What makes some firms more resistant to crises than others?

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Abstract: The paper analyses what kind of CEECs firms' characteristics make some of them more resilient to crisis than the others. Using panel VAR system on a large firm-level dataset we estimate the responses of firms' employment and investment to cyclical demand shocks and financial shocks. Cyclical drop in demand decreases firms' employment in subsequent periods, especially in small old firms, whereas the adjustment is less severe in exporters and in foreign-owned firms. Investment activity of large young firms is the most and of small young firms the least responsive to financial shocks. Exporters adjust their investment activity to financial shocks to a larger extent than non-exporters.
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1. Introduction

Before the outbreak of the last global financial and economic crisis, new EU member states from Central and Eastern Europe (CEECs) were experiencing rapid GDP and credit growth. Until the first quarter of 2008, CEECs seemed to be quite resilient to the crisis, but from September 2008 on the crisis in CEECs gained markedly in depth and intensity (for more see Gardo and Martin, 2010). The economic downturn has hit the corporate sectors of CEECs more than those of most old EU member states. From 2008 when EU firms were on the top of their activity to 2010, the total value added of CEECs' non-financial corporate sectors decreased on average by as much as 10.4 percentage points while that of old EU member states by only one percentage point. Figure 1 presenting value added at factor cost of the total business economies of EU countries in 2008-2010, clearly shows that with the exception of Slovakia, CEECs as a rule fared much worse than most of the old EU member states. The reasons behind are many, that is at the outbreak of the crisis, CEECs' economies were in a distinctive boom period in which they accumulated sizeable domestic and external imbalances, due to the nature and size of their economies CEECs have been more exposed to the reduction of international trade, the reduction of domestic demand and investment was more severe in CEECs,[1] CEECs' economic fundamentals were less robust than in the old EU member states, and CEECs' governments had fewer resources to react (Gardo and Martin, 2010; Correa and Iootty, 2010). The response of CEECs' governments to the crisis was quite similar to that of the old EU member states – that is they used standard and non-standard monetary policy measures, as well as fiscal policy measures, including putting large amounts of money in the financial and, to a lesser extent non-financial corporate sectors.

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With the ongoing economic recession in some and only slow recovery of corporate activity in other CEECs and in view of the inherent heterogeneity of firms the question arises which characteristics make some firms more resilient to crisis than others. The answer(s) to this question may contribute to more adequate policy measures for faster economic recovery. In this context, the objective of this paper is to identify those determinants of firms' growth which proved to help them resisting to crisis.

The paper is put in the context of the theory and empirical research of the growth of firms and its application to specificities of economic recession. The literature reveals the following factors which may impact firm's resistance to crisis and which we test in our model: (i) firm's size, (i) firm's age, (iii) firm's export propensity and (iv) foreign versus domestic ownership. Apart from firm-specific determinants, the literature suggests two other sets of factors that impact firm's resistance to crisis. The first is industry differences in behaviour during economic recession where we distinguish between manufacturing and services, and the third is different country specific settings which obviously have an important impact on the depth and length of the cycle. GDP, GDP per capita, market capitalization of listed firms, inward and outward FDI stock, current account balance, exports of goods, as well as

[1] As reported by Correa and Iootty (2010), between 70 percent-80 percent of firms from CEECs (Bulgaria, Hungary, Latvia, Lithuania, Romania, Turkey) claim that drop in demand was the most important effect of the crisis on their business, increased level of debt and reduction of access to credit altogether being claimed as the most important by only around 10 percent of the interviewed firms.

indicators of legal, political and economic institutions are used to identify impact of different country specific settings on firm's resistance to crisis.

We apply panel VAR analysis to identify firm-level and country-level determinants of firm employment and investment to cyclical fluctuations in nine CEECs (Bulgaria, Czech republic, Croatia, Hungary, Macedonia, Poland, Romania, Slovenia, and Slovakia). First, we explore which firm-level characteristics determine different responses of firms pre- and during the economic recession by splitting our panel of firms into two distinct samples on the chosen dimension and we evaluate the difference in impulse responses for the two samples. Second, we split firms based on the country of residence and compare the responses of key variables between distinct country groups. The micro data on firms from the analysed CEECs is derived from the AMADEUS database of firm financial accounts for the period 2000-2012 which is provided by the Bureau Van Dijk. We extracted data for all firms with at least one employee and positive total revenues which resulted in an unbalanced panel of 6.185 million firm-year observations and an excess of 1.7 million firms. Country-level variables included in the model to account for country-level variation in cyclical shocks and institutional environment in which firms operate are from the WDI database, UN COMTRADE data and Institutional Quality Dataset 1990–2010 provided by Kunčič (2014).

We find a positive response of firms' employment to a shock in demand, that is a drop in demand decreases employment in the next periods. Old firms and in particular small old firms react more swiftly to cyclical shocks and reduce employment when demand decreases. Furthermore, number of employees is more stable in exporters and foreign-owned firms. During the boom employment is more reactive to demand shocks than during recession. Stronger cyclical responses of service firms' employment may be to a great extent due to construction. Investment does not respond to demand shocks as such, but rather to the cash flow dimension of the economic cycle. Large young firms are the most responsive, whereas small young firms the least responsive to financial shocks in terms of their investment activity. In contrast to employment adjustments, investment activity of exporters is more responsive to cash flow changes than non-exporters. In the first year the shock initiates a significantly larger response of investment in foreign owned firms, yet in the following years the potency of responses becomes larger in domestically owned firms. Compared to industry, services are much more procyclical in terms of investment responses. Differences in country characteristics show important impact of firms' resistance to crisis. More developed countries and larger domestic markets exhibit lower sensitivity of employment and investment to business cycles and financial factors. Better functioning capital markets are associated with greater sensitivity of both variables. Cyclical responsiveness of employment and investment is lower in firms from countries with larger inward or outward FDI stock. Aggregate country exports exhibit positive correlation with the responsiveness of employment and investment, but these exports only relate to arms-length trade. The quality of legal institutional environment in a country is positively correlated with the employment sensitivity to shocks but it has no discernible effect on investment sensitivity. On the other hand, political and economic institutions make employment more stable over the cycle.

We contribute to the existing literature by analysing a complex set of determinants of firm's resistance to crisis using panel VAR technique. The novelty of our study is also the fact that we combine firm level data with country level data to see the impact of different country settings for firm's resistance to crisis.

The paper is structured as follows. In section two we look at the relevant findings of existing literature. Section three describes the methodology of panel VAR analysis while section four presents the data and descriptive statistics. Section five discusses the results and section six concludes.

2. Determinants of firm growth and recession resistance: literature review

Our objective - to analyse what makes some firms more resilient to economic recession than the others, to look which firm characteristics make some of them more resilient to (negative) external shocks in demand than the others, taking into account inherent heterogeneity of firms - puts the analysis in the context of the theory and empirical research of the growth of firms. In his review of the main theories of firm growth, Geroski (1999) classifies them into models of optimum firm size predicting that firms will tend to grow to their optimum size (see, for instance, Viner, 1952), stage theories where firms evolve through several phases of growth (see, for instance, Greiner, 1998), and models based on Penrose (1959) theory of the growth of the firm. Penrose's (1959) theory contains two types of arguments. The first is 'managerial limits to growth' hypothesis saying that "firm growth is led by an internal momentum generated by learning-by doing" (Coad, 2007: 32) from the (existing) management, and the second is 'resource based wiew' of the firm or models of organisational capabilities where "firms are composed of idiosyncratic configurations of resources" (Coad, 2007: 33) being basis of firm growth (for more see Geroski, 1999 and Coad, 2007).[2] Analysis of firm resilience to economic recession can best be explained by a combination of optimum size and resource based theory. On the one hand, model of optimum firm size basically says that optimum size depends on a number of exogenous variables (Geroski, 2000). Decrease of demand due to economic recession is an external shock to a firm and due to drop of demand a firm is pushed out of its existing ('optimal') size. On the other hand, resource based theory states that firm growth depends on inherent factors within the firm, such as technology, skilled personnel, efficient procedures, brand names, trade contacts. (Coad, 2007; Wernerfelt, 1984), and their efficient combination (organizational capabilities) meaning that return of a firm to its pre-recession size depends on its own specific competencies. This is very much in line with the search for stochastic factors affecting firm behaviour and the recognition of Gibrat's Law that "the factors that can affect firm growth relate not only to firm, but also to its environment" (Carrizosa, 2007).

Available empirical testing of the above theories discerns their low explanatory power and a strong stochastic element in explaining firm growth. According to Geroski (1999), very little in the theory is testable and different types of theories make different predictions about elements of corporate performance. He claims that the main conclusions of empirical work are that (i) firm size follows a random walk, meaning that increases in firm size are driven by unexpected shocks, (ii) that the evidence against the proposition that firm sizes do not converge within or across industries is not very strong, (iii) that corporate growth rates are likely to be idiosyncratic (for instance, company performance in cyclical downturns usually show that most of the effects of recessions are concentrated in a few firms; (iv) that many companies are not substantially affected and some actually prosper during cyclical downturns (Davis et al., 1996, Geroski and Gregg, 1997), (v) that corporate growth rates are not smoothed, meaning that firms do not appear to anticipate shocks, and (vi) that adjustment costs seem to be fixed and not variable to size (Geroski, 1999: 4-8). Similarly, Coad claims that the main result of empirical work on firm growth is that it is the stochastic element which is predominant, in other words that firm growth appears to be a idiosyncratic and fundamentally random process (Coad, 2007: 58). Consequently, he proposes that the way forward is through empirical analysis and quotes

[2] In his review of theories of firms growth, Coad (2007: 30-39) also points to the managerial perspective of Marris, evolutionary economics and the principle of 'growth of the fitter', and population ecology.

Starbuck (1971: 126) saying that the subject needs 'solid, systematic empirical research directed toward explicit hypotheses and utilizing sophisticated statistical methods' (Coad, 2007: 59-60).

In the above context, we look at the determinants of CEECs firms' resistance to crisis as defined in the theoretical and empirical literature. Overview of existing empirical studies[3] reveals the following determinants of firm's growth, which we, consequently, use as explanatory variables of firm's resistance to crisis in our model: firm's size, firm's age, firm's export propensity, type of firm where we distinguish between foreign-owned and locally-owned firms, firm's financial sources, that is the impact of financial constraints, firm's productivity, the dynamics of firm's growth in the pre-crisis period, [4] as well as industry specific and macro-economic factors. Below we briefly look at the main findings of the literature on the scope and direction of the above factors' impact on firms' activity, in general and in circumstance of recession in particular.

Firm size is one of the basic variables included in empirical analyses of firm's growth determinants. Conventional wisdom has claimed that expected firm growth rates are independent of size (Gibrat's Law) but more recent analyses tend to demonstrate a negative relationship between firm's size and growth (Cabral and Mata, 2003; Zhou and de Wit, 2009; Yasuda, 2005; Almus and Nerlinger, 2002; Bottazzi and Secchi, 2003; Calvo, 2006; Dunne and Hughes, 1994; Goddard et al., 2002; McPherson, 1996; Jensen, 2005).[5] Smaller firms grow faster if for no other reason because they have to reach the size of minimal efficiency (Audretsch et al., 2004). On the other hand, smaller firms seem to be more sensitive to economic cycles (Gertler and Gilchrist, 1994; Hardwick and Adams, 2002; Fort et al., 2013) and economic recession hit them harder than larger firms (Bugamelli et al., 2009). Difficulty to get external financing is one of the main reasons that smaller firms have more problems in recession than larger firms.

Firm age is the second basic variable included in empirical analyses of firm's growth determinants. The predominant finding is that there is a negative relationship between firm age and growth (Fizaine, 1968; Dunne et al., 1989; Evans, 1987; Geroski and Gugler, 2004, Glancey, 1998) although some analyses do not confirm this (Das, 1995; Barron et al., 1994). Fort et al. (2013: 27) who specifically analyse the role of firm's age and size in business cycles, find that young/small businesses are more cyclically sensitive so that the relative decline in employment during the 2007-2009 recession is greater for young and small businesses than for large and mature businesses. Similarly, Criscuolo et al. (2014) claim that the recent recession has affected disproportionally more young firms, both in their job creation and job destruction rates.

Export propensity and geographical structure of firm exports may be important for firm's resistance to recession not only because of the relationship between firm's performance and export propensity, but also because of the nature of the crisis in terms of its geographical structure and spread. The dominant conclusion of the literature is that export oriented firms are more productive and generally more successful than local market oriented firms (Bernard and Jensen, 1997a, 1997b, 1999a, 1999b; Bernard et al., 2005; Bernard and Wagner, 1997; Aw et al., 1997, 1998; Clerides et al., 1996; Hahn, 2004; Van Biesebroeck, 2003; Hallward-Driemeier et al., 2002; Criscuolo et al., 2005; Head

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[3] See Coad (2009) for an overview of determinants of firm growth used in empirical studies, and Storey (1994) for factors behind firm post-entry performance.

[4] Apart from these, the literature also puts forward R&D and innovation activity and human capital as determinants of firm's growth (see Coad, 2009; Dugal and Morbey, 1995; Mansfield, 1962; Geroski and Machin, 1992; Geroski and Toker, 1996; Roper 1997; Freel, 2000; Hall and Mairesse, 2006; Rauch et al., 2005).

[5] The explanation of contradictory results is given by Mansfield (1962) saying that surviving firms with lower than the minimum efficient size will not satisfy Gibrat's Law, whereas those with greater than the minimum efficient size will (see Carrizosa, 2007). The results, thus, depend on particular set of firms analysed.

and Ries, 2003; Burger et al., 2008), therefore, one expects that they will be, in principle, more successful in handling recession related problems. However, other aspects are also of importance here; namely is recession of a local character, is it concentrated on certain parts of the world or is it global. If the recession is global or if it hits firm's main markets, then export orientation is not necessarily an advantage. The timing is also important. At the beginning of the present recession, world trade decreased much more than GDP (see, for instance, Eaton et al., 2011), implying that exporters were relatively more hit in that period (Bugamelli et al. 2009). Thus, in principle, one would expect better resistance of exporters to economic recession, but much depends on the geographical structure and spread of the crises and of the fact that different parts of the world are in different stages of business cycle.

The literature suggest that firm's resistance to crisis may also depend on the type of firm in terms of *foreign-owned firms versus locally-owned internationalised firms with subsidiaries abroad versus other (non-internationalised) locally-owned firms*. Foreign-owned and internationalised locally-owned firms are the most productive firms (Helpman et al., 2003) and have, in principle, better capabilities (ownership specific advantages including better access to financial resources, multinationality, economies of scale, capacity to optimise business processes based on geographical relocation of processes) to achieve higher performance than locally-owned non-internationalised firms (see, for instance, Dunning, 1993; Head and Ries, 2003; Jaklič and Svetličič, 2003; Dunning and Lundan, 2008; Pfaffermayr and Bellak, 2000; Damijan et. al., 2013). In principle, this gives them better capacity to cope with the recession. Empirical analyses on the role of multinational enterprises (MNEs) in economic recession go both ways (Varum and Barros Rocha, 2011); some claim that they are a factor of stabilisation (Athukorala, 2003; Narjoko and Hill, 2007; Blalock et al., 2005; Chung and Beamish, 2005; Desai et al., 2004; Alvarez and Görg, 2007; Rajan and Zingales, 1998; Manova et al., 2009; McAleese and Counahan, 1979; Fukako, 2001; Wang et al., 2005), while the others believe that they make the situation even worse for the host countries (Flamm, 1984, Görg and Strobl, 2003; Lee and Makhija, 2009; Gao and Eshaghoff, 2004; Lipsey, 2001; Alvarez and Görg, 2009). The reaction of MNEs to the crisis also depends on basic motivation for foreign direct investment (FDI). Vertical FDI subsidiaries demonstrate much better responses to crisis than domestic firms, while horizontal FDI subsidiaries respond less positively (Alfaro and Chen, 2010; Varum and Barros Rocha, 2011).

The literature suggests that firms with *lower level of indebtedness* and those which are *less dependent on external sources of financing* have better chances to resist the pressures of economic recession; that is financial limitations, which are typical for periods of crises, are one of the main factors that restrain firms' growth in economic recession (Kroszner et al., 2007; Braun and Larrain, 2005; Bugamelli et al., 2009; Desai et al., 2004; Manova et al., 2009; Bricogne et al., 2009; Luzzi, 2006).

Any model of firm's growth must contain *productivity* as a control variable (see Alvarez and Görg, 2009). According to Coad (2009: 25), it is logical to expect that more productive firms grow while less productive ones reduce in size. Still, empirical analyses do not confirm this (Bottazzi et al., 2006). One possible explanation is that firms may increase their productivity with increasing or decreasing the extent of their operations (Foster et al., 1998). One may expect that firms with higher productivity will be more resistant to economic recession, but one may also expect that in economic recession firms will be on average more tempted to increase productivity by reduction of employment.

Dynamics of firm's growth before the crisis may also impact its resistance to economic recession. Geroski and Gregg (1996) and Knudsen (2011) find that firms with high growth rates in the pre-recession period may be less resistant to economic recession, because the recessionary contraction of demand is higher in the case of these firms. According to Lien (2010), firms with high pre-recession

growth rates are more vulnerable to recessionary pressures because marginal customers who enter a market in the later stages of a boom and cause the growth, are likely to be the first to exit the market when the good times end (see Knudsen, 2011: 5).[6]

Industrial sector in which a firm operates importantly co-determines its growth dynamics (see Coad, 2009; Audretsch, 1995; Gabe and Kraybill, 2002; Audretsch and Mahmood, 1994; Geroski and Toker, 1996) and resistance to economic recession (see Roubinchtein and Ayala, 2009; Jiang et al., 2009; Eaton et al., 2011; Bricongne et al., 2010; Levchenko et al., 2010; Chor and Manova, 2010; Bugamelli et al., 2009). According to Kim and Barrett (2002), one may distinguish among the following sectors with regard to their behaviour in economic recession: (i) declining sectors whose growth during recession is negative and is further slowing down (basic chemistry, machine-building, electrical equipment, natural gas and rubber products; (ii) growing sectors, whose growth during the recession is positive and is increasing (food and beverages, pharmaceuticals, computers and office equipment, production of hydro and nuclear energy, sales of electricity to households); (iii) sectors with decreasing but positive growth dynamics during the recession (communication equipment, semi-conductors and related electronic components, commercial and other sales of electricity); (iv) fast recovering sectors which have negative growth rates during the recession, but their growth is fast increasing (various household appliances, plastics, wooden products, car tyres, light trucks and steel for final consumers).

Coad (2009) also puts forward the importance of macro-economic factors for firm's growth. Differences in country specific settings have an important impact on the depth and length of the cycle and, thus, also on firms' resistance to crisis. To include country specific factors in our analysis we follow the approach of Dall'Olio et al. (2013). In modelling the factors of productivity growth in Europe they combine Amadeus firm-level data on productivity and firm characteristics with various country-level data (business environment, FDI, infrastructure quality, credit availability). They claim that in the new EU member states country characteristics are more important for productivity growth than firm level characteristics, and vice versa in old EU member states. Following this approach, we test to what extent differences in firms' resistance to crisis are due to country specific factors.

To sum up, based on the above literature review we will test the following hypotheses:

- Smaller and younger firms are more cyclically sensitive than large and mature firms and, thus, exhibit larger declines in employment and investment during the recession.
- In principle exporters are expected to exhibit better resistance to economic recession, but much depends on the geographical structure and spread of the crises.
- Foreign-owned firms have better capabilities to cope with the recession than locally owned ones.
- Industry has an important impact on firm behaviour during the economic recession.
- Country specific characteristics have an important impact on differences in firm's resistance to crisis.

3. Methodology: Panel VAR analysis

Panel VARs have been used to address a variety of issues of interest to applied macro- and microeconomists as well as policymakers (for an overview see Canova and Ciccarelli, 2013). We apply a panel VAR methodology using firm-level panel data to achieve identification with a relatively small number of variables after controlling for state, year and firm fixed effects. The former two fixed effects

[6] Another determinant of firm's resistance to crisis is its R&D and innovation activity. Dugal and Morbey (1995) analyse firms' behaviour in recessions of 1981-1982 in 1990-1991 and find that the extent of R&D activity and innovation intensity have positive impact on firms' sales. Due to the lack of data, this variable is not included in our model.

indicate we are controlling for economy-wide determinants for each country-year strata in an unrestricted way, while firm fixed effects capture firm-specific time-invariant unobservable characteristics. Using in addition a Cholesky ordering of the variables in the panel VAR we are able to estimate orthogonalized shocks in the system. In other words, the approach allows us to distinguish between the impact of the first variable in the ordering: sales-to-capital ratio (proxy for capital productivity and external demand shocks) and the second variable in the sequence: cash flow-to-capital ratio (proxy for financial factors) on firm employment and investment activity independently of their influence on each other and of the impact of aggregate macro shocks and firm-level time-invariant characteristics.

Panel VARs exhibit the same structure as VAR models, meaning that all variables are assumed to be endogenous and interdependent, but a cross sectional dimension is introduced to the specification. The first-order version of the model can be presented as follows:

$$y_{it} = \Gamma_0 + \Gamma_1 y_{it-1} + f_i + d_{ct} + \varepsilon_{it} \quad \text{i} = 1 \ldots \text{N} \quad \text{t} = 1 \ldots \text{T} \tag{1}$$

where y_{it} is a vector of covariates for firm *i* at time *t*, f_i is firm-specific time-invariant unobserved heterogeneity, d_{ct} denotes country-time-specific dummy, and ε_{it} are identically and independently distributed erors. The panel VAR used in micro studies is based on the pioneer work by Holtz-Eakin et al. (1988) or, more recently, by Vidangos (2009). It disregards interdependencies between different cross-section units and typically assumes cross sectional slope homogeneity (allowing for certain time-invariant individual characteristics). These features distinguish it from panel VAR approaches typically used for macroeconomic and financial analyses, that allow for the intercept, the slope and the variance of the shocks ε_{it} to be unit specific (Canova and Cicarelli, 2013). In estimating panel VAR we follow the approach developed by Holtz-Eakin et al. (1988) and make use of Inessa Love's STATA code (pvar.ado) kindly provided by the author. For y_{it} we assume a four-variable vector (SK, CFK, LK, IK) where SK denotes sales to capital ratio, our proxy for capital productivity and external demand shocks, CFK is cash flow per unit of capital employed, LK is employment scaled by capital, and IK is investment in fixed assets per capital stock. Our preferred specification uses variables scaled by firm's total assets. In the same way as our four primary variables, firm's assets adjust downwards during a crisis and balloon during a boom period. The procyclical nature of capital suppresses the variability of our system variables and therefore imposes a downward bias to the estimates. For robustness check we also normalized the variables using employment, however, the results are similar to those described below.

In our model sales to capital ratio (SK) capture the fundamental factors that determine the marginal productivity of labour and capital. Positive shocks to these fundamental factors, such as economy-wide boom in aggregate demand should lead to an increase in employment and investment as firms business opportunities improve. Likewise, a negative shock such as studied in this paper that comes through recessionary fall in demand should lead to employment redundancies and investment standstill.

CFK variable in the above model is defined as EBIT (earnings before interest and taxes) over capital stock and is a proxy for cash flow. Cash flow is commonly used in investment models as an indicator for internally available funds (for a review see Hubbard, 1998). As cash flow data are not available in the Amadeus data, we use data for operating profit/loss as a valid alternative.[7] Free cash

[7] EBIT is also defined as the sum of operating and non-operating income/profit (see, for instance, http://en.wikipedia.org/wiki/Earnings_before_interest_and_taxes). The relationship with free cash flow and EBIT is as follows: FCF to the firm (FCFF) = EBIT*(1-t) + D&A +/- Working Capital changes – Capital

flows as well as EBIT are widely used measures of financial performance yet both have their advantages and shortcomings. EBIT takes an enterprise perspective (whereas free cash flow is a capital measure of profit, because it identifies how much cash the company can distribute to providers of capital, regardless of the company's capital structure), is a hybrid accounting/cash flow metric because it ignores other adjustments you would typically see on free cash flow, like changes in working capital, and is easier to calculate. Where EBIT falls short compared to free cash flow is that if a capital-intensive firm invests heavily in new capital expenditures that are expected to generate higher future return on investment capital (ROIC), EBIT, which does not subtract capital expenditures, completely ignores that, and you may be left incorrectly assuming that the higher ROIC company is overvalued. Furthermore, if one only looks at free cash flows for a company after it secured a major contract with a customer its free cash flows may be very low as it ramps up working capital investments. On the other hand, firm's EBIT show a much more accurate picture of profitability (since the accrual method used for calculating net income matches revenues with costs). Here, we consider EBIT variable as a proxy for 'financial factors'. EBIT is also closely related to marginal productivity of capital and pick up some additional part of productivity not explained by our main measure of marginal productivity of capital and labour. If the investment expenditure lowers costs but leaves sales unchanged (increased firm productivity), the sales to capital ratio variable would not identify the effect, yet the cash flow to capital variable would. CFK thus captures some fundamental factors as well as financial factors affecting the investment and employment activities of firms.

VAR methodology enables us to implicitly base the analysis on an investment model in which we first control for the marginal profitability (SK), whereas the subsequent effect of the financial variables (CFK) on employment and investment is interpreted as indication of financial constraints. This interpretation rests on the orthogonalization of impulse responses. By keeping the fundamentals constant, using the orthogonalized shocks, the impulse response of employment and investment to cash flow isolates the effect of the financial factors. We interpret this orthogonalized response of employment and investment to financial factors as a measure of market frictions and financing constraints (Love and Zicchino, 2006).

The impulse-response functions show the response of a variable to the innovations in another variable in the VAR system, holding all other shocks equal to zero. For identification, we use a Cholesky causal ordering, since the actual variance–covariance matrix of the errors is unlikely to be diagonal. The Cholesky decomposition is based on a particular ordering of variables in the system and allocates any correlation between the residuals of any two variables to the variable that comes first in the ordering. The identifying assumption is that the variable that come earlier in the ordering (weakly exogenous variable) affects the following variable in the sequence contemporaneously, as well as with a lag. The variables that appear later affect the preceding variables only with a lag. In short, the variables that appear earlier in the systems are more exogenous whereas the ones that appear later are more endogenous.

The ordering of variables in the vector of covariates y_{it} conforms to the above identifying assumption. In Equation 1, we assume that current shock to the marginal productivity of capital (proxied by SK) have a contemporaneous effect on the value of employment and investment, while employment and investment have an effect on the marginal productivity of capital only with a lag. This assumption has two justifications. First, the sales to capital ratio is likely to be the most exogenous

expenditures. EBITDA, another widely used indicator, was not used due to lower availability of the data on depreciation and amortization expenses that would considerably reduce the number of available observations.

firm-level variable since it depends on the demand for firms' output, which is to a large extent determined by aggregate cyclical factors. Second, changes in employment and investment is likely to influence cash flow and sales with some delay since they require time for a firm to adapt to new employment structure and new production processes. Setting the CFK after SK, we assume that the effect of sales on cash flow is likely to be contemporaneous and that any reverse effect takes place with a lag. Furthermore, we assume that employment and investment respond to cash flow contemporaneously, while cash flow responds to changes in employment and investment only with a lag. Finally, we assume that because of institutional setting in most of the CEECs in our sample employment deems more exogenous than investment. Due to firing restrictions and costs, we assume that employment affects investment contemporaneously, whereby investment activities only have lagged effects on firm employment. Nevertheless, the results are robust to changing the order of employment and investment. Consequently, IK is the most endogenous variable in the system, thus capturing all the contemporaneous shocks to other variables.

In applying the VAR procedure to panel data, we need to impose the restriction that the underlying structure is the same for each cross-sectional unit. Since this constraint is likely to be violated in practice, one way to overcome the restriction on parameters is to allow for "individual heterogeneity" in the levels of the variables by introducing fixed effects, denoted by f_i in the model. The problem appears, since fixed effects and lagged dependent variables are inherently correlated, so that the mean-differencing procedure commonly used to eliminate fixed effects would create biased coefficients. Consistent with Love and Zicchino (2006), we avoid this problem by using forward mean-differencing, also referred to as the 'Helmert procedure' (see Arellano and Bover, 1995). This procedure removes only the forward mean, which is the mean of all the future observations available for each firm-year. The transformation preserves the orthogonality between transformed variables and lagged regressors, so we can use lagged regressors as instruments and estimate the coefficients by system GMM.

Our identification strategy recognizes that many factors outside firms' control influence their growth activity. We address this in several ways. First, as noted above, we place sales-to-capital ratio first in the causal ordering. Second, our model also allows for country-specific time dummies, d_{ct}, to control for aggregate, country-specific macro shocks (demand, supply and credit conditions) that may affect all firms in a given country and year in the same way. We eliminate these dummies by subtracting the means of each variable calculated for each country-year. SK therefore captures an innovation to a generic country-specific cyclical shock in demand, supply and other factors that affects the business conditions of an individual firm. Since the innovation part of the cash flow variable is orthogonal to the sales variable and country-time-specific shocks have been controlled for, it does not reflect the general business conditions in the country and in the firm. Instead, the orthogonalized cash flow innovation stems from the supply, demand or financial factors affecting cash flows that are not associated with general business conditions.

To analyse the impulse-response functions we need an estimate of their confidence intervals. Since the matrix of impulse-response functions is constructed from the estimated VAR coefficients, their standard errors need to be taken into account. We calculate standard errors of the impulse response functions and generate confidence intervals with Monte Carlo simulations. To compare the impulse responses across two samples of firms (for example small vs. large firms) we simply take their difference. Because our two samples are independent, the impulse responses of the differences are equal to the difference in impulse responses (the same applies to the simulated confidence intervals).

Finally, we also perform variance decompositions, which show the share of the variation in one variable that is explained by the shock to another variable, accumulated over time. The variance decompositions show the magnitude of the total effect. We report the total effect accumulated over the 10 years.

Our main objective is to identify firm-level and country-level determinants of the response of firm employment and investment to cyclical fluctuations in the analysed CEECs. We proceed in two directions. First, we inquire which firm-level characteristics determine different responses of firms prior to and during the economic recession by splitting our panel of firms into two distinct samples on the chosen dimension and we evaluate the difference in impulse responses for the two samples. Similar approach was chosen by Powell et al. (2002) and Love and Zicchino (2006). Following the determinants of firm's growth identified in the literature, the sample is split into two groups according to the following firm characteristics: size (small and large firms), age (young and old firms), export orientation (exporters and non-exporters), foreign ownership (subsidiaries and domestic ownership), sector (industry and services), and time period (before and during the great recession). Regarding the last dimension, it is worth emphasising that panel VAR technique does not allow us to identify asymmetric responses to cyclical and financial constraints innovations, meaning expansions vs. contractions. By splitting the sample into boom and bust periods, however, we do come closer to assessing the true difference in firm responses between the phases of the cycle. Second, we split firms on the country of residence basis and compare the responses of key variables between distinct country groups. In fact, we run regressions on all possible subsets of countries and investigate whether the estimates significantly correlate with the corresponding characteristics of countries included in the estimation. Explanatory variables included in this meta regression are GDP per capita, GDP, market capitalization of listed firms, inward FDI stock, outward FDI stock, current account balance, and export of goods. In addition, we separately analyse the correlation between the two coefficients of main interest and legal, political, and economic institutional index. The explanatory variables are constructed as weighted averages of individual country characteristics where weights are the number of observations that enter the estimation from each country.

4. Data and descriptive statistics

The micro data on firms from the analysed CEECs is derived from the AMADEUS database of firm financial accounts which is provided by the Bureau Van Dijk. We extracted data for all firms with at least one employee and positive total revenues from the following CEECs: Bulgaria, Czech Republic, Croatia, Hungary, Macedonia, Poland, Romania, Slovenia, and Slovakia. We excluded the Baltic countries from our sample because export data for these countries were unavailable. For the sample of selected companies we use data on the number of employees, the turnover, the cost of employees, fixed assets, total assets, operating profit/loss, export revenues, date of incorporation, the 4-digit industry NACE-code, and the nationality of the parent company for the period 2000 to 2012. Originally, all the data were expressed in current euros, so we deflated the variables with producer price indices for the corresponding 2-digit NACE code. The number of firms included in the sample varies greatly across the countries. Furthermore, while offering a rich and detailed database, AMADEUS coverage is skewed towards large firms and hence underestimating the small business population. In addition, not all the firms in the database report all the information we chose as our variables. In order to improve representativeness and reduce the bias, we applied a re-sampling procedure where we aligned sample distribution of firms across size classes and industries with the true population distribution of firms provided by the Eurostat Structural Business Statistics database. We created five sample sizes of firms

(1-9, 10-19, 20-49, 50-249 and 250+) and performed clustered sampling from the stratification criteria of size and sector. Where size-industry stratum in the sample lacked observations, we multiplied the firm clusters by the corresponding factor. Where stratum in the sample exceeded the required structural share, we drew a random sample of firm clusters (without replacements) according to the population distribution figures. Clustered sampling allowed us to make a compromise between strict conformity with population structure and not losing too many valuable observations of firms in time dimension when we drew random samples for each year separately. After the resampling procedure, the total number of observations remained roughly the same in each country, yet its structure in terms of industry and size now closely resembled the population image. The procedure resulted in an unbalanced panel of 6.185 million firm-year observations and an excess of 1.7 million firms.

We included several country-level variables to account for country-level variation in cyclical shocks and institutional environment in which firms operate. From the World Development Indicators (WDI) database we extracted the annual growth rate of GDP, GDP per capita in constant 2005 US $ (PPP), GDP in constant 2005 US $, market capitalization of listed companies (in percent of GDP), domestic credit to private sector (in percent of GDP), inward and outward FDI stock (in percent of GDP), net current account position (in percent of GDP), and export of goods (in percent of GDP). Kunčič (2014) Institutional Quality Dataset 1990 – 2010 provided us with additional three country-level synthetic institutional indices obtained with principal component analysis on more than thirty established institutional indicators, capturing the quality of legal, economic and political institutions.

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Table 1 near here

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Table 1 summarizes all the variables used in the panel VAR analysis (note that we normalized all the firm-level variables by the current capital stock). All the variables exhibit downward shift during the crisis when compared to pre-crisis period. With the exception of employment, the indicators also increased their variability during the recession. Next, we turn to the results of our empirical analysis.

5. Results

5.1. Baseline results

We estimate a panel VAR system as specified in Equation 1 and after the variables have been cleansed of country-year and firm-specific fixed effects. Table 2 reports coefficients of the system with the vector of variables (SK, CFK, LK, IK). The results of our particular interest are the responses of employment (that is employment to capital ratio, LK) and investment (that is investment in fixed assets per capital stock) to cyclical and financial shocks, proxied by innovations in sales (SK) and cash flow (CFK) per capital stock. These results are presented in Table 2 and Figure 2, while Figures A1-A20 in the Appendix show the difference in impulse response functions between different subsets of firms.

First, we look at the impact of cyclical fluctuations on employment. Employment shows an expected positive response to a shock in the sales-to-capital ratio (marginal profitability), corroborated by the estimated coefficients and the impulse responses. In line with the hypothesis, negative shock to demand, for example, translates into a drop in sales-to-capital ratio (SK), which decreases employment in the following periods. To see, whether different kind of firms react differently to cyclical fluctuations, we further compare the estimates in different subsamples of firms with each other and with the estimates of the full sample.

Contrary to our expectations, small and young firms exhibit less intensive response of employment to demand shocks than large and old firms. Thus, firms with less than 10 employees exhibit less intensive response of employment to demand shocks both compared to full sample as well as to the sample of large firms. The difference in impulse responses is nevertheless insignificant. Firms older than 10 years seem to be more responsive to cyclical shocks and the difference is significant also in impulse response functions. Since most of the young firms are also small and vice versa, most of the old firms grow large, we ran an estimation on a sample of old small firms in order to check which of the two characteristics, age or size, is driving the results. It turns out that age plays a larger role in firm responses to cyclical shocks since the difference in impulse responses between old small and young (and also mostly small) firms is larger compared to the difference between large and small firms reactions to a SK shock. Comparison between Figures A15 and A16 reveals that the difference in impulse responses between young and old firms is of higher magnitude in the segment of small firms compared to sample of all sizes. This means that old firms and especially small old firms reacted more swiftly to cyclical shocks in the observed period. Of course, these results could be driven by sample selection process where small firms exhibit higher propensity to exit the market than larger and older firms. Since we observe only the more resilient segment of young firms, the ones that survive show less labour shedding although most of the churning was already performed by the closure of their less successful young counterparts.

As hypothesised, number of employees adjusts less severely in exporters than in non-exporters, the finding confirmed both in terms of coefficient values as well as the difference in impulse response functions. Anecdotal evidence abounds that exporters can more easily switch to other markets where recession is less deep, having already covered sunk costs of establishing export links. According to our expectations, similar pattern holds for foreign-owned firms. Subsidiaries are more deeply rooted in global value chains where cyclical shocks can be absorbed more readily than in domestic firms.

Regarding the sectors of the economy, coefficient values and impulse response functions suggest that employment in services experienced larger declines in the recession. Here, most of the response is probably due to notable cyclicality of construction sector, where most of the net gain and consequent decline in employment was observed.

Finally we checked whether there are differences in employment responses during different phases of the economic cycle by splitting the sample into two subperiods, one before 2008 and the other afterwards. The results show that during the boom employment was more reactive to shocks in SK whereas during recession, firms responded less intensely in the other direction. Various labour market rigidities (that is minimum wages, unemployment insurance, severance pay, advance notice, labour taxes) and proactive government anti-crisis measures obviously diminish the negative outcome of economic downturn in labour market, causing the employment response during the crisis less sensitive than in the period of expansion.

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Table 2 near here

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Our second major point of interest is the response of firm investment to economic fluctuations. Results show that investment does not respond to shocks to firm sales, except in few isolated cases (exporters, non-exporters, and industry). Like in Love and Zicchino (2006), investment activity responds positively

to the cash flow variable, cleansed off of innovations in sales per capital and therefore corresponding to financial factors such as market frictions and financing constraints. In the majority of specifications we find positive and significant coefficients indicating that firms of various characteristics respond positively to increases in cash flow and negatively when funds run dry. Impulse response function on the full sample confirms the value of coefficients (Figure 2).

Where large firms' investment exhibits no significant response to financial (CFK) shocks, small firms are much more affected by shocks in financial factors. Impulse response analysis suggests a different conclusion as the CFK shock, once fed through the entire system produces stronger reactions in large firms. The difference in impulse responses is significant in favour of larger firms which obviously respond to the same shock to CFK with a more extensive investment activity. In this sense the pattern is the same as in the response of employment. Young firms reveal smaller coefficient on the response of past CFK on contemporaneous investment, yet impulse response function displays much stronger affect than in the group of old firms. The difference between the impulse response function is significant: young firms respond more intensely to cash flow shocks than older firms. These two findings combined suggest that it is large young firms that should be the most responsive and the small old firms the least responsive to credit market conditions. The proposition is confirmed by the results of the analysis on the sample of small old firms that exhibit significantly smaller impulse responses than the comparison group of young firms.

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Figure 2 near here

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Exporters adjust their investment activity to CFK shocks more extensively than non-exporters since the coefficient as well as the impulse responses exhibit larger values and the difference between the groups is significant. The finding is in contrast to employment adjustment revealed by exporters. This can be of no surprise since exporters can exploit more investment opportunities when the conditions are suitable due to their advantage of larger scale and opportunities to hedge downturns across different markets. Foreign ownership status also appears to be important to some extent. Coefficients prom panel VAR analysis reveal that only domestic firms respond significantly to past innovations in CFK. Impulse functions show a different result, namely in the first year, the shock initiates significantly larger response of investment in foreign owned firms, yet in the following years the potency of responses reverses in favour of domestically owned firms. Services are much more pro-cyclical in terms of investment than industry as both coefficients and impulse responses confirm. As was the case in employment responses, investment activity was again more vibrant to firm financial factors in the expansionary years.

5.2. Variance decomposition

In this section, we analyse the variance decomposition for various samples of firms, which explains how much of the forecast error variance of each of the variables can be explained by exogenous shocks to the other variables. In the full sample, SK and CFK explain very little variation in employment and investment activity of the firms. However, the magnitude of the effect is larger in some of the subsamples of firms.

In small firms sales-to-capital ratio is more important in explaining employment, while in large firms cash flow contributes much more than in smaller firms in evolution of firm investment. Namely,

SK explains about 6.2 percent of total variation in employment in small firms (negligible share in large firms), whereas CFK explains almost 16 percent of total variation in investment in large firms (negligible share in small firms). Old small firms are particularly sensitive to cycles when it comes to employment as SK explains as much as 14.6 percent of the variation in this production factor. The shocks in CFK in young firms account for considerably larger part of the variation in investment than in the older counterparts (3.1 percent vs. 0.06 percent).

Exporters again exhibit greater employment resilience since only 1 percent of the total variation in employment can be explained with the shocks in sales per capital, while the share in non-exporters stays at much higher 13.7 percent. The same pattern can be observed with regards to investment where more than twice as much variation in investment is explained by CFK in non-exporters than in exporters. In firms with domestic ownership, investment is to a larger extent driven by shocks in CFK (1.6 percent vs. 0.08 percent in foreign owned) but on the other hand, SK explains more of the change in employment 10 periods ahead in the sub-sample of foreign subsidiaries. Additionally, industry investment is to a larger extent driven by fundamental (0.7 percent) and financial factors (2.4 percent) than services. Lastly, pre-crisis years exhibit stronger influence of cash flow to capital on investment compared to the crisis years.

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Table 3 near here

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5.3. The impact of differences in country settings

In the following part we investigate which country-level characteristics are correlated with the sensitivity of firm employment and investment to fundamental and financial factors, respectively. We do this by running panel VAR on all possible subsets of the countries in our sample (510 different subsets or 255 different splits of countries into two groups) and regress the realizations of the two coefficients of our interest on the corresponding country group characteristics. The coefficients that we retrieve from each panel VAR estimation are the effect of past sales-to-capital ratio on employment-to-capital ratio and the effect of past cash flow to capital ratio on investment relative to total capital stock. Apart from using coefficients for each distinct group separately, we also calculate the difference between the value of coefficient in each country group and coefficient in the corresponding subgroup of the remaining countries. We then compare the differences in coefficients with the differences in group characteristics for each of the 255 possible splits of 9 countries.

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Table 4 near here

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The results of the regression are shown in Tables 4 and 5. More developed countries in terms of GDP per capita and larger domestic markets in terms of GDP exhibit lower sensitivity of employment and investment to business cycles and financial factors. Better functioning capital markets (market capitalization of listed companies) are associated with greater sensitivity of both variables. Inward as well as outward foreign direct investment stock both lower the cyclical responsiveness of employment and investment, corroborating firm-level results from above. Interestingly, exports exhibit positive correlation with the responsiveness of employment and investment, however, we have to bear in mind

that we are already controlling for inward and outward FDI stock which explains a lot of variation in the importance of trade flows. What remains is the part of total exports that cannot be explained by global value chain phenomenon and is associated with the arms-length trade. This type of flows is more erratic, possibly driving the positive association with the sensitivity of employment and investment activity. Current account is only significant in one specification; nonetheless, it suggests that countries with larger current account deficit react to cyclical shocks more fervently than countries with balanced or surplus current accounts.

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Table 5 near here

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Using Institutional quality dataset (Kunčič, 2014), we exploit a wide range of institutional indices clustered into three homogenous groups of formal institutions: legal, political and economic, which capture to a large extent the complete formal institutional environment of a country. The quality of legal institutional environment is positively correlated with the employment sensitivity to shocks but it has no discernible effect on investment sensitivity. Rule of law apparently enables firms to be more flexible in hiring and firing throughout the business cycle. On the other hand, political and economic institutions make employment more stable over the cycle. Flexible labour and goods markets render the unemployment less necessary if wages and prices are allowed to adjust to new fundamentals.

6. Conclusions

Current financial and economic crisis has hit the new EU member states harder than most of the old EU member states. This study analyses which firm characteristics make some firms more resistant to this economic shock than the others. We test for the following factors which may impact a firm's resistance to crisis and which we explore in our model: (i) firm size, (i) firm age, (iii) export propensity, (iv) type of firm where we distinguish between foreign-owned and locally-owned firms, and (v) sector in which a firm belongs. Apart from firm specific determinants, we also test how different country specific characteristics are associated with firms' employment and investment responses to cyclical and financial shocks. We apply panel VAR method to AMADEUS firm level data for 2000-2012 for all firms with at least one employee and positive total revenues, resulting in an unbalanced panel of 6.185 million firm-year observations and an excess of 1.7 million firms.

The panel VAR system results show that old firms and especially small old firms react more swiftly to cyclical shocks and reduce employment when demand decreases. Age plays a larger role in firms' employment responses to cyclical shocks than size, although the size exacerbates the effect. Exporting firms' adjustment in the number of employees is less pronounced than in non-exporters. Similarly, foreign-owned and manufacturing firms are more resilient in employment than domestic and service firms, respectively. Apart from being more productive in general, exporters seem to be able to switch more easily to other markets where recession is milder, having already covered sunk costs of establishing export links, while foreign subsidiaries operate in global value chains where cyclical shocks can be absorbed more readily than by domestic firms. The results also show that during the boom employment was more reactive to demand shocks, whereas during the recession firms responded less intensely in the other direction. Various labour market rigidities and a proactive government's anti-crisis measures apparently eased the negative outcome of economic downturn in labour market.

The study identified some interesting differences between employment and investment responses of firms to economic shocks. In general, investment does not respond to demand shocks directly but rather to cash flow component of cyclical fluctuations. Large young firms are the most and small old firms are the least responsive to financial shocks, that is to credit market conditions. In contrast to employment adjustments, exporters adjust their investment activity to cash flow to a larger extent than non-exporters. Foreign ownership status is also important. In the first year the shock initiates significantly larger response of investment in foreign owned firms, yet in the following years the potency of responses reverses in favour of domestically owned firms. Services are much more pro-cyclical in terms of investment than industry. As in the case in employment responses, investment activity was again more vibrant to firm financial factors in the expansionary years.

The variance decomposition explains how much of the forecast error variance of each of the variables can be explained by exogenous shocks to the other variables. Changes in sales-to-capital ratio explains about 6.2 percent of total variation in employment in small firms (negligible share in large firms). Furthermore, old small firms and non-exporters are particularly sensitive to cycles when it comes to employment as demand shocks explain as much as 14.6 percent and 13.7 percent of the variation in this production factor, respectively. Cash flow changes explain almost 16 percent of total variation in investment in large firms (negligible share in small firms). Here again, non-exporting and domestic firms' investment is to a much larger extent driven by exogenous shocks than in exporting and foreign owned counterparts.

Differences in country specific settings also have an impact on the depth and length of the cycle and, thus, also on firms' resistance to crisis. More developed countries and larger domestic markets exhibit lower sensitivity of employment and investment to business cycles and financial factors. Better functioning capital markets are associated with greater sensitivity of both variables. Inward as well as outward FDI both lower the cyclical responsiveness of employment and investment. Interestingly, aggregate exports exhibit positive correlation with the responsiveness of employment and investment in the corresponding country's firms, but these exports only relate to arms-length trade. The quality of legal institutional environment in a country is positively correlated with the employment sensitivity of firms to shocks but it has no discernible effect on their investment sensitivity. Rule of law seems to enable firms to be more flexible in hiring and firing throughout the business cycle. On the other hand, political and economic institutions make employment more stable over the cycle. Flexible labour and goods markets render the unemployment less necessary if wages and prices are allowed to adjust to new fundamentals.

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Appendix

Table A.1: Sample coverage across countries and years in the original sample

Year	BG	CZ	HR	HU	MK	PL	RO	SI	SK	Total
2000	43,416	6,197	0	49,429	357	5,794	180,468	0	1,129	286,790
2001	51,222	7,774	0	11,508	414	7,851	203,090	0	1,623	283,482
2002	20,336	18,634	0	20,035	112	10,899	226,287	8,617	2,419	307,339
2003	23,639	30,105	45,859	15,737	171	13,336	270,161	8,342	3,960	411,310
2004	24,486	37,946	49,383	128,927	432	13,608	320,157	10,111	5,152	590,202
2005	25,048	42,476	54,173	137,073	533	15,693	372,712	11,443	7,967	667,118
2006	33,768	55,205	61,422	64,906	720	27,273	358,307	11,059	15,113	627,773
2007	55,943	56,228	66,974	156,958	8,702	29,869	482,233	10,156	17,788	884,851
2008	36,133	42,044	74,696	152,503	341	30,121	464,799	7,932	9,981	818,550
2009	43,437	107,131	85,003	231,796	95	81,449	341,503	2,683	40,377	933,474
2010	49,287	363,177	87,157	285,946	270	83,982	472,893	51,648	119,105	1,513,465
2011	28,791	369,694	81,574	306,624	199	82,896	513,749	55,562	99,743	1,538,832
2012	280	12,367	135	168	0	1,685	0	37	424	15,096
N obs.	435,786	1,148,978	606,376	1,561,610	12,346	404,456	4,206,359	177,590	324,781	8,878,282
N firms	126,545	443,709	94,985	398,642	8,839	121,969	786,142	60,617	151,565	2,193,013

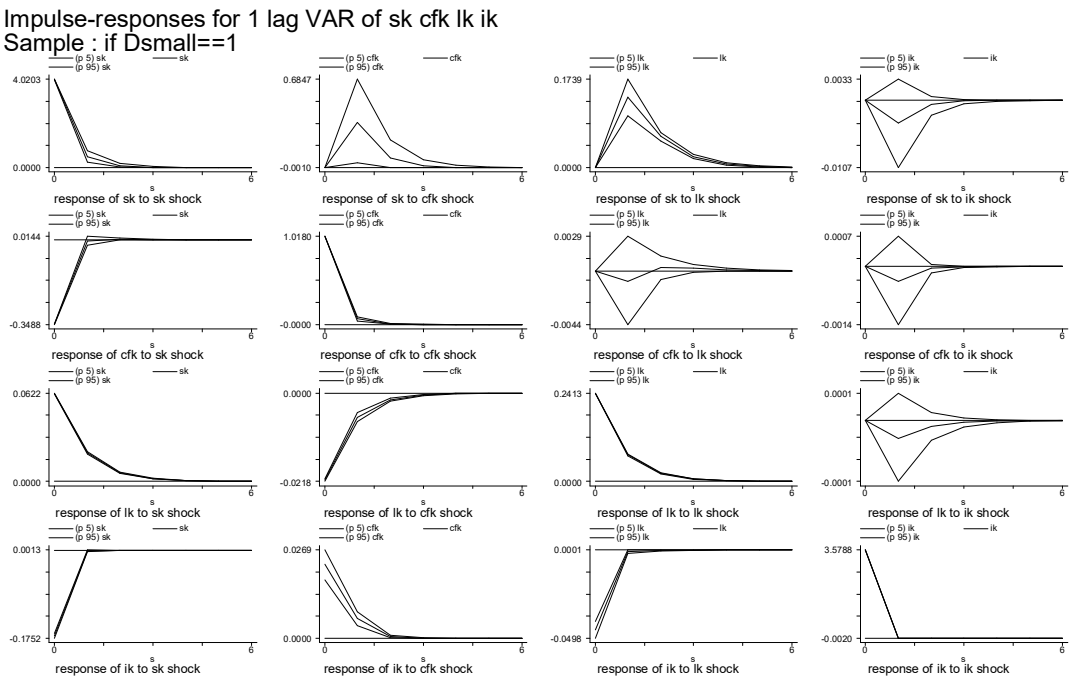
Source: own calculations based on AMADEUS data.

Table A.2: Sample coverage across countries and years in the resampled sample

Year	BG	CZ	HR	HU	MK	PL	RO	SI	SK	Total
2000	49,962	4,330	0	696	122	2,806	115,368	0	301	173,585
2001	60,501	5,685	0	262	159	5,578	120,797	0	439	193,421
2002	25,838	17,403	0	3,648	53	8,617	127,720	4,437	753	188,469
2003	23,946	30,346	36,504	282	69	11,026	180,487	5,715	1,285	289,660
2004	26,461	39,027	38,702	816	233	11,701	242,018	7,363	1,792	368,113
2005	26,596	43,891	41,373	1,829	393	15,457	281,428	8,541	4,157	423,665
2006	41,282	56,959	46,377	3,657	562	34,853	273,483	8,307	10,243	475,723
2007	63,260	58,505	49,889	83,040	6,280	40,729	346,241	7,693	12,599	668,236
2008	37,286	44,171	52,550	8,811	227	34,184	346,169	5,938	7,512	536,848
2009	51,113	81,543	61,184	151,657	71	118,881	319,981	2,287	31,274	817,991
2010	58,479	214,731	59,886	109,991	194	18,755	442,341	45,859	76,648	1,026,884
2011	29,911	218,904	56,547	113,568	142	7,976	480,330	48,019	58,451	1,013,848
2012	216	7,996	79	119	0	126	0	24	0	8,560
N obs.	494,851	823,491	443,091	478,376	8,505	310,689	3,276,363	144,183	205,454	6,185,003
N firms	147,091	273,443	80,092	234,291	6,488	149,120	659,627	53,572	99,442	1,703,166

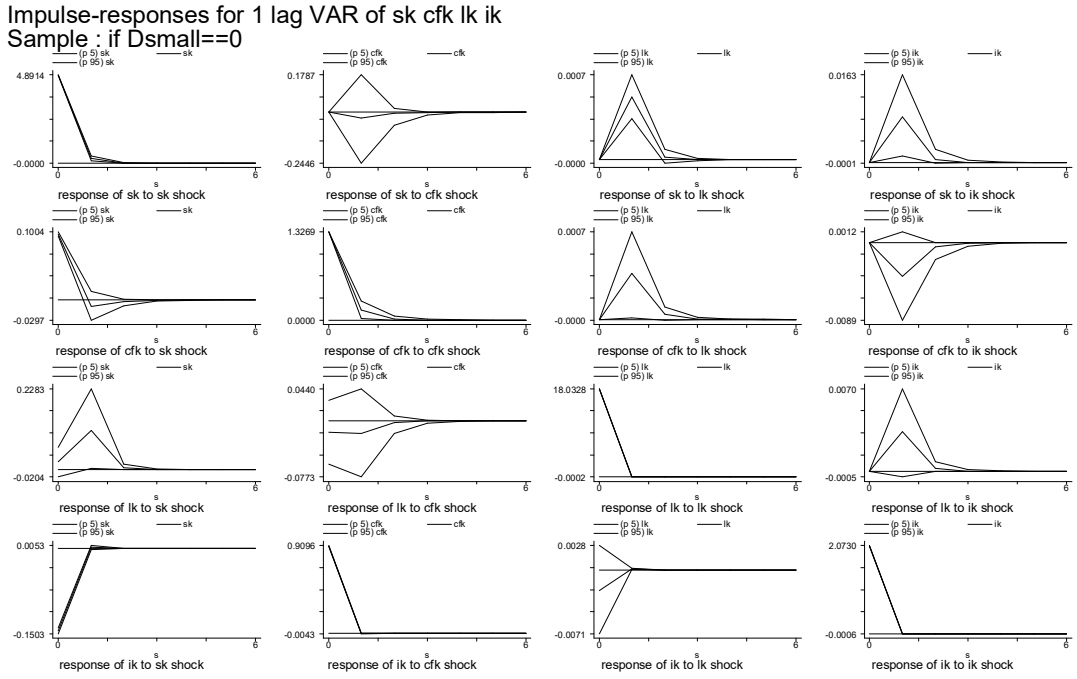
Source: own calculations based on AMADEUS data.

Figure A.1: Impulse response functions for small firms.



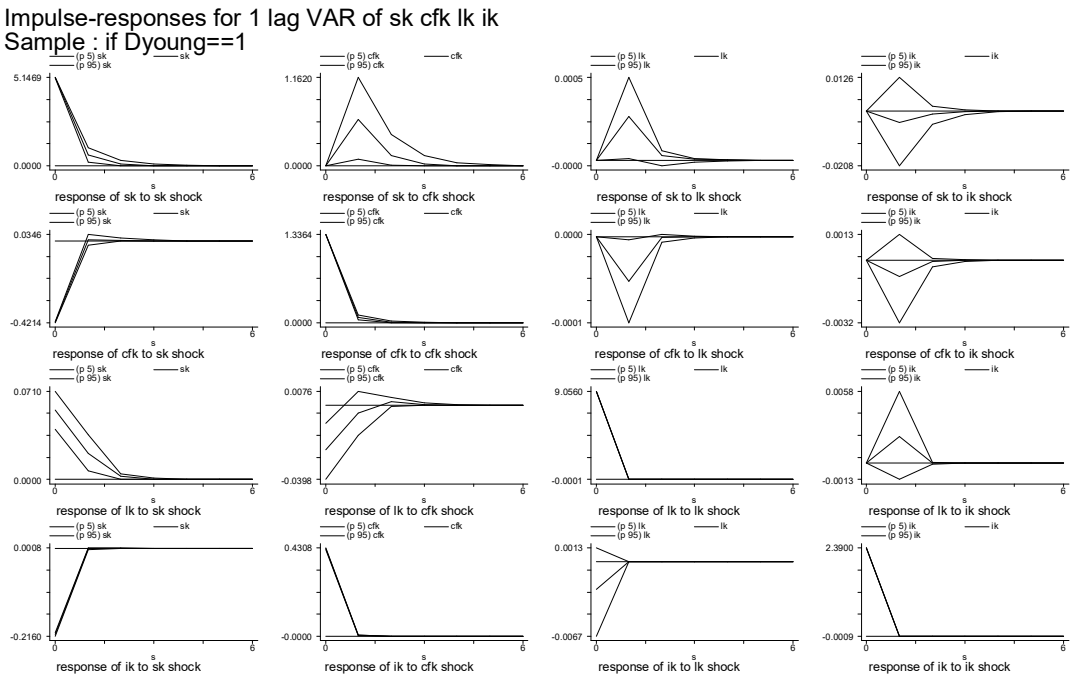
Source: own calculations based on AMADEUS data.

Figure A.2: Impulse response functions for large firms.



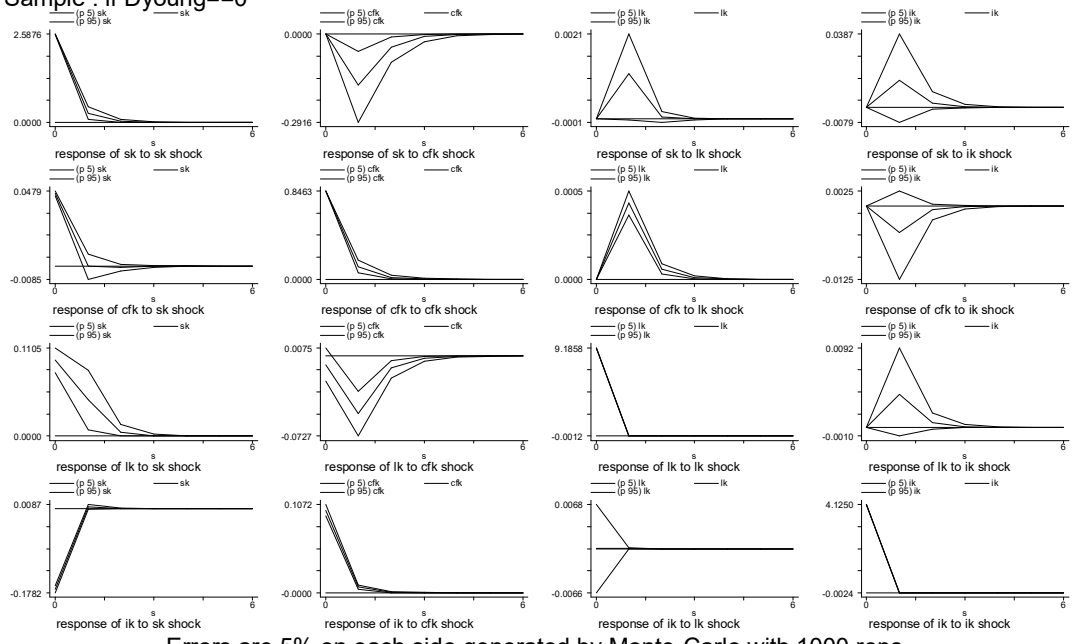
Source: own calculations based on AMADEUS data.

Figure A.3: Impulse response functions for young firms



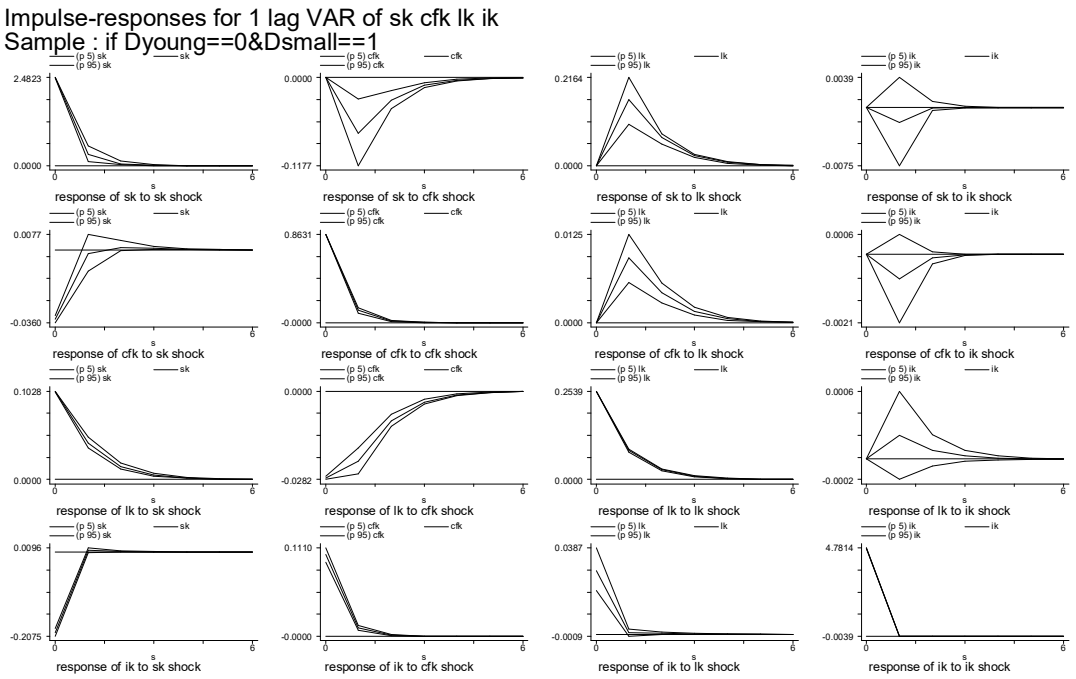
Source: own calculations based on AMADEUS data.

Figure A.4: Impulse response functions for old firms.



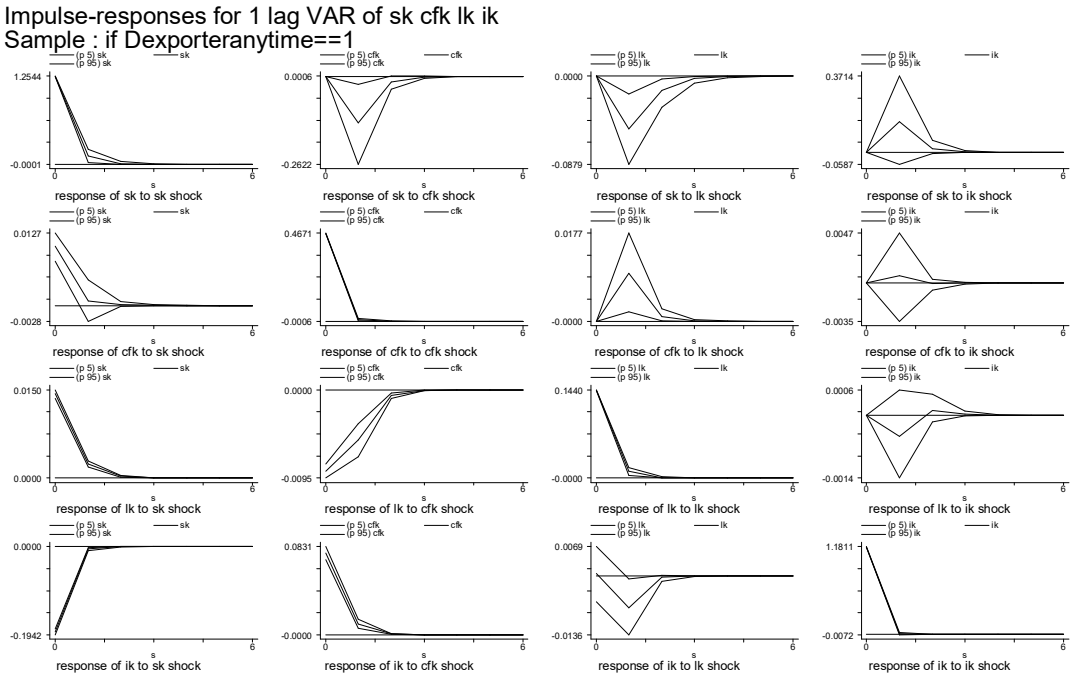
Source: own calculations based on AMADEUS data.

Figure A.5: Impulse response functions for old small firms.



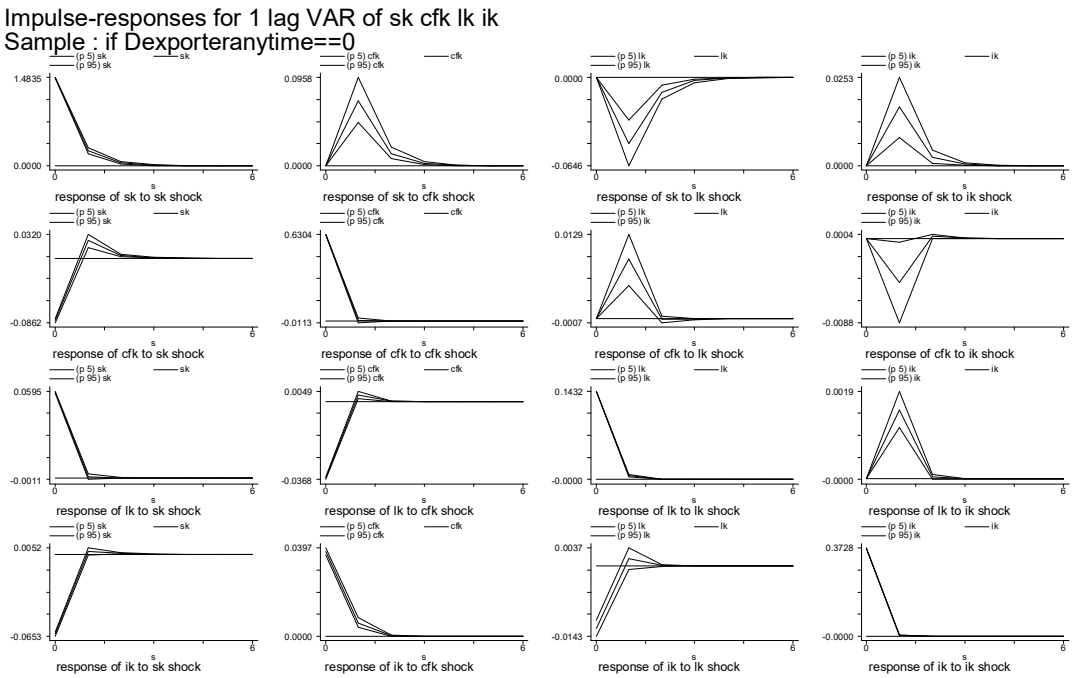
Source: own calculations based on AMADEUS data.

Figure A.6: Impulse response functions for exporters.



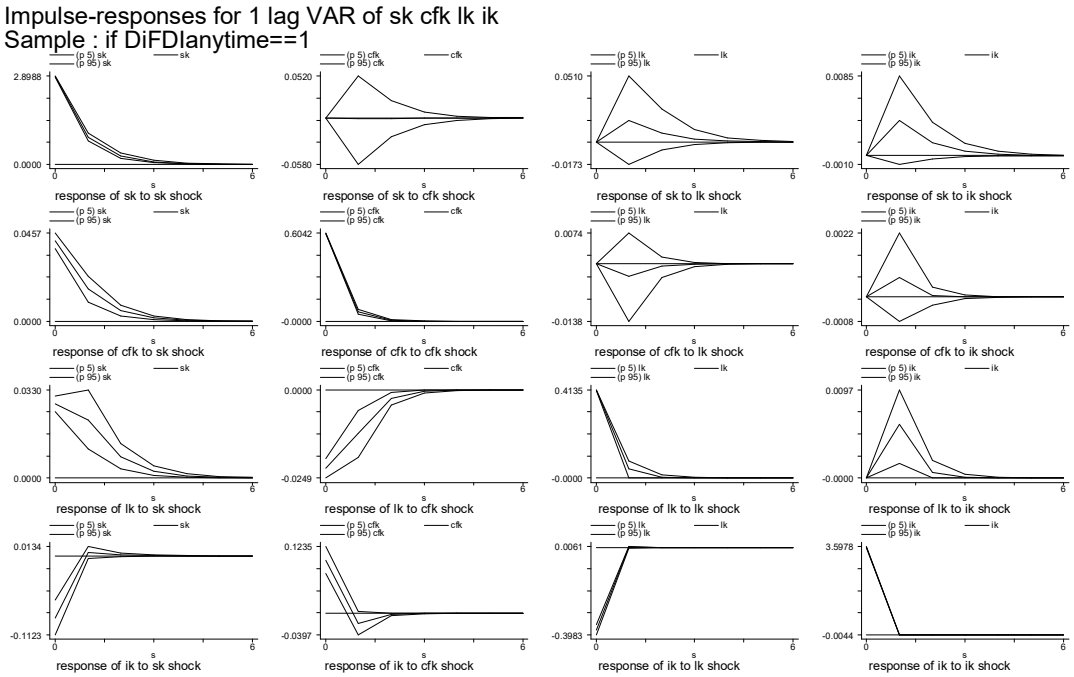
Source: own calculations based on AMADEUS data.

Figure A.7: Impulse response functions for non-exporters.



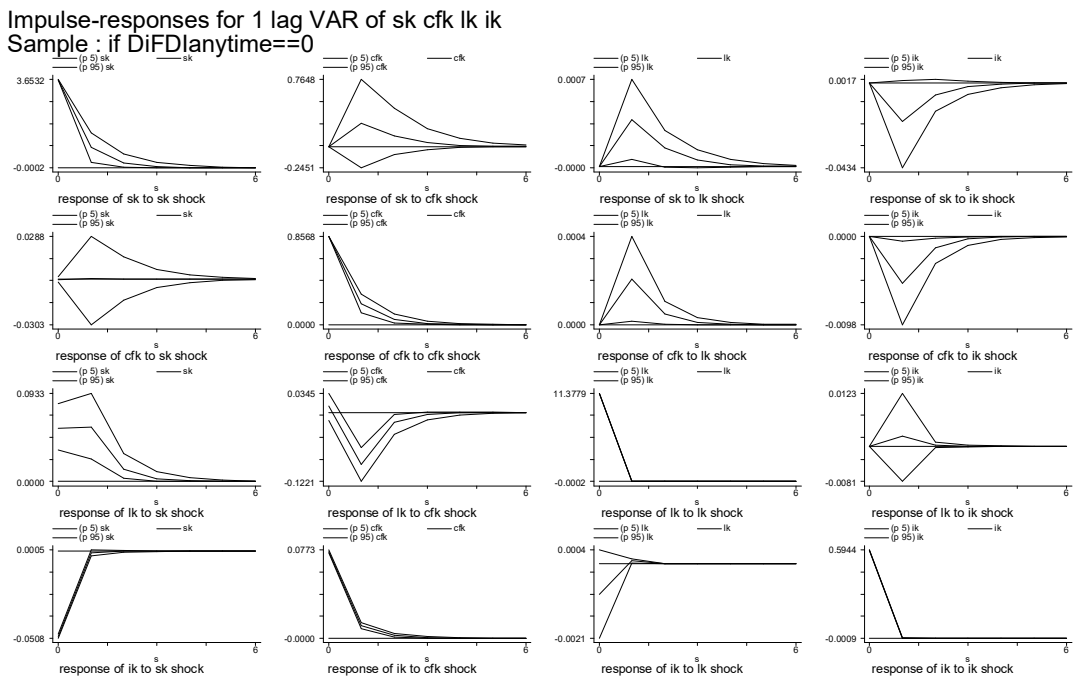
Source: own calculations based on AMADEUS data.

Figure A.8: Impulse response functions for foreign owned firms.



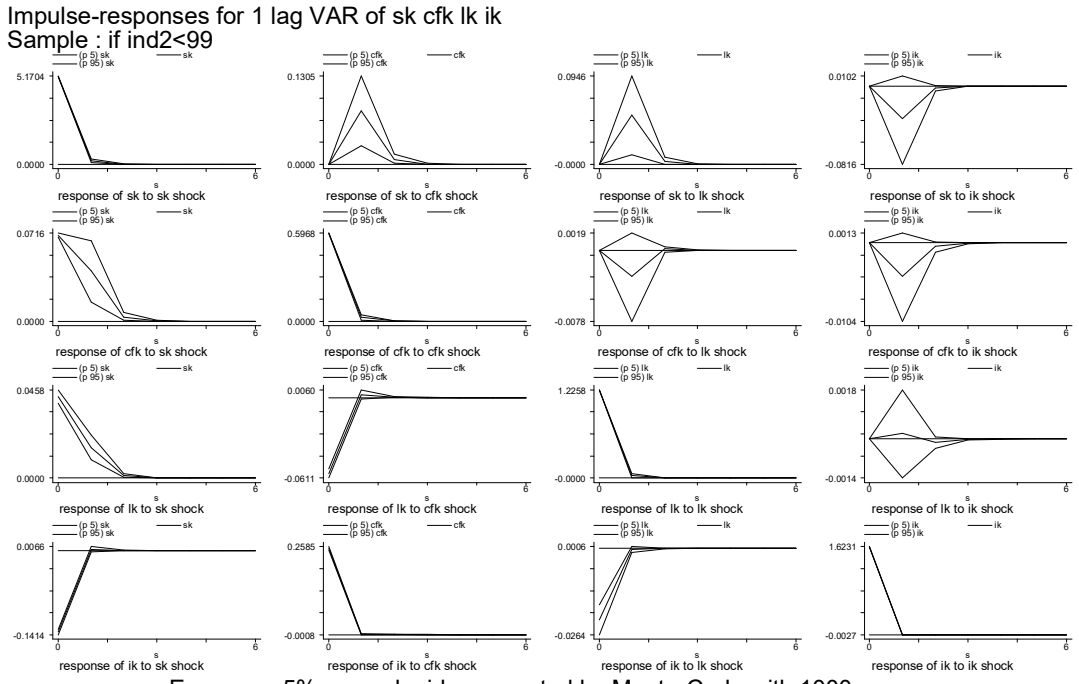
Source: own calculations based on AMADEUS data.

Figure A.9: Impulse response functions for firms in domestic ownership.



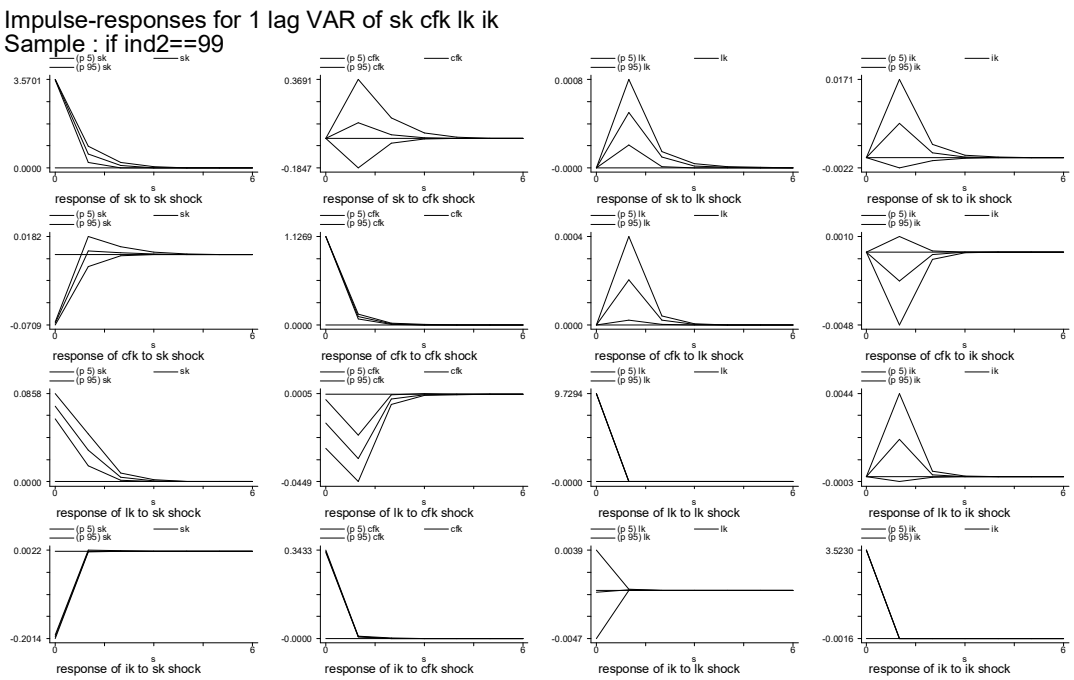
Source: own calculations based on AMADEUS data.

Figure A.10: Impulse response functions for industry.



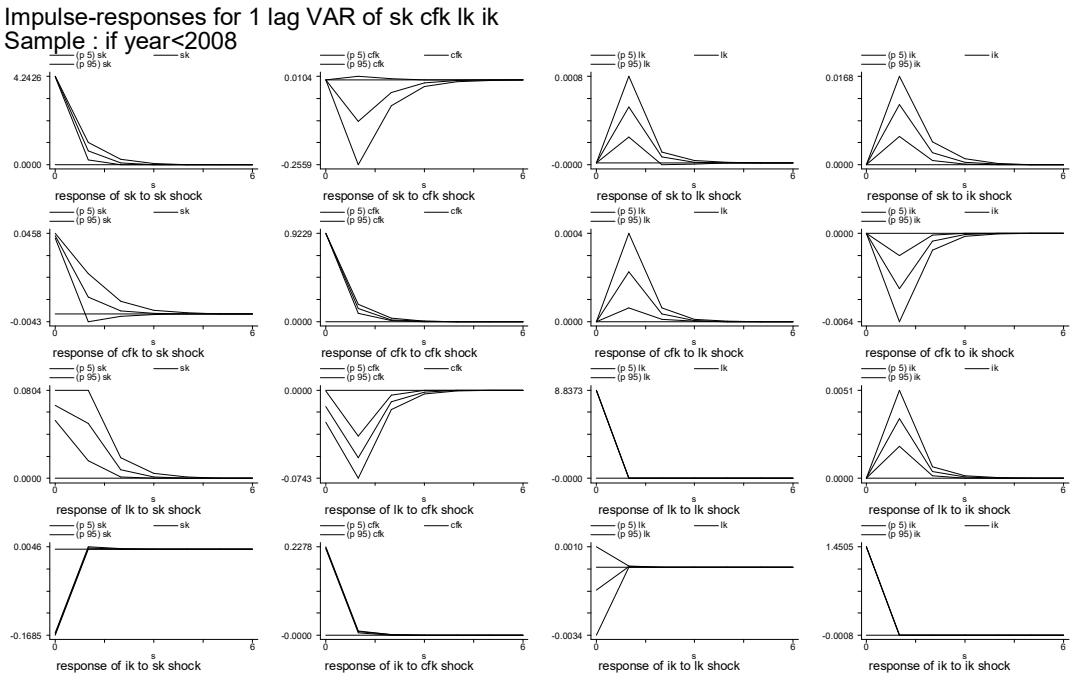
Source: own calculations based on AMADEUS data.

Figure A.11: Impulse response functions for services.



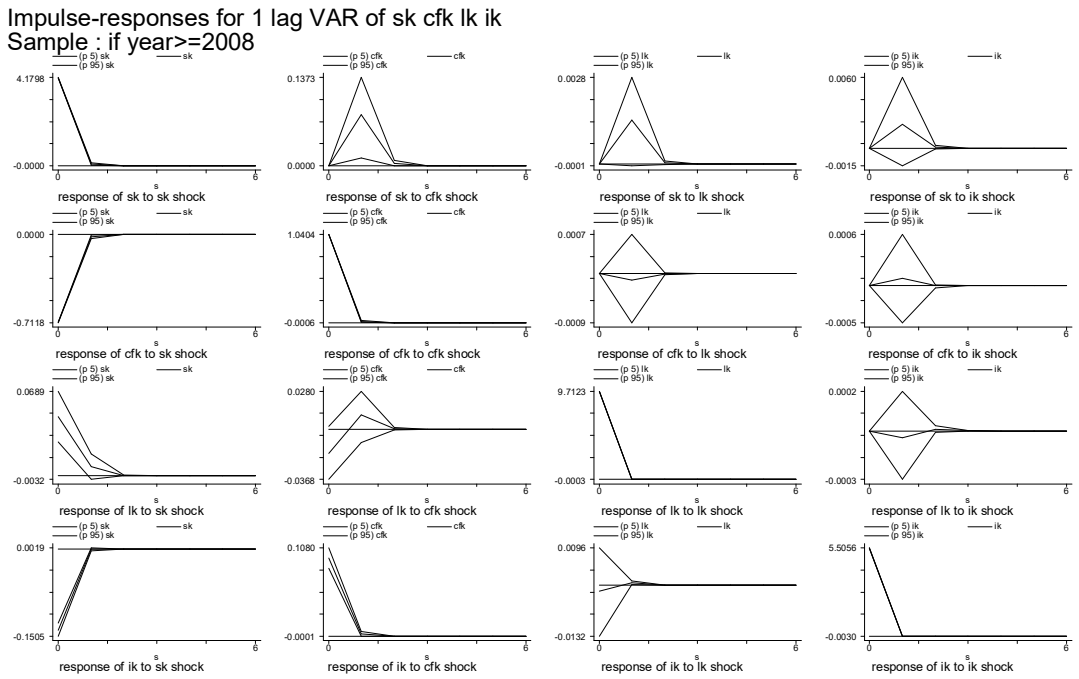
Source: own calculations based on AMADEUS data.

Figure A.12: Impulse response functions for the period 2000-2007.



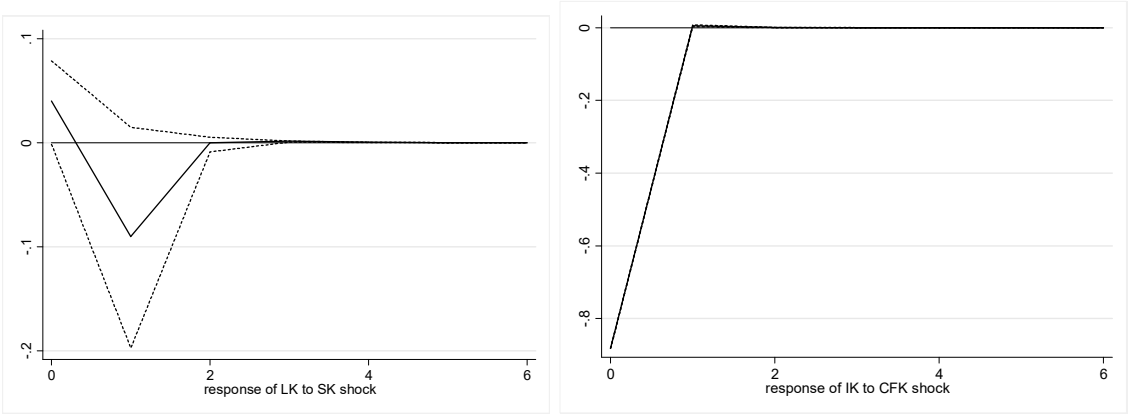
Source: own calculations based on AMADEUS data.

Figure A.13: Impulse response functions for the period 2008-2012.



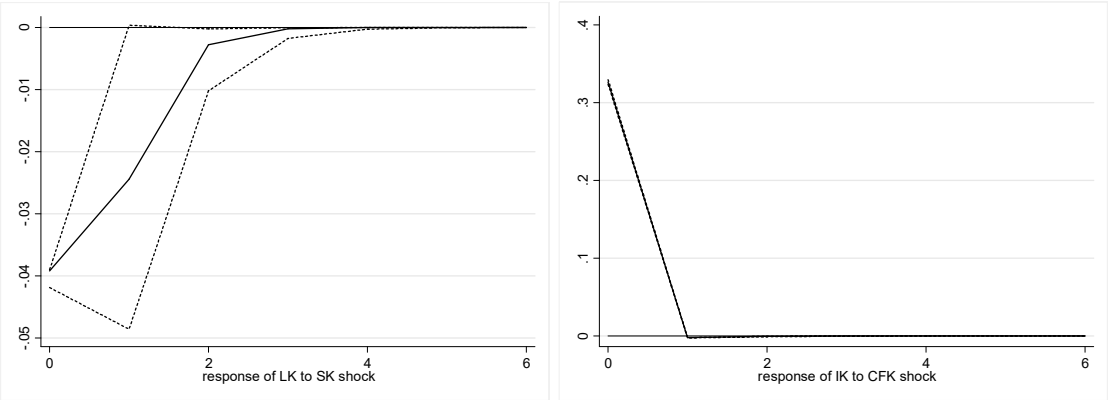
Source: own calculations based on AMADEUS data.

Figure A.14: Difference in impulse responses between small and large firms (small—large).



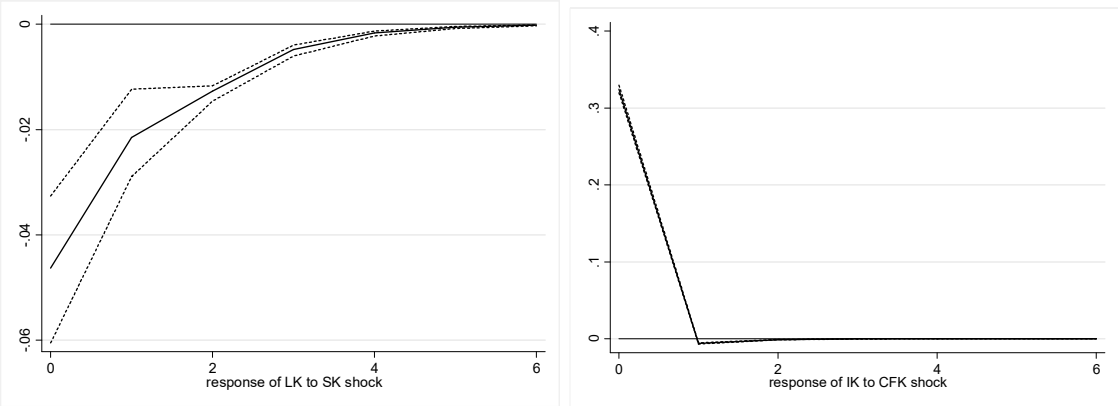
Source: own calculations based on AMADEUS data.

Figure A.15: Difference in impulse responses between young and old firms (young—old).



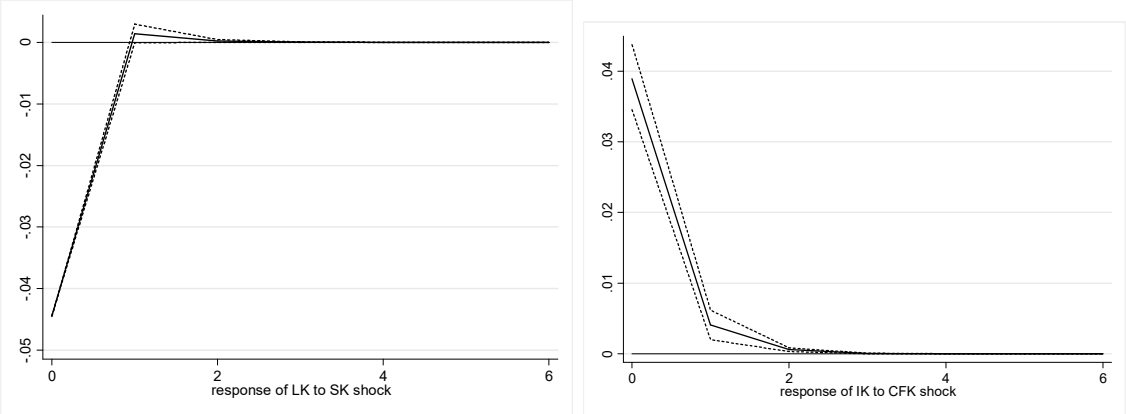
Source: own calculations based on AMADEUS data.

Figure A.16: Difference in impulse responses between young and small old firms (young—small old).



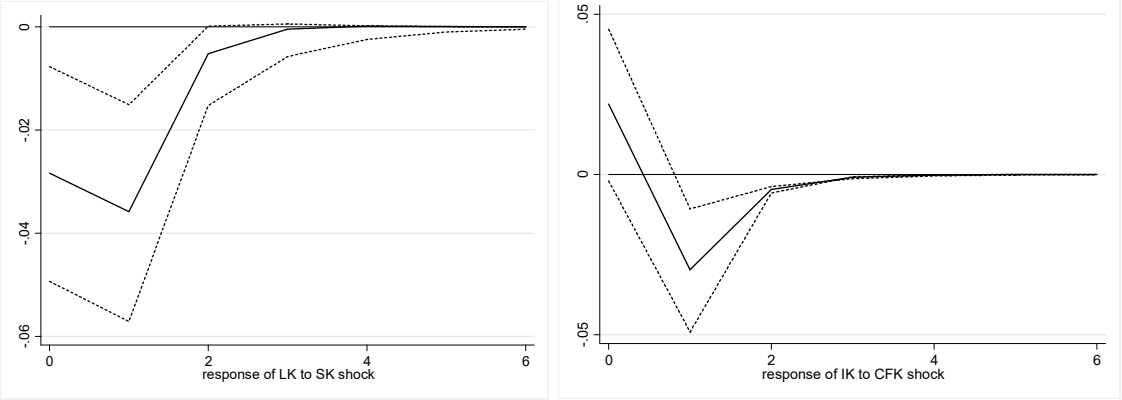
Source: own calculations based on AMADEUS data.

Figure A.17: Difference in impulse responses between exporters and non-exporters (exporters—non-exporters).



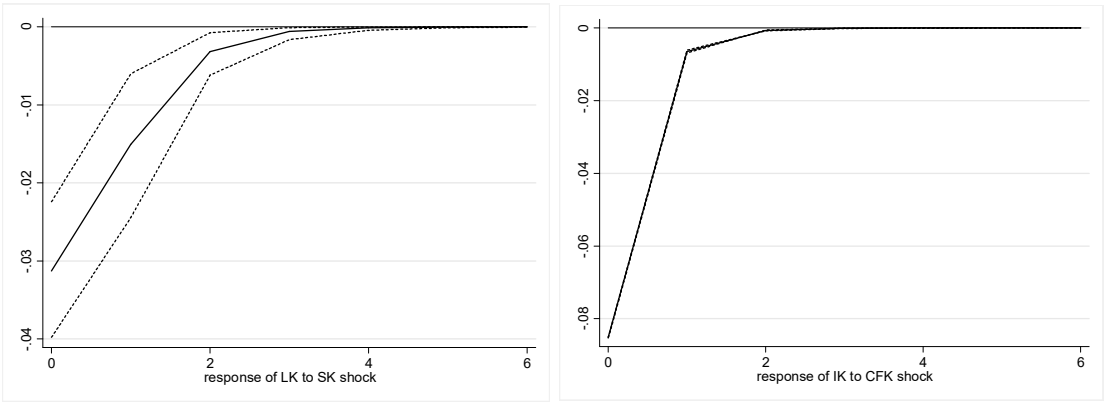
Source: own calculations based on AMADEUS data.

Figure A.18: Difference in impulse responses between foreign owned and domestic (foreign—domestic).



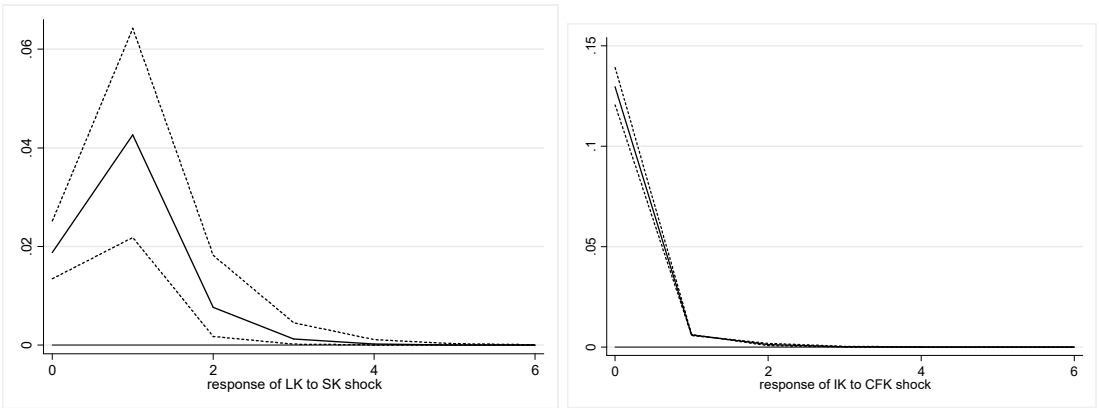
Source: own calculations based on AMADEUS data.

Figure A.19: Difference in impulse responses between industry and services (industry—services).



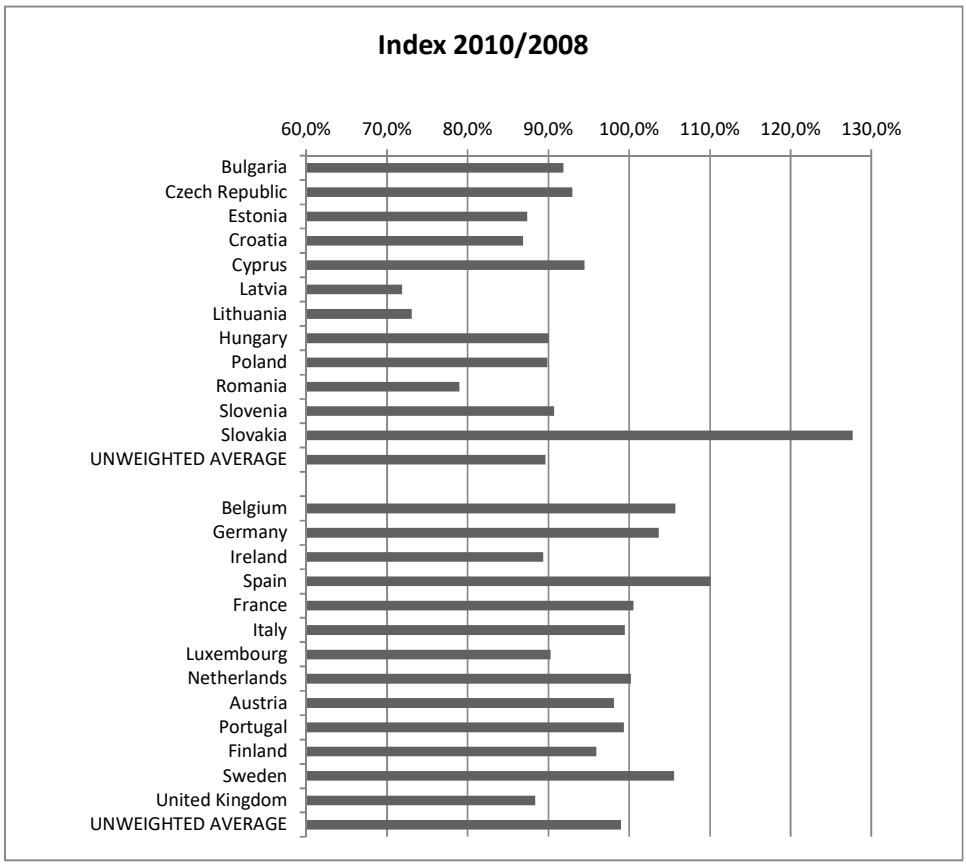
Source: own calculations based on AMADEUS data.

Figure A.20: Difference in impulse responses between pre-crisis and crisis years (pre-crisis—crisis).



Source: own calculations based on AMADEUS data.

Figure 1: Value added at factor cost of the total business economies (including repair of computers, personal and household goods, except financial and insurance activities) of EU countries; Index 2010/2008



Source: Eurostat, http://appsso.eurostat.ec.europa.eu/nui/submitViewTableAction.do

Table 1: Summary statistics for main variables

	Before the crisis (2000-2007)					During the crisis (2008-2012)				
	mean	st. dev.	5th perc.	50th perc.	95th perc.	mean	st. dev.	5th perc.	50th perc.	95th perc.
SK	2.68	9.41	0.20	1.75	7.67	2.30	17.2	0.0037	1.35	6.63
CFK	0.073	1.70	-0.52	0.063	0.79	-0.068	2.77	-0.92	0.024	0.58
LK	0.29	29.1	0.004	0.083	1.00	0.150	6.47	0.00	0.039	0.50
IK	0.039	2.92	-0.185	0.008	0.48	-0.053	10.52	-0.287	0.00	0.32

Note: SK denotes sales-capital ratio, CFK is free cash flow over capital, LK is labour-capital ratio, IK is investment-capital ratio.
Source: own calculation based on AMADEUS data.

Table 2: Results of the panel VAR(1) model estimation for different samples of firms, 2000-2012

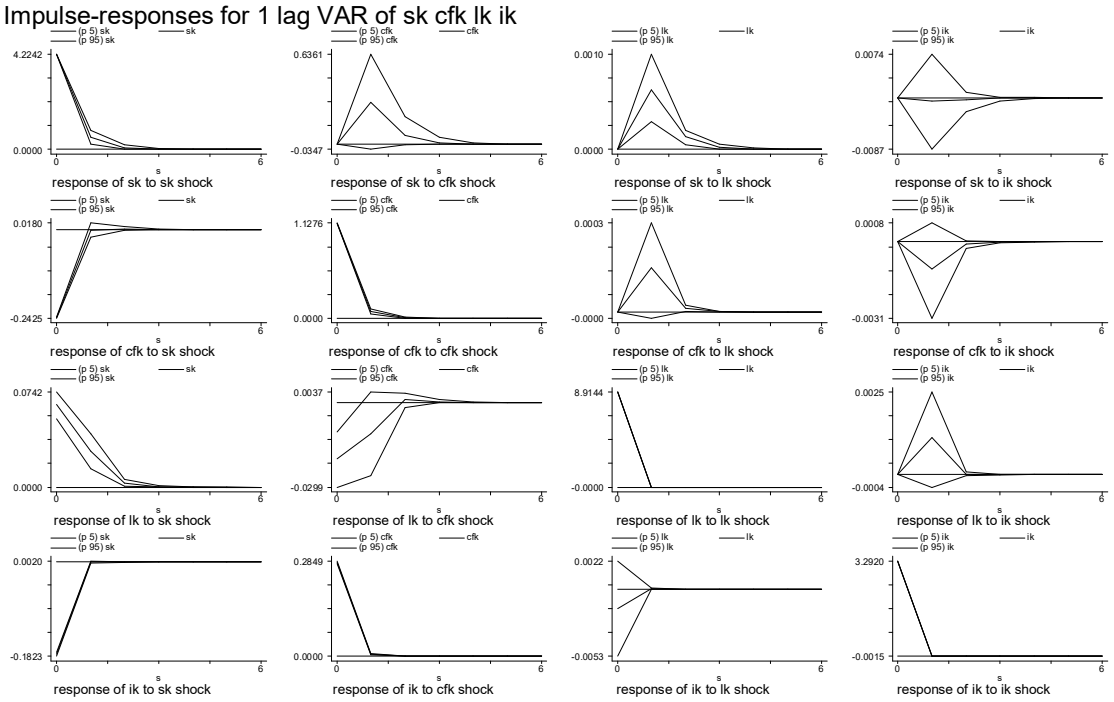
Response of	Response to							
Panel 1: Full sample								
	SK(t-1)		CFK(t-1)		LK(t-1)		IK(t-1)	
SK(t)	0.140	(2.878)***	0.262	(1.541)	0.0001	(2.907)***	-0.0002	(-0.121)
CFK(t)	0.004	(1.304)	0.072	(4.545)***	1.92E-05	(1.555)	-0.0003	(-0.959)
LK(t)	0.006	(2.935)***	-0.010	(-1.212)	0.0002	(1.688)*	0.0003	(1.253)
IK(t)	0.0003	(1.106)	0.005	(4.912)***	7.16E-06	(2.261)**	-0.0002	(-1.108)
N obs.	2,005,354							
Panel 2a: Small firms (less than 10 employees)								
	SK(t-1)		CFK(t-1)		LK(t-1)		IK(t-1)	
SK(t)	0.148	(2.625)***	0.357	(1.837)*	0.575	(6.278)***	-0.001	(-0.821)
CFK(t)	0.005	(1.404)	0.066	(4.473)***	-0.003	(-0.384)	-0.0001	(-0.547)
LK(t)	0.0004	(2.879)***	0.001	(0.750)	0.302	(49.245)***	-1.16E-05	(-0.644)
IK(t)	0.0004	(1.148)	0.006	(4.469)***	-0.004	(-1.615)	-0.0002	(-0.637)
N obs.	1,514,656							
Panel 2b: Large firms (at least 10 employees)								
	SK(t-1)		CFK(t-1)		LK(t-1)		IK(t-1)	
SK(t)	0.056	(3.160)***	-0.024	(-0.261)	3.11E-05	(4.639)***	0.004	(1.906)
CFK(t)	-0.004	(-1.207)	0.115	(1.899)	0.00002	(1.724)	-0.002	(-1.239)
LK(t)	0.023	(1.750)*	-0.014	(-0.497)	0.0001	(1.488)	0.002	(1.454)
IK(t)	0.0003	(0.762)	0.0004	(0.170)	7.54E-06	(2.417)**	-0.0001	(-1.067)
N obs.	490,698							
Panel 3a: Young firms (less than 10 years old)								
	SK(t-1)		CFK(t-1)		LK(t-1)		IK(t-1)	
SK(t)	0.161	(2.414)**	0.461	(1.924)*	3.15E-05	(1.734)*	-0.002	(-0.430)
CFK(t)	0.006	(1.540)	0.061	(3.808)***	-3.96E-06	(-1.936)*	-0.0003	(-0.620)
LK(t)	0.004	(2.091)**	-0.003	(-0.636)	0.0001	(1.441)	0.001	(0.945)
IK(t)	0.0001	(0.414)	0.004	(3.702)***	-4.53E-07	(-0.971)	3.79E-05	(0.156)
N obs.	972,580							
Panel 3b: Old firms (at least 10 years old)								
	SK(t-1)		CFK(t-1)		LK(t-1)		IK(t-1)	
SK(t)	0.110	(2.425)**	-0.200	(-2.313)**	0.0001	(1.727)*	0.004	(1.063)
CFK(t)	-0.003	(-1.168)	0.143	(3.296)***	4.53E-05	(10.295)***	-0.001	(-0.988)
LK(t)	0.019	(2.042)**	-0.062	(-4.304)***	0.0002	(0.984)	0.001	(1.204)
IK(t)	0.001	(1.133)	0.008	(4.772)***	1.54E-05	(2.123)**	-0.0003	(-1.238)
N obs.	943,234							
Panel 3c: Old small firms (at least 10 years old firms with less than 10 employees)								
	SK(t-1)		CFK(t-1)		LK(t-1)		IK(t-1)	
SK(t)	0.105	(1.726)*	-0.065	(-2.049)**	0.640	(4.628)***	-0.0004	(-0.531)
CFK(t)	-0.0003	(-0.119)	0.140	(7.919)***	0.036	(4.444)***	-0.0002	(-0.906)
LK(t)	0.003	(1.935)*	-0.015	(-4.954)***	0.329	(28.954)***	4.53E-05	(0.913)
IK(t)	0.001	(0.874)	0.012	(5.889)***	0.003	(0.794)	-0.0003	(-0.859)
N obs.	679,566							
Panel 4a: Exporters								
	SK(t-1)		CFK(t-1)		LK(t-1)		IK(t-1)	
SK(t)	0.121	(2.698)***	-0.326	(-1.952)*	-0.366	(-2.503)**	0.127	(1.120)
CFK(t)	-0.0002	(-0.102)	0.018	(2.088)**	0.067	(2.029)**	0.001	(0.285)
LK(t)	0.001	(2.753)***	-0.010	(-4.203)***	0.075	(2.654)***	-0.0004	(-0.756)
IK(t)	-0.003	(-2.236)**	0.019	(3.765)***	-0.051	(-1.901)*	0.008	(0.853)
N obs.	94,552							
Panel 4b: Non-exporters								
	SK(t-1)		CFK(t-1)		LK(t-1)		IK(t-1)	
SK(t)	0.193	(9.272)***	0.090	(3.745)***	-0.335	(-4.572)***	0.045	(3.012)***
CFK(t)	0.014	(4.370)***	0.012	(0.680)	0.062	(3.689)***	-0.013	(-1.778)*
LK(t)	-0.001	(-0.830)	0.007	(4.006)***	0.047	(5.308)***	0.004	(6.465)***
IK(t)	0.002	(2.250)**	0.010	(4.375)***	0.011	(1.268)	0.010	(2.954)***
N obs.	132,882							
Panel 5a: Foreign ownership								
	SK(t-1)		CFK(t-1)		LK(t-1)		IK(t-1)	
SK(t)	0.309	(11.243)***	-0.001	(-0.012)	0.042	(0.783)	0.001	(1.258)
CFK(t)	0.004	(2.975)***	0.111	(6.318)***	-0.007	(-0.429)	0.0002	(0.720)

LK(t)	0.007	(2.506)**	-0.017	(-2.099)**	0.107	(1.698)*	0.002	(2.257)**
IK(t)	0.002	(1.051)	-0.030	(-1.354)	0.005	(0.914)	-0.001	(-4.737)***
N obs.	58,091							
Panel 5b: Domestic ownership								
	SK(t-1)		CFK(t-1)		LK(t-1)		IK(t-1)	
SK(t)	0.231	(2.307)**	0.312	(0.832)	3.22E-05	(1.884)*	-0.033	(-1.474)
CFK(t)	4.85E-05	(0.010)	0.239	(3.604)***	1.82E-05	(1.778)*	-0.009	(-1.907)*
LK(t)	0.016	(2.719)***	-0.108	(-4.697)***	0.0001	(1.393)	0.004	(0.395)
IK(t)	-0.0003	(-1.063)	0.013	(6.811)***	7.28E-06	(2.359)**	0.001	(0.633)
N obs.	621,355							
Panel 6a: Industry								
	SK(t-1)		CFK(t-1)		LK(t-1)		IK(t-1)	
SK(t)	0.041	(3.067)	0.147	(2.989)***	0.043	(2.105)**	-0.021	(-1.223)
CFK(t)	0.007	(2.643)***	0.045	(2.459)**	-0.002	(-0.968)	-0.003	(-1.239)
LK(t)	0.003	(3.866)***	0.006	(1.961)**	0.027	(2.084)**	0.0001	(0.222)
IK(t)	0.0003	(0.686)***	0.002	(1.104)	-0.0003	(-0.548)	-0.0003	(-0.370)
N obs.	312,596							
Panel 6b: Services								
	SK(t-1)		CFK(t-1)		LK(t-1)		IK(t-1)	
SK(t)	0.160	(2.789)***	0.086	(0.572)	0.0001	(2.775)***	0.002	(1.272)
CFK(t)	0.003	(1.034)	0.096	(6.040)***	2.02E-05	(1.746)*	-0.001	(-1.042)
LK(t)	0.008	(3.111)***	-0.030	(-4.742)***	0.0001	(1.648)*	0.001	(1.405)
IK(t)	0.0002	(0.517)	0.007	(7.330)***	7.35E-06	(2.358)**	-0.0002	(-1.201)
N obs.	1,678,685							
Panel 7a: Pre-crisis years								
	SK(t-1)		CFK(t-1)		LK(t-1)		IK(t-1)	
SK(t)	0.159	(2.741)***	-0.137	(-1.653)*	0.0001	(3.191)***	0.008	(3.253)***
CFK(t)	0.001	(0.315)	0.148	(4.746)***	2.25E-05	(2.198)**	-0.003	(-2.705)***
LK(t)	0.013	(2.757)***	-0.063	(-5.679)***	0.0001	(3.506)***	0.002	(3.517)***
IK(t)	0.0004	(1.276)	0.010	(5.531)***	4.33E-06	(1.671)*	-0.0004	(-3.099)***
N obs.	1,130,745							
Panel 7b: Crisis years								
	SK(t-1)		CFK(t-1)		LK(t-1)		IK(t-1)	
SK(t)	0.036	(2.644)***	0.077	(2.057)**	0.0001	(1.763)*	0.0004	(0.880)
CFK(t)	-0.002	(-1.029)	0.014	(1.888)*	-1.15E-05	(-0.228)	1.54E-05	(0.269)
LK(t)	0.004	(1.073)	0.010	(0.929)	4.90E-05	(1.149)	-7.42E-06	(-0.249)
IK(t)	0.0003	(0.576)	0.003	(1.659)*	0.0001	(2.368)**	-0.0002	(-0.709)
N obs.	612,001							

Note: SK denotes sales-capital ratio, CFK is free cash flow over capital, LK is labour-capital ratio, IK is investment-capital ratio. A coefficient in each 4×4 table above represents the response of the corresponding contemporaneous row variable to the corresponding lagged column variable.

Source: own calculation based on AMADEUS data.

Figure 2: Impulse response functions for full sample of firms



Note: SK denotes sales-capital ratio, CFK is free cash flow over capital, LK is labour-capital ratio, IK is investment-capital ratio.
Source: own calculation based on AMADEUS data.

Table 3: Variance decompositions

	SK	CFK	LK	IK
Panel 1: Full sample				
SK	0.9950	0.0050	0.0000	0.0000
CFK	0.0436	0.9564	0.0000	0.0000
LK	0.0001	0.0000	0.9999	0.0000
IK	0.0029	0.0072	0.0000	0.9899

	SK	CFK	LK	IK		SK	CFK	LK	IK
Panel 2a: Small firms					Panel 2b: Large firms				
SK	0.9908	0.0077	0.0014	0.0000	SK	1.0000	0.0000	0.0000	0.0000
CFK	0.1041	0.8959	0.0000	0.0000	CFK	0.0053	0.9947	0.0000	0.0000
LK	0.0622	0.0073	0.9305	0.0000	LK	0.0000	0.0000	1.0000	0.0000
IK	0.0023	0.0000	0.0002	0.9975	IK	0.0041	0.1597	0.0000	0.8362

	SK	CFK	LK	IK		SK	CFK	LK	IK
Panel 3a: Young firms					Panel 3b: Old firms				
SK	0.9854	0.0146	0.0000	0.0000	SK	0.9955	0.0045	0.0000	0.0000
CFK	0.0895	0.9105	0.0000	0.0000	CFK	0.0029	0.9970	0.0000	0.0000
LK	0.0000	0.0000	0.9999	0.0000	LK	0.0001	0.0000	0.9998	0.0000
IK	0.0076	0.0308	0.0000	0.9617	IK	0.0017	0.0006	0.0000	0.9977

	SK	CFK	LK	IK
Panel 3c: Old small firms				
SK	0.9939	0.0010	0.0051	0.0000
CFK	0.0016	0.9983	0.0001	0.0000
LK	0.1456	0.0160	0.8384	0.0000
IK	0.0017	0.0005	0.0000	0.9978

	SK	CFK	LK	IK		SK	CFK	LK	IK
Panel 4a: Exporters					Panel 4b: Non-exporters				
SK	0.9721	0.0120	0.0018	0.0141	SK	0.9965	0.0023	0.0011	0.0001
CFK	0.0005	0.9991	0.0004	0.0000	CFK	0.0187	0.9811	0.0002	0.0001
LK	0.0101	0.0051	0.9848	0.0000	LK	0.1372	0.0522	0.8106	0.0001
IK	0.0247	0.0042	0.0000	0.9710	IK	0.0282	0.0103	0.0011	0.9603

	SK	CFK	LK	IK		SK	CFK	LK	IK
Panel 5a: Foreign ownership					Panel 5b: Domestic ownership				
SK	1.0000	0.0000	0.0000	0.0000	SK	0.9938	0.0062	0.0000	0.0000
CFK	0.0055	0.9944	0.0000	0.0000	CFK	0.0000	1.0000	0.0000	0.0000
LK	0.0076	0.0037	0.9885	0.0002	LK	0.0001	0.0001	0.9999	0.0000
IK	0.0006	0.0008	0.0109	0.9878	IK	0.0068	0.0164	0.0000	0.9768

	SK	CFK	LK	IK		SK	CFK	LK	IK
Panel 6a: Industry					Panel 6b: Services				
SK	0.9996	0.0002	0.0001	0.0000	SK	0.9992	0.0008	0.0000	0.0000
CFK	0.0181	0.9819	0.0000	0.0001	CFK	0.0038	0.9962	0.0000	0.0000
LK	0.0013	0.0022	0.9964	0.0000	LK	0.0001	0.0000	0.9999	0.0000
IK	0.0069	0.0237	0.0002	0.9692	IK	0.0031	0.0091	0.0000	0.9878

	SK	CFK	LK	IK		SK	CFK	LK	IK
Panel 7a: Pre-crisis years					Panel 7b: Crisis years				
SK	0.9991	0.0009	0.0000	0.0000	SK	0.9996	0.0004	0.0000	0.0000
CFK	0.0024	0.9976	0.0000	0.0000	CFK	0.3182	0.6818	0.0000	0.0000
LK	0.0001	0.0000	0.9999	0.0000	LK	0.0000	0.0000	1.0000	0.0000
IK	0.0127	0.0234	0.0000	0.9639	IK	0.0006	0.0003	0.0000	0.9991

Note: SK denotes sales-capital ratio, CFK is free cash flow over capital, LK is labour-capital ratio, IK is investment-capital ratio. Values correspond to the share of variation in the row variable (10 periods ahead) explained by column variable.
Source: own calculations based on AMADEUS data.

Table 4: Country level determinants of employment and investment responses to cyclical shocks

VARIABLES	$SK_{t-1} \rightarrow LK_t$		$CFK_{t-1} \rightarrow IK_t$	
	level	diff	level	diff
GDP p.c.	-2.200***	-2.508***	-3.792***	-3.741***
	(0.333)	(0.296)	(0.627)	(0.868)
GDP	-0.434***	-0.429***	-0.325***	-0.320**
	(0.0608)	(0.0535)	(0.114)	(0.157)
Market capital.	3.420***	3.321***	4.829***	4.712***
	(0.674)	(0.600)	(1.268)	(1.762)
inFDI stock	-2.629***	-2.541***	-1.988**	-1.964*
	(0.451)	(0.401)	(0.849)	(1.178)
outFDI stock	-1.472***	-1.474***	-2.235***	-2.153***
	(0.208)	(0.182)	(0.390)	(0.535)
Curr. account	-0.723**	-0.226	0.0154	0.0463
	(0.336)	(0.299)	(0.632)	(0.877)
Export of goods	3.823***	3.690***	4.793***	4.694***
	(0.690)	(0.613)	(1.298)	(1.800)
Constant	-1.27e-08	0.265***	-1.59e-08	-0.0266
	(0.0201)	(0.0274)	(0.0379)	(0.0804)
Observations	508	254	508	254
R-squared	0.797	0.950	0.282	0.287
F(7, 500) / F(7, 246)	280.5	674.7	28.00	14.14
Prob > F	0.0000	0.0000	0.0000	0.0000

Note: SK denotes sales-capital ratio, CFK is free cash flow over capital, LK is labour-capital ratio, IK is investment-capital ratio. Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1
Source: own calculations based on AMADEUS data.

Table 5: Institutional determinants of employment and investment responses to cyclical shocks

VARIABLES	$SK_{t-1} \rightarrow LK_t$		$CFK_{t-1} \rightarrow IK_t$	
	level	**diff**	**level**	**diff**
Legal inst.	0.923***	1.361***	-0.0682	-0.0208
	(0.0766)	(0.0810)	(0.142)	(0.178)
Political inst.	-1.531***	-1.740***	-0.288**	-0.250*
	(0.0660)	(0.0655)	(0.122)	(0.144)
Economic inst.	-0.199***	-0.515***	0.0787	0.0294
	(0.0387)	(0.0414)	(0.0716)	(0.0911)
Constant	1.63e-09	0.331***	-7.31e-10	-0.0811
	(0.0230)	(0.0401)	(0.0425)	(0.0882)
Observations	508	254	508	254
R-squared	0.734	0.889	0.089	0.104
F(7, 500) / F(7, 246)	462.8	669.8	16.48	9.687
Prob > F	0.0000	0.0000	0.0000	0.0000

Note: SK denotes sales-capital ratio, CFK is free cash flow over capital, LK is labour-capital ratio, IK is investment-capital ratio. Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1
Source: own calculations based on AMADEUS data.