Why do corporate cash holdings differ within reunified Germany?

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Abstract

This study examines German firms' managerial decision-making from the perspective of corporate cash holdings. An econometric analysis of 89,018 firm-year observations for 2004–2016 shows that East German firms hold significantly more cash than their West German counterparts. It is further demonstrated that no reasonable hypotheses (i.e. structural differences, access to financing, and historical differences) can explain East German firms' higher cash holdings. Instead, the difference in cash holdings is only relevant for small- and medium-sized enterprises (SMEs). Additionally, East German SMEs adjust excess cash more slowly than West German SMEs. These findings are consistent with the hypothesis that cultural attributes influence managerial decision-making and imply that the norms and values of the former German Democratic Republic persist.

Keywords Managerial decision-making · Corporate cash holdings · Speed of adjustment · SME · Cultural attributes · Germany

JEL Classification G30 · G32 · M14 · Z1

1 Introduction

The German reunification in 1990 caused an unexpected and rapid change in the political system of the former socialist German Democratic Republic (GDR).¹ While some studies estimated the transition to the West German system to be

¹ For the sake of readability, we refer to states of the former GDR as East Germany and the 'old' states of the Federal Republic of Germany as West Germany throughout the paper.

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completed within 5 to 15 years (Beirat des Bundeswirtschaftsministeriums 1991; Dornbusch and Wolf 1994), more recent research, however, posits that norms and values can persist across generations (Necker and Voskort 2014; Wyrwich 2015). Consequently, it is unsurprising that many studies use the reunification of Germany as a quasi-natural experiment to analyse the impact of exposure to the former GDR's norms and values. Differences have been observed, for instance, in the labour market (Fuchs-Schündeln and Izem 2012; Snower and Merkl 2006; Uhlig 2006) or in household consumption and savings (Bursztyn and Cantoni 2016; Friehe and Mechtel 2014; Fuchs-Schündeln 2008). Furthermore, the preference for state interventions (Alesina and Fuchs-Schündeln 2007), the degree of solidarity (Brosig-Koch et al. 2011), and the level of trust and values (Heineck and Süßmuth 2013; Necker and Voskort 2014; Rainer and Siedler 2009) vary between East and West Germany, indicating a persistence of pre-existing norms and values.

Expanding the literature on observed differences in entrepreneurial activity (Bauernschuster et al. 2012; Fritsch et al. 2015; Runst 2013; Wyrwich 2013), we study a subsample of the East and West German population comprising individuals who decided to be entrepreneurs or managers.² Thus, this study analyses managerial decision-making through the lens of corporate cash holdings, which reflects an important corporate finance decision independent of firm size. Our dataset ranges from 2004 to 2016 and contains 89,018 firm-year observations from 14,823 firms. Starting with an exploratory analysis, we observe statistically significant and robust differences in cash holdings between East and West German firms; specifically, East German firms have significantly higher cash levels than their West German counterparts.

We test several reasonable hypotheses that may potentially explain the higher cash holdings of East German firms. First, we exclude the possibility of structural differences in our sample by matching East German firms with West German firms based on firm characteristics and geographical proximity. Second, we control for different access to financing by considering different levels of external finance dependency, financial constraints, differences in bank concentration, and urbanisation effects. Third, we also address the possibility of historical differences by excluding firms founded before 1990 and by controlling for historical entrepreneurial roots. However, none of these specifications explain the significantly higher cash holdings of the East German firms.

The differences observed between East and West Germany in various situations, however, might also make a case for our analysis of managerial decision-making. In fact, Chen et al. (2015) observe that corporate cash holdings are influenced by cultural attributes and are higher in countries that are more collectivistic, whereas they are lower in the more individualistic countries, which is supported by our observation of higher cash holdings in East German firms. Therefore, we present two additional tests for the hypothesis of differences in cultural attributes between East and West German managerial decision-making. On the one hand, we separately compare

² For the ease of the readers, we use 'managers' throughout the paper even though our dataset mainly comprises micro-, small-, and medium-sized firms.

East and West German firms for different size classes and observe that while there is no significant difference in cash holdings for large firms, it exists for medium-, small-, and micro-sized firms. This result is consistent with the hypothesis that the smaller a firm, the fewer the individuals involved in decision-making and the lower the probability that cultural attributes are diversified. On the other hand, we also analyse the dynamic adjustment of cash holdings and find that if firms hold more cash than their target level, East German firms adjust the excess cash more slowly than their West German counterparts. However, as information about the managers' origin and their individual cultural attributes is unavailable for us, we cannot conclude that the cultural differences of East German firm managers are the reason for this observation. In general, however, our results are consistent with the hypothesis of different cultural attributes, implying the persistence of the former GDR's norms and values.

Our study makes a two-fold contribution to the literature. First, we extend the existing research on the differences between East and West Germany with respect to managerial decision-making by examining accounting data. The significantly different levels of cash holdings observed between East and West German firms, however, call for further survey-based research to examine the existence of cultural attribute differences. Second, we add to a recently growing body of finance research that analyses the effect of cultural attributes on corporate finance policy.

The remainder of the paper is structured as follows: Sect. 2 outlines the German reunification as our research environment. Section 3 provides an overview of our dataset, the model specification, and the results of our exploratory baseline regression. In Sect. 4, we test potential explanations about different levels of cash holdings. In Sect. 5, we demonstrate that our results are consistent with the hypothesis of differences in cultural attributes between East and West German managerial decision-making. Finally, in Sect. 6 we present our conclusions.

2 Research environment: Germany's reunification

The history of Germany and its reunification in 1990 is of special academic interest because it represents a proxy for the transformation process of all former socialist countries of the former Eastern bloc. Early studies in the mid-nineties estimated the complete transition process to take between 5 years and up to a generation (Barro 1991; Beirat des Bundeswirtschaftsministeriums 1991; Dornbusch and Wolf 1994). Meanwhile, a plethora of studies have examined whether differences still exist between East and West Germany. These studies, ranging from labour markets and saving rates (Fuchs-Schündeln 2008; Uhlig 2008) to preferences towards the former political system (Alesina and Fuchs-Schündeln 2007) and differences in self-reliance due to cultural exposure (Bauernschuster et al. 2012), unanimously observe that differences still exist, indicating the persistence of pre-existing norms and values.

In the same vein, one stream of literature focuses on the entrepreneurial perspective. Entrepreneurial activity represents an important indicator of development for market economies, and most literature draws on Baumol's (1990) claim regarding the relevance of institutions, namely, that the number of potential

entrepreneurs is similar across different societies, but a society's institutional framework determines whether this potential is actually exploited. According to Fritsch et al. (2015), lower self-employment rates in East Germany after reunification are explained mainly by the behavioural characteristics of the East Germans, having been exposed to the former GDR's norms and values. Similarly, Runst (2013) analyses the determinants of self-employment in reunified Germany and suggests that the probability of being self-employed is significantly lower for individuals socialised in East Germany. Behavioural differences between East and West German populations have been linked to individuals' personalities. For instance, Bauernschuster et al. (2012) relate the level of entrepreneurship with the level of self-reliance and find an association between lower self-reliance, as observed in East Germany, and lower self-employment. Similarly, Wyrwich (2013) finds that work experience is related to entrepreneurial activity, but this relation is lower for older East Germans than their West German counterparts.

While all the survey-based evidence indicates that entrepreneurial activity seems to be affected by the persistent norms and values of the former GDR, the differences in managerial decision-making between East and West Germany remain hitherto unexplored. Therefore, we focus on the subset of East and West Germans who decide to manage a firm and analyse their decisions rather than survey responses. In other words, while entrepreneurial activity varies between East and West Germany, we examine whether the specific individuals who choose to manage a firm differ in their decision-making.

We measure managerial decision-making through the level of corporate cash holdings because it serves as unconditional liquidity that is available at any time (Lins et al. 2010). Existing literature has developed several theories on why firms hold cash (e.g. transaction-costs motive or precautionary motive; see recent studies, such as Bates et al. 2009 or Weidemann 2019) and has highlighted its relevance for all firm sizes, which is crucial for this study, as our sample mainly comprises small- and medium-sized enterprises (SMEs). Further, we favour cash holdings as our variable of interest for managerial decision-making because setting the cash level represents a common corporate finance decision with a certain amount of variation over time. A low level of cash may increase the risk of sudden illiquidity for managers. Conversely, a high level of cash implies high opportunity costs resulting from low returns to cash and losing out on valuable investments. Managers face this trade-off when determining the firms' level of cash; thus, we examine whether East German managers differ from West German managers in this regard. On the one hand, given the sudden transformation of the legal and institutional framework from East Germany's socialism to West Germany's capitalism, as well as the myriad of studies that estimate the transition process to be complete, one would expect to see no differences in managerial decision-making, proxied by corporate cash holdings, between East and West Germany. On the other hand and as outlined above, differences between East Germany and West Germany have been observed in recent research. Therefore, we begin with an exploratory analysis of whether cash holdings differ between East and West German firms.

3 Data and first evidence

3.1 Data

The firm data for 2004–2016 is drawn from Creditreform AG,³ which provides comprehensive coverage and a representative sample of active companies registered in Germany. To ensure that the dataset is appropriate, data cleaning is performed as follows: First, for appropriate firm location, we discard companies with consolidated financial statements and only retain firms with individual financial statements. Second, we delete incorporations, as the board of directors may include international managers. Third, we exclude firms that were founded before 1950. Fourth, following studies such as Fritsch et al. (2014) and Uhlig (2006), we discard firms located in Berlin. Lastly, banking, finance, insurance, real estate companies, as well as utilities, public administration, and defence companies are excluded, because of differences in their balance sheets and income statements.

Several plausibility checks are performed to eliminate visibly incorrect observations (that is, negative values for cash holdings, total assets, total sales, and tangible assets, or if cash holdings are larger than total assets). Finally, we require at least four consecutive years of observations for each firm to be available.⁴ To mitigate the potential impact of outliers, we trim variables at the 2.5th percentile in both tails. The final dataset contains 14,823 firms with 89,018 firm-year observations, of which approximately 26% are included in the East German sample. Table 1 provides full-sample summary statistics for the dependent and all the main control variables (see Table 9 in the Appendix for an outline of variable construction).

Table 2 shows the summary statistics for East and West Germany separately and tests for the differences in means between the two regions. Furthermore, we explicitly differentiate between the full sample (Panel A) and an SME sample (Panel B) because SMEs are known to hold more cash than large-sized firms due to different economies of scale (Dittmar et al. 2003; Opler et al. 1999). Therefore, we also present all results for the full sample and the SME subsample in this study. For this purpose, we define SMEs according to §267 of the German Commercial Code, based on the number of employees, total assets, and total sales (see Appendix Table 10 for details).

The first row of Table 2 depicts the cash to total assets ratio; the t-statistics indicate an economically and statistically significant difference between East and West German firms. Notably, this is the case for both the full sample (Panel A) and the SME subsample (Panel B). We further observe that East German firms are smaller in size, have higher tangible fixed assets, and tend to be younger. These differences are statistically significant based on the t-statistic for the differences in means. However, according to Garcia-Appendini (2018) and Imbens and Wooldridge (2009),

³ Creditreform AG is a holding company providing core services like business intelligence and receivables management.

⁴ Note that this procedure does not yield a survivorship bias. All results remain unchanged upon re-estimating all models with at least two consecutive years of observations available (not tabulated).

Table 1 Summary statistics

	Mean	Median	25th Pct.	75th Pct.	Std.Dev.	N
<i>Cash_t</i>	0.119	0.059	0.013	0.176	0.146	89,018
<i>Operating cash flow_{t-1}</i>	0.111	0.097	0.049	0.163	0.105	89,018
<i>Cash flow volatility_{t-1}</i>	0.055	0.041	0.022	0.073	0.047	89,018
<i>Inventory_{t-1}</i>	0.230	0.193	0.063	0.361	0.188	89,018
<i>Net working capital_{t-1}</i>	0.008	0.015	− 0.147	0.179	0.257	89,018
<i>Sales growth_{t-1}</i>	0.063	0.034	− 0.047	0.132	0.236	89,018
<i>Tangible assets_{t-1}</i>	0.253	0.186	0.069	0.394	0.220	89,018
<i>Debt_{t-1}</i>	0.665	0.703	0.492	0.862	0.239	89,018
<i>Short-term bank debt_{t-1}</i>	0.139	0.085	0.026	0.202	0.144	54,340
<i>Total assets_{t-1}</i> (in Mio. €)	15.332	15.339	14.041	16.544	1.726	89,018
<i>Age_t</i> (in years)	21.514	19.000	12.000	28.000	12.977	89,018

This table reports summary statistics for the full sample. All variables except *Cash flow volatility*, *Sales growth*, *Age* and *Total assets* are defined as ratios. The lower number of observations in *Short-term bank debt* is due to missing data. We refer to Table 9 in the Appendix for details on the variable construction. Variables with subscript $t - 1$ are lagged by one year in the regression analysis

the normalised difference is more accurate than the t-statistic for large sample as t-statistics increase with rising sample size. As a rule of thumb, the critical level of normalised absolute differences is 0.25. Normalised differences below this level imply that linear regression models are not sensitive to the specification.⁵ Nonetheless, this necessitates multivariate regression analyses to exclude the possibility of interdependencies with other firm characteristics and control for different sources of heterogeneity.

3.2 Model specification

The dependent variable is firms' cash holdings divided by total assets (*Cash_{i,t}*). We follow existing literature by using cash as a ratio of total assets and by specifying the econometric model (Bates et al. 2009; Opler et al. 1999; Phan et al. 2019). We additionally account for the firms' location (whether East or West Germany). Our regression model therefore reads as follows:

$$Cash_{i,t} = \alpha + \beta East_i + \gamma X_{i,t} + D_t + D_j + \epsilon_{i,t}, \quad (1)$$

where *Cash_{i,t}* is the dependent variable, that is, firm *i*'s cash holdings in year *t* divided by firm *i*'s total assets in year *t*. Our main independent variable of interest is *East_i*, which is a dummy variable that takes a value of 1 if the company is in

⁵ The normalised difference is calculated as follows: $\Delta_x = \frac{\bar{X}_1 - \bar{X}_0}{\sqrt{S_1^2 + S_0^2}}$, where $\bar{X}_1$ and $\bar{X}_0$ are the sample averages and S_1^2 and S_0^2 are the sample variances of variable *X* in the East and the West sample, respectively (Garcia-Appendini 2018; Imbens and Wooldridge 2009).

Table 2 Summary statistics for East and West German firms

	East			West			Test for equality in means		
	Mean	Median	N	Mean	Median	N	Δ	<i>t</i> -stat	Norm. diff.
Panel A: Full sample									
<i>Cash_t</i>	0.127	0.071	23,268	0.116	0.055	65,750	0.011***	9.843	0.053
<i>Operating cash flow_{t-1}</i>	0.112	0.100	23,268	0.110	0.096	65,750	0.002**	3.239	0.018
<i>Cash flow volatility_{t-1}</i>	0.052	0.039	23,268	0.056	0.042	65,750	-0.004***	-10.671	-0.058
<i>Inventory_{t-1}</i>	0.210	0.166	23,268	0.237	0.204	65,750	-0.027***	-18.872	-0.103
<i>Net working capital_{t-1}</i>	-0.018	-0.009	23,268	0.018	0.025	65,750	-0.036***	-18.413	-0.101
<i>Sales growth_{t-1}</i>	0.072	0.035	23,268	0.060	0.034	65,750	0.012***	6.607	0.034
<i>Tangible assets_{t-1}</i>	0.319	0.276	23,268	0.230	0.158	65,750	0.089***	54.084	0.287
<i>Debt_{t-1}</i>	0.647	0.682	23,268	0.672	0.711	65,750	-0.024***	-13.189	-0.071
<i>Short-term bank debt_{t-1}</i>	0.130	0.082	16,076	0.140	0.087	38,264	-0.009***	-6.697	-0.045
<i>Total assets_{t-1}</i> (in Mio. €)	14.794	14.760	23,268	15.522	15.560	65,750	-0.728***	-56.281	-0.310
<i>Age_t</i> (in years)	16.557	17.000	23,268	23.268	20.000	65,750	-6.711***	-69.617	-0.426
Panel B: SME									
<i>Cash_t</i>	0.132	0.075	21,072	0.123	0.058	49,331	0.009***	7.248	0.042
<i>Operating cash flow_{t-1}</i>	0.113	0.101	21,072	0.112	0.098	49,331	0.001	1.004	0.006
<i>Cash flow volatility_{t-1}</i>	0.053	0.040	21,072	0.059	0.045	49,331	-0.006***	-14.479	-0.085
<i>Inventory_{t-1}</i>	0.214	0.170	21,072	0.250	0.219	49,331	-0.036***	-23.085	-0.136
<i>Net working capital_{t-1}</i>	-0.019	-0.010	21,072	0.017	0.026	49,331	-0.036***	-16.891	-0.100
<i>Sales growth_{t-1}</i>	0.073	0.034	21,072	0.063	0.033	49,331	0.010***	5.006	0.028
<i>Tangible assets_{t-1}</i>	0.308	0.263	21,072	0.213	0.143	49,331	0.095***	55.326	0.315
<i>Debt_{t-1}</i>	0.661	0.695	21,072	0.687	0.732	49,331	-0.026***	-13.405	-0.078

Table 2 (continued)

	East			West			Test for equality in means		
	Mean	Median	N	Mean	Median	N	Δ	t-stat	Norm. diff.
<i>Short-term bank debt</i> _{<i>t-1</i>}	0.134	0.085	14,750	0.152	0.104	29,805	- 0.018***	- 12.302	- 0.089
<i>Total assets</i> _{<i>t-1</i>} (in Mio. €)	14.491	14.563	21,072	14.784	14.942	49,331	- 0.293***	- 27.164	- 0.158
<i>Age</i> _{<i>t</i>} (in years)	16.518	17.000	21,072	22.398	19.000	49,331	- 5.880***	- 59.244	- 0.383

This table reports summary statistics for East and West German firms. All variables except *Cash flow volatility*, *Sales growth*, *Age* and *Total assets* are defined as ratios. The lower number of observations in *Short-term bank debt* is due to missing data. Panel A includes the full sample of firms and Panel B includes only SMEs. The sizing of SME and large firms is classified according to §267 of the German Commercial Code. Firms are classified either as SME or Large if two of the following three criteria apply: employees smaller or equal to 250, total assets smaller or equal to € 19.25 Mio. and total sales smaller or equal to € 38.5 Mio. Variables with subscript $t - 1$ are lagged by 1 year in the regression analysis. *, ** and *** indicate statistical significance at the 10%, 5% and 1% level

East Germany, and 0 otherwise (West Germany). If cash holdings between East and West German firms differ, we would expect β in Eq. (1) to be significant. We apply a random-effects generalised least squares (GLS) model with year (D_t) and industry fixed effects based on NACE2 Level 1 classification (D_j), which allows us to control for heterogeneity across industries, business cycle fluctuations, and other life-cycle effects. $X_{i,t}$ represents a vector of control variables that are key determinants of corporate cash holdings, including operating cash flow, operating cash flow volatility, inventory, working capital net cash, sales growth, fixed assets labelled as tangible assets, total liabilities, the natural logarithm of total assets, and firm age (see Gao et al. 2013, for a detailed outline). To calculate operating cash flow volatility, we follow Keefe and Yaghoubi (2016) and use a minimum of 2 years; if more firm-year observations are available, a maximum of 5 years is used. This ensures proper measurement without the loss of too many observations. We also control for region-specific economic developments by including the GDP per capita growth rate of the federal state in which the firm is located.⁶ To avoid simultaneity bias, all control variables except age are lagged by 1 year. Furthermore, analogous to the dependent variable, we scale all control variables, except cash flow volatility, sales growth, total assets, and firm age, by total assets. Considering that observations of the same firm over time are not independent, we cluster standard errors at the firm level.

3.3 Results of the exploratory analysis

Table 3 shows the main estimation results for Eq. (1) and includes additional robustness checks. First, Column (1) corresponds to the full sample and tests for differences in cash holdings between East and West German firms. There is a statistically significant difference in cash holdings between East and West German firms (represented by *East*). The cash level is significantly higher in East German firms, even after controlling for firm- and industry-specific characteristics. We observe the same for the SME subsample [Column (2)]. Note that these differences are also economically relevant, as the cash ratio of East German firms, on average, is 15% higher than that of West German firms (i.e. the coefficient of *East* (1.8%) divided by the average cash ratio (11.9%) from Table 1).

Equation (1) assumes that the impact of the control variables is the same for East and West German firms. To relax this assumption and allow for different control variable coefficients for East and West German firms, we include interaction terms of all control variables with the *East* dummy. The estimation results are shown in Columns (3) and (4) of Table 3; the main observation remains unchanged with this specification. Notably, the only significant interaction term is $East \times Total\ assets_{t-1}$,

⁶ In additional (unreported) robustness checks, we add macroeconomic variables that vary across federal states (i.e. the growth rate of gross capital investments, the growth rate of household savings, and the growth rate of employment) and replace GDP per capita with GDP per resident, GDP per work force, and GDP per working hour. Qualitatively, our results remain the same and are available upon request. The data on macroeconomic variables are sourced from <https://www.statistikportal.de/de/vgrdl/ergebnisse-laenderebene/bruttoinlandsprodukt-bruttowertschoepfung> (28.05.2021).

Table 3 Cash holdings in East and West Germany

	Baseline		Interaction effects		Crisis		Last available year	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	All	SME	All	SME	All	SME	All	SME
<i>East</i>	0.018*** (0.002)	0.020*** (0.002)	0.088*** (0.023)	0.084*** (0.028)	0.018*** (0.002)	0.020*** (0.002)	0.014*** (0.003)	0.017*** (0.003)
<i>Operating cash flow</i> _{<i>t</i>-1}	0.086*** (0.005)	0.095*** (0.005)	0.082*** (0.006)	0.090*** (0.006)	0.086*** (0.005)	0.095*** (0.005)	0.147*** (0.011)	0.164*** (0.013)
<i>Cash flow volatility</i> _{<i>t</i>-1}	0.041*** (0.012)	0.043*** (0.013)	0.043*** (0.014)	0.043*** (0.015)	0.041*** (0.012)	0.043*** (0.013)	- 0.030 (0.027)	- 0.005 (0.030)
<i>Inventory</i> _{<i>t</i>-1}	- 0.059*** (0.004)	- 0.056*** (0.005)	- 0.059*** (0.005)	- 0.056*** (0.005)	- 0.059*** (0.004)	- 0.057*** (0.005)	- 0.105*** (0.007)	- 0.113*** (0.007)
<i>Net working capital</i> _{<i>t</i>-1}	- 0.071*** (0.003)	- 0.071*** (0.003)	- 0.073*** (0.004)	- 0.071*** (0.004)	- 0.071*** (0.003)	- 0.071*** (0.003)	- 0.177*** (0.006)	- 0.172*** (0.007)
<i>Sales growth</i> _{<i>t</i>-1}	- 0.002 (0.001)	- 0.002 (0.001)	- 0.002 (0.002)	- 0.003 (0.002)	- 0.002 (0.001)	- 0.002 (0.001)	0.008 (0.005)	0.007 (0.006)
<i>Tangible assets</i> _{<i>t</i>-1}	- 0.175*** (0.004)	- 0.179*** (0.005)	- 0.171*** (0.005)	- 0.174*** (0.006)	- 0.175*** (0.005)	- 0.179*** (0.005)	- 0.253*** (0.006)	- 0.261*** (0.007)
<i>Debt</i> _{<i>t</i>-1}	- 0.125*** (0.004)	- 0.136*** (0.005)	- 0.128*** (0.005)	- 0.141*** (0.006)	- 0.125*** (0.004)	- 0.136*** (0.005)	- 0.268*** (0.007)	- 0.277*** (0.007)
<i>Total assets</i> _{<i>t</i>-1}	- 0.010*** (0.001)	- 0.009*** (0.001)	- 0.008*** (0.001)	- 0.007*** (0.001)	- 0.010*** (0.001)	- 0.009*** (0.001)	- 0.015*** (0.001)	- 0.014*** (0.001)
<i>Age</i> _{<i>t</i>}	0.007*** (0.001)	0.006*** (0.002)	0.006*** (0.001)	0.006*** (0.002)	0.007*** (0.001)	0.006*** (0.002)	0.011*** (0.002)	0.010*** (0.002)
<i>GDP growth</i> _{<i>t</i>-1}	- 0.027 (0.025)	- 0.028 (0.030)	- 0.030 (0.025)	- 0.030 (0.030)	- 0.027 (0.025)	- 0.027 (0.030)	- 0.058 (0.102)	- 0.042 (0.118)

Table 3 (continued)

	Baseline		Interaction effects		Crisis		Last available year	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	All	SME	All	SME	All	SME	All	SME
<i>East</i> × <i>Operating cash flow</i> _{<i>t</i>-1}			0.021*	0.017				
			(0.011)	(0.012)				
<i>East</i> × <i>Cash flow volatility</i> _{<i>t</i>-1}			- 0.010	- 0.005				
			(0.029)	(0.030)				
<i>East</i> × <i>Inventory</i> _{<i>t</i>-1}			0.002	0.000				
			(0.009)	(0.010)				
<i>East</i> × <i>Net working capital</i> _{<i>t</i>-1}			0.006	0.001				
			(0.007)	(0.007)				
<i>East</i> × <i>Sales growth</i> _{<i>t</i>-1}			0.002	0.002				
			(0.003)	(0.003)				
<i>East</i> × <i>Tangible assets</i> _{<i>t</i>-1}			- 0.011	- 0.013				
			(0.009)	(0.010)				
<i>East</i> × <i>Debt</i> _{<i>t</i>-1}			0.008	0.014				
			(0.009)	(0.010)				
<i>East</i> × <i>Total assets</i> _{<i>t</i>-1}			- 0.006***	- 0.006***				
			(0.001)	(0.002)				
<i>East</i> × <i>Age_t</i>			0.003	0.004				
			(0.003)	(0.004)				
<i>East</i> × <i>GDP growth</i> _{<i>t</i>-1}			0.034	0.025				
			(0.023)	(0.026)				

Table 3 (continued)

	Baseline		Interaction effects		Crisis		Last available year	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	All	SME	All	SME	All	SME	All	SME
<i>Crisis</i>					0.006*	0.006		
					(0.003)	(0.004)		
<i>East × Crisis</i>					0.000	0.001		
					(0.002)	(0.002)		
<i>Industry FE</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Year FE</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>R</i> ²	0.260	0.276	0.260	0.276	0.260	0.276	0.300	0.309
<i>N</i>	89,018	70,403	89,018	70,403	89,018	70,403	14,800	12,279

This table reports random effects panel regression results with robust standard errors clustered at the firm level in parentheses. The first row indicates the model/interaction used. The second row indicates the sample used. In Column (1) we use the full sample. In Column (2) we use the sample of SMEs only, which is defined according to §267 of the German Commercial Code. In Columns (3)–(4), we interact the *East* dummy with all covariates. In Columns (5)–(6), we interact the *East* dummy with the *Crisis* dummy, which is 1 for the years from 2008 to 2012 and 0 otherwise. In Columns (7)–(8), we report OLS estimates using the last available year. All specifications include year and industry fixed effects. We refer to Table 9 in the Appendix for details on the variable construction. Subscript $t - 1$ means that the variable is lagged one period. *, ** and *** indicate statistical significance at the 10%, 5% and 1% level

implying that firm size is differently correlated with cash holdings for East and West German firms. We address this observation in more detail in Sect. 5.1.

In the above-mentioned baseline estimations, we emphasise the dummy variable in *East* to analyse differences in corporate cash holdings between East and West German firms and further test the economic and econometric robustness of this finding. First, while the results indicate that the cash holdings of East and West German firms are significantly different, it is ambiguous whether this is true for all East German regions. To test the consistency of our analysis, we re-estimate the baseline regression using federal state-specific dummy variables. Further differences in regional economic growth are accounted for by adding aggregated federal state-specific growth rates of household savings, gross capital investment, and employment as controls. Figure 1 shows a heat map of Germany using the coefficients of the individual federal states as underlying data after estimating Eq. (1) for the full sample, with Baden–Württemberg as the reference state. The results suggest that cash holdings are significantly higher across all East German federal states.

Second, our sample period includes the 2008 financial crisis, which may have had a potentially confounding effect in terms of its different impact on East and West German firms. If firms were constrained from acquiring loans during the financial crisis because of any latent causes such as liquidity shortfalls or bank distress, cash holdings would be higher as a substitute for absent institutional credit during the credit crunch (Bedendo et al. 2020). Consequently, the present results may simply capture these distortions. A difference in cash holdings would be observed if, for instance, East German firms were more financially constrained and compelled to stockpile more cash as an alternative funding source. To test for this, we re-estimate the baseline specification in Eq. (1) as follows: We include a dummy variable *Crisis*, which takes a value of 1 for the crisis years (from 2008 to 2012), and 0 otherwise, as well as an interaction term $East \times Crisis$, which allows us to disentangle the differences in cash holdings between East and West German firms during the financial crisis. The results shown in Columns (5) and (6) of Table 3 suggest that the financial crisis did not affect the *East* dummy. East German firms hold more cash independent of the financial crisis.

Third, to exclude the possibility that the significant differences in cash holdings are driven by sample size, we re-estimate Eq. (1) using only the last available year for each firm. This robustness test further addresses the possibility of serial correlation within our estimates (Bertrand et al. 2004) as the analysis period is quite long (i.e. maximum of 13 years). Because our variable of interest—the *East* dummy—does not vary over time, the standard error for $\hat{\beta}$ in Eq. (1) can underestimate its standard deviation. The robustness check results are tabulated in Columns (7) and (8) of Table 3. The coefficients and standard errors are similar to our baseline results; thus, we may conclude that the results are not driven by serial correlation or sample size.

Finally, we replace the dependent variable with alternative definitions of cash holdings by using the natural logarithm of cash holdings to total assets ($\log(Cash_{i,t})$) and the natural logarithm of cash holdings to net total assets ($\log(Net\ Cash_{i,t})$) to account for extreme outliers (Bates et al. 2009; Foley et al. 2007; Opler et al. 1999). These alternative specifications yield similar results to those presented in Table 3, indicating that using the cash-to-assets ratio is appropriate (not tabulated).

Fig. 1 Cash holdings—Federal states. This figure depicts a heat map with the coefficients of German federal states for a random effects panel regression with robust standard errors clustered at the firm level. The regression model is given by: $Cash_{i,t} = \alpha + \beta Federal\ state_j + \gamma X_{i,t} + D_t + D_j + \epsilon_{i,t}$, while the reference state is Baden-Württemberg. Covariates are the same as those mentioned in Sect. 3.2. To account for potential differences in economic growth among the various federal states, the following macroeconomic variables are included: lagged growth rate of gross capital investment, lagged growth rate of household savings and lagged growth rate of employment. The values in the legend indicate the size range of the coefficients for the respective colour class. The black bold line displays the border of the former GDR

4 Possible explanations

The main observation in Sect. 3.3 demonstrates significant and robust differences in cash holdings between East and West German firms. However, this does not necessarily imply differences in managerial decision-making. Several reasonable, empirically validated explanations that stem from economic theory may hold as well. We thus address the most important ones in the following subsections.

4.1 Structural differences

On average, East German firms are smaller, younger, and have fewer tangible assets than West German firms (see Table 2). Consequently, the observed difference in cash holdings may emerge from an ‘unbalanced’ sample. While SMEs have been considered separately in our baseline estimation, structural differences between East and West German SMEs may still exist. Cash holdings are highly dependent on a firm’s industry, and larger firms usually hold less cash due to economies of scale (Dittmar et al. 2003; Opler et al. 1999). Several economic theories explain these differences in capital structure. Pettit and Singer (1985) argue that a debt tax shield has little importance for smaller firms since its objective—generating high profits—is less relevant for them. Second, information asymmetry is higher for smaller firms,

as their typical opaqueness implies high information costs for banks (Psillaki 1995). Third, Jensen and Meckling's (1976) agency theory holds little importance for smaller firms, as most of them are owned and managed by the same person. Thus, smaller firms mainly rely on internal financing, avoid debt, and are expected to hold more cash (Daskalakis et al. 2013). To mitigate the potential effect of structural differences, we create a 'balanced' sample by applying a propensity score matching which constructs a most similar sample of East and West German firms.

The propensity score is calculated as the probability of a West German firm i matching an East German firm, given its set of variables X_i (i.e. $P_i(X) = \text{Prob}(\text{East}_i = 1 \mid X_i)$). The variables of interest in X_i are total assets, average number of employees, average total sales, average tangible fixed assets, and age. Additionally, firms that match must be in the same industry (two-digit NACE2 code). To enhance accuracy, we allow for matching with replacement, as applied by Garcia-Appendini (2018).

Panel A of Table 4 presents the summary statistics for the firm-characteristic matched sample. Notably, all normalised differences between East and West German firms now lie considerably below the critical level of 0.25, and the t-statistics are substantially lower. Thus, firm-characteristic matching makes the sample more homogenous. We re-estimate Eq. (1) to analyse whether similar firms in East and West Germany still differ in their level of cash holdings. The results are tabulated in Columns (1) and (2) in Panel C of Table 4 and are identical to the baseline estimation in Table 3.⁷

While propensity score matching ensures that East and West German firms are similar in terms of firm characteristics, these firms may be geographically very distant. For example, a West German firm can be close to Switzerland, while its matched East German counterpart is close to the Polish border. To account for this aspect, we also 'geographically' match our sample by selecting only firms that are—based on the firms' postal code—close to the former border between East and West Germany. Figure 2 shows the respective areas in East and West Germany, from which we select the relevant firms for this exercise. The summary statistics of the location-based matching are tabulated in Panel B of Table 4. The re-estimation of Eq. (1) does not change our initial finding of higher cash holdings in East German firms (see Columns (3) and (4) in Panel C, Table 4). Note that the sizes of the full sample differ only slightly, indicating that firms located in this area are mainly SMEs.

We consequently conclude that the baseline regression results in Sect. 3.3 are not driven by potential structural differences, as neither the firm-characteristic matching nor the location-based matching changes our main observation of higher cash holdings in East German firms.⁸

⁷ For robustness, we also limit the absolute differences of all matching variables for each matched pair. More specifically, we keep a matching pair when each variable difference is lower than one (two) standard deviation(s) from the mean difference of the matched sample. While the number of observations decreases considerably to 19,457 (43,515) for the case of one (two) standard deviation(s), the results remain qualitatively and quantitatively the same (not tabulated).

⁸ Note that we also combined location-based matching by keeping only firms in that area and applying propensity score matching afterwards. Due to the low number of firms after location-based matching (14,186 firm-years for 2406 firms in total), appropriate firm-characteristic matching is no longer possible.

Table 4 Structural differences—matched sample

	East			West			Test for equality in means		
	Mean	Median	N	Mean	Median	N	Δ	<i>t</i> -stat	Norm. diff.
Panel A: Summary statistics—firm-characteristic matching									
<i>Cash_t</i>	0.127	0.071	23,223	0.110	0.050	22,542	0.017***	12.621	0.083
<i>Operating cash flow_{t-1}</i>	0.112	0.100	23,223	0.117	0.104	22,542	− 0.005***	− 4.902	− 0.032
<i>Cash flow volatility_{t-1}</i>	0.052	0.039	23,223	0.058	0.044	22,542	− 0.006***	− 13.524	− 0.089
<i>Inventory_{t-1}</i>	0.210	0.166	23,223	0.221	0.181	22,542	− 0.011***	− 6.146	− 0.041
<i>Net working capital_{t-1}</i>	− 0.019	− 0.010	23,223	− 0.015	− 0.008	22,542	− 0.004	− 1.620	− 0.011
<i>Sales growth_{t-1}</i>	0.072	0.035	23,223	0.068	0.037	22,542	0.004	1.494	0.010
<i>Tangible assets_{t-1}</i>	0.319	0.277	23,223	0.308	0.250	22,542	0.011***	5.253	0.035
<i>Debt_{t-1}</i>	0.648	0.682	23,223	0.675	0.713	22,542	− 0.027***	− 11.995	− 0.079
<i>Short-term bank debt_{t-1}</i>	0.130	0.082	16,064	0.141	0.092	14,713	− 0.010***	− 6.451	− 0.052
<i>Total assets_{t-1}</i> (in Mio. €)	14.795	14.761	23,223	14.830	14.721	22,542	− 0.035**	− 2.288	− 0.015
<i>Age_t</i> (in years)	16.558	17.000	23,223	15.879	14.000	22,542	0.679***	8.688	0.057
Panel B: Summary statistics—location-based matching									
<i>Cash_t</i>	0.115	0.059	8882	0.109	0.049	5304	0.006**	2.459	0.030
<i>Operating cash flow_{t-1}</i>	0.112	0.101	8882	0.111	0.095	5304	0.001	0.404	0.005
<i>Cash flow volatility_{t-1}</i>	0.049	0.037	8882	0.052	0.039	5304	− 0.003***	− 3.946	− 0.048
<i>Inventory_{t-1}</i>	0.212	0.170	8882	0.229	0.170	5304	− 0.017***	− 5.283	− 0.064
<i>Net working capital_{t-1}</i>	− 0.013	− 0.009	8882	0.004	0.008	5304	− 0.017***	− 3.823	− 0.047
<i>Sales growth_{t-1}</i>	0.071	0.035	8882	0.056	0.029	5304	0.015***	3.526	0.044
<i>Tangible assets_{t-1}</i>	0.340	0.303	8882	0.273	0.208	5304	0.067***	17.114	0.210
<i>Debt_{t-1}</i>	0.647	0.679	8882	0.656	0.690	5304	− 0.009**	− 2.154	− 0.026
<i>Short-term bank debt_{t-1}</i>	0.132	0.084	6338	0.133	0.079	3219	− 0.001	− 0.358	− 0.005

Table 4 (continued)

	East			West			Test for equality in means		
	Mean	Median	N	Mean	Median	N	Δ	<i>t</i> -stat	Norm. diff.
<i>Total assets</i> _{<i>t</i>-1} (in Mio. €)	15.029	15.001	8882	15.389	15.419	5304	0.360***	- 13.011	- 0.159
<i>Age</i> _{<i>t</i>} (in years)	16.878	17.000	8882	22.124	18.000	5304	- 5.246***	- 29.237	- 0.331
	Firm-characteristic matching						Location-based matching		
	(1)			(2)			(3)		
	All			SME			All		
							SME		
Panel C: Regression results									
<i>East</i>									
<i>Operating cash flow</i> _{<i>t</i>-1}	0.018*** (0.002)	0.019*** (0.003)	0.017*** (0.005)	0.017*** (0.005)	0.018*** (0.005)	0.018*** (0.005)			
<i>Cash flow volatility</i> _{<i>t</i>-1}	0.097*** (0.007)	0.103*** (0.008)	0.106*** (0.012)	0.106*** (0.012)	0.111*** (0.013)	0.111*** (0.013)			
<i>Inventory</i> _{<i>t</i>-1}	0.033** (0.017)	0.031* (0.018)	0.046 (0.032)	0.046 (0.032)	0.053 (0.034)	0.053 (0.034)			
	- 0.056*** (0.006)	- 0.053*** (0.006)	- 0.059*** (0.010)	- 0.059*** (0.010)	- 0.057*** (0.011)	- 0.057*** (0.011)			
<i>Net working capital</i> _{<i>t</i>-1}	- 0.064*** (0.004)	- 0.066*** (0.004)	- 0.070*** (0.007)	- 0.070*** (0.007)	- 0.072*** (0.008)	- 0.072*** (0.008)			
<i>Sales growth</i> _{<i>t</i>-1}	- 0.001 (0.002)	- 0.001 (0.002)	- 0.003 (0.003)	- 0.003 (0.003)	- 0.003 (0.003)	- 0.003 (0.003)			
<i>Tangible assets</i> _{<i>t</i>-1}	- 0.172*** (0.005)	- 0.175*** (0.006)	- 0.174*** (0.010)	- 0.174*** (0.010)	- 0.174*** (0.011)	- 0.174*** (0.011)			

Table 4 (continued)

	Firm-characteristic matching		Location-based matching	
	(1)	(2)	(3)	(4)
	All	SME	All	SME
$Debt_{t-1}$	-0.132*** (0.005)	-0.141*** (0.005)	-0.126*** (0.009)	-0.132*** (0.010)
$Total\ assets_{t-1}$	-0.011*** (0.001)	-0.010*** (0.001)	-0.010*** (0.002)	-0.010*** (0.002)
Age_t	0.005*** (0.002)	0.005*** (0.002)	0.006* (0.004)	0.007* (0.004)
$GDP\ growth_{t-1}$	0.027 (0.036)	0.029 (0.039)	0.047 (0.056)	0.039 (0.063)
$IndustryFE$	Yes	Yes	Yes	Yes
$YearFE$	Yes	Yes	Yes	Yes
R^2	0.285	0.291	0.292	0.300
N	45,765	41,102	14,186	12,025

This table reports summary statistics for the firm-characteristic matched sample in Panel A and for the location-based matched sample in Panel B. The random effects panel regression results with robust standard errors clustered at the firm level in parentheses are shown in Panel C. The regression model is given by: $Cash_{i,t} = \alpha + \beta East_t + \gamma X_{i,t} + D_t + D_j + \epsilon_{i,t}$. The first row of Panel C indicates the applied matching procedure and the second row indicates the sample used. All specifications include year and industry fixed effects. We refer to Table 9 in the Appendix for details on the variable construction. Subscript $t - 1$ means that the variable is lagged one period. *, **, and *** indicate statistical significance at the 10%, 5% and 1% level

Fig. 2 Relevant area for location-based matching. This figure shows the selected area for the location-based matching. Dark-grey (mid-grey) colour indicates the relevant area for East (West) German firms to be selected for the location-based matching. Light-grey colour indicates the area of the remaining parts of East and West Germany that is not used for this analysis. The black bold line displays the border of the former GDR

4.2 Different access to financing

Lehmann et al. (2004) document either worse or more expensive access to external finance for East German firms. East German firms in industries with higher external finance dependence may thus be forced to save more cash to avoid losing valuable investment opportunities. Therefore, we test whether dependence on external finance can explain the differences in cash holdings. As industry-level measures of external finance dependence are generally claimed to be more exogenous than individual firm measures (Duchin et al. 2010; Garcia-Appendini and Montoriol-Garriga 2013), we follow Rajan and Zingales (1998) to calculate an industry-level measure of external finance dependence for firm i in industry j with $EFD_{i,j}$. More specifically, we calculate $\frac{CAPEX_{i,t} - \text{Operating cash flow}_{i,t}}{CAPEX_{i,t}}$ for each firm-year observation, where $CAPEX$ is capital expenditure. We then use the sample and industry (two-digit NACE2) medians to determine whether a firm belongs to an industry with high external finance dependence (that is, its industry's median lies above the sample median). Columns (1) and (2) of Table 5 indicate that external finance dependence negatively affects corporate cash holdings. To further test whether East German firms in highly dependent industries react differently than West German firms, we include an interaction term ($East \times EFD_j$). However, East German firms acting in industries with high external finance dependence are not observed to pre-emptively save more cash. Consequently, dependence on external

finance cannot explain the differences in cash holdings between East and West German firms, as the dummy variable *East* remains statistically significant.

To account for the broader relationship between external capital and internal funds, the idea of financial constraints emerged (Fazzari et al. 1988). Financially constrained firms typically rely more on internal funds than on external capital, and as a result, hold more cash. To control whether financial constraints drive our main observation, we must first determine which firms are financially constrained. While the Kaplan and Zingales (1997) index is an established method to identify financially constrained firms, the index is designed for publicly-listed firms and cannot be applied to private firms. Schauer et al. (2019) propose an alternative financial constraints index, which targets private firms and can also be applied to SMEs. To calculate the financial constraints index for private firms (FCP), only four variables are needed—total assets, interest coverage, return on assets, and cash holdings.⁹ To identify financially constrained firms, we categorise all firms into terciles based on their FCP index value for each year. All firms in the bottom tercile (i.e. 33% firms with the lowest FCP index value) are indicated to be financially constrained. To examine whether our results are driven by such firms, we create a dummy variable $Constrained_{i,t}$, that takes a value of 1 if firm i is in the bottom tercile of the FCP index in year t , and 0 otherwise. The results including $Constrained_i$ and the interaction term $East \times Constrained_i$ in the baseline estimation are shown in Columns (3) and (4) of Table 5. The dummy variable $Constrained_i$ is positive and statistically significant. Thus, in line with economic theory, financially constrained firms hold significantly more cash. However, the insignificant interaction term indicates that there is no difference between financially constrained East and West German firms. As the dummy variable *East* remains statistically significant, we further conclude that our main observation is not driven by financially constrained firms.

Acharya et al.'s (2007) model examines financially optimal cash–debt substitutability and predicts situations in which the relationship between cash holdings and debt varies. Thus, some firms may favour short-term bank debt instead of cash. Therefore, we control for a firm's level of short-term bank debt. We add the control variable $Short-term\ bank\ debt_{i,t-1}$ and the interaction term $East_i \times Short-term\ bank\ debt_{i,t-1}$. The latter allows for different coefficients between East and West German firms. The results are shown in Columns (5) and (6) of Table 5. While the negative and significant coefficient of $Short-term\ bank\ debt_{t-1}$ indicates that it is in fact a substitute for cash holdings, the insignificant interaction term $East \times Short-term\ bank\ debt_{t-1}$ implies that there is no difference between East and West German firms. Moreover, the significant positive effect of *East* remains, implying that East German firms do not hold significantly more cash than West German firms because of a worse or more expensive access to short-term bank debt.¹⁰

⁹ Table 9 in the Appendix provides the equation for the FCP index calculation.

¹⁰ We also use a more exogenous measure of bank debt to account for access to bank financing, that is, the yearly growth rate of the aggregate granted bank loan volume for each federal state. The results are similar, indicating that aggregate growth in federal bank debt is not related to the cash holdings of federal state-specific firms (not tabulated). The data on the aggregated bank loan volume is available on <https://www.bundesbank.de/en/statistics/banks-and-other-financial-corporations> (28.05.2021).

Table 5 Access to financing

	External finance dependence		Financial constraints		Short-term bank debt		Bank concentration		Urban/rural area	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	All	SME	All	SME	All	SME	All	SME	All	SME
<i>East</i>	0.017*** (0.003)	0.019*** (0.003)	0.017*** (0.002)	0.019*** (0.002)	0.022*** (0.002)	0.024*** (0.003)	0.019*** (0.002)	0.021*** (0.003)	0.018*** (0.002)	0.021*** (0.002)
<i>Operating cash flow_{t-1}</i>	0.086*** (0.005)	0.096*** (0.006)	0.057*** (0.005)	0.063*** (0.006)	0.097*** (0.005)	0.101*** (0.006)	0.082*** (0.005)	0.088*** (0.006)	0.086*** (0.005)	0.095*** (0.005)
<i>Cash flow volatility_{t-1}</i>	0.045*** (0.012)	0.048*** (0.014)	0.039*** (0.012)	0.040*** (0.013)	0.039*** (0.014)	0.034*** (0.015)	0.052*** (0.013)	0.058*** (0.015)	0.041*** (0.012)	0.042*** (0.013)
<i>Inventory_{t-1}</i>	-0.059*** (0.004)	-0.057*** (0.005)	-0.058*** (0.004)	-0.056*** (0.005)	-0.044*** (0.005)	-0.038*** (0.005)	-0.053*** (0.004)	-0.052*** (0.005)	-0.058*** (0.004)	-0.056*** (0.005)
<i>Net working capital_{t-1}</i>	-0.069*** (0.003)	-0.069*** (0.003)	-0.069*** (0.003)	-0.068*** (0.003)	-0.071*** (0.004)	-0.076*** (0.004)	-0.063*** (0.003)	-0.062*** (0.003)	-0.071*** (0.003)	-0.071*** (0.003)
<i>Sales growth_{t-1}</i>	-0.002 (0.001)	-0.002 (0.001)	-0.004*** (0.001)	-0.004*** (0.001)	-0.004*** (0.001)	-0.003*** (0.002)	-0.001 (0.001)	-0.001 (0.002)	-0.002 (0.001)	-0.002 (0.001)
<i>Tangible assets_{t-1}</i>	-0.170*** (0.005)	-0.172*** (0.005)	-0.165*** (0.004)	-0.169*** (0.005)	-0.134*** (0.005)	-0.129*** (0.005)	-0.171*** (0.005)	-0.174*** (0.005)	-0.174*** (0.005)	-0.179*** (0.005)
<i>Debt_{t-1}</i>	-0.123*** (0.004)	-0.135*** (0.005)	-0.124*** (0.004)	-0.136*** (0.005)	-0.094*** (0.004)	-0.104*** (0.005)	-0.123*** (0.004)	-0.133*** (0.005)	-0.125*** (0.004)	-0.136*** (0.005)
<i>Total assets_{t-1}</i>	-0.009*** (0.001)	-0.008*** (0.001)	-0.011*** (0.001)	-0.010*** (0.001)	-0.006*** (0.001)	-0.005*** (0.001)	-0.010*** (0.001)	-0.009*** (0.001)	-0.010*** (0.001)	-0.009*** (0.001)
<i>Age_t</i>	0.007*** (0.001)	0.007*** (0.002)	0.007*** (0.001)	0.007*** (0.002)	0.004*** (0.001)	0.004*** (0.001)	0.009*** (0.001)	0.008*** (0.002)	0.007*** (0.001)	0.006*** (0.002)
<i>GDP growth_{t-1}</i>	-0.025 (0.025)	-0.024 (0.030)	-0.028 (0.025)	-0.030 (0.030)	-0.048* (0.026)	-0.041 (0.031)	-0.021 (0.025)	-0.025 (0.030)	-0.026 (0.025)	-0.026 (0.030)
<i>EFD_j</i>	-0.011*** (0.002)	-0.009*** (0.003)								

Table 5 (continued)

	External finance dependence		Financial constraints		Short-term bank debt		Bank concentration		Urban/rural area	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	All	SME	All	SME	All	SME	All	SME	All	SME
$East \times EFD_j$	0.003 (0.004)	0.003 (0.005)								
$Constrained_i$			0.021*** (0.002)	0.022*** (0.001)						
$East \times Constrained_i$			0.002 (0.002)	0.003 (0.003)						
$Short\text{-}term\ bank\ debt_{t-1}$					-0.078*** (0.005)	-0.084*** (0.005)				
$East \times Short\text{-}term\ bank\ debt_{t-1}$					-0.010 (0.007)	-0.010 (0.008)				
$Bank\ concentration_{f,t}$							0.001 (0.002)	0.002 (0.002)		
$Urban\ area_k$									0.004** (0.002)	0.004*** (0.002)
$IndustryFE$	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
$YearFE$	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.258	0.275	0.287	0.301	0.224	0.239	0.256	0.274	0.260	0.276
N	84,661	67,122	89,018	70,403	54,340	44,555	73,588	58,846	89,010	70,395

This table reports random effects panel regression results with robust standard errors clustered at the firm level in parentheses. The baseline regression model is given by: $Cash_{i,t} = \alpha + \beta East_i + \gamma X_{i,t} + D_t + D_j + \epsilon_{i,t}$. The first row indicates the additional variables used. The second row indicates the sample used. In Columns (1)–(2), we interact the *East* dummy with EFD_j , which is a dummy variable that is 1 if a firm acts in an industry (two digit NACE2) with high dependency on external finance. In Columns (3)–(4), we control for financial constraints with the dummy $Constrained_i$ and interact with the *East* dummy. In Columns (5)–(6), we interact the *East* dummy with $Short\text{-}term\ bank\ debt_{t-1}$, representing a firm's short-term bank debt. In Columns (7)–(8), we control for bank concentration in the various federal states. The variable $Bank\ concentration_{f,t}$ is calculated by the number of banks in the federal state f in year t divided by the surface area of the federal state f per square kilometre. In Columns (9)–(10), we control whether a firm is located in an urban or rural area. All specifications include year and industry fixed effects. We refer to Table 9 in the Appendix for details on the variable construction. Subscript $t - 1$ means that the variable is lagged one period. *, ** and *** indicate statistical significance at the 10%, 5% and 1% level

Agarwal and Hauswald (2010) document that the distance between a lender and a bank is negatively related to the loan rate due to asymmetric information.¹¹ As shown by González and González (2008), pecking order theory also relates to the level of bank concentration—higher information asymmetries due to the banking concentration increase a firm's usage of internal funds (i.e. cash holdings). Put differently, the closer a bank is to a firm, the less relevant the information asymmetries and, *ceteris paribus*, the lower the interest rate demanded. Thus, regional bank concentration, as an institutional factor, may affect the financing structure of a firm, and consequently, its cash holdings. As shown by Bernhardt and Schwartz (2015), East Germany has a lower regional bank concentration than West Germany, which, based on the pecking order theory, may explain the differences in cash holdings. To control for the effect of regional bank concentration, we add the control variable *Bank concentration*_{*f,t*} as the federal bank concentration *f* in year *t*. The variable is computed by dividing the total number of branches of German savings banks and credit unions (i.e. Sparkassen-und Genossenschaftsbanken) by the federal state area (in square kilometres) for each year.¹² While there are substantial differences in our proxy for bank concentration across German federal states and over time, Columns (7) and (8) of Table 5 suggest that bank concentration is unrelated to corporate cash holdings.

Further, Arena and Dewally (2012) observe that firms located in rural areas face higher interest expenses on their outstanding debt. Firms located in urban areas are closer to their banks which lowers potential information asymmetries and consequently facilitates borrowing. Therefore, firms located in rural areas may keep more cash to substitute costly bank debt which would lead, based on the pecking order theory, to the same conclusion as above (González and González 2008). Firms located in rural areas might not have unrestricted access to external capital markets and thus highly depend on their own operating cash flow. As the marginal value of cash is higher for rural firms, they experience cash constraints. To examine whether our results are driven by a firm's location, we control for the type of town or municipality a firm is located in by including the dummy variable *Urban area*_{*i,k*}, which equals 1 if firm *i* is domiciled at least in a medium-sized town, and 0 otherwise.¹³ If an urbanisation effect drives our results, a negative coefficient would be expected for urban firms, while the effect of *East* diminishes. As shown in Columns (9) and (10) of Table 5, the dummy variable *Urban area*_{*k*} is positive and statistically significant. Thus, urban firms are found to have significantly higher cash levels, extending the findings of González and González (2008). Nonetheless, it does not change our main observation that corporate cash holdings are significantly higher in East Germany.

¹¹ See Degryse and Ongena (2005) for an overview of alternative models on lender distance and loan rates.

¹² The current number of bank branches is provided by the Deutsche Bundesbank and available on <https://www.bundesbank.de/en/statistics/banks-and-other-financial-corporations> (28.05.2021). The authors gratefully acknowledge the support of the Deutsche Bundesbank for providing historical data on the number of bank branches.

¹³ The data on the type of a town or municipality are available at <https://www.bbsr.bund.de/BBSR/DE/forschung/raumbeobachtung/downloads/downloadsReferenz2.html> (28.05.2021).

Table 6 Historical differences

	Founded after 1990		Entrepreneurial roots	
	(1)	(2)	(3)	(4)
	All	SME	All	SME
<i>East</i>	0.018*** (0.003)	0.019*** (0.003)	0.018*** (0.002)	0.020*** (0.002)
<i>Operating cash flow</i> _{<i>t</i>-1}	0.092*** (0.006)	0.096*** (0.007)	0.086*** (0.005)	0.095*** (0.005)
<i>Cash flow volatility</i> _{<i>t</i>-1}	0.039** (0.016)	0.042** (0.017)	0.042*** (0.012)	0.043*** (0.013)
<i>Inventory</i> _{<i>t</i>-1}	- 0.049*** (0.005)	- 0.046*** (0.006)	- 0.059*** (0.004)	- 0.056*** (0.005)
<i>Net working capital</i> _{<i>t</i>-1}	- 0.070*** (0.004)	- 0.072*** (0.004)	- 0.072*** (0.003)	- 0.071*** (0.003)
<i>Sales growth</i> _{<i>t</i>-1}	- 0.002 (0.002)	- 0.002 (0.002)	- 0.002 (0.001)	- 0.002 (0.001)
<i>Tangible assets</i> _{<i>t</i>-1}	- 0.171*** (0.006)	- 0.173*** (0.006)	- 0.175*** (0.005)	- 0.180*** (0.005)
<i>Debt</i> _{<i>t</i>-1}	- 0.127*** (0.005)	- 0.141*** (0.006)	- 0.125*** (0.004)	- 0.137*** (0.005)
<i>Total assets</i> _{<i>t</i>-1}	- 0.011*** (0.001)	- 0.011*** (0.001)	- 0.010*** (0.001)	- 0.009*** (0.001)
<i>Age</i> _{<i>t</i>}	0.004* (0.002)	0.004 (0.003)	0.007*** (0.001)	0.006*** (0.002)
<i>GDP growth</i> _{<i>t</i>-1}	- 0.005 (0.033)	- 0.003 (0.039)	- 0.028 (0.025)	- 0.029 (0.030)
<i>Entr. roots</i> _{<i>r</i>}			0.000 (0.002)	0.002 (0.002)
<i>IndustryFE</i>	Yes	Yes	Yes	Yes
<i>YearFE</i>	Yes	Yes	Yes	Yes
<i>R</i> ²	0.271	0.287	0.260	0.276
<i>N</i>	53,180	44,158	88,339	69,733

This table reports random effects panel regression results with robust standard errors clustered at the firm level in parentheses. The baseline regression model is given by: $Cash_{i,t} = \alpha + \beta East_i + \gamma X_{i,t} + D_t + D_j + \epsilon_{i,t}$. The first row indicates the time/additional variable used. The second row indicates the sample used. In Columns (1)–(2), we interact the *East* dummy with all firms in our sample that were founded after 1990. In Columns (3)–(4), we control for historical entrepreneurial roots in a German region *r*. All specifications include year and industry fixed effects. We refer to Table 9 in the Appendix for details on the variable construction. Subscript *t* – 1 means that the variable is lagged one period. *, ** and *** indicate statistical significance at the 10%, 5% and 1% level

Overall, the results in Table 5 indicate that the differences in corporate cash holdings between East and West German firms are not caused by differences in access to financing. Although factors relevant to access to financing are correlated with cash holdings, the difference between East and West German firms remains significant in all specifications.

4.3 Historical differences

Fritsch et al. (2014), among others, highlight the existence of anti-entrepreneurship strategies of the former GDR and the resulting low rates of self-employment. Political pressure may be the reason why pre-reunification East German firms are different from those founded after 1990. Thus, to exclude the possibility of adverse selection, we re-estimate the baseline regression in Eq. (1) and include only firms that were founded after 1990. Columns (1) and (2) of Table 6 indicate that the *East* dummy does not change for this subsample. Thus, East German firms founded after reunification also hold significantly more cash.

Fritsch and Wyrwich (2014) highlight the impact of early historical differences, considering Germany's entrepreneurial spirit during the 1920s, on entrepreneurship in Germany. These differences are measured by the distribution of self-employed persons in non-agricultural sectors across German regions in 1925. The authors show that the correlation between the 1925 self-employment rate and the self-employment and start-up rates for the 1984–2005 period is significantly positive, implying the long-term persistence of these historical differences. Thus, it is possible that the observed differences in cash holdings may be caused by these historical entrepreneurial roots in Germany. To test this hypothesis, we use Fritsch and Wyrwich's (2014) information about historical entrepreneurial roots and create a dummy variable that equals 1 if self-employment was above a specific level in region r , and 0 otherwise.¹⁴ We extend the baseline regression in Eq. (1) including this dummy (that is, $Entr. roots_{i,r}$). In Columns (3) and (4) of Table 6, the *East* dummy remains statistically significant after controlling for historical entrepreneurial differences. In addition, the insignificant coefficient of $Entr. roots_r$ indicates that corporate cash holdings are not related to historical differences in entrepreneurship.

We thus conclude that historical differences, whether due to political pressure or early entrepreneurial spirit, do not explain the difference in corporate cash holdings between East and West German firms.

5 Potential differences in cultural attributes

In the previous section, we considered several meaningful hypotheses to explain the differences in cash holdings between East and West German firms, however, none of them can do so. In the light of the existing literature that observes differences in

¹⁴ More specifically, we use Figure 6 in Fritsch and Wyrwich (2014) and create a dummy variable that is 1 if the share of self-employed persons was higher than 9810 in a German region in 1925, and 0 otherwise.

various situations between East and West Germany (see Sect. 2), one may conjecture that this makes a case for managerial decision-making as well.

In fact, an increasing stream of finance research argues that cultural attributes are an important determinant of corporate finance decisions (see Aggarwal et al. (2016) for an overview and Nadler and Breuer (2019) for a systematic classification). For cash holdings, Chen et al. (2015) analyse the impact of culture on corporate cash holdings and argue that specific cultural attributes affect managers and their decisions. Based on an international sample and a subsample of only US firms, the authors develop their hypotheses regarding corporate cash holdings and observe that the national and regional levels of individualism have a significantly negative effect on firms' cash levels. Firms located in countries with an individualistic culture hold less cash than firms located in countries with a collectivistic culture. A high level of individualism is generally related to self-centredness and an overconfidence bias, which results in high optimism and overestimation of (own) abilities (Heine and Lehman 1995; Saad et al. 2015). In this context, Orlova (2020) observes that firms located in individualistic countries not only differ in cash holdings but also adjust cash holdings in another (more confidently) way than firms located in collectivistic countries. Further, Ramirez and Tadesse (2009) examine whether the national level of uncertainty avoidance (as another cultural attribute) affects corporate cash holdings. They observe that firms in countries with a high level of uncertainty avoidance hold more cash than their counterparts with low uncertainty levels. Notably, they include the level of sales generated in a foreign country to account for the level of firm multi-nationality and find that it weakens the cultural impact of uncertainty avoidance on cash holdings. Thus, firms with mainly domestic customers adhere more closely to cultural attributes. Chang and Noorbakhsh (2009) investigate the effect of culture on corporate cash holdings using besides uncertainty avoidance also long-term orientation and cultural masculinity as cultural attributes. Their results indicate that firms' cash holdings are positively correlated with uncertainty avoidance, masculinity, and long-term orientation.

These studies suggest that cultural attributes influence managerial decision-making measured by the level of corporate cash holdings. In our context, if the norms and values of the former GDR have a persistent impact on East German firm managers (implying different cultural attributes), differences in decision-making would be observed between East and West German firms as well. In other words, our main observation may be driven by differences in cultural attributes that influence managerial decision-making. If we assume that East and West German firm managers' cultural attributes are more collectivistic and individualistic, respectively, Chen et al.'s (2015) hypothesis would state that East German firms generally hold more cash than West German firms, and this is actually observed in our exploratory analysis.

Thus, higher cash holdings in East German firms are consistent with the hypothesis of different cultural attributes between East and West German managerial decision-making. However, we cannot definitively conclude that cultural attributes are the reason for this observation, as we only have the firms' locations but do not have any information about the managers' origin and their individual cultural attributes. In the following subsections, however, we present further evidence that corroborates our conjecture of differences in cultural attributes between East and West German managerial decision-making being the explanation for our main observation.

Table 7 Cash holdings by size classes

	(1) Micro	(2) Small	(3) Medium	(4) Large
<i>East</i>	0.030*** (0.007)	0.021*** (0.003)	0.012*** (0.004)	– 0.005 (0.006)
<i>Operating cash flow</i> _{<i>t</i>–1}	0.071*** (0.017)	0.113*** (0.007)	0.077*** (0.008)	0.047*** (0.010)
<i>Cash flow volatility</i> _{<i>t</i>–1}	0.042 (0.043)	0.045** (0.018)	0.032 (0.022)	0.012 (0.026)
<i>Inventory</i> _{<i>t</i>–1}	– 0.065*** (0.015)	– 0.056*** (0.006)	– 0.062*** (0.008)	– 0.070*** (0.012)
<i>Net working capital</i> _{<i>t</i>–1}	– 0.071*** (0.011)	– 0.070*** (0.004)	– 0.078*** (0.006)	– 0.073*** (0.008)
<i>Sales growth</i> _{<i>t</i>–1}	– 0.003 (0.006)	– 0.004** (0.002)	– 0.000 (0.003)	0.002 (0.003)
<i>Tangible assets</i> _{<i>t</i>–1}	– 0.158*** (0.016)	– 0.189*** (0.006)	– 0.181*** (0.009)	– 0.151*** (0.011)
<i>Debt</i> _{<i>t</i>–1}	– 0.228*** (0.015)	– 0.139*** (0.006)	– 0.125*** (0.008)	– 0.078*** (0.009)
<i>Total assets</i> _{<i>t</i>–1}	– 0.011** (0.005)	– 0.007*** (0.001)	– 0.007*** (0.002)	– 0.006* (0.003)
<i>Age</i> _{<i>t</i>}	0.001 (0.005)	0.005** (0.002)	0.008*** (0.003)	0.003 (0.003)
<i>GDP growth</i> _{<i>t</i>–1}	0.163 (0.143)	– 0.018 (0.042)	– 0.014 (0.044)	– 0.016 (0.041)
<i>IndustryFE</i>	Yes	Yes	Yes	Yes
<i>YearFE</i>	Yes	Yes	Yes	Yes
<i>R</i> ²	0.308	0.292	0.258	0.179
<i>N</i>	5221	38,446	26,736	18,615

This table reports random effects panel regression results with robust standard errors clustered at the firm level in parentheses. The baseline regression model is given by: $Cash_{i,t} = \alpha + \beta East_i + \gamma X_{i,t} + D_t + D_j + \epsilon_{i,t}$. The first row indicates the respective size class subsample. Size classes are defined according to §267 of the German Commercial Code. All specifications include year and industry fixed effects. We refer to Table 9 in the Appendix for details on the variable construction and to Table 10 in the Appendix for details on the size class definitions. Subscript $t - 1$ means that the variable is lagged one period. *, ** and *** indicate statistical significance at the 10%, 5% and 1% level

5.1 Firm size differentiation

If different cultural attributes are responsible for higher cash holdings in East German firms, we would expect this observation to vary with firm size. Large-sized firms typically base their corporate policy on group decisions which lead, according to Jansen et al. (2013), to a more diverse information set, implying less influence of an individual's cultural background. SMEs, on the other hand, involve fewer persons

in the decision-making process; therefore, the cultural background of individual decision-makers is more prevalent. Consequently, managerial decision-making in SMEs tends to be more influenced by cultural attributes than managerial decision-making in large firms.

To examine whether this is the case for our data, we further classify firms into detailed size categories and analyse them separately. We use the §267 classification of the German Commercial Code (see Table 10 in the Appendix for further details). For each firm size category (i.e. micro, small, medium, and large), we re-estimate Eq. (1). Columns (1) to (4) of Table 7 show that the *East* coefficient is highest for micro-sized firms and insignificant for large-sized firms, which is consistent with the hypothesis that different cultural attributes exist between East and West German managerial decision-making. While large-sized firms with diversified cultural attributes do not differ in managerial decision-making, smaller firms significantly differ in our proxy for managerial decision-making.

In this context, it is also important to note that all the studies mentioned above analyse large, listed firms that are likely to include more than one person in their decision-making processes and act in the global market. This might also imply that the potential effect of cultural attributes is diluted and actually underestimated by mainly focusing on large firms.

5.2 Speed of adjustment

If different cultural attributes are responsible for the higher cash holdings of East German firms, we would also expect the dynamic adjustment of cash to differ. In other words, we would expect a different behaviour if the target cash level is not met (i.e. excess cash or cash shortage). In fact, Orlova (2020) observes that firms located in individualistic countries tend to adjust cash slower in the case of a cash shortage and faster in the case of excess cash (compared with firms located in collectivist countries). As outlined above, this finding is also consistent with Chen et al.'s (2015) hypothesis. Another study by El Kalak et al. (2020) explicitly links managerial overconfidence with cash holdings' speed of adjustment and finds that overconfident firm managers adjust cash slower (faster) in the case of a cash shortage (excess cash).

As these studies document a relationship between cultural attributes and the dynamic adjustment of cash holdings, we expect to observe a similar pattern in our data. Therefore, we estimate a firm's target cash level and then analyse its speed of adjustment for a deviation from the target. According to Jiang and Lie (2016), the speed of adjustment (back to the target level) depends, among other aspects, on managers' willingness to make cash adjustments. Using Orlova's (2020) finding, we would consequently expect that East German firms adjust their level of cash for a deviation from the target differently than West German firms. We would expect to observe a lower speed of adjustment for East German firms in the case of excess cash, as there may be preferences for an excess liquidity buffer. For a cash shortage, on the other hand, we would expect to observe a higher speed of adjustment compared with their West German counterparts to reach the target cash level as quickly as possible.

Table 8 Speed of adjustment

	(1) All	(2) SME	(3) Large
Panel A: Excess cash: $Cash_{i,t}^* - Cash_{i,t-1} \leq 40$ th Pct.			
$East \times (Cash_{i,t}^* - Cash_{i,t-1})$	- 0.051** (0.022)	- 0.057** (0.023)	0.024 (0.074)
$Cash_{i,t}^* - Cash_{i,t-1}$	0.300*** (0.017)	0.311*** (0.018)	0.177*** (0.046)
$East$	0.002 (0.002)	0.002 (0.003)	0.004 (0.005)
R^2	0.074	0.075	0.055
N	20,324	18,343	1980
Panel B: Cash shortage: $Cash_{i,t}^* - Cash_{i,t-1} \geq 60$ th Pct.			
$East \times (Cash_{i,t}^* - Cash_{i,t-1})$	0.008 (0.032)	0.016 (0.034)	0.044 (0.055)
$Cash_{i,t}^* - Cash_{i,t-1}$	0.112*** (0.021)	0.107*** (0.022)	0.014 (0.037)
$East$	0.002 (0.003)	0.002 (0.003)	- 0.004 (0.005)
R^2	0.004	0.004	- 0.000
N	20,324	18,344	1980

This table reports the differences in speed of adjustment between East German firms and West German firms using the firm-characteristic matched sample. The regression model is given by: $\Delta Cash_{i,t} = \alpha + \beta_1 East \times (Cash_{i,t}^* - Cash_{i,t-1}) + \beta_2 (Cash_{i,t}^* - Cash_{i,t-1}) + \beta_3 East + \epsilon_{i,t}$. $Cash_{i,t}^*$ is the predicted cash ratio, when estimating the baseline model from Eq. (1) for West German firms in the matched samples. The first row of each panel indicates the sample used. We sort the sample according to $Cash_{i,t}^* - Cash_{i,t-1}$. If a firm i 's $Cash_{i,t}^* - Cash_{i,t-1}$ lies within the bottom two quintiles (≤ 40 th percentile), we include it in Panel A—the sample of excess cash. If it lies within the top two quintiles (≥ 60 th percentile), we include it in Panel B—the sample of cash shortage. *, ** and *** indicate statistical significance at the 10%, 5% and 1% level

As firm characteristics may considerably determine excess cash and speed of adjustment, we solely use the firm-characteristic matched sample (used in Sect. 4.1) for this exercise. Following Gao et al. (2013), we estimate the following partial adjustment model:

$$\Delta Cash_{i,t} = \alpha + \beta_1 East \times (Cash_{i,t}^* - Cash_{i,t-1}) + \beta_2 (Cash_{i,t}^* - Cash_{i,t-1}) + \beta_3 East + \epsilon_{i,t}, \quad (2)$$

where $\Delta Cash_{i,t}$ is the variation in cash from $t - 1$ to t . $Cash_{i,t}^*$ is the firm's target cash ratio estimated by Eq. (1) using only the West German firms of the matched sample. $Cash_{i,t}^* - Cash_{i,t-1}$ represents the firm's deviation from its target cash level, and β_2 measures how quickly firms adjust their cash holdings to their target level, that is, the speed of adjustment. Thus, β_1 measures whether the speed of adjustment differs between the East and West German firms. To differentiate between excess cash and cash shortages, we again follow Gao et al. (2013) and split the sample into two

subsamples, wherein one consists of firms with $Cash_{i,t}^* - Cash_{i,t-1}$ lying within the bottom two quintiles (i.e. ≤ 40 th percentile) representing the case for excess cash. The other subsample consists of firms with $Cash_{i,t}^* - Cash_{i,t-1}$ lying within the top two quintiles (i.e. ≥ 60 th percentile) representing the case for cash shortage. Panel A of Table 8 illustrates the results for excess cash holdings. The negative and statistically significant sign of the interaction term suggests that East German firms adapt their cash holdings more slowly to the target level in the case of excess cash. In other words, they tend to reduce excess cash more slowly than West German firms do. Importantly, this effect is significant only for SMEs. For a cash shortage (i.e. Panel B of Table 8), we observe that East German firms adapt their cash holdings at the same speed as West German firms do. While this result for a cash shortage is not in line with our expectation, it seems reasonable from an economic perspective that, given the importance of avoiding illiquidity, East and West German firms do not differ from each other in this case. Nonetheless, this suggests that East German firms differ not only in their cash levels but also in their dynamic adjustment of cash holdings in the case of excess cash.

6 Conclusions

In this study, we examine managerial decision-making through the lens of corporate cash holdings. Our exploratory analysis shows a significant difference in cash holdings between the East German and West German firms. These differences also have economic relevance, as our results suggest that cash holdings (relative to total assets) in East German firms are, on average, 15% higher than that of West German firms. We test several reasonable, empirically validated hypotheses that stem from economic theory to help explain the observed differences in cash holdings. First, we exclude the possibility of structural differences in our sample by creating more homogenous subsamples. Second, we control for the possibility that East and West German firms have a different access to financing. Third, we control for historical differences in attitudes toward entrepreneurship. However, none of the tested hypotheses explain the observed differences in cash holdings.

Existing research holds the persistent norms and values of the former GDR accountable for observing differences in various situations between East and West Germany; this may hold true for the present study as well. However, because the underlying dataset of this study is only balance sheet data, such a conclusion is impossible, as we cannot exclude the existence of other unobserved determinants or underlying mechanisms. Nonetheless, we investigate this aspect in more detail and adapt existing research that documents a significant influence of cultural attributes on the level of cash holdings to our setting. The higher cash holdings in East German firms would indicate that cultural attributes between East and West German firm managers are different, implying that the norms and values of the former GDR are persistent. In this stream of literature, we present two additional analyses that investigate the differences in cash holdings based on different cultural attributes. While the results of both analyses (i.e. firm size differentiation and dynamic speed of adjustment) are consistent with the hypothesis of different cultural attributes

between East and West German managerial decision-making, we acknowledge that our study has several limitations which, nonetheless, provide fruitful paths for future research.

First, as we lack information on the firm managers themselves, we cannot control for the case wherein West Germans migrate to East Germany to run a business, and vice versa. According to Wyrwich's (2010) survey, however, more than 85% of East German firms are owned by East Germans. It may further be worthwhile to combine managers' demographic data (i.e. gender, place of birth, level, and location of education) with accounting data to widen the knowledge base about differing cultural attributes of East and West German firm managers, respectively. Second, by drawing on Chen et al.'s (2015) and Orlova's (2020) hypotheses, we show that our observation is consistent with the hypothesis of different cultural attributes between East and West German managerial decision-making. However, existing research has also used several other cultural attributes to explain differences in corporate cash holdings—similar hypotheses can be developed with differences in, for instance, uncertainty avoidance, long-term orientation, or the level of trust. Third, we focus only on the level of corporate cash holdings as one aspect of managerial decision-making. While cash holdings represent an important corporate finance decision, future studies can also focus on other managerial decisions such as inventories, accounts payable, or retained earnings.

In conclusion, survey-based research in combination with accounting data is necessary to investigate the underlying mechanisms of managerial decision-making and whether (and if so, which) cultural attributes differ between East and West German firm managers. The survey data can indicate potential differences in cultural attributes, while the combined accounting data can allow conclusions regarding the effect on managerial decision-making. While this study contributes to the existing literature by extending research on the differences between East and West Germany and adding to the growing body of finance research on cultural attributes, further research that investigates the underlying mechanisms is of paramount importance. Understanding the determinants of differences in managerial decision-making can be valuable for transition economies worldwide that are experiencing a change in their socioeconomic framework. Such research adds an additional dimension to the literature that examines entrepreneurship, financial deepening, and consumption behaviour in transition economies (see Bursztyn and Cantoni 2016; McMillan and Woodruff 2002; Smallbone and Welter 2001; Wu et al. 2012).

Appendix

Table 9 Variable definition

Variable	Formula	Description
Dependent variables		
$Cash_{i,t}$	$\frac{Cash_{i,t}}{Total\ assets_{i,t}}$	Cash to total assets
$\Delta Cash_{i,t}$	$Cash_{i,t} - Cash_{i,t-1}$	Change in cash holdings (used in Sect. 5.2)
Main variable of interest		
$East_i$		Dummy that is 1 if the firm is located in East Germany and 0 otherwise
Control variables/covariates		
$Operating\ cash\ flow_{i,t-1}$	$\frac{Operating\ cash\ flow_{i,t-1}}{Total\ assets_{i,t-1}}$	Operating cash flow to total assets
$Cash\ flow\ volatility_{i,t-1}$		Standard deviation of operating cash flow for a minimum of two and a maximum of 5 years
$Inventory_{i,t-1}$	$\frac{Inventory_{i,t-1}}{Total\ assets_{i,t-1}}$	Inventory to total assets
$Net\ working\ capital_{i,t-1}$	$\frac{Total\ assets_{i,t-1} - (Working\ capital - Cash)_{i,t-1}}{(Working\ capital - Cash)_{i,t-1}}$	Working capital net cash to total assets
$Sales\ growth_{i,t-1}$	$\frac{Sales_{i,t-1} - Sales_{i,t-2}}{Sales_{i,t-2}}$	Sales growth
$Tangible\ assets_{i,t-1}$	$\frac{Tangible\ assets_{i,t-1}}{Total\ assets_{i,t-1}}$	Fixed assets to total assets labeled as tangible assets
$Debt_{i,t-1}$	$\frac{Debt_{i,t-1}}{Total\ assets_{i,t-1}}$	Total liabilities to total assets
$Total\ assets_{i,t-1}$	$\log(Total\ assets_{i,t-1})$	Natural logarithm of total assets
$Age_{i,t}$	$\log(Age_{i,t})$	Natural logarithm of age
$GDP\ growth_{i,t-1}$	$\frac{GDP_{i,t-1} - GDP_{i,t-2}}{GDP_{i,t-2}}$	GDP per capita growth at the federal state level
Robustness		
$Crisis$		Dummy that is 1 during the crisis years 2008 to 2012 and 0 otherwise
Alternative specifications		
Access to financing		
$EFD_{i,j}$		Dummy that is 1 if the firm acts in an industry j with high external finance dependence and 0 otherwise (see Rajan and Zingales 1998)

Table 9 (continued)

Variable	Formula	Description
$FCP_{i,t}$		$FCP_{i,t} = -0.130 \times Total\ assets_{i,t-1} - 0.021 \times Interest\ coverage_{i,t-1}$ $-4.857 \times ROA_{i,t-1} - 2.384 \times Cash_{i,t-1}$ (see Schauer et al. 2019)
$Constrained_{i,t}$		Dummy that is 1 if the firm is in the bottom tercile of the FCP index in year t and 0 otherwise (see Schauer et al. 2019)
$Short-term\ bank\ debt_{i,t-1}$		Short-term bank debt to total assets
$Bank\ concentration_{i,t}$	$\frac{Short-term\ bank\ debt_{i,t-1}}{\frac{Total\ assets_{i,t-1}}{Number\ of\ banks_{i,t}}}$ $\frac{Short-term\ bank\ debt_{i,t-1}}{Surface\ area_{i,t}}$	Aggregate number of bank branches in federal state f to its surface area in km^2
$Urban_{i,k}$		Dummy that is 1 if the firm is located in a municipality that is at least a medium-sized town and 0 otherwise
Historical differences		
$Entr.\ roots_{i,r}$		Dummy that is 1 if the firm is located in a German region r with high historical self-employment rates and 0 otherwise (see Fritsch and Wyrwich 2014)
Speed of adjustment		
$Cash_{i,t}^*$		Predicted cash ratio
$Speed\ of\ adjustment_{i,t}$	$Cash_{i,t}^* - Cash_{i,t-1}$	Speed of adjustment to target cash (see Gao et al. 2013)

Table 10 Firm size definition

Size	Employees	Total assets (in €)	Total sales (in €)
Micro	$x \leq 10$	$x \leq 350,000$	$x \leq 700,000$
Small	$10 < x \leq 50$	$350,000 < x \leq 484,000$	$700,000 < x \leq 968,000$
Medium	$50 < x \leq 250$	$484,000 < x \leq 19.25 \text{ Mio.}$	$968,000 < x \leq 38.5 \text{ Mio.}$
Large	> 250	$> 19.25 \text{ Mio.}$	$> 38.5 \text{ Mio.}$

This table outlines the specification of firm size categories according to §267 of the German Commercial Code: micro, small, medium and large-sized firms. At least two of the respective criteria have to be fulfilled to be assigned to one of the categories. Regarding the classification of SME, a firm is classified as SME if it either belongs to the micro, small, or medium-sized category

Declarations

Conflict of interest The authors have no relevant financial or non-financial interests to disclose.

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