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BUSINESS FIXED INVESTMENT: EVIDENCE OF A FINANCIAL ACCELERATOR IN EUROPE

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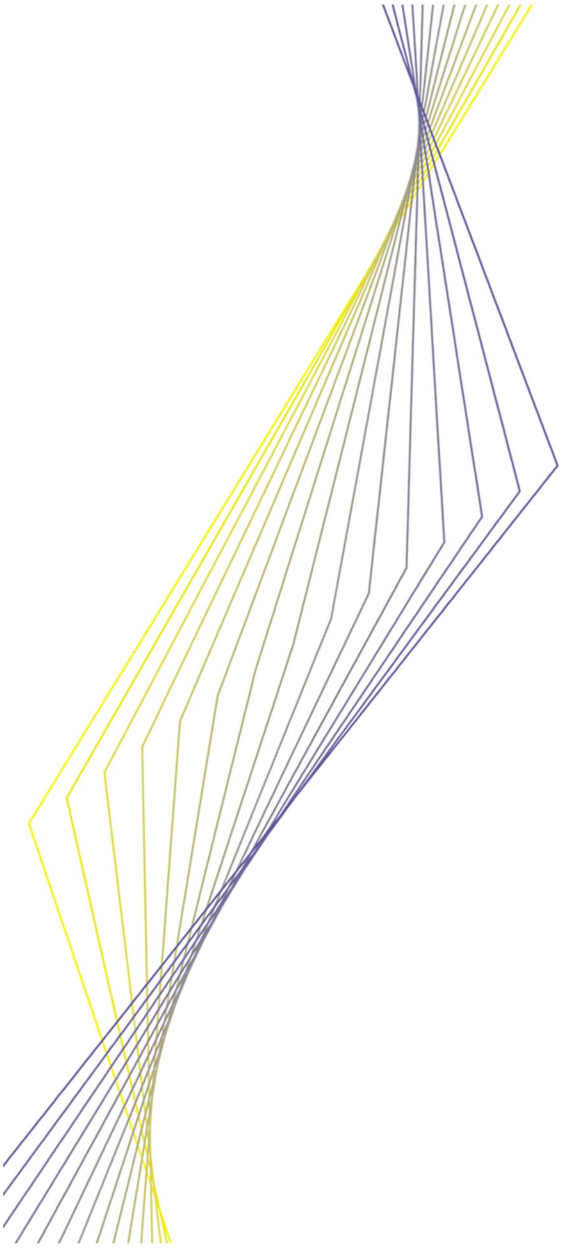

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BY PHILIP VERMEULEN*

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Abstract

Financial accelerator theories imply that weak balance sheets can amplify adverse shocks on firm investment. This effect should be asymmetric, stronger in downturns than in upturns and stronger for small firms than for large firms. This paper privides empirical evidence of the presence of a financial accelerator in the four largest euro area economies: Germany, France, Italy and Spain. Using annual firm balance sheet data over the period 1983–1997 it is shown that weak balance sheets are more important in explaining investment during downturns than during upturns. It is further shown that the effects of the accelerator are largest for small firms.

JEL classification: E22, E44.
Keywords: financial accelerator, investment, panel data.

1 Introduction

A large empirical literature initiated by Fazzari, Hubbard and Petersen (1988) has provided substantial evidence that firm investment is a function of liquidity and strength of the balance sheet.[1] The financial accelerator theory put forward by Bernanke, Gertler and Gilchrist (1999) uses the insights of this literature and links this evidence with cyclical movements of investment and output. The central theorem of the financial accelerator theory is that real or monetary policy shocks can be amplified by firms with weak balance sheets.[2] The financial accelerator theory is closely related with the bank lending channel theory (Bernanke and Blinder, 1988). This theory predicts that when banks are impaired to make loans by a drain on reserves, a restriction in loan supply might hit harder some firms then others. Where the credit channel focuses on balance sheets differences of banks, the supply of credit and monetary policy shocks, the financial accelerator theory focuses on differences in the balance sheet of firms and their implication for both real and nominal shocks.

The financial accelerator, also called financial propagation mechanism, implies that a firms' investment spending is influenced by its balance sheet position. Weak balance sheets can amplify shocks on firm spending. The mechanism usually being that asymmetric information makes firm access to investment finance a function of its balance sheet. Weak balance sheets than restrict firm investment financing and as a corollary firm investment. The initial shocks being amplified can be either real or nominal shocks. The financial accelerator therefore provides one (among many) possible transmission mechanism of real shocks or monetary policy shocks.

An important feature of the financial accelerator is its perceived double asymmetry: balance sheet effects should be stronger in downturns than in booms and stronger for small firms than for large firms. Or as stated by Gertler and Gilchrist(1993,1994): *"The financial propagation mechanism is likely to be asymmetric over the cycle- more potent in downturns than in booms."* and *"It is hopefully not controversial to suggest that the financial propagation mechanism is more applicable to "small" borrowers."* [3]

A number of studies have provided empirical evidence of such asymmetric effects after real or monetary shocks for the U.S. Using a panel of 421 firms, Gertler and Hubbard (1988) find that fixed investment for firms with high dividend retention is more sensitive to cash flow fluctuations in recessions than outside recessions, while this is not the case for low retention firms. Kashyap,

[1]However controversy still reigns. See the debate between Fazzari, Hubbard and Petersen (1996) and Kaplan and Zingales (1997).

[2]A closely related theory by Kiyotaki and Moore (1997) focuses on credit cycles induced by movements in collateral values.

[3]Oliner and Rudebush (1994) also believe that small firms are more vulnerable:*"The information asymmetries that underlie a broad credit channel should be more severe for small firms than for large firms. Thus, if the broad credit channel exists, we should see its effects more strongly for small firms."*

Lamont and Stein (1994) find that for firms without bond rating, liquidity (as measured by the firm's ratio of cash and marketable securities to total assets) matters for inventory investment during the 1982-1983 recession. They also find that outside recessions, liquidity matters much less. Gertler and Gilchrist (1994) find that for small firms the effect of the coverage ratio (cash flow on interest payments) on inventory investment is asymmetric over the cycle: higher in low growth periods, lower in high growth periods. Oliner and Rudebush (1994) find that after monetary tightening the relationship between cash flow and fixed investment becomes close for small firms but not for large firms.

There is much less evidence for Europe. Rondi, Sack, Schiantarelli and Sembenelli (1998) provide evidence for Italy. They show that inventory and fixed investment decisions of small firms are more sensitive to the coverage ratio after periods of monetary tightening. Guariglia(1999) provides evidence for the U.K.

The findings referred to above can be reduced to three testable hypothesis on the financial accelerator:

H1: balance sheet positions are significant determinants of firm investment spending.

H2: in downturns, balance sheet positions are more important in explaining firm investment spending than in other times.[4]

H3: the financial accelerator influences small and large firm investment spending differently, with small firms being most likely to be influenced most.

By testing these hypothesis, this paper provides additional evidence for Europe. I investigate investment behavior in the period 1983-1997 for Germany, France, Italy and Spain (the four largest countries in the euro area) and test whether size matters and whether balance sheet effects on investment are significantly different during the downturn of the early nineties. More generally, I investigate the case to be made for the financial accelerator in Europe.

2 The database

This research uses the BACH-database which is held at the European commission and which covers 11 European countries for a period from the early 1980's to the mid-1990's. The BACH-database is constructed through the aggregation of a large number of individual firm balance sheet and profit and loss accounts. Aggregated firm balance sheets and profit and loss accounts are provided for 3 firm size classes and for 23 different industries and this over different years. Usually, the number of firms used in the aggregation differs from year to year but in general it is quite large. For instance, for Germany this is about 10000

[4] The research on the financial accelerator is closely related with the research on liquidity constraints and fixed investment. It is different however on its emphasis on the asymmetric effects over the cycle.

firms yearly (counting only the industries used in this paper.) For Italy this is even more, around 15000 each year.

A unit of observation is defined by size, industry, country and year. For instance, large German firms in the food, drink and tabacco industry in 1990 is one observational unit, small French firms in the chemical and man made fibers industry in 1994 is another. Before the aggregation takes place, the accounting data are harmonised across countries in a single format, which contains 83 items either from the balance sheet or the profit and loss accounts. Therefore, each observational unit has one aggregated balance sheet and one profit and loss account that should be relatively comparable across countries.

In this paper I focus on the 10 manufacturing industries present in BACH.[5] The three size classes are: small firms (turnover of less than 7 million ECU), medium size firms (turnover between 7 million and 40 million ECU), large firms (turnover in excess of 40 million ECU). An important advantage of this database is the inclusion of very small firms. The firms used for aggregation in the small firms size class have on average 36 (!) employees. The medium sized firms have on average 129 employees and the large firms have on average 1208 employees.[6]

Unfortunately, the use of the data for cross-country comparison is severely hampered by the fact that for many countries, many items are not available (i.e. left blank in the database). Because of this reason, in this paper only the information on Germany[7] , France, Italy and Spain could be used. Only these countries provide enough information on the variables used in this study. Fortunately, these countries represent a large part of euro-area wide manufacturing investment.

3 Downturns and Aggregate Investment

In order to test whether a financial accelerator is more potent during downturns, one has to identify downturns first. Table 1 provides the industrial production index (excluding construction) for Germany, France, Italy and Spain.

As is clear from Table 1, all four countries experienced a downturn in the early nineties. The boxed numbers indicate the downturn years coinciding with the 1993 recession, which was quite general in Europe. To compare the magnitude of the downturn, the index base year for each country is set at the year before the start of the downturn. For Italy and Spain the downturn lasted 4 years, for France it lasted 3 years while for Germany only 2 years. However,

[5]One reason to focus on manufacturing and leave services out of the analysis is that labor input might be more important for services than capital input. Also, services output is thought to be less cyclical than manufacturing output. Finally, it remains in the tradition of former research in this area.

[6]These numbers are based on the data used in the regressions in this paper excluding Spain since BACH does not contain employee numbers for Spain.

[7]Since BACH only contains West-German firm data, all numbers used in this paper are based on West-German data only.

the length of the downturn is not necessarily an indication of the severity of the downturn. The downturn was the worst in Germany followed by Spain, France and Italy.

TABLE 1
Industrial Production

Year	Germany	France	Italy	Spain
1983	77.4	na	80.2	83.7
1984	79.6	na	83.3	84.4
1985	84.1	89.3	84.0	86.1
1986	85.7	89.9	87.3	88.5
1987	85.9	91.0	89.6	92.6
1988	88.3	95.0	96.0	95.6
1989	93.3	98.6	100	100
1990	98.0	100	99.5	99.9
1991	100	98.7	98.3	99.1
1992	97.7	97.7	96.9	96.1
1993	90.2	93.9	94.7	92.0
1994	93.5	97.6	101.1	98.9
1995	94.5	99.6	107.7	103.4
1996	95.1	99.8	105.4	102.4
1997	98.7	103.7	109.5	109.7

Source: Eurostat

Table 2 provides more insight in the nature of these countries downturns. In this table the real change during the downturn in total domestic expenditure from the national accounts data is disaggregated into the real changes in aggregate government consumption, private final consumption, change in inventories and gross fixed capital formation. Note that the sum of those 4 changes is equal to the change in total domestic expenditure. [8]

From Table 2, it is clear that every downturn coincides with a serious decrease in both gross fixed investment and a reduction in inventories. The reduction in gross fixed investment (and in inventories) is *the* most important mark of a downturn. In all countries, the decline in gross fixed capital formation forms more than 100% of the total decline of domestic expenditure. It is therefore warranted to look at fixed capital investment in the search of financial accelerator effects.

[8] The numbers are related by

$$\frac{TDE_{t+i} - TDE_t}{TDE_t} = \frac{GC_{t+i} - GC_t}{TDE_t} + \frac{C_{t+i} - C_t}{TDE_t} + \frac{\Delta INV_{t+i} - \Delta INV_t}{TDE_t} + \frac{I_{t+i} - I_t}{TDE_t} \quad (1)$$

TABLE 2

Disentangling the real change in total domestic expenditure: real change (in % from total domestic expenditure)

Year	Germany	France	Italy	Spain
Period	91-93	90-93	89-93	89-93
Government consumption	0.7	1.8	0.8	2.9
Private final consumption	1.3	1.7	2.1	4.0
Change in inventories	-1.1	-2.8	-1.0	-1.0
Gross fixed capital formation	-2.4	-1.8	-2.2	-1.7
Total domestic expenditure	-1.4	-1.1	-0.3	4.3

Source: own calculations based on OECD National Accounts

4 Investment according to the BACH-database

In this section I present the BACH-data and show that the investment decline was quite broad based across firm size classes.

TABLE 3

Sample medians

Investment-capital ratio: all size classes

Year	Germany	France	Italy	Spain
1983	na	na	14.8	10.7
1984	na	na	19.1	12.4
1985	na	20.6	21.7	13.9
1986	na	21.3	23.2	16.0
1987	30.7	21.3	25.5	17.5
1988	32.1	23.3	28.5	19.0
1989	32.8	23.1	26.2	18.8
1990	32.3	22.8	24.2	17.3
1991	33.1	18.2	19.8	17.5
1992	28.7	16.9	17.3	14.9
1993	23.2	12.5	14.2	12.4
1994	23.7	13.4	14.6	13.5
1995	25.1	16.6	18.2	16.3
1996	24.1	17.0	15.9	18.4
1997	na	16.0	16.4	17.0

Source: own calculations using BACH-database

Table 3 provides the median investment-capital ratio for Germany, France, Italy, and Spain calculated with the BACH-data. Each median presented in Table 3 is calculated using 30 observations (3 size classes times 10 industries gives 30.)[9] As is clear from Table 3, all four countries experienced an investment collapse in the early nineties coinciding with the general downturn. All countries saw their median investment-capital ratio decrease to the bottom

[9] Note that one has to be careful when comparing the levels of this ratio across countries based on this data. Differences might be real but also differences in country accounting definitions and data collection might cause differences. I concentrate on the time series behaviour within each country.

level in 1993. After 1993, the investment-capital ratio started to increase in all countries.

TABLE 4
Sample medians
Investment-capital ratio: small firms

Year	Germany	France	Italy	Spain
1983	na	na	14.2	10.9
1984	na	na	17.3	13.4
1985	na	22.7	18.6	14.9
1986	na	21.8	21.1	18.5
1987	31.9	21.8	23.8	22.5
1988	32.9	23.7	23.3	19.7
1989	36.1	23.2	22.4	20.3
1990	32.2	22.2	22.8	16.9
1991	35.8	18.2	19.3	22.0
1992	29.3	15.5	17.8	18.5
1993	23.3	12.3	13.2	12.3
1994	26.3	13.0	11.1	13.8
1995	26.2	17.5	15.9	21.2
1996	25	18.2	13.2	20.6
1997	na	15.9	13.3	22.3

Source: own calculations using BACH-database

TABLE 5
Sample medians
Investment-capital ratio: medium size firms

Year	Germany	France	Italy	Spain
1983	na	na	17.1	10.7
1984	na	na	21.7	12.4
1985	na	20.6	23.8	14.0
1986	na	21.9	27.2	16.9
1987	27.1	22.9	29.1	17.9
1988	29.5	25.2	30.8	20.5
1989	32.5	24.9	29.5	18.8
1990	32.3	26.3	24.8	18.0
1991	32.4	21.0	20.7	16.0
1992	27.3	18.0	17.3	13.3
1993	22.6	13.4	14.7	13.5
1994	23.4	15.6	15.2	15.4
1995	25.1	17.9	22.1	17.4
1996	23.8	17.3	19.4	18.4
1997	na	18.3	19.8	19.3

Source: own calculations using BACH-database

TABLE 6
Sample medians
Investment-capital ratio: large size firms

Year	Germany	France	Italy	Spain
1983	na	na	15.6	9.5
1984	na	na	18.2	9.7
1985	na	18.8	21.8	12.7
1986	na	19.3	23.6	14.3
1987	31.4	20.0	26.5	13.1
1988	32.1	18.1	29.2	16.1
1989	32.3	18.1	29.5	18.4
1990	32.3	18.5	25.0	16.9
1991	31.9	17.2	18.8	14.5
1992	28.7	15.5	16.6	11.0
1993	23.5	9.9	15.4	9.7
1994	19.8	9.3	15.5	9.7
1995	23.5	11.3	20.3	13.9
1996	22.1	14.0	17.1	13.4
1997	na	13.0	16.8	14.8

Source: own calculations using BACH-database

The median investment-capital ratio for each size class are represented in Tables 4,5 and 6.[10] Again a box surrounds the same downturn years as in Table 1.

As is clear from Tables 4,5 and 6, the decline in investment coincides remarkably well with the downturn in industrial production. The decline in investment is also broad based, all size classes (in all countries) suffer from a decline.

5 Testing the hypotheses underlying the financial accelerator

5.1 Balance sheet indicators and the level of investment

The proponents of the financial accelerator theory have used the term "firms with weak balance sheets"[11] to indicate which firms are vulnerable to a financial accelerator. In this section I test the first hypothesis which was stated in the introduction:

H1: balance sheet positions are significant determinants of firm investment spending.

This hypothesis forms an essential feature of what has become known as "the financial accelerator" theory. Since "weak balance sheet" is a rather vague

[10]Since there are 10 manufacturing industries, the median investment-capital ratio for each size class can be calculated on the basis of 10 numbers.

[11]See e.g. Bernanke, Gertler and Gilchrist (1996).

term it has to be operationalized. This is done by using four different indicators for the balance sheet.

These indicators are presented in Table 7. The first indicator, total debt as a fraction of total assets DA_{it}, is an indicator of the general indebtedness or leverage of the firm. The second indicator, short-term debt on current assets $SDCA_{it}$, is an indicator of short term liquidity. It indicates whether short-term liabilities (which are to become due) are backed with relatively liquid assets. The third indicator, short-term debt as a fraction of total debt FS_{it}, attempts to measure the extent the firm has to finance itself short-term rather than long-term and is therefore related to its access to long-term finance. The coverage ratio COV_{it}, or cash flow on interest payments measures the extent to which cash flow is sufficient to pay for financial costs and is therefore related to credit worthiness.

The direction in which these indicators convey weaker balance sheets are supposed to run as follows. The higher total debt as a fraction of total assets and the higher short term debt on current assets, the weaker the balance sheet. The higher short-term debt as a fraction of total debt, the weaker the balance sheet. The higher the coverage ratio the stronger the balance sheet.

Although the coverage ratio has been used in former studies as a measure of credit worthiness (Gertler and Gilchrist, 1994 and Rondi, Sack, Schiantarelli and Sembenelli, 1998), it is a contentious variable. Cash flow is known to be highly correlated with investment. It is uncertain however whether this is due to true accelerator effects or to an informational channel: cash flow contains information on future profitability. Since the denominator of the coverage ratio contains cash flow, the same problem of distinguishing informational and accelerator effects holds.

TABLE 7
Indicators of balance sheet position

DA_{it}	Total debt as a fraction of total assets (leverage)
$SDCA_{it}$	Short-term debt on current assets (liquidity)
FS_{it}	Short-term debt as a fraction of total debt (market access)
COV_{it}	Coverage ratio: Cash flow on interest payments (credit worthiness)

The nature of the data determines the available choice of the investment specification to test for hypothesis H1. Since, because of aggregation, the data considered are what one could call "representative-firms" rather than individual firms, euler equations or other structural investment equations are likely not to hold. Also, the nature of the data makes Tobin-q approaches impossible. A simple specification is the sales-accelerator model. The sales-accelerator specification has a long tradition and performs usually superior compared to more sofisticated investment specifications (Oliner, Rudebush and Sichel, 1995).

Therefore, to test for hypothesis H1, the following sales-accelerator specification of the investment rate is used,

$$IK_{it} = \alpha + \beta IK_{i,t-1} + \gamma SK_{i,t-1} + \theta B_{i,t-1} + \delta_t + u_i + \epsilon_{i,t}, \tag{2}$$

where IK_{it} is the investment-rate of firm i at time t (i.e. investment capital ratio), SK_{it-1} is the sales-capital ratio at time $t-1$, $B_{i,t-1}$ is a measure of the balance sheet position (i.e. $DA_{it-1}, SDCA_{it-1}, FS_{it-1}$ or COV_{it-1}), δ_t is a time fixed effect, u_i is an unobserved firm fixed effect, and $\epsilon_{i,t}$ is a serially uncorrelated error term which is also uncorrelated with all variables at time $t-1$. The user cost of capital does not enter the equation explicitly. The inclusion of the time fixed effect and the firm fixed effect in the empirical specification controls for its variation.

The coefficient θ measures the sensitivity of the investment capital ratio with respect to changes in the balance sheet indicator. If the financial accelerator hypothesis (H1) is correct, θ should be negative when B_{it-1} is measured by DA_{it-1},$SDCA_{it-1}$ or FS_{it-1}, and should be positive when measured by COV_{it-1}.

The (unbalanced) sample used in this paper contains 112 "representative" firms (i=1,...,112) which are observed over at least 5 consecutive years in the period between 1983 and 1997 (t=1983,...,1997). Table 8 provides summary statistics of the variables used in (2).

TABLE 8

Summary statistics of the variables used

Variable	MEAN	ST.DEV	MEDIAN	MINIMUM	MAXIMUM
IK	20.45	7.21	19.85	-13.14	42.32
SK	5.69	2.30	5.28	1.19	12.42
DA	59.85	9.71	61.82	20.47	89.87
SDCA	70.65	10.70	71.17	32.57	107.86
FS	76.69	8.50	78.53	37.94	94.12
COV	3.21	1.31	3.08	0.07	8.71

The investment regression (2) contains both a lagged dependent variable IK_{t-1} and a firm fixed effect. Because of the presence of the lagged dependent variable the within estimator (least squares after subtracting the individual means from the variables) is necessarily inconsistent (Nickel, 1981).

Instead, I use the GMM-estimation procedure suggested by Arellano and Bond (1991) which delivers efficient and consistent estimates. First, equation (2) is first differenced. The first differenced equation does not longer contain the firm fixed effect:

$$\Delta IK_{it} = \beta \Delta IK_{i,t-1} + \gamma \Delta SK_{i,t-1} + \theta \Delta B_{i,t-1} + \delta'_t + \epsilon_{i,t} - \epsilon_{i,t-1}, \tag{3}$$

with $\delta'_t = \delta_t - \delta_{t-1}$. Note that by taking first differences also (possible) country, industry or size specific effects are removed. That is, if in (2) u_i would be replaced by $u_i + C_j + I_k + S_l$ with C_j standing for country j effect,

I_k standing for industry k effect and S_l standing for size l effect, than the first differenced equation would still be (3).

The assumption of lack of serial correlation of the error term ϵ_t (i.e. $E(\epsilon_t \epsilon_s) = 0 \, \forall t \neq s$) is essential and allows identification of the model. It allows the model variables lagged two periods or more to be used as instruments. Basically, the model implies the following linear moment restrictions:

$$E[(\epsilon_{i,t} - \epsilon_{i,t-1})Z_{i,t-j}] \;\; j = 2, ..., (t-1), t = 1985, ...1997 \tag{4}$$

where $Z_{i,t-j}$ is any of the following variables: $IK_{i,t-j}, SK_{i,t-j}, B_{i,t-j}$. If the errors ϵ_{it} are serially uncorrelated, than the differenced residuals $(\epsilon_{i,t} - \epsilon_{i,t-1})$ should be first order negatively correlated and there should be no evidence of second order correlation (i.e. $(\epsilon_{i,t} - \epsilon_{i,t-1})$ should be uncorrelated with $(\epsilon_{i,t-2} - \epsilon_{i,t-3})$). Arellano and Bond (1991) have developed test statistics to test first order and second order correlation of the differenced residuals. Presence of second order correlation would indicate that the assumptions used in estimating the model where violated. Both test statistics are presented together with the estimates. Also, the usual Sargan-test of overidentifying restriction is presented.

The GMM-estimation procedure proposed by Arellano and Bond (1991) is a two-step estimator. Two sets of estimates are obtained.[12] Both first and second step estimates are consistent. The second step estimates are efficient while the first ones are not. However, in small samples, the estimated standard errors of the second step estimates are usually biased downward. Since the sample used here can be considered small, both the first step and second step estimates and standard errors are shown.

The result of the estimations are in Table 9.[13] In all the estimations, the model variables lagged two and lagged three periods are used as instruments. For all regressions there is no sign of second order serial correlation of the first differenced residuals. However the Sargan test rejects the regression containing the variable FS_{it-1} at the 5% level. The estimated coefficients on all balance sheet variables have the correct sign. Both the first and second step estimates of the debt-asset ratio and the short-term debt short-term asset ratio are not significant however. The coverage ratio is highly significant. Although as indicated earlier, it is uncertain whether this is due to informational or accelerator effects. Considering this together with the insignificance of the debt-asset ratio and the short-term debt short term asset ratio, the direct evidence in favour of the accelerator hypothesis stemming from these regressions is weak.

However two observations should make these results not too surprising. First, the "firms" used in these regressions are "representative firms" the variables of each "representative firm" are essentially averages over a number of

[12]To obtain second step estimates, the residuals of the first step are used to produce an optimal new weighting matrix (the inverse of the covariance matrix of the orthogonality conditions). For details see Arellano and Bond (1991).

[13]All estimations are performed using the DPD98-gauss program written by Arellano and Bond.

firms. If each "representative firm contains firms with "strong" and "weak" balance sheets, it is highly likely that the coefficient presented here are biased downward. Second, possible asymmetric effects of the accelerator: differences over the cycle and/or differences across size classes should invalidate these simple regressions.

In the next section, the possible asymmetric effect of the financial accelerator is investigated. It is tested whether the coefficients on the balance sheet variables could differ significantly in downturns versus out of downturns.

TABLE 9
Balance sheet indicators and the investment-capital ratio

Dependent variable is IK_{it} GMM estimates of first differenced equation								
Variable	GMM1	GMM2	GMM1	GMM2	GMM1	GMM2	GMM1	GMM2
IK_{it-1}	0.30*	0.29*	0.29*	0.31*	0.31*	0.33*	0.19**	0.18*
	(0.07)	(0.02)	(0.07)	(0.02)	(0.07)	(0.03)	(0.08)	(0.02)
SK_{it-1}	2.48*	2.11*	2.39*	2.04*	2.20*	1.77*	2.49*	2.41*
	(0.72)	(0.34)	(0.71)	(0.25)	(0.82)	(0.28)	(0.68)	(0.26)
DA_{it-1}	−0.04	−0.06	-	-	-	-	-	-
	(0.07)	(0.03)	-	-	-	-	-	-
$SDCA_{it-1}$	-	-	−0.05	−0.03	-	-	-	-
	-	-	(0.06)	(0.02)	-	-	-	-
FS_{it-1}	-	-	-	-	−0.17	−0.11**	-	-
	-	-	-	-	(0.13)	(0.05)	-	-
COV_{it-1}	-	-	-	-	-	-	1.91*	1.94*
	-	-	-	-	-	-	(0.46)	(0.23)
m_1	−6.58	−5.68	−6.62	−5.87	−7.02	−5.88	−6.25	−5.73
p	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
m_2	1.27	1.21	1.24	1.31	1.14	1.20	1.43	1.31
p	0.21	0.22	0.21	0.19	0.26	0.23	0.15	0.19
S		90.3		84.9		94.0		85.1
p		0.07		0.14		0.04		0.14

Each regression uses 1072 observations on 112 firms. Sample period is 1985-1997
Each regression includes 13 time dummies
Standard errors are heteroskedasticity consistent
m1, m2 are first-order and second order serial correlation tests, both are asymptotically N(0,1)
S is Sargan test: asymptotically χ^2_{72}
* Significant at 1% level, ** at 5% level

5.2 Asymmetric working of the accelerator

In this section the following hypothesis is tested:

H2: in downturns, balance sheet positions are more important in explaining firm investment spending than in other times.

To test for hypothesis H2, the sales-accelerator specification of the investment rate is adjusted to allow for a different parameter on the balance sheet indicator during a downturn. The regression equation becomes,

$$IK_{it} = \alpha + \beta IK_{i,t-1} + \gamma SK_{i,t-1} + (\theta_1 + \theta_2 R_{jt})B_{i,t-1} + \delta_t + u_i + \epsilon_{i,t}, \quad (5)$$

where R_{jt} is a dummy variable which indicates whether the country j (to which firm i belongs) is in a downturn or not. The coefficient θ_1 now measures the sensitivity of investment with respect to the balance sheet indicator outside a downturn only. The coefficient θ_2 measures the differential effect of the financial accelerator during a downturn. If the financial accelerator is stronger in downturns than outside downturns one should expect θ_2 to be negative for B_{it-1} measured by DA_{it-1}, $SDCA_{it-1}$ or FS_{it-1} and positive when measured by COV_{it-1}.

According to the determination of downturn years earlier, the downturn years are: 1992, 1993 for Germany, 1991, 1992, 1993 for France and 1990, 1991, 1992, 1993 for Italy and Spain.

The results of the estimations are in table 10. Hypothesis H2 can clearly not be rejected. For all regressions, the second step estimate of the coefficient θ_2 (measuring the differential effect of a downturn) is significant at the 1% level. It has the correct sign for all variables except the coverage ratio. The negative sign for the coverage ratio is consistent with the informational interpretation of cash flow. It is not unnatural to believe that cash flow contains "less" information on future profitability during downturns. A negative sign could hence be interpreted in this way.

For all the other variables also the first step estimates of θ_2 are significant at the one percent level and have the correct sign. Since the standard errors of the second step estimates could be biased downward it is encouraging to see that also these first step estimates are significant. In contrast, the first step estimates of θ_1 are all insignificant (except again for the coverage ratio). The second step estimates of θ_1 are all significant and of the expected sign. Hence the evidence for a financial accelerator working during downturns is much stronger than the evidence of a financial accelerator outside downturns. It could be however that the "aggregation effects" mask the financial accelerator effect outside of downturns, where during a downturn, where the big majority of firms are hit, the financial accelerator becomes clear.

In any case, the second step estimates for both θ_1 and θ_2 are all economically significant. A one standard deviation increase of the debt-asset ratio DA_{it} leads to a drop in the investment capital ratio of 1.07 percentage point (9.71×-0.11) outside downturns and 1.65 percentage points (9.71×-0.17) in a downturn. Likewise, a one standard deviation increase in the short-term debt current assets ratio $SDCA_{it}$, leads to a drop in the investment rate of 0.75 percentage point outside downturns and 1.18 in a downturn. For the fraction of short-term debt as a fraction of total debt the numbers are respectively 1.19 and 1.44. For the coverage ratio they are 2.5 and 2.19. Note that the effect of a one standard deviation increase in the balance sheet variable is on the same order of magnitude for all balance sheet variables except the coverage ratio. There the effect is larger. This strengthens the presumption that the coverage ratio might also be picking up informational effects.

TABLE 10

Asymmetric effects of the financial accelerator

Dependent variable is IK_{it}

GMM estimates of first differenced equation

Variable	GMM1	GMM2	GMM1	GMM2	GMM1	GMM2	GMM1	GMM2
IK_{it-1}	0.24*	0.23*	0.25*	0.26*	0.27*	0.27*	0.19**	0.17*
	(0.06)	(0.02)	(0.06)	(0.02)	(0.07)	(0.03)	(0.08)	(0.02)
SK_{it-1}	2.92*	2.80*	2.95*	2.49*	2.81*	2.55*	2.57*	2.48*
	(0.74)	(0.34)	(0.74)	(0.26)	(0.85)	(0.33)	(0.70)	(0.26)
DA_{it-1}	−0.10	−0.11*	-	-	-	-	-	-
	(0.07)	(0.03)	-	-	-	-	-	-
$R_t * DA_{it-1}$	−0.06*	−0.06*	-	-	-	-	-	-
	(0.01)	(0.01)	-	-	-	-	-	-
$SDCA_{it-1}$	-	-	−0.10	−0.07*	-	-	-	-
	-	-	(0.06)	(0.03)	-	-	-	-
$R_t * SDCA_{it-1}$	-	-	−0.04*	−0.04*	-	-	-	-
	-	-	(0.01)	(0.01)	-	-	-	-
FS_{it-1}	-	-	-	-	−0.19	−0.14*	-	-
	-	-	-	-	(0.13)	(0.05)	-	-
$R_t * FS_{it-1}$	-	-	-	-	−0.03*	−0.03*	-	-
	-	-	-	-	(0.01)	(0.005)	-	-
COV_{it-1}	-	-	-	-	-	-	1.88*	1.91*
	-	-	-	-	-	-	(0.46)	(0.23)
$R_t * COV_{it-1}$	-	-	-	-	-	-	−0.18	−0.24*
	-	-	-	-	-	-	(0.22)	(0.08)
m_1	−6.31	−5.65	−6.23	−5.72	−6.76	−5.84	−6.14	−5.69
p	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
m_2	1.35	1.27	1.26	1.30	1.08	1.13	1.44	1.32
p	0.18	0.20	0.21	0.19	0.28	0.26	0.15	0.19
S		84.24		77.94		90.61		83.3
p		0.14		0.27		0.06		0.15

Each regression uses 1072 observations on 112 firms. Sample period is 1985-1997

Each regression includes 13 time dummies

Standard errors are heteroskedasticity consistent

m1, m2 are first-order and second order serial correlation tests, both are asymptotically N(0,1)

S is Sargan test: asymptotically χ^2_{71}

* Significant at 1% level, ** at 5% level

5.3 Size and the financial accelerator

Does the strength of the financial accelerator channel differ across firm size classes? In this section estimation results using the following specification are presented,

$$IK_{it} = \beta IK_{i,t-1} + \gamma SK_{i,t-1} + \theta_s S_i B_{i,t-1} + \theta_m M_i B_{i,t-1} + \theta_l L_i\ B_{i,t-1} + \delta_t + u_i + \epsilon_{i,t}, \quad (6)$$

where S_i, M_i and L_i are dummy variables indicating the size of the firm (small, medium size or large). Now the coefficients θ_s, θ_m and θ_l measure the sensitivity of the investment-rate with respect to the balance sheet indicators of the different firm size classes. It is expected that small firms show larger sensitivity than medium size firms and medium size firms show larger sensitivity than large firms. Since there are only 112 firms in the sample, the precision of the coefficients can be expected to be low.

The results of the estimations are presented in Table 11. For the first step estimates, only the coverage ratio is significant at the 5% level for the small firms and significant at the 1% level for the medium sized firms. The relative magnitudes of the coefficients on the coverage ratio are as expected: largest for the small firms, smaller for the medium sized firms and insignificant for the large firms. The first step estimates for the other variables $DA_{it}, SDCA_{it}$ and FS_{it} are insignificant. However, as expected the magnitudes are the largest (in absolute value) for the small firms.

The second step estimates also confirm the expectation that small firms are influenced by a stronger financial accelerator. For all balance sheet indicators, the small firm coefficient is significant at the 1% level and presents the strongest financial accelerator. The point estimates for the small firms (θ_s) are also much larger than the point estimates presented earlier in Table 9 (when only a single estimate was obtained per balance sheet variable).

For medium and large size firms the results are less clear. For both these size classes there is no evidence that the debt-asset ratio DA_{it} has any effect. For the short-term debt current assets ratio and the fraction of short term debt on total debt ratio, the medium size firms have the wrong (and significant coefficient). For large firms only the fraction of short-term debt as a fraction of total debt and the coverage ratio show some effect.

Overall, the evidence points towards strong accelerator effects for small firms. A one standard deviation increase in the debt assets ratio DA_{it} leads to a drop in the investment rate of 5.6 percentage point. Likewise, for the short-term debt short-term assets ratio this number is 2.6 percentage point. For FS_{it} and COV_{it} it is 4.8 and 5.7 respectively. Whether any difference can be found in and out of a downturn, is taken up in the next section.

TABLE 11

Firm size and the financial accelerator

Dependent variable is IK_{it}								
GMM estimates of first differenced equation								
Variable	GMM1	GMM2	GMM1	GMM2	GMM1	GMM2	GMM1	GMM2
IK_{it-1}	0.29*	0.29*	0.30*	0.33*	0.31*	0.31*	0.10	0.10*
	(0.07)	(0.02)	(0.07)	(0.02)	(0.08)	(0.03)	(0.06)	(0.02)
SK_{it-1}	2.74*	2.31*	2.26*	1.95*	2.40*	1.96*	2.50*	2.10*
	(0.81)	(0.36)	(0.72)	(0.25)	(0.87)	(0.34)	(0.69)	(0.25)
$S_i * DA_{it-1}$	−0.65	−0.58*	-	-	-	-	-	-
	(0.34)	(0.12)	-	-	-	-	-	-
$M_i * DA_{it-1}$	−0.08	−0.004	-	-	-	-	-	-
	(0.33)	(0.14)	-	-	-	-	-	-
$L_i * DA_{it-1}$	0.26	0.12	-	-	-	-	-	-
	(0.16)	(0.07)	-	-	-	-	-	-
$S_i * SDCA_{it-1}$	-	-	−0.22	−0.24*	-	-	-	-
	-	-	(0.19)	(0.08)	-	-	-	-
$M_i * SDCA_{it-1}$	-	-	0.07	0.22**	-	-	-	-
	-	-	(0.22)	(0.10)	-	-	-	-
$L_i * SDCA_{it-1}$	-	-	-0.01	−0.02	-	-	-	-
	-	-	(0.09)	(0.04)	-	-	-	-
$S_i * FS_{it-1}$	-	-	-	-	−0.46	−0.56*	-	-
	-	-	-	-	(0.42)	(0.15)	-	-
$M_i * FS_{it-1}$	-	-	-	-	0.73	0.80*	-	-
	-	-	-	-	(0.49)	(0.21)	-	-
$L_i * FS_{it-1}$	-	-	-	-	−0.36	−0.27*	-	-
	-	-	-	-	(0.21)	(0.08)	-	-
$S_i * COV_{it-1}$	-	-	-	-	-	-	4.86**	4.31*
	-	-	-	-	-	-	(1.95)	(0.82)
$M_i * COV_{it-1}$	-	-	-	-	-	-	4.52*	3.70*
	-	-	-	-	-	-	(1.53)	(0.60)
$L_i * COV_{it-1}$	-	-	-	-	-	-	1.00	0.83*
	-	-	-	-	-	-	(0.65)	(0.29)
m_1	−6.27	−5.59	−6.66	−5.92	−6.89	−5.99	−6.47	−5.87
p	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
m_2	1.22	1.29	1.21	1.36	1.27	1.11	1.44	1.29
p	0.22	0.20	0.23	0.17	0.21	0.26	0.15	0.20
S		91.24		82.87		90.71		74.57
p		0.05		0.14		0.05		0.33

Each regression uses 1072 observations on 112 firms. Sample period is 1985-1997

Each regression includes 13 time dummies

Standard errors are heteroskedasticity consistent

m1, m2 are first-order and second order serial correlation tests, both are asymptotically N(0,1)

S is Sargan test: asymptotically χ^2_{70}

* Significant at 1% level, ** at 5% level

5.4 Size, downturns and the financial accelerator

In this section, the most complete specification is used. It allows for both differences in accelerator effects across size classes as well as in and out of downturns. The specification used is:

$$IK_{it} = \beta IK_{i,t-1} + \gamma SK_{i,t-1} + (\theta_s + \theta_{sr} R_{jt}) S_i B_{i,t-1} \quad (7)$$

$$+(\theta_m + \theta_{mr} R_{jt}) M_i B_{i,t-1} + (\theta_l + \theta_{lr} R_{jt}) L_i \ B_{i,t-1} + \delta_t + u_i + \epsilon_{i,t}, \quad (8)$$

where θ_{sr}, θ_{mr} and θ_{lr} now measure the differential effect of the financial accelerator in downturns for small, medium and large firms respectively. Again, dummy variable R_{jt} indicates whether country j is in a downturn and S_i, M_i and L_i are the dummy variables indicating the size of the firm.

It is expected that outside downturns small firms show larger sensitivity than median size firms and large firms (i.e.$|\theta_s| > |\theta_m| > |\theta_l|$). It is further expected that inside downturns, the effect of the accelerator 'accelerating' is larger for small firms than for medium and large firms(i.e $|\theta_{sr}| > |\theta_{mr}| > |\theta_{lr}|$).

The results of the regression are presented in Table 12. As expected, small firms show larger sensitivity with respect to balance sheet variables outside downturns. The first step estimates for the small firms all have the correct sign and the absolute value is largest for all balance sheet variables, with the one exception being the coverage ratio for which medium size firms have the largest point estimate. The first step estimates of $SDCA$ and FS are not significant however. Given the small size of the sample this should not be too surprising however. The second step estimates are all significant.

For the median size firms, there is little evidence of a financial accelerator outside downturns. The first step estimates are all insignificant (with again the exception of the coverage ratio). The second step estimates for the median sized firms are all significant, but somewhat unexpectedly of the wrong sign (except COV). The first and second step estimates for the large firms outside downturns are all insignificant with the exception of the coverage ratio and second step estimate of the fraction of short term debt on total debt, FS. However the point estimate is 4 times smaller than the one of the small firms (-0.15 versus -0.60).

The coefficient estimates of the differential effect of a downturn do not fully confirm expectations. There is no evidence of an 'accelerating' accelerator for small firms. Hence, although balance sheet variables are important for small firms, there is no evidence that this importance increases during a downturn. Downturns do seem to effect medium size firms however. The first step estimates all have the correct sign (except COV) and only the variable FS is not significant. The second step estimates are all significant. For large firms there is also no evidence of an 'accelerating' accelerator. Hence the evidence here suggests that the stronger effect in downturns found in the previous section can be attributed to the medium size firms.

TABLE 12
Firm size, downturns and the financial accelerator

Dependent variable is IK_{it}
GMM estimates of first differenced equation

Variable	GMM1	GMM2	GMM1	GMM2	GMM1	GMM2	GMM1	GMM2
IK_{it-1}	0.18^{**}	0.16^{*}	0.19^{**}	0.19^{*}	0.21^{**}	0.17^{*}	0.04	0.03
	(0.08)	(0.03)	(0.09)	(0.03)	(0.08)	(0.03)	(0.06)	(0.03)
SK_{it-1}	2.50^{**}	2.09^{*}	2.28^{**}	2.24^{**}	2.44^{*}	2.30^{*}	3.05^{*}	2.95^{*}
	(1.25)	(0.42)	(1.05)	(0.34)	(1.05)	(0.37)	(0.78)	(0.31)
$S_i * DA_{it-1}$	-0.85^{**}	-0.81^{*}	-	-	-	-	-	-
	(0.41)	(0.18)	-	-	-	-	-	-
$M_i * DA_{it-1}$	0.21	0.40^{*}	-	-	-	-	-	-
	(0.46)	(0.14)	-	-	-	-	-	-
$L_i * DA_{it-1}$	0.19	0.04	-	-	-	-	-	-
	(0.19)	(0.07)	-	-	-	-	-	-
$R_t * S_i * DA_{it-1}$	0.04	0.009	-	-	-	-	-	-
	(0.04)	(0.02)	-	-	-	-	-	-
$R_t * M_i * DA_{it-1}$	-0.23^{*}	-0.19^{*}	-	-	-	-	-	-
	(0.08)	(0.04)	-	-	-	-	-	-
$R_t * L_i * DA_{it-1}$	0.01	-0.004	-	-	-	-	-	-
	(0.05)	(0.02)	-	-	-	-	-	-
$S_i * SDCA_{it-1}$	-	-	-0.55	-0.57^{*}	-	-	-	-
	-	-	(0.31)	(0.09)	-	-	-	-
$M_i * SDCA_{it-1}$	-	-	0.14	0.23^{**}	-	-	-	-
	-	-	(0.31)	(0.10)	-	-	-	-
$L_i * SDCA_{it-1}$	-	-	0.06	0.02	-	-	-	-
	-	-	(0.13)	(0.07)	-	-	-	-
$R_t * S_i * SDCA_{it-1}$	-	-	0.05	0.03	-	-	-	-
	-	-	(0.04)	(0.01)	-	-	-	-
$R_t * M_i * SDCA_{it-1}$	-	-	-0.20^{*}	-0.17^{**}	-	-	-	-
	-	-	(0.06)	(0.04)	-	-	-	-
$R_t * L_i * SDCA_{it-1}$	-	-	-0.01	-0.02	-	-	-	-
	-	-	(0.04)	(0.02)	-	-	-	-
$S_i * FS_{it-1}$	-	-	-	-	-0.40	-0.60^{*}	-	-
	-	-	-	-	(0.44)	(0.16)	-	-
$M_i * FS_{it-1}$	-	-	-	-	0.63	0.70^{*}	-	-
	-	-	-	-	(0.54)	(0.19)	-	-
$L_i * FS_{it-1}$	-	-	-	-	-0.21	-0.15^{*}	-	-
	-	-	-	-	(0.23)	(0.11)	-	-
$R_t * S_i * FS_{it-1}$	-	-	-	-	0.06^{**}	0.06^{*}	-	-
	-	-	-	-	(0.03)	(0.01)	-	-
$R_t * M_i * FS_{it-1}$	-	-	-	-	-0.14	-0.13^{*}	-	-
	-	-	-	-	(0.05)	(0.02)	-	-
$R_t * L_i * FS_{it-1}$	-	-	-	-	-0.01	-0.03	-	-
	-	-	-	-	(0.04)	(0.02)	-	-
$S_i * COV_{it-1}$	-	-	-	-	-	-	3.97^{**}	2.75^{*}
	-	-	-	-	-	-	(2.01)	(0.88)
$M_i * COV_{it-1}$	-	-	-	-	-	-	4.42^{**}	3.71^{*}
	-	-	-	-	-	-	(1.76)	(0.73)
$L_i * COV_{it-1}$	-	-	-	-	-	-	1.90^{**}	2.05^{*}
	-	-	-	-	-	-	(0.82)	(0.42)
$R_t * S_i * COV_{it-1}$	-	-	-	-	-	-	-1.32	-1.46^{*}
	-	-	-	-	-	-	(1.16)	(0.39)
$R_t * M_i * COV_{it-1}$	-	-	-	-	-	-	-0.74^{*}	-0.55
	-	-	-	-	-	-	(1.36)	(0.45)
$R_t * L_i * COV_{it-1}$	-	-	-	-	-	-	1.37	0.94^{*}
	-	-	-	-	-	-	(0.83)	(0.36)
m_1	-5.37	-5.07	-5.78	-5.04	-6.37	-5.37	-5.98	-5.50
p	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
m_2	-0.25	0.23	-0.48	0.10	0.06	-0.15	0.70	0.63
p	0.80	0.82	0.63	0.93	0.95	0.88	0.49	0.53
S		78.25		74.17		86.68		63.15
p		0.16		0.26		0.05		0.61

Each regression uses 1072 observations on 112 firms. Sample period is 1985-1997
Each regression includes 13 time dummies
Standard errors are heteroskedasticity consistent
m1, m2 are first-order and second order serial correlation tests, both are asymptotically N(0,1)
S is Sargan test: asymptotically χ^2_{67}
* Significant at 1% level, ** at 5% level

6 Country differences in the financial accelerator

'Do country differences exist in the strenght of the financial accelerator?' For instance, do firms in Germany react more to weak balance sheets in downturns than firms in France? Guiso, Kashyap, Panetta and Terlizzese (1999) argue that micro-economic data is more likely to provide possible answers to this and similar questions than macro-economic data. They argue that attempts with macro-economic data have not been entirely succesfull.

Clearly attempting to answer questions such as the one above with this database remains fairly ambitious due to the rather small cross-section dimension of the individual country data. In total there are 27 units of observation for Germany and Spain and 29 for France and Italy. Therefore only when large differences across countries exist they will likely show up significantly. Small differences will be hard to detect with this amount of data. [14]

The purpose of this section should therefore be interpreted in the following way. Are there large differences across countries so that the results of the pooled regressions are really driven by for instance one country? Given the above, only for hypothesis H1 and H2 one can reasonably check for country differences. To check for country differences in balance sheet effects, regression (2) is transformed to allow for country differences.

$$IK_{it} = \alpha + \beta IK_{i,t-1} + \gamma SK_{i,t-1} + \theta_g G * B_{i,t-1} + \tag{9}$$

$$\theta_f F * B_{i,t-1} + \theta_i I * B_{i,t-1} + \theta_s S * B_{i,t-1} + \delta_t + u_i + \epsilon_{i,t} \tag{10}$$

where G,F,I,S are four country dummies (Germany, France, Italy and Spain respectively).

The results of these regressions is given in Table 13. The large standard errors of the country specific coefficient estimates are not surprising. The only significant first step estimates are for Germany for SDCA and COV. According to this criterion German firms seem to be more vulnerable to balance sheet effects. However when balance sheet weakness is measured by FS, or DA the point estimate for Germany is insignificant. The first-step estimates for all other countries are insignificant. The insignificance of the estimates is consistent with the results of regression 2 (See table 9).

In table 14 results are presented of the following equation.

$$IK_{it} = \alpha + \beta IK_{i,t-1} + \gamma SK_{i,t-1} + \theta * B_{i,t-1} + \tag{11}$$

$$\theta_{gr} G * R_{gt} * B_{i,t-1} + \theta_{fr} F * R_{ft} * B_{i,t-1} + \theta_{ir} I * R_{it} * B_{i,t-1} + \tag{12}$$

$$\theta_{sr} S * R_{st} * B_{i,t-1} + \delta_t + u_i + \epsilon_{i,t} \tag{13}$$

This equation tests whether during downturns there are asymmetric effects across countries. For each country a separate coefficient for the downturn-balance sheet interaction is estimated. The point estimates of these interactions are similar across France and Italy. They are significant (in both first and second step) for all balance sheet variables (except the interaction with COV for France). The point estimates for Germany and Spain give some indication that balance sheet effects in downturns are less than in the other two

[14]This relates to the (asymptotic) efficiency of the panel GMM estimator which depends on the cross-section dimension. Otherwise said, N is the relevant dimension for efficiency not N times T.

countries. The first step estimates are not significant (except the interaction with DA for Germany). For the balance sheet variables DA, SCDA and FS the point estimates for Spain are the lowest. Given the size of the dataset, these results need to be taken with caution however.

TABLE 13

Balance sheet indicators
and the investment-capital ratio: country differences

Dependent variable is IK_{it}

GMM estimates of first differenced equation

Variable	GMM1	GMM2	GMM1	GMM2	GMM1	GMM2	GMM1	GMM2
IK_{it-1}	0.26*	0.25*	0.26*	0.27*	0.32*	0.34*	0.19**	0.17*
	(0.06)	(0.02)	(0.07)	(0.02)	(0.07)	(0.03)	(0.08)	(0.03)
SK_{it-1}	3.01*	2.62*	2.83*	2.50*	2.35*	1.97*	2.17*	2.02*
	(0.80)	(0.36)	(0.78)	(0.31)	(0.86)	(0.29)	(0.70)	(0.28)
$G * DA_{it-1}$	−0.41	−0.51	-	-	-	-	-	-
	(0.30)	(0.12)	-	-	-	-	-	-
$F * DA_{it-1}$	−0.17	−0.16**	-	-	-	-	-	
	(0.18)	(0.07)	-	-	-	-	-	-
$I * DA_{it-1}$	−0.27	−0.08	-	-	-	-	-	-
	(0.30)	(0.13)	-	-	-	-	-	-
$S * DA_{it-1}$	0.27	0.21*	-	-	-	-	-	-
	(0.14)	(0.06)	-	-	-	-	-	
$G * SDCA_{it-1}$	-	-	−0.30**	−0.23*	-	-	-	-
	-	-	(0.13)	(0.07)	-	-	-	-
$F * SDCA_{it-1}$	-	-	-0.08	-0.06	-	-	-	-
	-	-	(0.25)	(0.11)	-	-	-	-
$I * SDCA_{it-1}$	-	-	-0.17	-0.06	-	-	-	-
			(0.16)	(0.06)	-	-	-	-
$S * SDCA_{it-1}$	-	-	0.14	0.13*	-	-	-	-
	-	-	(0.08)	(0.03)	-	-	-	-
$G * FS_{it-1}$	-	-	-	-	0.12	0.19	-	-
	-	-	-	-	(0.47)	(0.21)		
$F * FS_{it-1}$	-	-	-	-	-0.32	-0.28*	-	-
	-	-	-	-	(0.21)	(0.11)	-	-
$I * FS_{it-1}$	-	-	-	-	-0.35	−0.26**	-	-
	-	-	-	-	(0.36)	(0.13)		
$S * FS_{it-1}$	-	-	-	-	-0.08	-0.09	-	-
	-	-	-	-	(0.23)	(0.11)	-	-
$G * COV_{it-1}$	-	-	-	-	-	-	3.20*	3.30*
	-	-	-	-	-	-	(0.80)	(0.43)
$F * COV_{it-1}$	-	-	-	-	-	-	1.04	0.78**
	-	-	-	-	-	-	(0.55)	(0.30)
$I * COV_{it-1}$	-	-	-	-	-	-	1.25	1.48*
	-	-	-	-	-	-	(0.90)	(0.40)
$S * COV_{it-1}$	-	-	-	-	-	-	0.78	0.94*
	-	-	-	-	-	-	(0.84)	(0.31)
m_1	−6.47	−5.51	−6.10	−5.63	−7.10	−5.99	−6.02	−5.63
p	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
m_2	1.15	1.06	0.95	1.05	1.24	1.25	1.26	1.13
p	0.25	0.29	0.34	0.29	0.21	0.21	0.21	0.26
S		84.0		80.6		93.6		78.4
p		0.11		0.16		0.03		0.21

Each regression uses 1072 observations on 112 firms. Sample period is 1985-1997

Each regression includes 13 time dummies

Standard errors are heteroskedasticity consistent

m1, m2 are first-order and second order serial correlation tests, both are asymptotically N(0,1)

S is Sargan test: asymptotically χ^2_{72}

* Significant at 1% level, ** at 5% level

TABLE 14
Asymmetric effects of the financial accelerator
country differences

Dependent variable is IK_{it}
GMM estimates of first differenced equation

Variable	GMM1	GMM2	GMM1	GMM2	GMM1	GMM2	GMM1	GMM2
IK_{it-1}	0.23*	0.21*	0.22*	0.22*	0.21*	0.23*	0.21**	0.17*
	(0.06)	(0.02)	(0.06)	(0.03)	(0.06)	(0.02)	(0.07)	(0.03)
SK_{it-1}	2.56*	2.42*	2.44*	2.20*	2.67*	2.50*	2.32*	2.11*
	(0.77)	(0.34)	(0.76)	(0.32)	(0.88)	(0.35)	(0.72)	(0.28)
DA_{it-1}	−0.08	−0.11*	-	-	-	-	-	-
	(0.08)	(0.04)	-	-	-	-	-	-
$G * R_t * DA_{it-1}$	−0.04**	−0.04*	-	-	-	-	-	-
	(0.02)	(0.01)	-	-	-	-	-	-
$F * R_t * DA_{it-1}$	−0.06*	−0.06*	-	-	-	-	-	
	(0.01)	(0.01)	-	-	-	-	-	-
$I * R_t * DA_{it-1}$	−0.07*	−0.06*	-	-	-	-	-	-
	(0.03)	(0.01)	-	-	-	-	-	-
$S * R_t * DA_{it-1}$	−0.02	−0.02**	-	-	-	-	-	-
	(0.03)	(0.01)	-	-	-	-	-	
$SDCA_{it-1}$	-	-	−0.08	−0.06**	-	-	-	-
	-	-	(0.06)	(0.03)	-	-	-	-
$G * R_t * SDCA_{it-1}$	-	-	−0.03	−0.03*	-	-	-	-
	-	-	(0.02)	(0.01)	-	-	-	-
$F * R_t * SDCA_{it-1}$	-	-	−0.07*	−0.07*	-	-	-	-
	-	-	(0.02)	(0.01)	-	-	-	-
$I * R_t * SDCA_{it-1}$	-	-	−0.05*	−0.05*	-	-	-	-
			(0.02)	(0.01)	-	-	-	-
$S * R_t * SDCA_{it-1}$	-	-	-0.01	0.02**	-	-	-	-
	-	-	(0.02)	(0.01)	-	-	-	-
FS_{it-1}	-	-	-	-	-0.30	−0.32*	-	-
	-	-	-	-	(0.16)	(0.06)		
$G * R_t * FS_{it-1}$	-	-	-	-	-0.02	0.02*	-	-
	-	-	-	-	(0.01)	(0.01)		
$F * R_t * FS_{it-1}$	-	-	-	-	−0.06*	-0.08*	-	-
	-	-	-	-	(0.01)	(0.01)	-	-
$I * R_t * FS_{it-1}$	-	-	-	-	−0.08*	−0.07*	-	-
	-	-	-	-	(0.03)	(0.01)		
$S * R_t * FS_{it-1}$	-	-	-	-	-0.001	-0.01	-	-
	-	-	-	-	(0.01)	(0.01)	-	-
COV_{it-1}	-	-	-	-	-	-	1.29*	1.61*
	-	-	-	-	-	-	(0.45)	(0.25)
$G * R_t * COV_{it-1}$	-	-	-	-	-	-	−0.23	0.29**
	-	-	-	-	-	-	(0.30)	(0.15)
$F * R_t COV_{it-1}$	-	-	-	-	-	-	-0.29	0.15
	-	-	-	-	-	-	(0.23)	(0.12)
$I * R_t * COV_{it-1}$	-	-	-	-	-	-	1.62**	1.60*
	-	-	-	-	-	-	(0.70)	(0.28)
$S * R_t * COV_{it-1}$	-	-	-	-	-	-	0.55	0.46**
	-	-	-	-	-	-	(0.41)	(0.18)
m_1	−5.99	−5.66	−5.93	−5.68	−6.14	−6.18	−5.50	−5.26
p	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
m_2	1.29	1.27	1.18	1.22	0.89	1.06	1.06	0.81
p	0.20	0.21	0.24	0.22	0.38	0.29	0.29	0.42
S		85.2		73.0		85.3		74.6
p		0.08		0.32		0.08		0.27

Each regression uses 1072 observations on 112 firms. Sample period is 1985-1997
Each regression includes 13 time dummies
Standard errors are heteroskedasticity consistent
m1, m2 are first-order and second order serial correlation tests, both are asymptotically N(0,1)
S is Sargan test: asymptotically χ^2_{72}
* Significant at 1% level, ** at 5% level

7 Conclusion

The financial accelerator implies that weak balance sheets can amplify shocks and have a negative effect on firm investment spending. The different strength of the accelerator across firm size classes and asymmetric effects over the cycle are investigated in this paper. This paper fills a gap in the evidence on this issue for the euro area.

The financial accelerator hypothesis was tested using data on the four largest euro area economies: Germany, France, Italy and Spain. There is ample evidence that a financial accelerator with different strength across size classes and asymmetric effects over the cycle is working in Europe.

There is strong evidence that small firm investment is the most vulnerable to weak balance sheets. There is no evidence that small firms are victim of a stronger accelerator during downturns than outside downturns. For medium sized firms and large firms there is no evidence that an accelerator is working outside downturns. However, during downturns, medium firms with weak balance sheets seem to become victim of an accelerator. During downturns, large firms seem to be able to endure the storm. No evidence was found for an accelerator for them.

The effect of weak balance sheets in downturns seems to be stronger in France and Italy then in Germany and Spain. Clearly further research with larger datasets is needed to address possible asymmetric effects of the financial accelerator in this dimension. Also, identifying different (real versus monetary) shocks over time might provide insight in the mechanism through which balance sheet variables matter. This is of special importance for policy makers. For this however, data at a higher frequency will be needed.

A APPENDIX

A.1 Construction of the sample

The source of the data is the BACH-database from the European Commission. It contains aggregated balance sheet and profit and loss account information for different industries and size classes of firms. Initially the 10 manufacturing industries (see below) and 3 size classes for Germany, France and Italy and Spain where selected. This gives 30 "representative firms" for each country, which is 120 in total. The years of data available are for Germany (1987-1996), for France (1985-1997), for Italy (1983-1997) and for Spain (1983-1997). This gives a total of 1590 observations. The 1% outliers of the variables used in the regression are removed and thereafter firms are eliminated for which not at least 5 consecutive years of data are available. This leaves a final data set of 112 "representative" firms.

A.2 Construction of the variables

IK: Investment capital ratio. Investment is measured by BACH item Acquisition of tangible fixed assets minus sales and disposals. Capital is measured by fixed assets.
SK: Sales capital ratio. Sales is measured by the sales variable in BACH.
DA: Debt asset ratio. Debt is measured by summing creditors: amounts becoming due and payable within one year and Creditors: amounts becoming due and payable after more than one year. Assets are measured by total assets.
$SDCA$: Short-term debt short-term assets ratio. Short-term debt is measured by Creditors: amounts becoming due and payable within one year. Short-term assets are measured by Current assets.
FS: short-term debt as fraction of total debt. Short-term debt is measured as above. Total debt is measured as above.
COV: Cash flow on interest payments. Cash flow is measured as gross operating profit (which is net operating profit plus depreciation). Interest payments are measured as interest and similar charges.

A.3 List of the industries used

The following industries are used.
D211: Extraction of metalliferous ores and preliminary processing of metal
D212: Extraction of non-metalliferous ores and manufacture of non-metallic mineral products
D213: Chemical and man-made fibers
D221: Manufacture of metal articles, mechanical and instrument engineering
D222: Electrical and electronic equipment including office and computing equipment
D223: Manufacture of transport equipment

D231: Food, drink and tobacco
D232: Textiles, leather and clothing
D233: Timber and Paper manufacturing, printing
D234: Other manufacturing industries not elsewhere specified

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