

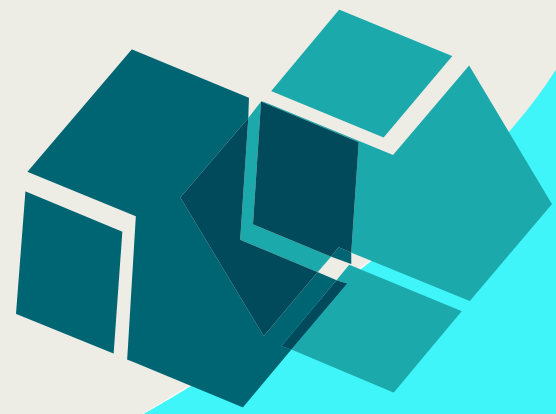


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Determinants of Firm Performance and Growth during Economic Recession: The Case of Central and Eastern European Countries

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Determinants of Firm Performance and Growth during Economic Recession: The Case of Central and Eastern European Countries

Abstract

The paper analyses the determinants of the resistance to economic recession of firms from Central and Eastern European countries (CEECs) and is put in the context of the literature on firm's growth. By the panel VAR system and using large firm level database we estimate the responses of firms' employment and investment to cyclical and financial shocks, and distinguishing firms by size, age, export propensity, foreign versus domestic ownership, pre-crisis growth. We also control for sectoral and country differences. The results show a positive response of firms' employment to a shock in demand, i.e. a drop in demand decreases employment in the next periods. Old firms and especially small old firms reacted more swiftly to cyclical shocks and reduce employment when demand decreases. Number of employees adjusts less severely in exporters and in 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.

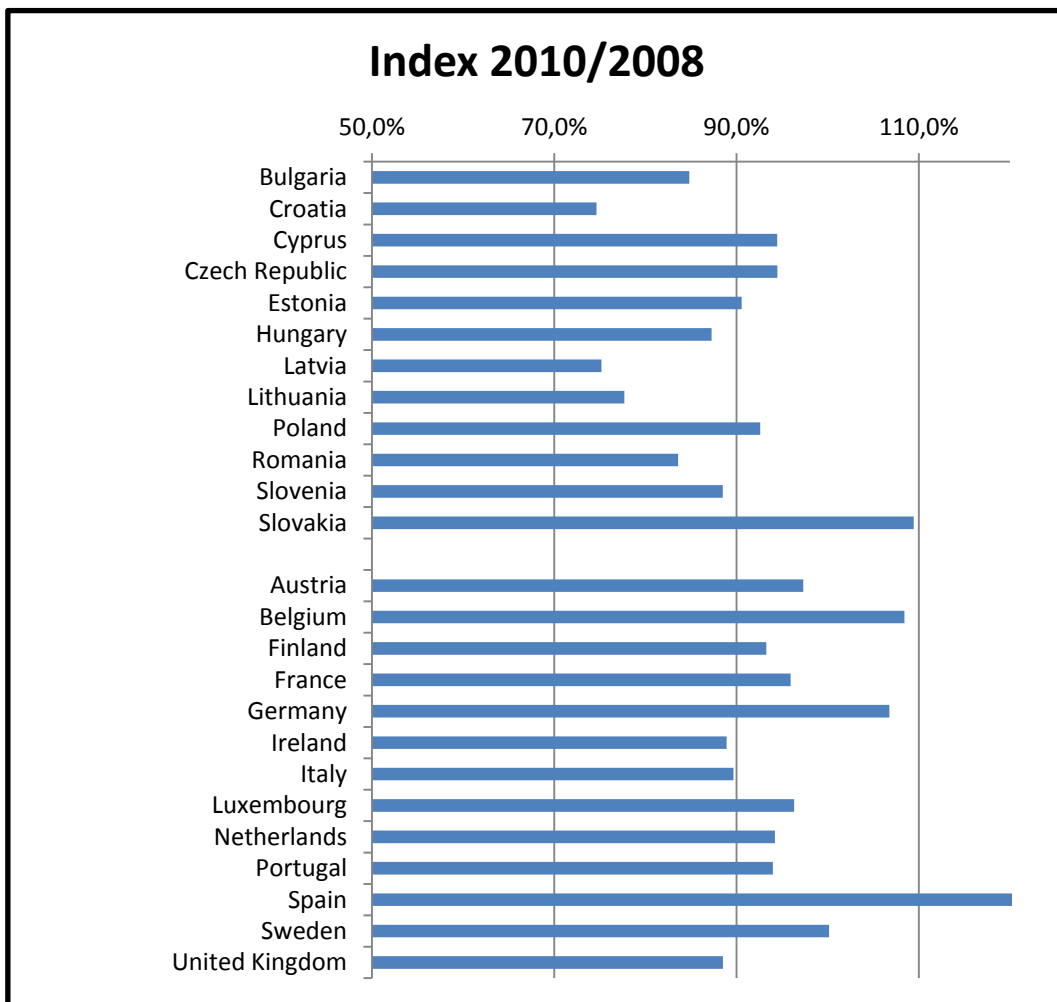
In general, investment does not respond to demand shocks, but in the majority of specifications firms of various characteristics respond negatively to the reduction of cash flow. It is large young firms that are the most and the small young firms the least responsive to financial shocks. In contrast to employment adjustments, exporters adjust their investment activity to cash flow to a larger extent than non-exporters. 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 procyclical in terms of investment than industry.

Differences in country specific settings also 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. Inward as well as outward FDI both lower the cyclical responsiveness of employment and investment. 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.

1. Introduction

Figure 1 presenting the production value of the total business economies of EU countries in 2008-2010 clearly shows that current financial and economic crisis has hit the new EU member states from Central and Eastern Europe (CEECs) more than most old EU member states. With the ongoing economic recession in some and only slow recovery of corporate activity in other CEECs the question arises what kind of firms show better resistance to economic recession. More precisely, what are those firm characteristics that make some firms more resistance to crisis than the 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.

Figure 1. Production value* 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/show.do>

* Production value measures the amount actually produced by the unit, based on sales, including changes in stocks and the resale of goods and services. The production value is defined as turnover, plus or minus the changes in stocks of finished products, work in progress and goods and services purchased for resale, minus the purchases of goods and services for resale, plus capitalised production, plus other operating income (excluding subsidies). Income and expenditure classified as financial or extra-ordinary in company accounts is excluded from production value (see Eurostat; http://epp.eurostat.ec.europa.eu/cache/ITY_SDDS/EN/sbs_esms.htm#stat_pres)

The paper is put in the context of the literature on firm's growth, i.e. we look at the existing empirical research on the determinants of firm growth and identify (see Coad, 2009, for an overview) the following factors which may impact firm's resistance to crisis and which we test in our model: (i) firm's size, (ii) firm's age, (iii) firm's export propensity, (iv) type of firm where we distinguish between foreign-owned and locally-owned firms, (v) firm's financial sources, i.e. the impact of financial constraints, (vi) firm's productivity, (vii) and the dynamics of firm's growth in the pre-crisis period. Apart from firm specific determinants, the literature puts forward two other sets of factors which impact firm's resistance to crisis. The first is sectoral differences in behaviour during economic recession where we distinguish between industry 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 indicators of legal, political and economic institutions are used to look at the 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 on the country of residence basis and compare the responses of key variables between distinct country groups. The micro data on firms from nine 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 of Kunčič (2014).

We find a positive response of firms' employment to a shock in demand, i.e. a drop in demand decreases employment in the next periods. Old firms and especially small old firms reacted more swiftly to cyclical shocks and reduce employment when demand decreases. Number of employees adjusts less severely in exporters and in 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 generally does not respond to demand shocks, but in the majority of specifications firms of various characteristics respond negatively to the reduction of cash flow. It is large young firms that are the most and the small young firms the least responsive to financial shocks. In contrast to employment adjustments, exporters adjust their investment activity to cash flow to a larger extent than non-exporters. 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 procyclical in terms of investment than industry. Differences in country specific settings also 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. Inward as well as outward FDI both lower the cyclical responsiveness of employment and

investment. 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.

The contributions of the paper are: (i) to the best of our knowledge this is the first attempt to analyse a complex set of determinants of firm's resistance to crisis, not only for CEECs but in general; (ii) firm level data are combined 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

We look at the determinants of CEECs firms' resistance to crisis in the context of the literature on the determinants of firm's growth¹ and its application to specificities of economic recession. Overview of existing empirical studies 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, i.e. the impact of financial constraints, firm's productivity, the dynamics of firm's growth in the pre-crisis period,² 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. Most analyses demonstrate negative relationship between firm's size and growth (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). Smaller firms grow faster if nothing else 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 more 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's age and growth (Fizaine, 1968; Dunne et al., 1989; Evans, 1987; Geroski and Gugler, 2004, Glancey, 1998 etc.) 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

¹ See Coad (2009) for an overview of growth theories of the firm and for a comprehensive review of empirical studies dealing with determinants of firm's growth.

² 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).

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.

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 and Ries, 2003; Burger et al., 2006), therefore, one expects that they will be, in principle, more successful in handling the recession problems. However, other aspects are also of importance here; i.e. 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 time factor is also important. At the beginning of the present recession, world trade decreased much more than GDP (see, for instance, Eaton et al., 2011), meaning 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 crisis.

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., 2008). 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 Coughlan, 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 on 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; i.e. financial limitations which are typical for periods of crises is one of the main factors that restrains 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 the 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).³

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. No doubt, 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.

³ Yet 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.

To conclude, 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 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 and internationalised locally-owned firms have better capabilities to cope with the recession than locally owned firms.
- 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.
- Firms with higher productivity will be more resistant to economic recession but in economic recession they will be on average more tempted to increase productivity by reduction of employment.
- Firms with unusually high growth rates in the pre-recession period may be less resistant to economic recession.
- Industrial sector in which a firm operates importantly co-determines its reaction and behaviour in 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 and 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 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 sales-to-capital ratio (proxy for capital productivity and external demand shocks) and 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. The fact that cash flow is likely to be correlated with future investment profitability makes it difficult to distinguish the response of investment and employment to the fundamental factors such as marginal profitability of capital and labour, and financial factors, such as net worth (see Gilchrist and Himmelberg, 1995, 1998 for further discussion). Panel VAR approach overcomes this problem by isolating the response of investment and employment to financial and fundamental factors (Love and Zicchino, 2006).

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:

$$y_{it} = \Gamma_0 + \Gamma_1 y_{it-1} + f_i + d_{ct} + \varepsilon_{it} \quad i = 1 \dots N \quad t = 1 \dots T \quad (1)$$

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 errors. 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 {SKB, CFKB, LKB, IKB} where SKB denotes sales to capital ratio, our proxy for capital productivity and external demand shocks, CFKB is cash flow per unit of capital employed, LKB is employment scaled by capital, and IKB is investment in fixed assets per capital stock.

In our model sales to capital ratio (SKB) 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 analysis that comes through recessionary fall in demand should lead to employment redundancies and investment standstill.

CFKB 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.⁴ Free cash flows as well as EBIT are widely used measures of financial performance yet both have their own 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 cash flow variable, for which we use EBIT, also 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

⁴ 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 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.

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. CFKB 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 (SKB), whereas the subsequent effect of the financial variables (CFKB) 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, i.e. 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 SKB) 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 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 (the so-called "time-to-build" effect). Setting the CFKB after SKB, 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, IKB 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. SKB 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 again 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 nine CEECs. We proceed in two directions. First, we inquire 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. 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 coefficient 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 nine 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 countries: 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 was unfeasible whereas for Bosnia and Herzegovina too few firms is available in the Amadeus database compared to the population number. For the sample of selected companies we extracted 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 tried to align 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 include several country-level variables to account for country-level variation in cyclical shocks and institutional environment in which firms operate. From the 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 % of GDP), domestic credit to private sector (in % of GDP), inward and outward FDI stock (in % of GDP), net current account position (in % of GDP), and export of goods (in % of GDP). Using UN COMTRADE data, we calculated for each country in our sample a weighted average of major ten export partners' growth rates, giving us the measure of the external demand conditions. Making use of 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.

Table 1. Summary statistics for main variables

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

Source: own calculation based on AMADEUS data.

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 precrisis 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

We estimate the 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 {SKB, CFKB, LKB, IKB}. The results of our particular interest are the responses of employment and investment to cyclical and financial shocks, proxied by SKB and CFKB, respectively. The response of employment-to-capital ratio and of investment in fixed assets relative to total assets on innovations in sales and cash flow per capital stock are presented in Table 2 and Figure 2, while Figures in the Appendix show the difference in impulse response functions between different subsets of firms.

Employment shows an expected positive response to a shock in the sales-to-capital ratio (marginal profitability), which is corroborated in the estimated coefficients and in the impulse responses. In line with the hypothesis, negative shock to demand, for example, conveys itself as a drop in SKB, which decreases employment in the next periods. Next, we compare the estimates in different subsamples 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 size plays a larger role in firm responses to cyclical shocks since the difference in coefficients between old small and young (and also mostly small) firms is minor compared to the difference between large and small firms reactions to a SKB shock. The difference in impulse responses is significant and of the similar magnitude as the difference in impulse responses between old and young firms, whereas there is no significant difference in impulse responses between small and large firms. 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 operate in a 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 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 SKB whereas during recession, firms responded less intensely in the other direction. Various labour market rigidities (i.e. minimum wages, unemployment insurance, severance pay, advance notice, labour taxes) and proactive government anticrisis 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.

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								
	SKB(t-1)		CFKB(t-1)		LKB(t-1)		IKB(t-1)	
SKB(t)	0.140	(2.878)***	0.262	(1.541)	0.0001	(2.907)***	-0.0002	(-0.121)
CFKB(t)	0.004	(1.304)	0.072	(4.545)***	1.92E-05	(1.555)	-0.0003	(-0.959)
LKB(t)	0.006	(2.935)***	-0.010	(-1.212)	0.0002	(1.688)*	0.0003	(1.253)
IKB(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)								
	SKB(t-1)		CFKB(t-1)		LKB(t-1)		IKB(t-1)	
SKB(t)	0.148	(2.625)***	0.357	(1.837)*	0.575	(6.278)***	-0.001	(-0.821)
CFKB(t)	0.005	(1.404)	0.066	(4.473)***	-0.003	(-0.384)	-0.0001	(-0.547)
LKB(t)	0.0004	(2.879)***	0.001	(0.750)	0.302	(49.245)***	-1.16E-05	(-0.644)
IKB(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)								
	SKB(t-1)		CFKB(t-1)		LKB(t-1)		IKB(t-1)	
SKB(t)	0.056	(3.160)***	-0.024	(-0.261)	3.11E-05	(4.639)***	0.004	(1.906)

CFKB(t)	-0.004	(-1.207)	0.115	(1.899)	0.00002	(1.724)	-0.002	(-1.239)
LKB(t)	0.023	(1.750)*	-0.014	(-0.497)	0.0001	(1.488)	0.002	(1.454)
IKB(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)

	SKB(t-1)	CFKB(t-1)	LKB(t-1)	IKB(t-1)
SKB(t)	0.161	(2.414)**	0.461	(1.924)*
CFKB(t)	0.006	(1.540)	0.061	(3.808)***
LKB(t)	0.004	(2.091)**	-0.003	(-0.636)
IKB(t)	0.0001	(0.414)	0.004	(3.702)***
N obs.	972,580			

Panel 3b: Old firms (at least 10 years old)

	SKB(t-1)	CFKB(t-1)	LKB(t-1)	IKB(t-1)
SKB(t)	0.110	(2.425)**	-0.200	(-2.313)**
CFKB(t)	-0.003	(-1.168)	0.143	(3.296)***
LKB(t)	0.019	(2.042)**	-0.062	(-4.304)***
IKB(t)	0.001	(1.133)	0.008	(4.772)***
N obs.	943,234			

Panel 3c: Old small firms (at least 10 years old firms with less than 10 employees)

	SKB(t-1)	CFKB(t-1)	LKB(t-1)	IKB(t-1)
SKB(t)	0.105	(1.726)*	-0.065	(-2.049)**
CFKB(t)	-0.0003	(-0.119)	0.140	(7.919)***
LKB(t)	0.003	(1.935)*	-0.015	(-4.954)***
IKB(t)	0.001	(0.874)	0.012	(5.889)***
N obs.	679,566			

Panel 4a: Exporters

	SKB(t-1)	CFKB(t-1)	LKB(t-1)	IKB(t-1)
SKB(t)	0.121	(2.698)***	-0.326	(-1.952)*
CFKB(t)	-0.0002	(-0.102)	0.018	(2.088)**
LKB(t)	0.001	(2.753)***	-0.010	(-4.203)***
IKB(t)	-0.003	(-2.236)**	0.019	(3.765)***
N obs.	94,552			

Panel 4b: Non-exporters

	SKB(t-1)	CFKB(t-1)	LKB(t-1)	IKB(t-1)
SKB(t)	0.193	(9.272)***	0.090	(3.745)***
CFKB(t)	0.014	(4.370)***	0.012	(0.680)
LKB(t)	-0.001	(-0.830)	0.007	(4.006)***
IKB(t)	0.002	(2.250)**	0.010	(4.375)***
N obs.	132,882			

Panel 5a: Foreign ownership

	SKB(t-1)	CFKB(t-1)	LKB(t-1)	IKB(t-1)
SKB(t)	0.309	(11.243)***	-0.001	(-0.012)
CFKB(t)	0.004	(2.975)***	0.111	(6.318)***
LKB(t)	0.007	(2.506)**	-0.017	(-2.099)**
IKB(t)	0.002	(1.051)	-0.030	(-1.354)
N obs.	58,091			

Panel 5b: Domestic ownership

	SKB(t-1)	CFKB(t-1)	LKB(t-1)	IKB(t-1)
SKB(t)	0.231	(2.307)**	0.312	(0.832)
CFKB(t)	4.85E-05	(0.010)	0.239	(3.604)***
LKB(t)	0.016	(2.719)***	-0.108	(-4.697)***
IKB(t)	-0.0003	(-1.063)	0.013	(6.811)***
N obs.	621,355			

Panel 6a: Industry

	SKB(t-1)	CFKB(t-1)	LKB(t-1)	IKB(t-1)
SKB(t)	0.041	(3.067)	0.147	(2.989)***
CFKB(t)	0.007	(2.643)***	0.045	(2.459)**
LKB(t)	0.003	(3.866)***	0.006	(1.961)**
IKB(t)	0.0003	(0.686)***	0.002	(1.104)
N obs.	312,596			

Panel 6b: Services

	SKB(t-1)	CFKB(t-1)	LKB(t-1)	IKB(t-1)
SKB(t)	0.160	(2.789)***	0.086	(0.572)
N obs.	312,596			

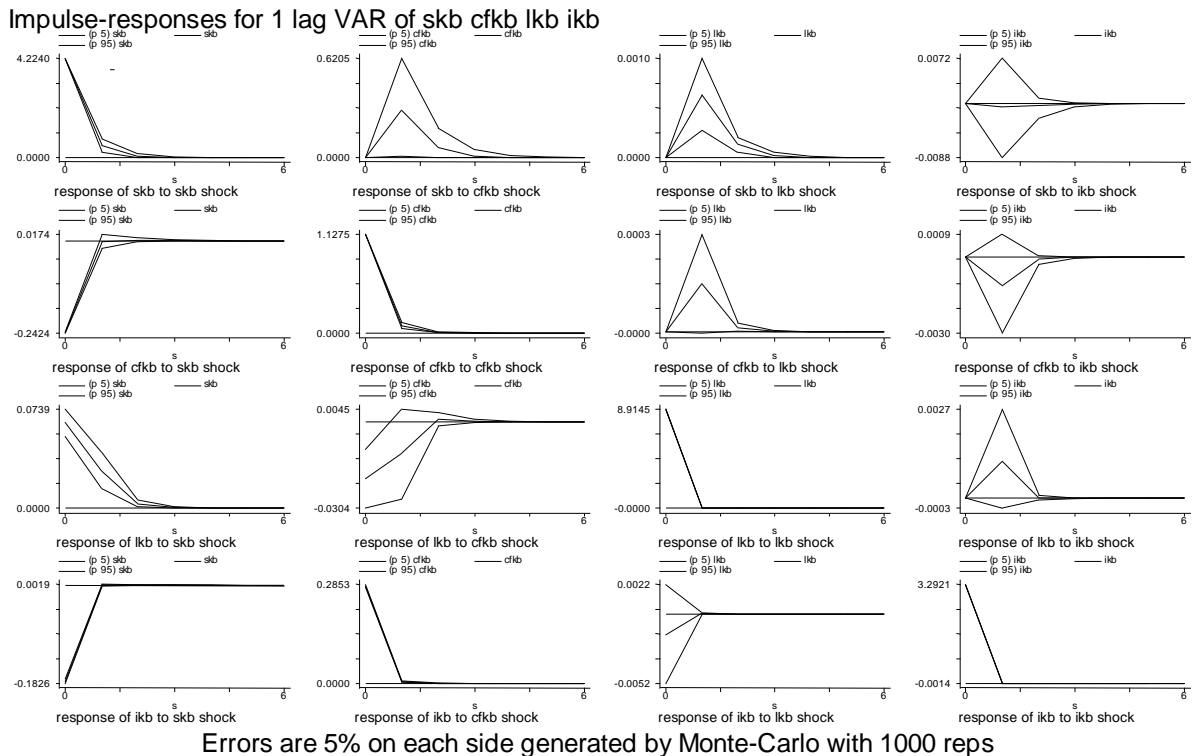
CFKB(t)	0.003	(1.034)	0.096	(6.040)***	2.02E-05	(1.746)*	-0.001	(-1.042)
LKB(t)	0.008	(3.111)***	-0.030	(-4.742)***	0.0001	(1.648)*	0.001	(1.405)
IKB(t)	0.0002	(0.517)	0.007	(7.330)***	7.35E-06	(2.358)**	-0.0002	(-1.201)
N obs.	1,678,685							
Panel 7a: Pre-crisis years								
	SKB(t-1)		CFKB(t-1)		LKB(t-1)		IKB(t-1)	
SKB(t)	0.159	(2.741)***	-0.137	(-1.653)*	0.0001	(3.191)***	0.008	(3.253)***
CFKB(t)	0.001	(0.315)	0.148	(4.746)***	2.25E-05	(2.198)**	-0.003	(-2.705)***
LKB(t)	0.013	(2.757)***	-0.063	(-5.679)***	0.0001	(3.506)***	0.002	(3.517)***
IKB(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								
	SKB(t-1)		CFKB(t-1)		LKB(t-1)		IKB(t-1)	
SKB(t)	0.036	(2.644)***	0.077	(2.057)**	0.0001	(1.763)*	0.0004	(0.880)
CFKB(t)	-0.002	(-1.029)	0.014	(1.888)*	-1.15E-05	(-0.228)	1.54E-05	(0.269)
LKB(t)	0.004	(1.073)	0.010	(0.929)	4.90E-05	(1.149)	-7.42E-06	(-0.249)
IKB(t)	0.0003	(0.576)	0.003	(1.659)*	0.0001	(2.368)**	-0.0002	(-0.709)
N obs.	612,001							

Source: own calculation based on AMADEUS data.

Our second major point of interest is the response of firm investment to economic fluctuations. In general, investment does not respond to shocks to sales, except in few isolated cases (exporters, non-exporters, and industry). Like in Love and Zicchino (2006), investment 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 exhibit no significant response to CFKB shocks, small firms are much more affected by shocks in financial factors. Impulse response analysis suggests a different conclusion as the CFKB 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 CFKB 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 CFKB on temporary 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 young 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. Exporters adjust their investment activity to a larger extent than non-exporters since the coefficient as well as the impulse responses exhibit larger values and the difference between the groups is significant. This 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 from panel VAR analysis reveal that only domestic firms respond significantly to past innovations in CFKB whereas impulse response functions show that 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 procyclical 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.

Figure 2. Impulse response functions for full sample of firms



Source: own calculation based on AMADEUS data.

Next, 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, SKB and CFKB 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, SKB explains about 6.2% of total variation in employment in small firms (negligible share in large firms), whereas CFKB explains almost 16% 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 SKB explains as much as 14.6% of the variation in this production factor. The shocks in CFKB in young firms account for considerably larger part of the variation in investment than in the older counterparts (3.1% vs. 0.06%). Exporters again exhibit greater employment resilience since only 1% of the total variation in employment can be explained with the shocks in sales per capital, while the share in non-exporters stays much higher at 13.7%. The same pattern can be observed with regards to investment where more than twice as much variation in investment is explained by CFKB in non-exporters than in exporters. In firms with home ownership, investment is to a larger extent driven by shocks in CFKB (1.6% vs. 0.08% in foreign owned) but on the other hand, SKB 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%) and financial factors (2.4%) than services. Lastly, pre-crisis years exhibit stronger influence of cash flow to capital on investment compared to the crisis years.

Table 3. Variance decompositions

	SKB	CFKB	LKB	IKB		SKB	CFKB	LKB	IKB
Panel 1: Full sample									
SKB	0.9950	0.0050	0.0000	0.0000					
CFKB	0.0436	0.9564	0.0000	0.0000					
LKB	0.0001	0.0000	0.9999	0.0000					
IKB	0.0029	0.0072	0.0000	0.9899					
Panel 2a: Small firms					Panel 2b: Large firms				
SKB	0.9908	0.0077	0.0014	0.0000	SKB	1.0000	0.0000	0.0000	0.0000
CFKB	0.1041	0.8959	0.0000	0.0000	CFKB	0.0053	0.9947	0.0000	0.0000
LKB	0.0622	0.0073	0.9305	0.0000	LKB	0.0000	0.0000	1.0000	0.0000
IKB	0.0023	0.0000	0.0002	0.9975	IKB	0.0041	0.1597	0.0000	0.8362
Panel 3a: Young firms					Panel 3b: Old firms				
SKB	0.9854	0.0146	0.0000	0.0000	SKB	0.9955	0.0045	0.0000	0.0000
CFKB	0.0895	0.9105	0.0000	0.0000	CFKB	0.0029	0.9970	0.0000	0.0000
LKB	0.0000	0.0000	0.9999	0.0000	LKB	0.0001	0.0000	0.9998	0.0000
IKB	0.0076	0.0308	0.0000	0.9617	IKB	0.0017	0.0006	0.0000	0.9977
Panel 3c: Old small firms									
SKB	0.9939	0.0010	0.0051	0.0000					
CFKB	0.0016	0.9983	0.0001	0.0000					
LKB	0.1456	0.0160	0.8384	0.0000					
IKB	0.0017	0.0005	0.0000	0.9978					
Panel 4a: Exporters					Panel 4b: Non-exporters				
SKB	0.9721	0.0120	0.0018	0.0141	SKB	0.9965	0.0023	0.0011	0.0001
CFKB	0.0005	0.9991	0.0004	0.0000	CFKB	0.0187	0.9811	0.0002	0.0001
LKB	0.0101	0.0051	0.9848	0.0000	LKB	0.1372	0.0522	0.8106	0.0001
IKB	0.0247	0.0042	0.0000	0.9710	IKB	0.0282	0.0103	0.0011	0.9603
Panel 5a: Foreign ownership					Panel 5b: Domestic ownership				
SKB	1.0000	0.0000	0.0000	0.0000	SKB	0.9938	0.0062	0.0000	0.0000
CFKB	0.0055	0.9944	0.0000	0.0000	CFKB	0.0000	1.0000	0.0000	0.0000
LKB	0.0076	0.0037	0.9885	0.0002	LKB	0.0001	0.0001	0.9999	0.0000
IKB	0.0006	0.0008	0.0109	0.9878	IKB	0.0068	0.0164	0.0000	0.9768
Panel 6a: Industry					Panel 6b: Services				
SKB	0.9996	0.0002	0.0001	0.0000	SKB	0.9992	0.0008	0.0000	0.0000
CFKB	0.0181	0.9819	0.0000	0.0001	CFKB	0.0038	0.9962	0.0000	0.0000
LKB	0.0013	0.0022	0.9964	0.0000	LKB	0.0001	0.0000	0.9999	0.0000
IKB	0.0069	0.0237	0.0002	0.9692	IKB	0.0031	0.0091	0.0000	0.9878
Panel 7a: Pre-crisis years					Panel 7b: Crisis years				
SKB	0.9991	0.0009	0.0000	0.0000	SKB	0.9996	0.0004	0.0000	0.0000
CFKB	0.0024	0.9976	0.0000	0.0000	CFKB	0.3182	0.6818	0.0000	0.0000
LKB	0.0001	0.0000	0.9999	0.0000	LKB	0.0000	0.0000	1.0000	0.0000
IKB	0.0127	0.0234	0.0000	0.9639	IKB	0.0006	0.0003	0.0000	0.9991

Note: 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.

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. We do this by running panel VAR on all possible subsets of nine 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 the coefficients for each distinct group separately, we also create the difference between the value of coefficient in each country group and the 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.

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

VARIABLES	SKB _{t-1} →LKB _t		CFKB _{t-1} →IKB _t	
	level	diff	level	diff
GDP p.c.	-2.200*** (0.333)	-2.508*** (0.296)	-3.792*** (0.627)	-3.741*** (0.868)
GDP	-0.434*** (0.0608)	-0.429*** (0.0535)	-0.325*** (0.114)	-0.320** (0.157)
Market capital.	3.420*** (0.674)	3.321*** (0.600)	4.829*** (1.268)	4.712*** (1.762)
inFDI stock	-2.629*** (0.451)	-2.541*** (0.401)	-1.988** (0.849)	-1.964* (1.178)
outFDI stock	-1.472*** (0.208)	-1.474*** (0.182)	-2.235*** (0.390)	-2.153*** (0.535)
Curr. account	-0.723** (0.336)	-0.226 (0.299)	0.0154 (0.632)	0.0463 (0.877)
Export of goods	3.823*** (0.690)	3.690*** (0.613)	4.793*** (1.298)	4.694*** (1.800)
Constant	-1.27e-08 (0.0201)	0.265*** (0.0274)	-1.59e-08 (0.0379)	-0.0266 (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: Standard errors are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Source: own calculations based on AMADEUS data.

The results of the regression are shown in Table 4 and Table 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 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 obviously the part of total exports that cannot be explained by global value chain phenomenon and represents 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.

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

VARIABLES	SKB _{t-1} →LKB _t		CFKB _{t-1} →IKB _t	
	level	diff	level	diff
Legal inst.	0.923*** (0.0766)	1.361*** (0.0810)	-0.0682 (0.142)	-0.0208 (0.178)
Political inst.	-1.531*** (0.0660)	-1.740*** (0.0655)	-0.288** (0.122)	-0.250* (0.144)
Economic inst.	-0.199*** (0.0387)	-0.515*** (0.0414)	0.0787 (0.0716)	0.0294 (0.0911)
Constant	1.63e-09 (0.0230)	0.331*** (0.0401)	-7.31e-10 (0.0425)	-0.0811 (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: Standard errors are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Source: own calculations based on AMADEUS data.

Using Institutional quality dataset provided by 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 obviously 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 from Central and Eastern Europe (CEECs) harder than most old EU member states. The paper analyses what kind of firms show better resistance to economic recession, i.e. what are those firm characteristics that make some firms more resistance to crisis than the others. The analysis is performed in the context of the literature on firm growth. 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, (ii) firm age, (iii) export propensity, (iv) type of firm where we distinguish between foreign-owned and locally-owned firms, (v) firm's financial sources, i.e. the impact of financial constraints, (vi) firm's productivity, (vii) and the dynamics of firm's growth in the pre-crisis period. Apart from firm specific determinants, the literature puts forward two other sets factors which impact firm's resistance to crisis, i.e. sectoral differences and different country specific settings. By the panel VAR system we estimate the responses of firms' employment and investment to cyclical and financial shocks. The AMADEUS firm level data for 2000-2012 for all firms with at least one employee and positive total revenues are used resulting in an

unbalanced panel of 6.185 million firm-year observations and an excess of 1.7 million firms, and combined with country-level variables.

The panel VAR system results show expected positive response of firms' employment to a shock in demand, i.e. a drop in demand decreases employment in the next periods. Old firms and especially small old firms reacted more swiftly to cyclical shocks and reduce employment when demand decreases. Size plays a larger role in firms' employment responses to cyclical shocks than age. Exporter adjustment of the number of employees is less pronounced than in non-exporters, in foreign-owned than domestic firms and in manufacturing industry compared with service firms. Exporters seem to switch to other markets where recession is less deep more easily, having already covered sunk costs of establishing export links, while foreign subsidiaries operate in a global value chains where cyclical shocks can be absorbed more readily than in domestic firms. Stronger cyclical responses of service firms' employment may be to a great extent due to construction. 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 anticrisis measures obviously diminish the negative outcome of economic downturn in labour market.

In response of firms' investment to economic fluctuations some interesting differences appear as compared to reaction in employment. In general, investment does not respond to demand shocks. However, in the majority of specifications firms of various characteristics respond positively to increases in cash flow and likewise, negatively when funds run dry. As far as the size and age of firms is concerned, it is large young firms that are the most and the small young firms the least responsive to financial shocks, i.e. to credit market conditions. In contrast to employment adjustments, exporters adjust their investment activity to cash flow to a larger extent than non-exporters. Obviously exporters can exploit more investment opportunities than non-exporters. Foreign ownership status is also important. Only domestic firms respond significantly to past innovations in cash flows whereas impulse response functions show that 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 procyclical 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. In general, demand shocks (sales to capital ratio) and cash flow changes explain very little variation in employment and investment activity of firms, however, considerable differences exists among subsamples of firms. Changes in sales to capital ratio explains about 6.2% of total variation in employment in small firms (negligible share in large firms), whereas cash flow changes explains almost 16% 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 demand shocks explain as much as 14.6% of the variation in this production factor. The cash flow shocks in young firms account for considerably larger part of the variation in investment than in the older counterparts (3.1% vs. 0.06%). Exporters again exhibit greater employment resilience to demand shocks (only 1%) than non-exporters (13.7%). The pattern is the same with regards to investment reaction to cash flow changes. In domestic as compared to foreign-owned firms, investment is to a larger extent driven by shocks in cash flow, but not so in case

of employment responsiveness to sales to capital ratio changes, where foreign-owned firms respond more.

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. By panel VAR we investigate which country-level characteristics are correlated with the sensitivity of firm employment and investment to fundamental (demand) and financial factors. 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, exports exhibit positive correlation with the responsiveness of employment and investment, but these exports only relate to arms-length trade (controlling for inward and outward FDI explains a lot of variation in the importance of trade flows), which tend to be more erratic, possibly driving the positive association with the sensitivity of employment and investment activity. 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. 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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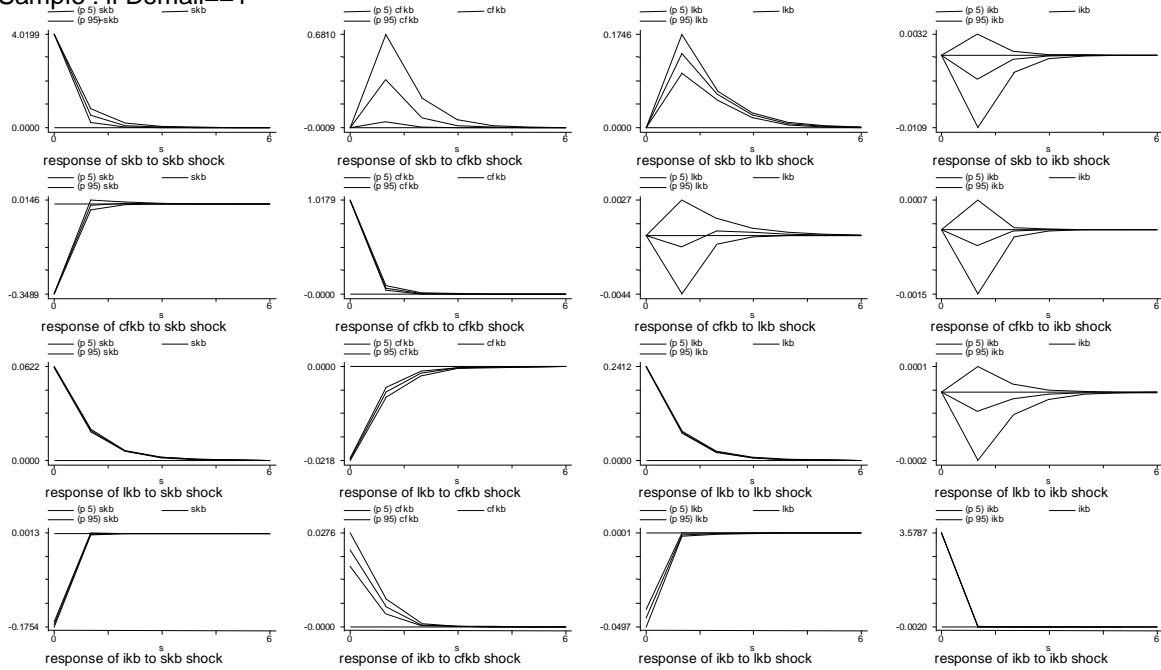
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Appendix

Figure 3. Impulse response functions for small firms.

Impulse-responses for 1 lag VAR of skb cfkb lkb ikb
 Sample : if Dsmall==1

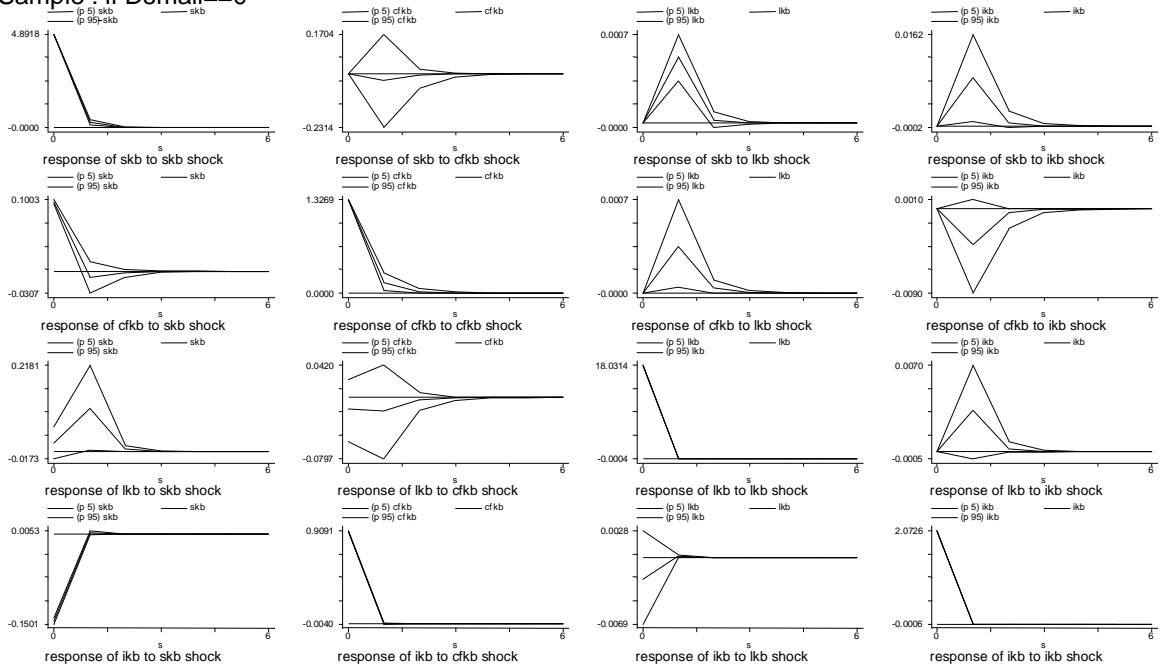


Errors are 5% on each side generated by Monte-Carlo with 1000 reps

Source: own calculations based on AMADEUS data.

Figure 4. Impulse response functions for large firms.

Impulse-responses for 1 lag VAR of skb cfkb lkb ikb
 Sample : if Dsmall==0

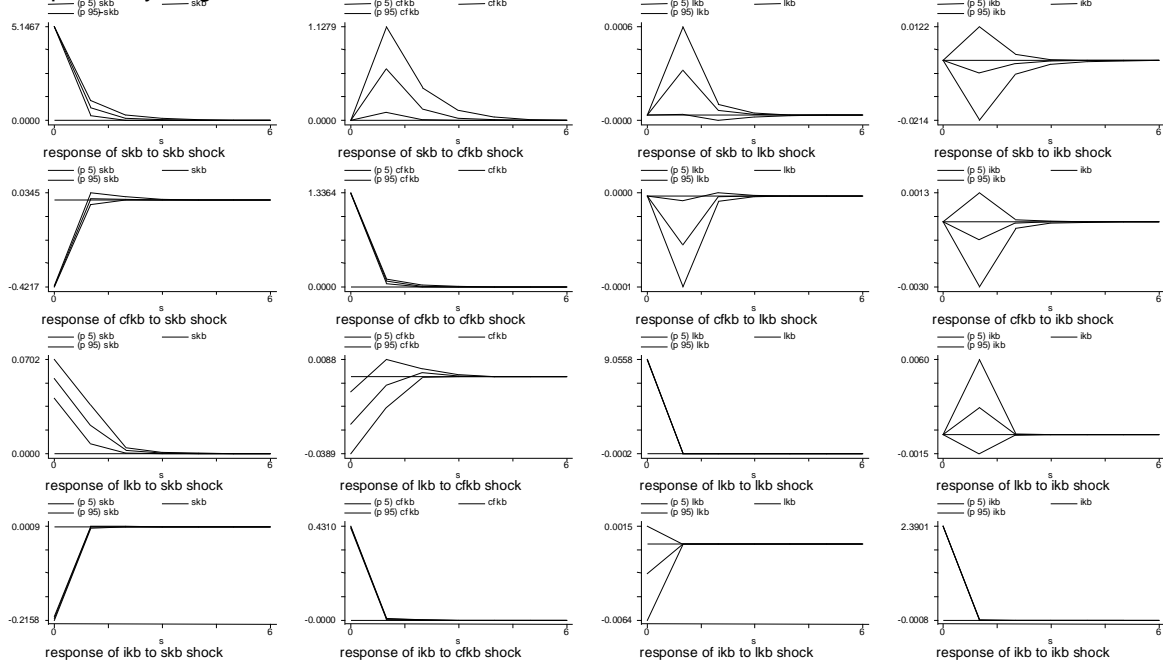


Errors are 5% on each side generated by Monte-Carlo with 1000 reps

Source: own calculations based on AMADEUS data.

Figure 5. Impulse response functions for young firms

Impulse-responses for 1 lag VAR of skb cfkb lkb ikb
 Sample : if Dyoung==1

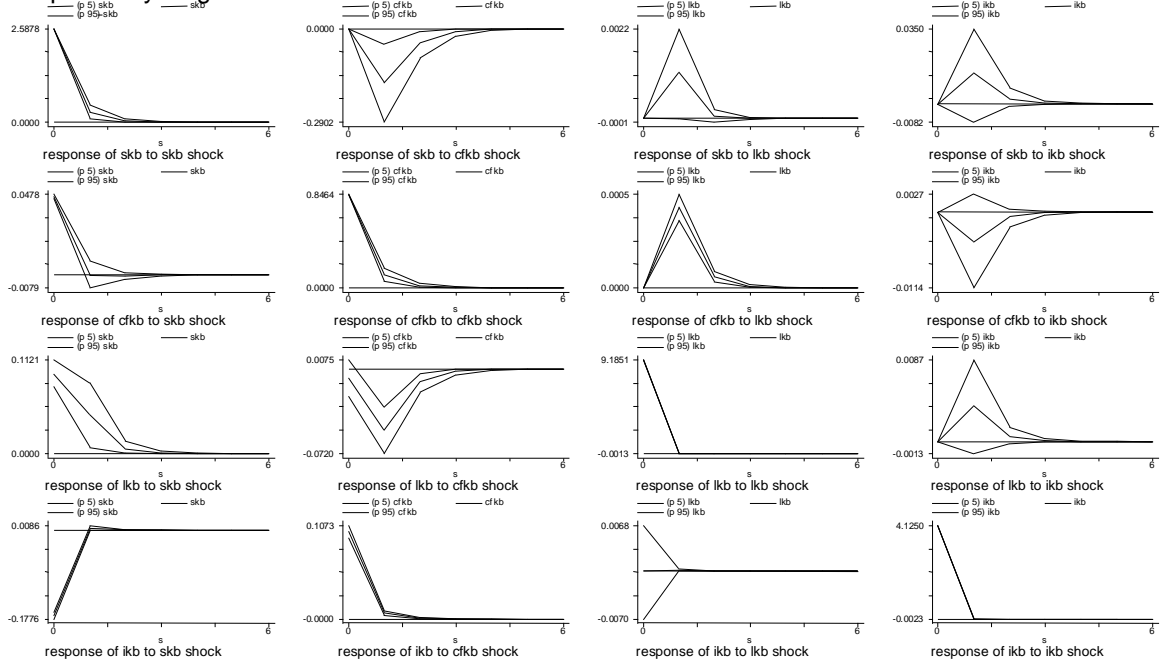


Errors are 5% on each side generated by Monte-Carlo with 1000 reps

Source: own calculations based on AMADEUS data.

Figure 6. Impulse response functions for old firms.

Impulse-responses for 1 lag VAR of skb cfkb lkb ikb
 Sample : if Dyoung==0

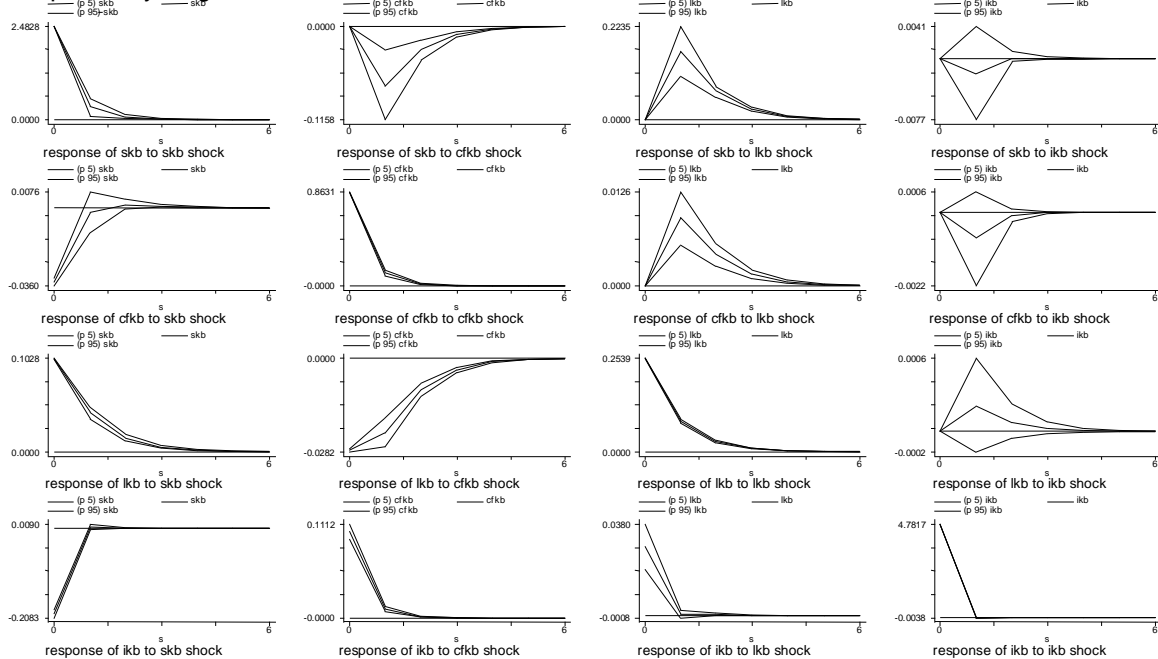


Errors are 5% on each side generated by Monte-Carlo with 1000 reps

Source: own calculations based on AMADEUS data.

Figure 7. Impulse response functions for old small firms.

Impulse-responses for 1 lag VAR of skb cfkb lkb ikb
 Sample : if Dyoung==0&Dsmall==1

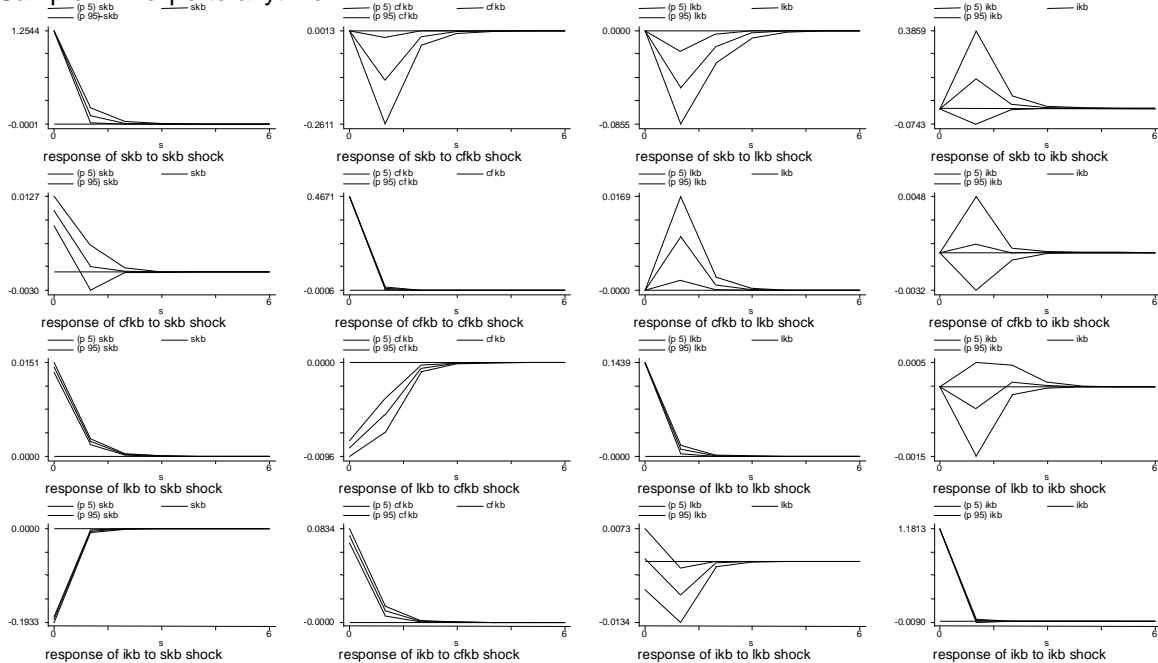


Errors are 5% on each side generated by Monte-Carlo with 1000 reps

Source: own calculations based on AMADEUS data.

Figure 8. Impulse response functions for exporters.

Impulse-responses for 1 lag VAR of skb cfkb lkb ikb
 Sample : if Dexporteranytime==1

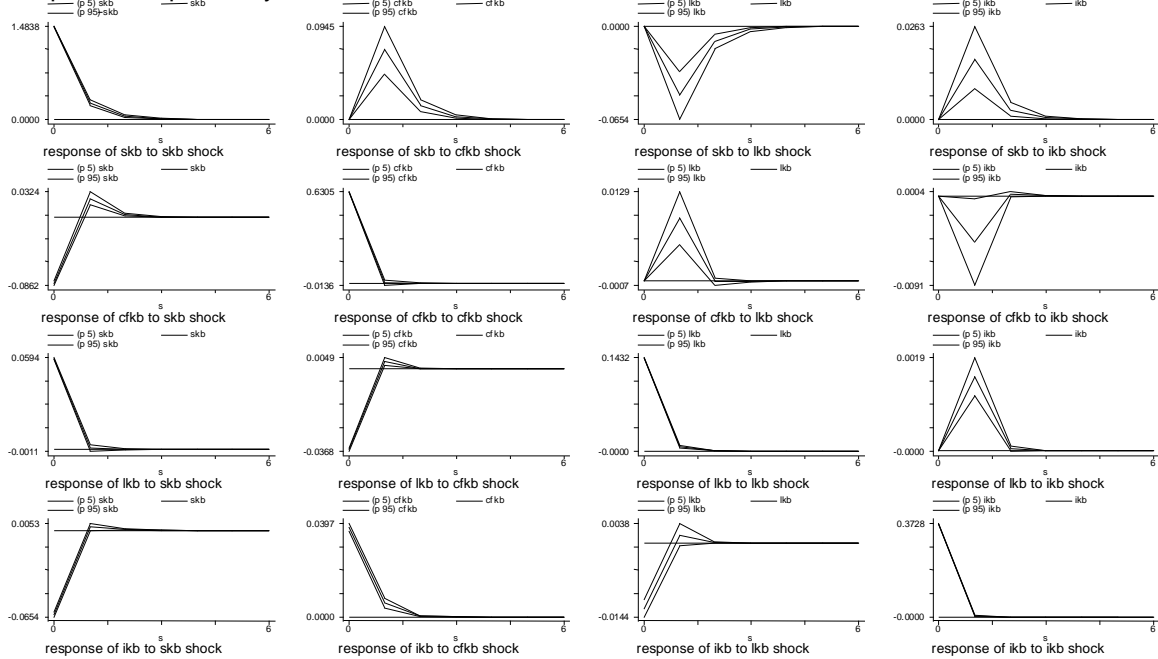


Errors are 5% on each side generated by Monte-Carlo with 1000 reps

Source: own calculations based on AMADEUS data.

Figure 9. Impulse response functions for non-exporters.

Impulse-responses for 1 lag VAR of skb cfkb lkb ikb
 Sample : if Dexporteranytime==0

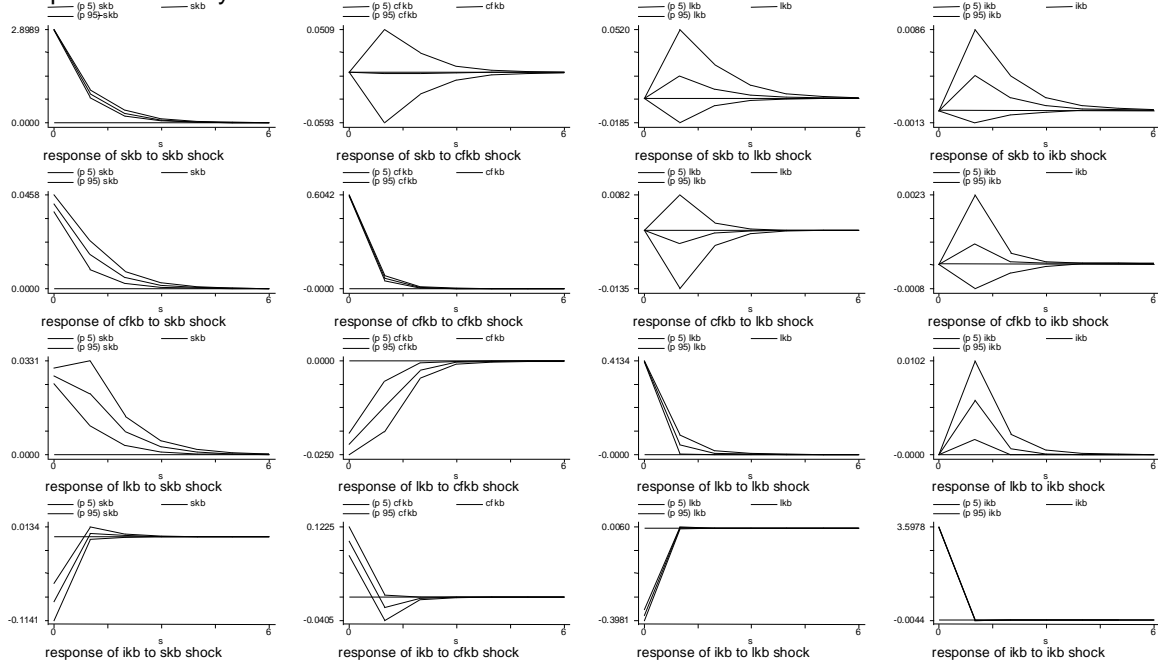


Errors are 5% on each side generated by Monte-Carlo with 1000 reps

Source: own calculations based on AMADEUS data.

Figure 10. Impulse response functions for foreign owned firms.

Impulse-responses for 1 lag VAR of skb cfkb lkb ikb
 Sample : if DiFDlanytime==1

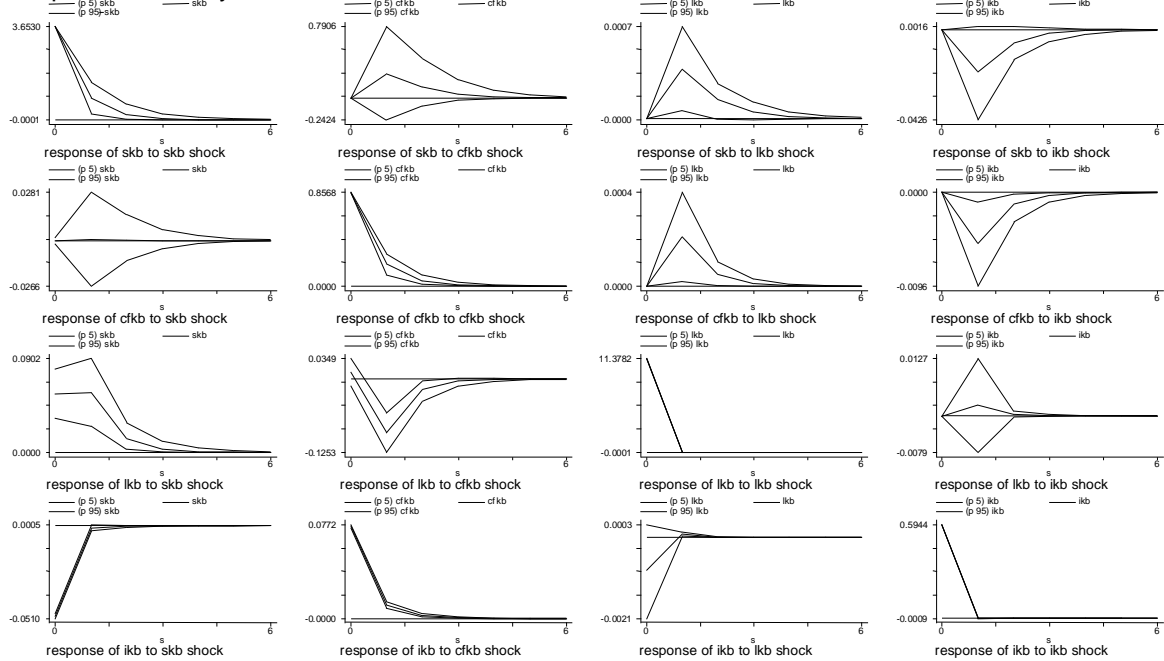


Errors are 5% on each side generated by Monte-Carlo with 1000 reps

Source: own calculations based on AMADEUS data.

Figure 11. Impulse response functions for firms in domestic ownership.

Impulse-responses for 1 lag VAR of skb cfkb lkb ikb
 Sample : if DiFDlanytime==0

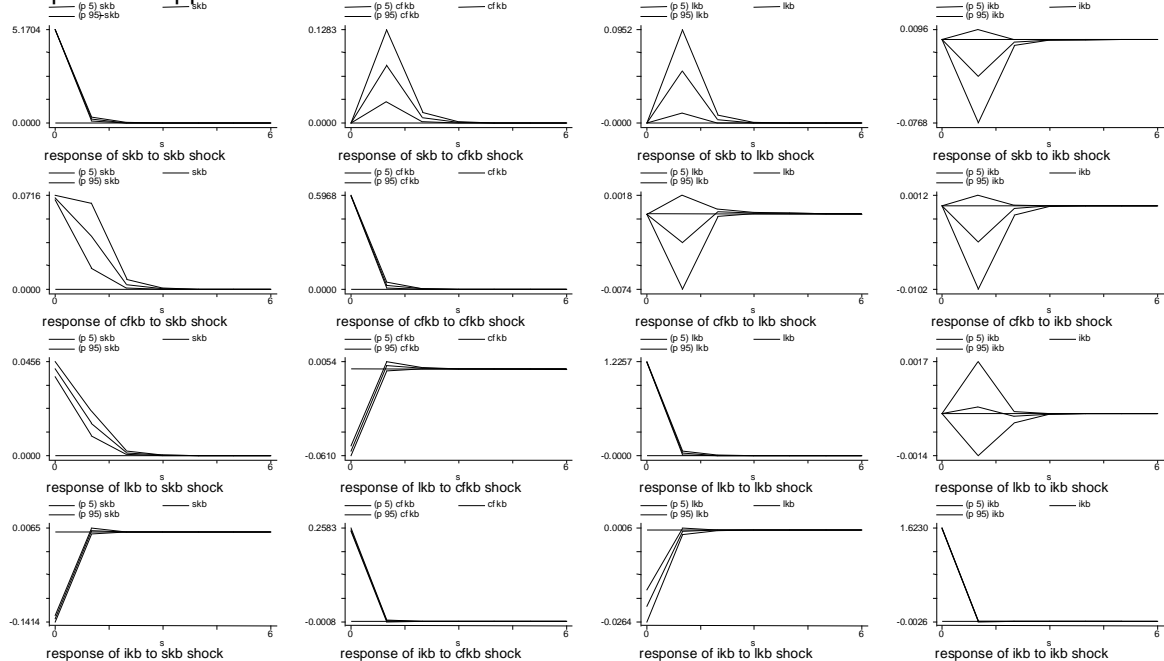


Errors are 5% on each side generated by Monte-Carlo with 1000 reps

Source: own calculations based on AMADEUS data.

Figure 12. Impulse response functions for industry.

Impulse-responses for 1 lag VAR of skb cfkb lkb ikb
 Sample : if ind2ppi<99

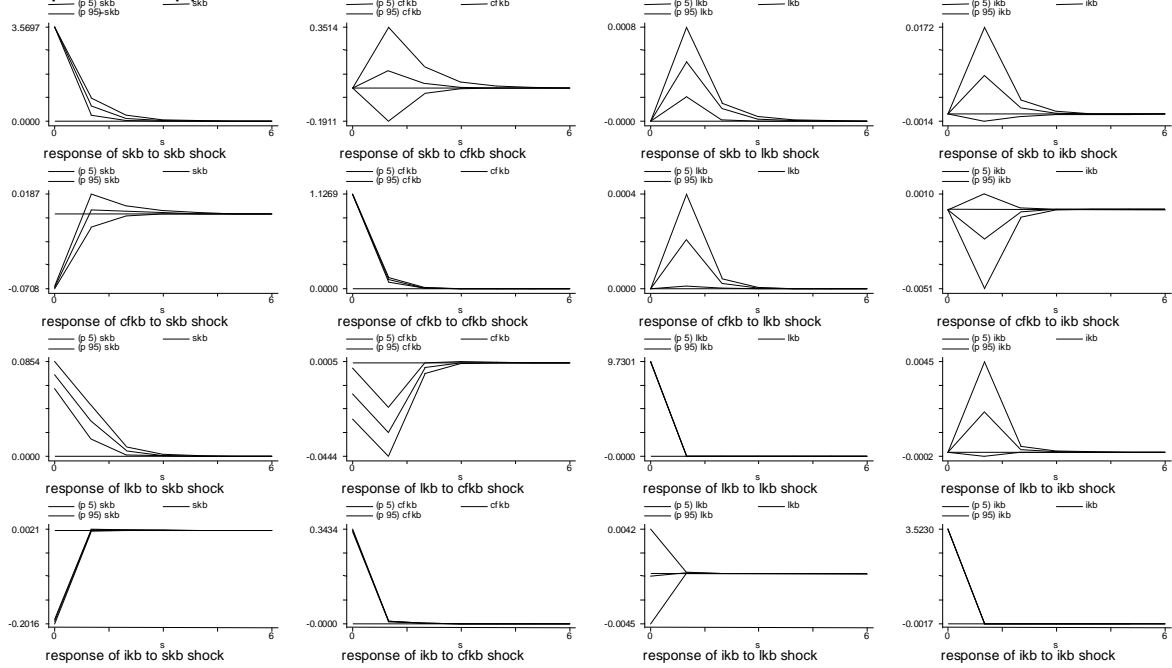


Errors are 5% on each side generated by Monte-Carlo with 1000 reps

Source: own calculations based on AMADEUS data.

Figure 13. Impulse response functions for services.

Impulse-responses for 1 lag VAR of skb cfkb lkb ikb
 Sample : if ind2ppi==99

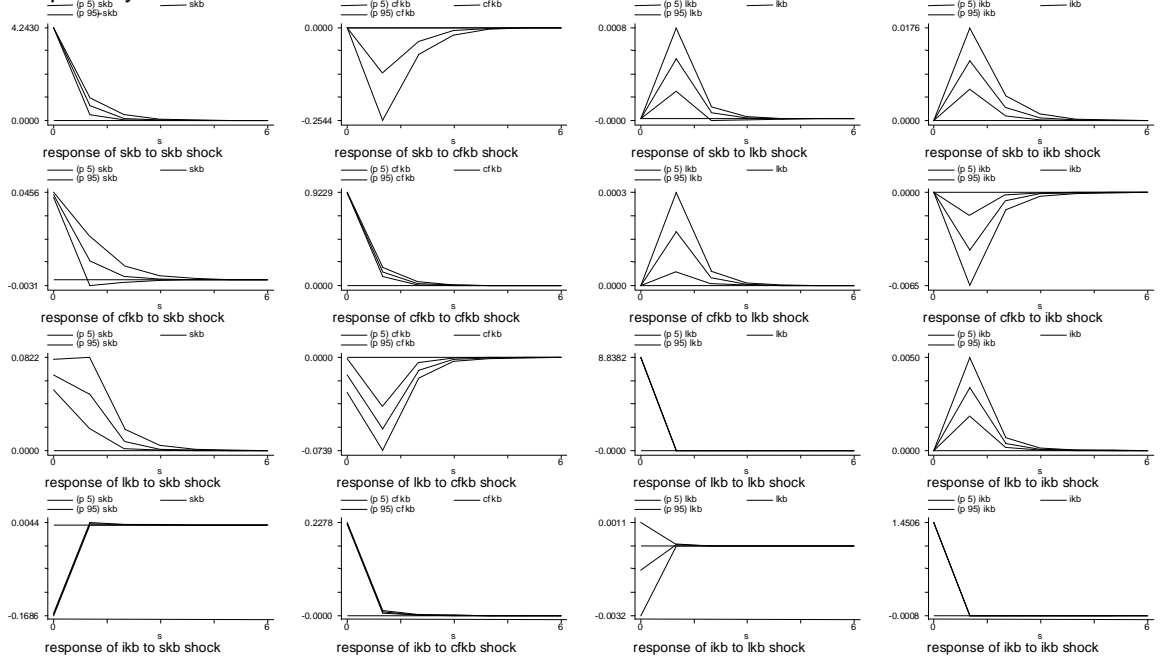


Errors are 5% on each side generated by Monte-Carlo with 1000 reps

Source: own calculations based on AMADEUS data.

Figure 14. Impulse response functions for the period 2000-2007.

Impulse-responses for 1 lag VAR of skb cfkb lkb ikb
 Sample : if year<2008

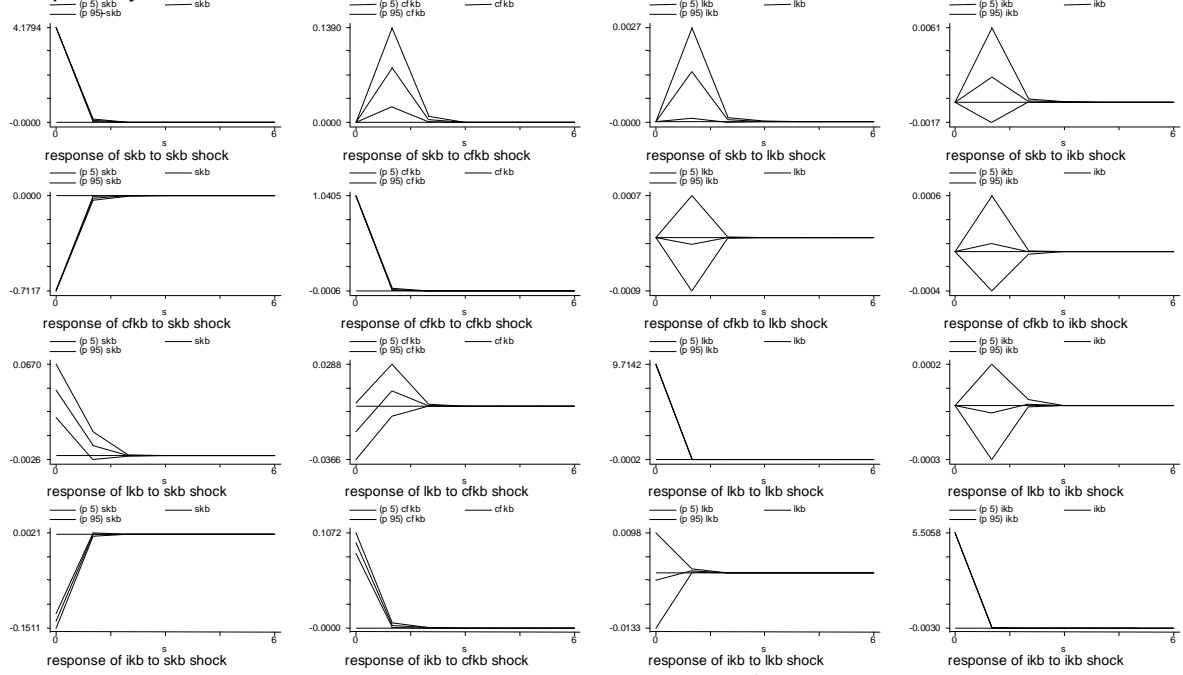


Errors are 5% on each side generated by Monte-Carlo with 1000 reps

Source: own calculations based on AMADEUS data.

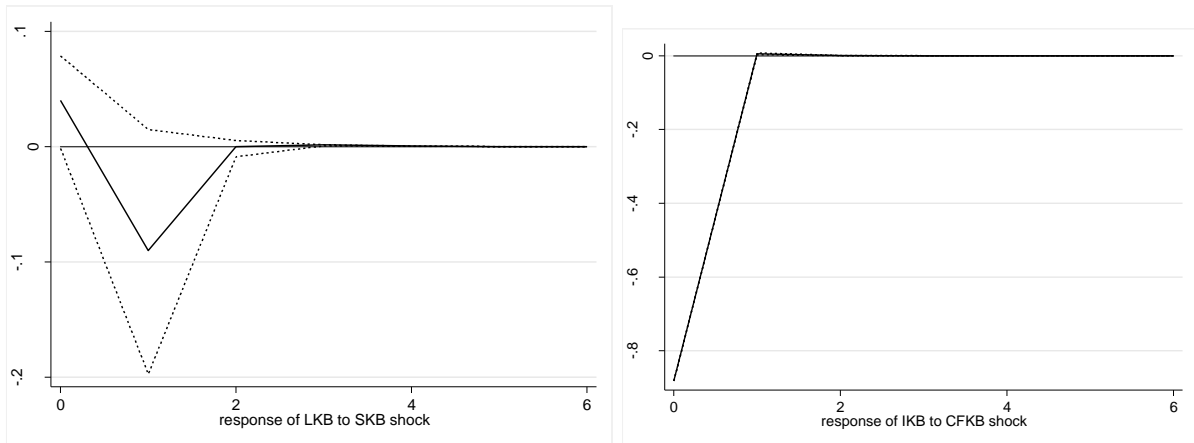
Figure 15. Impulse response functions for the period 2008-2012.

Impulse-responses for 1 lag VAR of skb cskb lkb ikb
 Sample : if year >= 2008



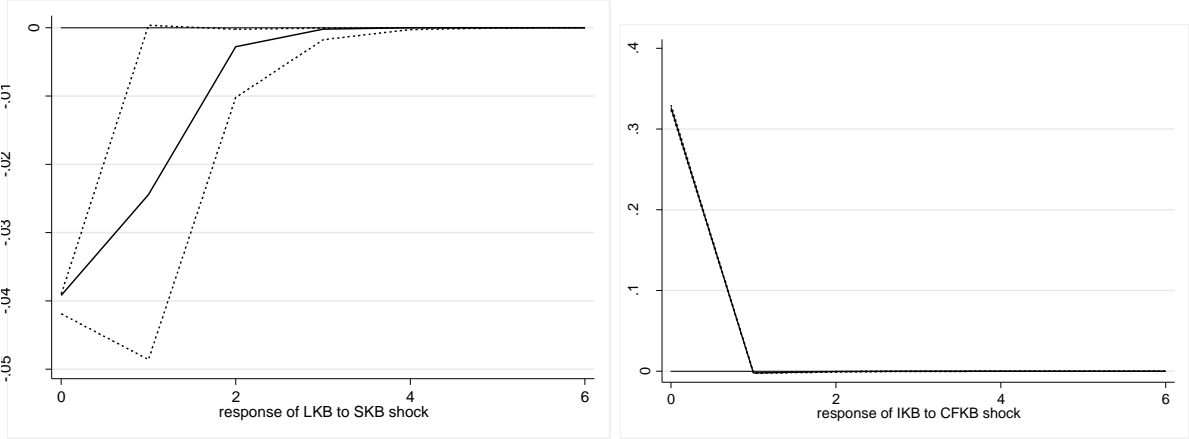
Source: own calculations based on AMADEUS data.

Figure 16. Difference in impulse responses between small and large firms (small—large).



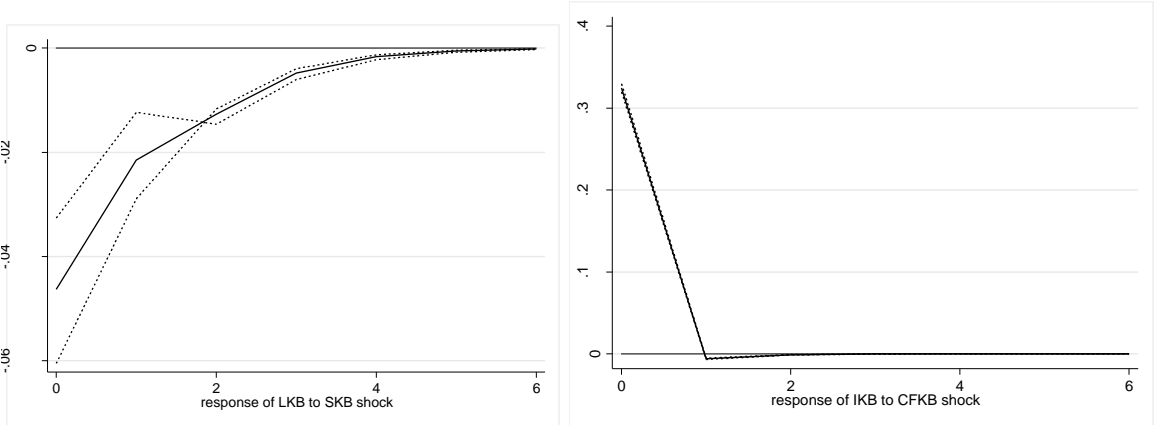
Source: own calculations based on AMADEUS data.

Figure 17. Difference in impulse responses between young and old firms (young—old).



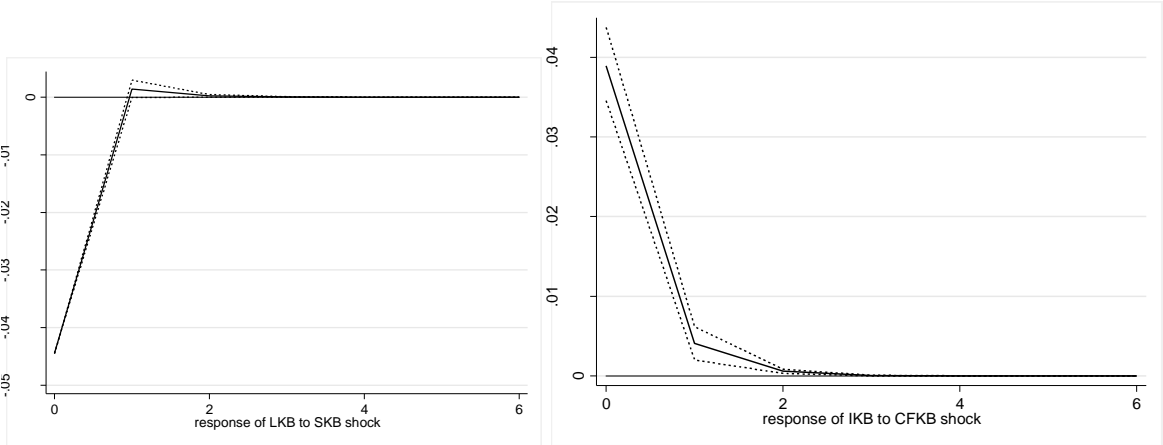
Source: own calculations based on AMADEUS data.

Figure 18. Difference in impulse responses between young and small old firms (young—small old).



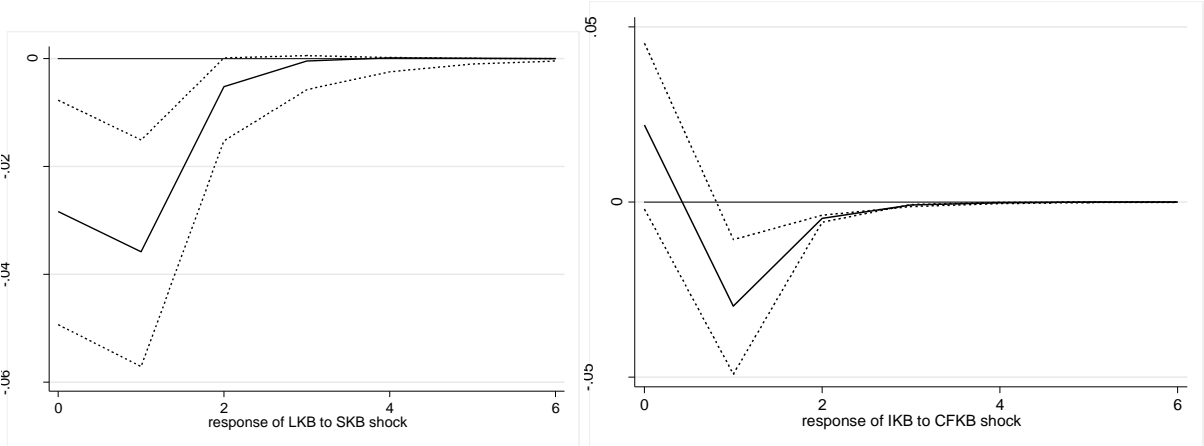
Source: own calculations based on AMADEUS data.

Figure 19. Difference in impulse responses between exporters and non-exporters (exporters—non-exporters).



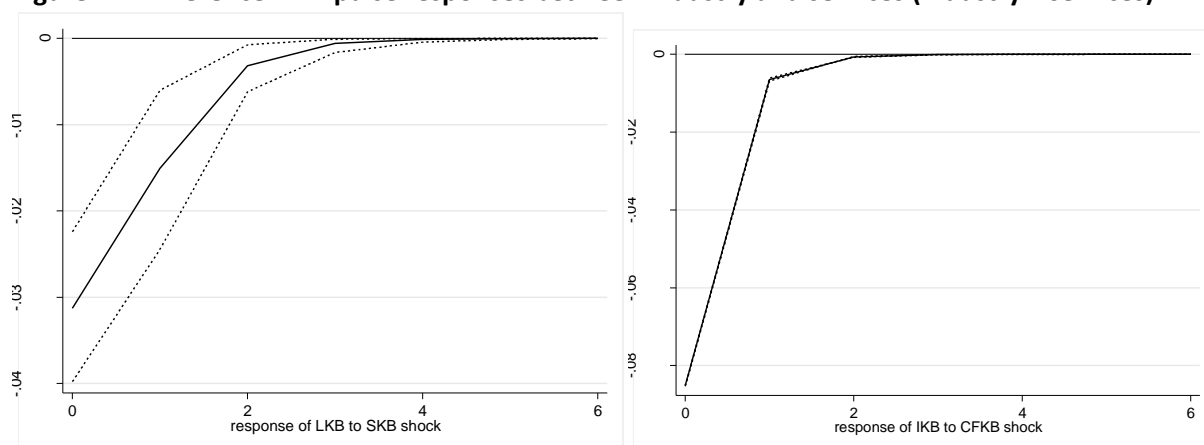
Source: own calculations based on AMADEUS data.

Figure 20. Difference in impulse responses between foreign owned and domestic (foreign—domestic).



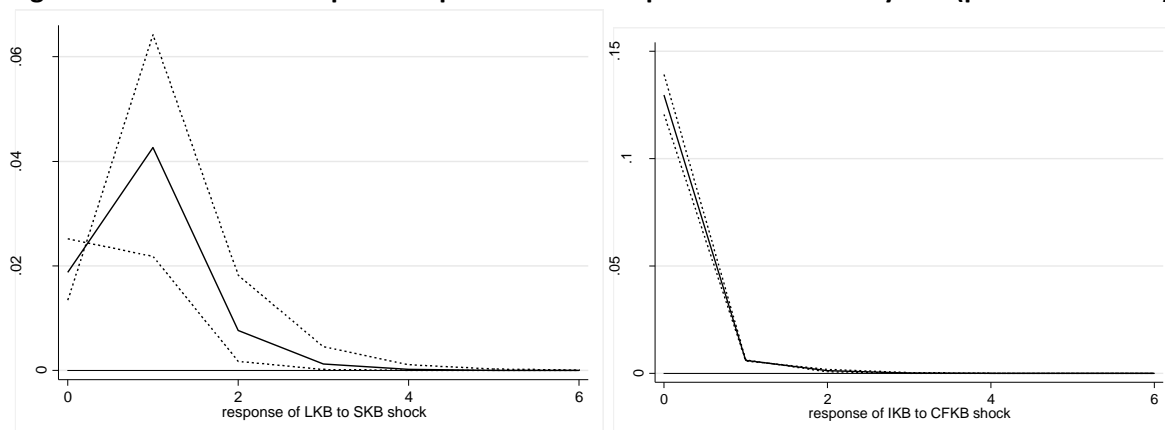
Source: own calculations based on AMADEUS data.

Figure 21. Difference in impulse responses between industry and services (industry—services).



Source: own calculations based on AMADEUS data.

Figure 22. Difference in impulse responses between pre-crisis and crisis years (pre-crisis—crisis).



Source: own calculations based on AMADEUS data.

Table 6. 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 7. 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.