average to adopt an intangible-driven business model that proved successful in reducing the probability of default after recession.

This evidence supports the conclusion that a degree of isomorphism in company behavior may be present both in districts and in family firms, as they tend to replicate existing courses of actions. This result is also consistent with the assumed lack of (new) competencies in districtual firms, or the preference for risk-avoiding strategies in family firms. Conversely, family corporate entrepreneurship seems to help family-owned companies to adopt long-term strategies aimed at preserving the company for future generations.

The paper presents a number of limitations, mainly concerning the variables used to operationalize the changes in the business model. Firstly, these variables can be complementary and should not be considered in isolation. Secondly, they mainly describe the operative structure of the company and only tangentially the strategic response of the company. Therefore, they could be usefully complemented by more specific proxies of the firm entrepreneurial behavior, consistently derived from the growing literature on corporate entrepreneurship and business model innovation.

As for the implications, at the firm-level the paper suggests to avoid complexity and vertical integration as the safest strategic options to ensure post-crisis firm survival, together with an intense investment in intangible assets. At the aggregate level, instead, the research points out that the absence of significant learning by company may amplify the impact of economic downturns on aggregate performance, as this influence depends on how much firms are able to learn from previous experience. Even an equilibrating mechanism that restores stability after a crisis may turn out to be ineffective if companies are supposed to adjust once they learn from previous experience. In this scenario, self-regulating systems, as those operating in industrial districts, may be only partially effective if learning is limited. Conversely, compensating mechanisms that are usually neglected, as the role of family ownership in sustaining investment in intangibles, may gain more relevance (Thomsen, 1999). Industrial policy should therefore

include these tools in the larger set of instruments that are normally taken into account to address the entrepreneurial reorganization of the economy after a crisis, especially when the economic system is made of a large number of SMEs, owned and managed by families and located in districtual areas.

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Table 1
Descriptive statistics and variable definitions.

Variable	Mean	Std. Dev.	Definition
Default	0.05	0.22	Dummy variable equal to one if, according to the BvD-AIDA classification, the firm results to be 'Into Liquidation' or 'Inactive' in 2013, and zero otherwise.
Increased Vertical Integration	0.57	0.50	Dummy variable equal to one if value added on total sales increased more than 10 percent between 2003 and 2008, and zero otherwise.
Reduced Vertical Integration	0.19	0.39	Dummy variable equal to one if value added on total sales reduced more than 10 percent between 2003 and 2008, and zero otherwise.
Increased Intangibles	0.38	0.49	Dummy variable equal to one if intangible assets (scaled by total assets) increased more than 10 percent between 2003 and 2008, and zero otherwise.
Reduced Intangibles	0.54	0.50	Dummy variable equal to one if intangible assets (scaled by total assets) reduced more than 10 percent between 2003 and 2008, and zero otherwise.
Increased Complexity	0.32	0.47	Dummy variable equal to one if external services on total sales increased more than 10 percent between 2003 and 2008, and zero otherwise.
Reduced Complexity	0.34	0.47	Dummy variable equal to one if external services on total sales reduced more than 10 percent between 2003 and 2008, and zero otherwise.
Family Firm	0.84	0.37	Dummy variable equal to one if, according to the BvD-AIDA classification, the GUO is 'one or more named individuals or families', and zero otherwise.
District	0.43	0.49	Dummy variable equal to one if the firm is located in an industrial district, and zero otherwise.
Size	41.33	208.46	Number of employees.
Age	24.13	14.91	Number of years from firm's inception.
ROS Diff 2004	0.51	6.54	Difference between the firm's individual ROS and the median ROS of its industry sector, computed in 2004.
ROS Diff 2012	0.04	7.61	Difference between the firm's individual ROS and the median ROS of its industry sector, computed in 2012.
Poor Performance	0.50	0.50	Dummy variable equal to one if the firm's individual ROS was lower than the median ROS of its industry sector in 2003, and zero otherwise.

Table 2
Correlation matrix

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
(1)	Default	1.0000													
(2)	Increased Vertical Integration	-0.0159*	1.0000												
(3)	Reduced Vertical Integration	0.0256*	-0.5530*	1.0000											
(4)	Increased Intangibles	0.0234*	-0.0258*	0.0343*	1.0000										
(5)	Reduced Intangibles	-0.0270*	0.0203*	-0.0248*	-0.8508*	1.0000									
(6)	Increased Complexity	0.0086*	-0.1076*	0.1195*	0.0130*	-0.0099*	1.0000								
(7)	Reduced Complexity	-0.0031	0.1351*	-0.0895*	-0.0030	0,0054	-0.4948*	1.0000							
(8)	Family Firm	-0.0427*	0.0172*	-0.0268*	0.0096*	0.0052	0.0244*	0.0032	1.0000						
(9)	District	-0.0184*	0.0214*	-0.0304*	-0.0131*	0.0163*	-0.0110*	-0.0188*	0.0503*	1.0000					
(10)	Size	-0.0047	-0.0219*	-0.0049	-0.0048	-0.0016	-0.0187*	-0.0084*	-0.1467*	-0.0285*	1.0000				
(11)	Age	-0.0256*	-0.0485*	0.0112*	0.0194*	-0.0054	-0.0491*	-0.0495*	-0.0742*	-0.0091*	0.0723*	1.0000			
(12)	ROS Diff 2004	-0.0516*	-0.2025*	0.1442*	0.0103*	-0.0011	0.0711*	-0.1058*	0.0245*	0.0038	-0.0095*	0.0295*	1.0000		
(13)	ROS Diff 2012	-0.1959*	0.0849*	-0.0886*	-0.0320*	0.0349*	-0.0119*	0.0205*	0.0721*	0.0085*	-0.0057	-0.0370*	0.2102*	1.0000	
(14)	Poor Performance	0.0393*	0.1774*	-0.1289*	-0.0115*	0.0066	-0.0519*	0.0730*	-0.0111*	0.0050	-0.0012	-0.0302*	-0.1579*	-0.6230*	1.0000

Notes: One star (*) means at least a 90 percent level of significance. All of the variables are defined in Table 1.

Table 3
Preliminary descriptive evidence

Business Model Definition	Strategy	Mean	Obs.	Default Probability in 2013
Vertical Integration	Increased Vertical Integration	0.567	36,643	0.058
	Unchanged Vertical Integration	0.242	36,643	0.057
	Reduced Vertical Integration	0.191	36,643	0.076
Intangibles	Increased Intangibles	0.379	40,832	0.059
	Unchanged Intangibles	0.079	40,832	0.059
	Reduced Intangibles	0.542	40,832	0.046
Complexity	Increased Complexity	0.325	42,744	0.054
	Unchanged Intangibles	0.335	42,744	0.050
	Reduced Complexity	0.340	42,744	0.052

Notes: All of the variables are defined in Table 1.

Table 4

Business model change and firm survival: Second step estimation

Pr(Default)	(1)	(2)	(3)	(4)	(5)	(6)
Increased Vertical Integration	0.205***					
	(0.025)					
Reduced Vertical Integration		-0.185***				
		(0.031)				
Increased Intangibles			-1.540***			
			(0.157)			
Reduced Intangibles				2.791***		
				(0.373)		
Increased Complexity					0.263***	
					(0.053)	
Reduced Complexity						-0.344***
						(0.044)
ROS Diff 2004	-0.005***	-0.006***	-0.008***	-0.007***	-0.011***	-0.006***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
ROS Diff 2012	-0.043***	-0.043***	-0.043***	-0.043***	-0.043***	-0.043***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Size_{50\text{-}100}$	0.192***	0.164***	0.209***	0.251***	0.221***	0.232***
	(0.014)	(0.014)	(0.014)	(0.017)	(0.016)	(0.015)
$Size_{100\text{-}250}$	0.194***	0.168***	0.119***	0.219***	0.234***	0.226***
	(0.018)	(0.018)	(0.019)	(0.019)	(0.021)	(0.019)
$Size_{>250}$	-0.053	-0.088***	-0.187***	-0.025	-0.029	-0.014
	(0.033)	(0.033)	(0.034)	(0.034)	(0.035)	(0.034)
Observations	34,494	34,494	31,222	31,222	28,741	28,741
R^2	0.108	0.107	0.108	0.108	0.107	0.108

Notes: The table reports estimated coefficients. All of the variables are defined in Table 1. Three, two and one star (*) mean, respectively, a 99, 95 and 90 percent level of significance. Robust standard errors are in parentheses. The reference category for the variable SIZE is 0-50 employees. All regressions include industry and regional dummies, not reported for reasons of space.

Table 5
Learning from crisis: First step estimation

Pr(ΔBM)	**Increased Vertical Int.**	**Reduced Vertical Int.**	**Increased Intangibles**	**Reduced Intangibles**	**Increased Complexity**	**Reduced Complexity**
	BAD STRATEGY	*GOOD STRATEGY*	*GOOD STRATEGY*	*BAD STRATEGY*	*BAD STRATEGY*	*GOOD STRATEGY*
	(1)	(2)	(3)	(4)	(5)	(6)
Poor Performance 2003	0.458***	-0.387***	-0.037***	0.023***	-0.135***	0.179***
	(0.007)	(0.009)	(0.005)	(0.005)	(0.005)	(0.005)
Family Firm	0.029***	-0.111***	0.033***	0.004	0.028***	-0.028***
	(0.009)	(0.010)	(0.007)	(0.007)	(0.007)	(0.007)
District	0.045***	-0.101***	-0.042***	0.052***	-0.041***	-0.041***
	(0.007)	(0.009)	(0.005)	(0.005)	(0.005)	(0.005)
$Size_{50\text{-}100}$	-0.032***	-0.091***	0.009	-0.029***	-0.111***	-0.127***
	(0.010)	(0.011)	(0.008)	(0.008)	(0.009)	(0.009)
$Size_{100\text{-}250}$	-0.046***	-0.089***	-0.047***	-0.002	-0.117***	-0.100***
	(0.012)	(0.014)	(0.011)	(0.011)	(0.011)	(0.011)
$Size_{>250}$	-0.135***	-0.038**	-0.060***	-0.038**	-0.141***	-0.214***
	(0.016)	(0.019)	(0.016)	(0.015)	(0.016)	(0.016)
Age	-0.003***	0.001***	0.002***	0.000	-0.005***	-0.003***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	34,494	34,494	31,222	31,222	28,741	28,741
R^2	0.032	0.028	0.001	0.001	0.007	0.010

Notes: The table reports estimated coefficients. All of the variables are defined in Table 1. Three, two and one star (*) mean, respectively, a 99, 95 and 90 percent level of significance. Robust standard errors are in parentheses. The reference category for the variable SIZE is 0-50 employees. All regressions include industry and regional dummies, not reported for reasons of space.

Table 6

Learning from crisis: The role of family ownership and districtual affiliation

Pr(ΔBM)	**Increased Vertical Int.**	**Reduced Vertical Int.**	**Increased Intangibles**	**Reduced Intangibles**	**Increased Complexity**	**Reduced Complexity**
	BAD STRATEGY	*GOOD STRATEGY*	*GOOD STRATEGY*	*BAD STRATEGY*	*BAD STRATEGY*	*GOOD STRATEGY*
	(1)	(2)	(3)	(4)	(5)	(6)
Poor Performance 2003	0.438***	-0.361***	-0.084***	0.052***	-0.119***	0.247***
	(0.015)	(0.017)	(0.012)	(0.012)	(0.013)	(0.013)
Poor Performance x Family Firm	0.030*	-0.031	0.060***	-0.037***	-0.022	-0.069**
	(0.016)	(0.019)	(0.013)	(0.013)	(0.013)	(0.013)
Poor Performance x District	-0.005	-0.010	-0.004	0.003	0.005	-0.025**
	(0.015)	(0.017)	(0.010)	(0.010)	(0.010)	(0.010)
Family Firm	0.014	-0.097***	0.002	0.023**	0.039***	0.008
	(0.012)	(0.013)	(0.010)	(0.009)	(0.010)	(0.010)
District	0.047***	-0.097***	-0.040***	0.050***	-0.043***	-0.028***
	(0.010)	(0.011)	(0.007)	(0.007)	(0.007)	(0.007)
$Size_{50\text{-}100}$	-0.032***	-0.091***	0.009	-0.029***	-0.111***	-0.127***
	(0.010)	(0.011)	(0.008)	(0.008)	(0.009)	(0.009)
$Size_{100\text{-}250}$	-0.047***	-0.089***	-0.047***	-0.002	-0.117***	-0.100***
	(0.012)	(0.014)	(0.011)	(0.011)	(0.011)	(0.011)
$Size_{>250}$	-0.135***	-0.039**	-0.060***	-0.038**	-0.141***	-0.214***
	(0.016)	(0.019)	(0.016)	(0.015)	(0.016)	(0.016)
Age	-0.003***	0.001***	0.002***	0.000	-0.005***	-0.003***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	34,494	34,494	31,222	31,222	28,741	28,741
R^2	0.032	0.028	0.001	0.001	0.007	0.010

Notes: The table reports estimated coefficients. All of the variables are defined in Table 1. Three, two and one star (*) mean, respectively, a 99, 95 and 90 percent level of significance. Robust standard errors are in parentheses. The reference category for the variable SIZE is 0-50 employees. All regressions include industry and regional dummies, not reported for reasons of space.

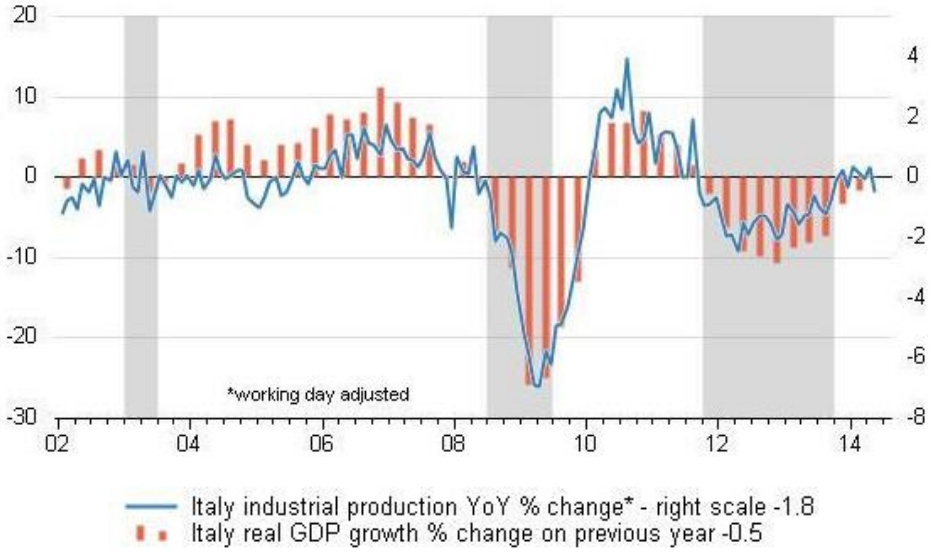
Appendix

Table A.1
Sample coverage by size class

0-19 Employees	20-49 Employees	50-99 Employees	100-249 Employees	+ 250 Employees
38.7 %	73.8 %	86.7 %	87.6 %	95.2 %

Notes: The sample coverage is expressed as a share of Census data.

Figure A.1
Italy industrial production (2003-2014)



Source: Thomson Reuters

Notes: Boxes in grey indicate recessions.