FINANCIAL PRESSURE, MONETARY POLICY EFFECTS AND INVENTORY ADJUSTMENT BY UK AND SPANISH FIRMS

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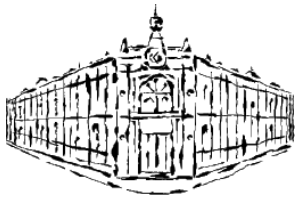

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Financial pressure, monetary policy effects and inventory adjustment by UK and Spanish firms

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Abstract:

This paper examines the adjustment of inventories by firms in the UK and Spain. A widely-held view–but one which has not found much support in previous studies of inventories– is that a key channel for monetary policy is through influencing inventory accumulation. Using a large company-level panel dataset for both countries, significant effects associated with borrowing costs on inventories are estimated. Financial effects associated with liquidity and the borrowing ratio are estimated to be weaker in Spain than in the UK. Since the Spanish financial system is more clearly bank-based, this is interpreted as contrary to the 'bank-dependence hypothesis'.

Introduction

Inventory adjustment is important at both the micro- and macro-economic level. At the micro-level, companies have a number of means of adjustment available to them in response to some shock. Inventory (dis)investment may be an especially useful form of adjustment since the costs of adjusting through inventories appear to be relatively modest, compared to other mechanisms that companies may have available. How companies respond to shocks in this way is an important subject since it relates to the transmission mechanism of monetary policy, as well as company behaviour more generally. Inventories are of further interest in their own right. Inventory management is a significant concern of most businesses in the manufacturing and retail sectors, yet relatively little is known–particularly in the case of UK and Spanish firms to be studied here–about how these inventory management policies are set.

The hypothesis that inventory investment may be influenced by financial conditions of the firm, such as liquidity and cash flow, is of special interest. Kashyap *et al.* (1994) motivate their study of inventory investment by attempting to understand the role of monetary policy in this context. An important means by which monetary policy is expected to operate through the corporate sector is through its influence on the cost of financing inventory investment (see Monetary Policy Committee, 1999, p.7). As noted by Blinder and Maccini (1991) and Kashyap *et al.* (1994) however, there has been scant empirical evidence of such effects. Ramey and West (1999, p.907) also note that none of the studies they review, all of which use aggregate data for the US, find evidence of an interest rate effect on inventories.[1] Partly in the light of this, Kashyap *et al.* (1994) examine the impact of liquidity on inventories. They interpret their results as supportive of a 'bank lending channel' of monetary policy as liquidity effects are strongest among companies identified as more dependent on banks for their finance and during periods following a monetary contraction. But this remains rather indirect evidence. Policy-makers themselves appear to attach more emphasis on the direct effect of monetary policy in influencing inventory and other investment through the direct impact of changes in the official rate on borrowing costs (Monetary Policy Committee, 1999).

This paper considers a more direct role for financial conditions in influencing company

inventory investment using company-level data for two countries, namely the UK and Spain. In addition to the liquidity and cash flow effects previously considered–although largely for US companies–this study also considers the impact of the financial pressure associated with debt-servicing interest costs. The approach complements that of Nickell and Nicolitsas (1999) who examine how companies respond to such financial pressure associated with servicing debt, and how monetary policy operates on other firm-level outcomes, namely employment, wage growth and productivity. Guariglia (1999) employs data on a panel of UK firms and finds significant evidence of financial effects on inventories particularly among those companies anticipated to be more likely financially constrained.[2]

A second contribution of the paper concerns the bank-dependence hypothesis itself. A central concern in this context is the identification of the companies that are more bank-dependent for their finance. Attempts to identify groups of companies that are more strongly bank-dependent using criteria such as bond ratings (Kashyap *et al.* 1994), or firm size (Carpenter *et al.* 1994), meet with the natural objection that they appear rather ad hoc criteria and such characteristics may well be endogenous. For the first time, this paper employs a cross-country comparison using micro-data to consider the bank-dependence hypothesis. Comparing across countries is likely to be significantly more informative in this regard.

An important difference between the two countries examined here is the more advanced financial markets in the UK and lower costs of access to public markets for UK firms than is the case in Spain, where companies are more likely to obtain funds through intermediaries in particular through banks. These are distinctly different financial systems. Several studies have demonstrated that Spanish companies are typically more dependent on bank finance than are (particularly, quoted) UK companies. Since a realistic claim can be made to argue that this situation is exogenous to most companies, an international comparison of this kind may provide unique information on the validity of the bank-dependence hypothesis–at least as it applies to the UK and Spanish economies.

It should be no surprise therefore to observe that monetary policy-makers attach great significance to the inventory cycle in examining the state of the business cycle and the extent of adjustment undertaken by firms.[3] Indeed, at the macroeconomic level, the importance of inventories stems largely from the observation that movements in inventories account for a

large proportion of changes in economic activity, particularly during recessions (Blinder and Maccini, 1991).

The remainder of the paper is organised as follows. Section I outlines the theoretical background to the analysis of the inventory adjustment behaviour of UK and Spanish firms, focusing on the motives for holding inventories. Section II provides data description and estimation results for inventory behaviour for a panel of 926 manufacturing and retail companies over the period 1973 to 2000 in the UK and 3,905 manufacturing and retail companies in Spain for the period 1985 to 2000. Section III concludes.

I. Economic background

Why do companies hold inventories? The literature identifies three main motives. First, the production-smoothing motive maintains that (output) inventories help economise production costs where marginal costs are increasing, or there are costs of changing output, and demand varies over time. If part of this variation in demand is random, then inventories also play the role of a buffer stock. Second, the stockout-avoidance motive suggests that inventories allow companies to avoid stockouts and thereby the loss of sales (Kahn, 1992). A generalisation of this model is provided by Bils and Kahn (2000) who consider inventories as facilitating sales. For instance, holding a larger stock of inventories of similar goods but with different specifications may facilitate matching with customers with specific tastes. Third, (S,s) models relate to the holding of inventories of finished goods. The seller of the good incurs a fixed cost when placing an order for the good from the manufacturer. The benefit of a lower unit cost of a larger order is traded off against the opportunity cost (eg. interest income). Inventories are kept within the (S,s) range. When inventories fall below the lower bound 's' an order is placed that increases them to 'S', from which point they are reduced until at 's'.

Most models of inventories focus on the relationship between inventory investment and sales. Under the production-smoothing model, in response to demand shocks inventory investment will be negatively related to sales. The introduction of cost shocks implies the converse however (Blinder, 1986). In this case, companies increase production and accumulate

inventories when marginal cost is low such that inventories covary positively with output and sales. Production is also more volatile than sales, as tends to be the case empirically.

Rather than testing between these models the main concern here lies in using the approaches to identify the main influences on inventories. This provides a benchmark specification which is then supplemented with variables reflecting the financial pressure experienced by a company. The variation in the importance of any financial pressure effects across groups of companies allows us to consider the bank-dependence hypothesis of Kashyap *et al.* (1994). This paper maintains that the comparison between the UK and Spain is especially informative in this respect. The case for describing the financial system in Spain to be a bank-based system whilst that in the UK as being a market-based system finds support in the classification scheme of Demirgüç-Kunt and Maksimovic (1999, 2002). On the basis of several indicators of the relative magnitudes and activities of public markets and banking sectors, Demirgüç-Kunt and Maksimovic (1999, 2002) classify the UK financial system as market-based whilst that facing Spanish companies is classified as bank-based.

Kashyap *et al.* (1994, p.567) maintain that "if the [bank] lending view is correct, one should expect the inventories of bank-dependent firms to fall *more sharply* in response to a monetary contraction than the inventories of those firms who... do not need to rely on bank financing" (italics in original). Under the bank lending channel, a monetary contraction leads to a contraction of bank loan supply, (in particular, among small, low capitalised or less liquid banks). As such, the inventory investment of bank-dependent firms would be more sensitive to their availability of internal funds. This is the test employed by Kashyap *et al.* (1994) who compared liquidity effects for companies with and without a bond-rating as the proxy for bank-dependence. The finding of greater liquidity constraints on inventory investment among bank-dependent firms was interpreted as evidence consistent with the bank lending view. It could be argued that when banks restrict their supply of loans, they do this in a selective way, for instance, they first restrict loans to customers with a worse financial condition. Nickell and Nicolitsas (1999), argue that a common measure of financial conditions is the (flow) borrowing ratio defined as the ratio of interest costs to cash flow. In a study of the effects of monetary policy, as in Nickell and Nicolitsas (1999), this variable has the further advantage that it reflects directly the burden of borrowing costs associated with the state of monetary policy

and varies in cross-section, . If the borrowing ratio proxies financial conditions, investment of bank-dependent customers would be more sensitive to changes in this variable. The bank lending view therefore also implies the presence of stronger effects from this variable upon inventory investment in a bank-based financial system. Hence the consideration of the bank lending channel leads to an interest in the relative magnitude of the liquidity and borrowing ratio effects in the UK and Spanish financial systems, where the latter is more bank-based. Indeed, Kashyap and Stein (1997) discuss differences in banking systems across Europe in the context of the bank lending view. They conclude that differences in the potency of the bank lending view, with implications for variables such as inventory investment, should be expected. It is suggested that the UK is the country where the effects should be weakest with significantly stronger effects expected in Spain.[4]

Empirical implementation

The previous discussion gives rise to the following specification for estimation:

$$\begin{aligned} \Delta \ln H_{it} &= \alpha_i + \beta_1 \Delta \ln S_{it} + \beta_2 \Delta \ln S_{it-1} + \beta_3 \ln \left(\frac{H}{S}\right)_{it-1} \\ &\quad + \beta_4 \left(\frac{m}{K}\right)_{it-1} + \beta_5 br_{it-1} + \gamma_t + \varepsilon_{it} \end{aligned} \tag{1}$$

where i indexes companies, i=1...N and t indexes years, t=1...T. Δ denotes a first difference, H is real (end-of-year) inventories, S is real sales. α_i are company-specific fixed effects, controlling for time-invariant unobservable influences on inventory investment. m is beginning-of-year liquid assets or, considered alternatively, cash flow. K is capital stock measured at replacement cost; br is the borrowing ratio, given as the ratio of debt interest payments to cash flow. This is the measure of financial pressure favoured by Nickell and Nicolitsas (1999) in their study of employment, wage growth and productivity at UK companies. γ_t are time effects that control for macroeconomic influences on inventory investment common across companies (including technological improvements). ε_{it} is a serially-uncorrelated but possibly heteroskedastic error term.

The specification (1) is essentially that of Kashyap *et al.* (1994), although Kashyap *et al.* (1994) estimate cross-sectional models (ie. without fixed effects, α_i) and supplemented

with additional financial pressure terms. It is also similar to that of Guariglia (1999) although liquidity effects, a key concern in the present paper, are not investigated there. The coefficients β_1 and β_2 indicate the short-run responsiveness of inventory investment to sales growth, whilst the coefficient β_3 indicates the speed of adjustment of inventories towards the long-run relationship between inventories and sales. This is expected to be negatively signed. Note that the two main stylised facts of inventories highlighted by Ramey and West (1999), namely that inventories are procyclical and that they are persistent, imply that $(\beta_1+\beta_2) > 0$ and that $|\beta_3|$ indicates quite a slow speed of adjustment. The coefficients β_4 and β_5 on liquidity and the borrowing ratio, respectively, are used to assess the importance of financial factors. The existence of liquidity effects implies that $\beta_4 > 0$. The bank-dependence hypothesis is interpreted as implying that monetary policy effects should be greater for firms in a financial system that is more bank-dependent ie. $\beta_5^{Spain} > \beta_5^{UK}$. Since part of the bank lending channel acts through the tightening of liquidity constraints this implies that inventory investment should also be more sensitive to liquidity effects among the bank-dependent firms. More generally, evidence of direct monetary policy effects associated with the impact of borrowing costs is of interest given their long tradition beginning with Hawtrey (1928) but having been absent from many studies (Blinder and Maccini, 1991). In addition to the estimating equation given by (1), further experiments are conducted by using a cash flow term, CF/K_{it-1}, in place of the liquidity measure m/K_{it-1}, and a role for the underlying net indebtedness of the company, $(B-m)/K_{it-1}$, is considered as a more long-term measure of financial pressure (Sharpe, 1994). Other details of the estimation method are described below.

III Data and Estimation

(a) Data Description

This paper employs two large micro datasets of companies in the UK and Spain. The UK data refer to some 926 quoted companies in the manufacturing and retail sectors over the period 1973 to 2000. These data were drawn from the Datastream database of quoted UK company accounts.[5] The Spanish companies formally cover both the quoted and non-quoted sectors, but they are overwhelmingly non-quoted (2.9 per cent being listed on the Spanish

exchange). These data are derived from the Annual Central Balance Sheet Database (Central de Balances, CBA) of the Bank of Spain. This consists of a voluntary, large-scale survey of non-financial companies in Spain. In terms of gross value added the survey respondents jointly represent around 35 per cent of the total gross value added of the non-financial corporate sector in Spain.[6] This study selects on a minimum of 10 employees in either the manufacturing or retail sectors. For both the UK and Spanish firm data, companies have also been selected on a minimum of five consecutive observations per company. The resulting Spanish data consist of 3,905 companies over the period 1985 to 2000.

A unique feature of this paper is the ability to compare across these two countries in examining inventory investment using company-level data. This is important since it also relates directly to the bank-dependence hypothesis highlighted by Kashyap *et al.* (1994). Spanish firms are much more heavily dependent on bank finance than UK firms (eg. Demirgüç-Kunt and Maksimovic (1999, 2002)).[7] This paper motivates the comparison between UK and Spanish firms in part by maintaining that the greater reliance on bank finance for Spanish companies partly reflects higher costs of access to public markets and that this is exogenous to firms. Under the Kashyap *et al.* (1994) bank-dependence hypothesis, this has the empirical implication that liquidity and financial pressure effects on inventories should be greater in Spain than in the UK, at the same stage of the business cycle (see also Kashyap and Stein, 1997). The coverage of both quoted and unquoted companies within Spain is also noteworthy. As with the UK data used in this paper, Kashyap *et al.* (1994) were restricted to quoted US companies but commented (p.574) that "Ideally we would prefer to also examine non-traded firms, since we suspect that these companies are most dependent on bank financing and hence most likely to be susceptible to a credit crunch. Unfortunately, we are unaware of any consistent firm-level data for nontraded companies." This provides a further reason for expecting the borrowing ratio and liquidity effects to be stronger for the Spanish sample under the Kashyap *et al.* (1994) hypothesis.

Sample medians on the main characteristics of the UK and Spanish firms are presented in Table 1.[8] A comparable sub-period for the UK data is provided to cover the same period as for the Spanish data, whilst the descriptive statistics for Spanish companies are also provided for a sample of larger Spanish companies that also will be used below. Each of these companies

has an (average) employment level of at least 100 employees.

The median rate of real inventory growth over the period among UK companies is 0.022 and compares to 0.007 among the Spanish companies. The typical inventory-sales ratio over the period is 0.166, quite similar to the figure for Spanish companies of 0.137. Companies in the manufacturing or retail sectors therefore typically hold around 2 months' sales as inventories.[9] There is considerable variation across companies and over time in these measures of inventories and these are described below.

A comparison of the median figures for (post-tax) cash flow (CF/K) for UK and Spanish companies shows these to be slightly higher for Spanish firms, and the level of indebtedness is higher for the Spanish firms. The burden of servicing debt and its variation across firms reflects jointly variation in debt, interest rates and corporate profits. Over the period, this has tended to be higher among the Spanish companies. Other differences among the groups of companies are apparent. The UK firms are typically rather larger than their Spanish counterparts, with median sales of £56.4mn compared to E7.1mn in the Spanish sample and E30.1mn for the sample of larger Spanish firms. A similar proportion of firms are in the manufacturing retail sectors in the two countries.

The discussion in Section II highlighted the relationship between company inventories and sales. Figure 1 is a cross-plot of the level of log inventories and log sales for the samples of UK and Spanish firms. There is a strong positive relationship between the two variables in both countries. Given the scales on the figures, Figure 1 suggests that a log-linear relationship with a unit elasticity in the long-run would be highly plausible. A pooled cross-sectional regression using the UK data produces an elasticity estimate (robust standard error) of inventories with respect to sales of 0.948 (0.003), indicating that the error-correction form of (1) may be a useful representation of the data. In the case of the 35,428 Spanish firm-year observations the corresponding elasticity (robust standard error) is 0.951 (0.003). The slighter greater dispersion around this 'attractor' observed for the Spanish sample might suggest a slightly slower speed of adjustment in the case of the Spanish set of firms.

Some of the time-series variation in inventory investment and sales is shown in Figure 2, which illustrates the relationship between mean inventory investment and growth in sales over the respective sample periods for the two countries. The cycles in the two variables are

highly synchronous, consistent with the main cycles in aggregate output over this period. In the UK, the recession of 1974/75 saw mean inventory investment fall from 15.5 per cent in 1974 to disinvestment of 7.8 per cent in 1975, from which point growth in mean inventories was recorded, reaching 9.1 per cent in 1978. In the subsequent recession, disinvestment was recorded of 7.6 per cent and 10.7 per cent in 1981 and 1982 respectively. A similar pattern was observed in the late 1980s with a somewhat smaller degree of disinvestment then witnessed in the recession of the early 1990s. In a similar vein, in Spain in the late 1980s and early 1990s as sales growth eased so too did that in inventory growth, subsequently picking up from 1993.

It is commonly suggested that inventory control methods have improved over time, with the introduction of just-in-time practices for instance.[10] Figure 3 provides some evidence consistent with this for UK firms but to a much lesser extent in Spain. The figures illustrate the cross-sectional distributions of the inventory-sales ratio over time in the two countries. For the typical (median) UK company, its ratio of inventories to sales has fallen steadily over time from 21.7 per cent in 1979 to 12.6 per cent in 2000. Moreover, at the top of the cross-sectional distribution companies have economised further on their inventories relative to sales. In 1979, the 90th percentile of the inventory-sales ratio was 36.3 per cent but had fallen to 21.4 per cent by 2000. When considered separately, this decline occurs in both the retail and manufacturing sectors, but is slightly more pronounced in manufacturing.[11] In Spain however, any such suggestion in the data is distinctly weaker. For the median Spanish company, its inventory/sales ratio has fallen from 15.1 per cent to 13.4 per cent over the full sample period, accounted for by the experience of manufacturing companies where the median ratio fell from 15.5 per cent to 13.1 per cent, rather than in retail where inventories relative to sales have remained steady over the period. At the 90th percentile, the ratio has remained stable at 33 per cent in Spain. The overall impression is that to the extent that inventory control methods have resulted in a lower inventory/sales ratio this effect is largely restricted to UK companies and not those in Spain.[12]

In the raw data, do the cycles in inventories appear related to movements in liquidity? Figure 4 considers the case of the typical or median company, illustrating the growth in liquidity against the growth in inventories also at the median. The cycles appear to be

related in both countries but are stronger for UK companies. There is some suggestion that movements in liquidity appear to predate those in inventory investment by around 1 year in both countries.

Figure 5 turns to the relation between the time-series variation in inventories and the borrowing ratio, reflecting the financial burden of servicing debt, for the median company in each year. It shows a striking inverse relation between the two in both countries. In the UK, the two recessions of the early 1980s and early 1990s coincided with increases in the typical company borrowing ratio as financial pressure of servicing debt was tightened, and at the same time inventory investment became sharply negative. In a similar vein, the reductions in financial pressure witnessed during the mid-1980s coincided with steady growth in inventory investment. In Spain, the decline in inventory investment of the median company from the late-1980s through the early-1990s, reaching a low-point in 1993, moved inversely with the steady increases in financial pressure measured by the cost of servicing debt which peaked in 1993, from which point it has declined steadily through the remainder of the 1990s.[13]

The data description has inspected aspects of the cross-sectional and time-series variation across companies in inventories. The patterns in the raw data point towards a stable positive long-run relationship between inventories and sales albeit subject to aggregate movements, with inventory cycles coinciding closely with cycles in company sales and liquidity on the one hand and moving inversely with movements in the borrowing ratio. These patterns exist in both countries, although casual inspection suggests that the relations with the financial variables appear slightly stronger for the UK firms. The estimation analysis below exploits more formally time-series variation at the individual company-level in inventories and the other explanatory variables of interest to examine these relationships and the factors driving companies' inventory investment decisions.

(b) Estimation and results

Dynamic fixed effects models are estimated using the GMM-System estimator proposed by Arellano and Bover (1995) and examined by Blundell and Bond (1998). This estimator is an extension of the GMM estimator of Arellano and Bond (1991) and estimates equations in levels as well as in first-differences. Where there is persistence in the data such that the lagged levels of a variable are not highly correlated with the first difference, also estimating the levels

equations with a lagged difference term as an instrument offers significant gains, countering the bias associated with weak instruments (see Blundell and Bond, 1998). Several of the variables employed display high levels of serial correlation. The estimation method requires the absence of second order serial correlation in the first differenced residuals for which the test of Arellano and Bond (1991) is presented, (labelled M_2), alongside a conventional Sargan test for instrument validity.

Evidence for UK firms

The estimation results for the panel of UK firms are shown in Table 2. A basic specification that considers the two sales growth terms, the error-correction term $ln(H/S)_{it-1}$, and the liquidity term m/K_{it-1}, is presented in column 1. In each of the specifications that are shown for all UK firms, it was necessary to specify the instruments from $t-3$ in the difference equation and as $\Delta t-2$ in the levels equation in order that the Sargan test statistic was not significant at the 5 per cent level.

The estimates find significant positive dynamic effects from sales growth and lagged sales growth with coefficients (standard errors) of 0.408 (0.066) and 0.103 (0.051) respectively. The coefficient on the error correction term indicates an annual speed of adjustment to the long-run equilibrium of 13.2 per cent and is highly significant. This is similar to that reported in US evidence by Blinder and Maccini (1991), but *prima facie* this points to quite a slow rate of adjustment in inventories. Ramey and West (1999) argue that such persistence is a key feature of inventories. They suggest this can be explained by highly persistent shocks to the costs of production and/or quite large costs of adjusting production. Relatedly, Feldstein and Auerbach (1976) rationalised such observations in terms of a persistently varying target for inventories relative to sales (although in the long-run these move one for one), rather than representing persistent deviations from a given target. The latter was argued to be at variance with the apparent ease with which companies can adjust inventories to sales surprises.

A key result concerns the significance of the liquidity term, with a robust 't-ratio' in excess of two. The point estimate indicates that the elasticity of inventory investment with respect to liquidity, evaluated at the means is 0.36. A 10 per cent increase in liquid assets therefor facilitates higher inventory investment of 3.6 per cent. In column 2, the cash flow term CF/K_{it-1}, is used in place of the liquidity term. This also attracts a significantly

positive coefficient, again consistent with important financial effects in influencing inventory movements.

Column 3 considers the borrowing ratio term, br_{it-1}, alongside the liquidity term. The liquidity term is barely affected by the inclusion of this term, whilst the br_{it-1} term itself is highly significant with a point estimate (standard error) of -0.090 (0.018). An increase in financial pressure associated with the cost of servicing debt, leads to a significant reduction in inventory levels. This is interpreted as consistent with an important direct monetary policy channel operating through inventories. The sensitivity relative to that estimated for Spanish firms, that are more likely to be bank-dependent is discussed below. Recall, however, that the borrowing ratio term is defined as the ratio of interest payments to cash flow. It is possible that the br term is simply picking up a cash flow effect. To consider this possibility, the specification in column 4 includes the cash flow term alongside the borrowing ratio. The estimated effect of the borrowing ratio remains highly significant, whilst the cash flow term also retains its positive coefficient on the margin of significance. The results suggest no evidence of second-order serial correlation.

Separate estimates of the model in column 4 with the cash flow and borrowing ratio terms are then shown according to whether the firm is in the manufacturing or retail sectors. The dynamics and speed of adjustment are estimated to be similar in the two sectors. The financial effects are also estimated to be quite similar, with the borrowing ratio term being significant in both sectors, albeit marginally stronger in the retail sector. The cash flow effect remains significant ('t-value'=1.7) in the retail sector but becomes insignificant in the manufacturing sector when included alongside the borrowing ratio term.[14] Results for the other models shown are also quite similar across the two sectors.[15]

Quantitatively, how important is the monetary policy effect? A useful experiment, also considered by Nickell and Nicolitsas (1999) and Benito and Young (2002), is to consider the case of an increase in the policy interest rate from 5 to 8 percentage points.[16] The estimates (ie. Table 2 column 4 which controls separately for cash flow) imply that, evaluated at the mean ($\overline{br} = 0.194$), the implied change in the borrowing ratio would result in a short-run impact on inventory investment of -1.1 percentage points. Compared to mean inventory growth of 3.0 per cent this is quite a large effect in response to a significant tightening in

monetary policy. It remains to be seen whether this financial pressure effect is estimated to be stronger among firms in Spain, a finding that could be considered consistent with the bank-dependence hypothesis, given the more important role for banks as providers of finance.

Evidence for Spanish firms

Estimation results for the panel of Spanish firms are presented in Table 3. The specifications are the same as those presented for UK firms.

Column 1 presents the baseline specification with liquidity $(m/K)_{it-1}$ as the key financial factor considered, alongside the variables for the growth rate in sales $(\Delta \ln S)$ and the error correction term, $ln(H/S)_{it-1}$ representing correction towards the long-run equilibrium relation between inventories and sales. The contemporaneous and lagged growth rate in sales terms are significantly positive in all specifications, confirming the procyclicality, at the company-level of inventories. The coefficient on the $ln(H/S)_{it-1}$ term, at -0.10 indicates a relatively slow speed of adjustment, similar to that for UK firms and quite well-determined. Inventories also have the property of being quite persistent in Spain, a feature highlighted by Ramey and West (1999).

In column 1, the liquidity term, m/K_{it-1} attracts a coefficient that is quantitatively small, at 0.020, but is statistically significantly different from zero ('t-value'=5.17). This corresponds to an elasticity of inventory investment with respect to liquidity of 0.20 compared to 0.36 estimated in the case of UK firms. The smaller sensitivity of inventories to liquidity in Spain than in the UK (see Table 2) contrasts with the suggestion described earlier, under the bank lending hypothesis of Kashyap *et al.* (1994), which should imply that the responsiveness of inventories to liquidity should be greater for the sample of Spanish firms than in the UK. This leads to the conclusion that although there is evidence of significant liquidity effects in influencing inventory investment in the Spain and the UK, the pattern is not consistent with a bank lending channel of monetary policy operating in Spain (see specifically the suggestion of Kashyap and Stein (1997, Table 6) that such effects should be stronger in Spain than the UK). Note that this interpretation is consistent with that of Hernando and Martínez-Pagés (2001) who examine bank behaviour in Spain and, employing a similar approach to that of Kashyap and Stein (2000) for US data, found no evidence of such a bank lending channel. They do argue, however, that the finding may be sample-specific in that the balance sheets of Spanish

banks have displayed large amounts of liquid assets that may have reduced the elasticity of their loan supply to monetary policy shocks. In reviewing both micro- and macro-evidence on the monetary policy transmission mechanism for the euro area, Angeloni *et al.* (2002) also concluded that there is no evidence of a bank lending channel for Spain.[17] These results are consistent with that interpretation with weaker financial effects in a sample of firms which are more bank dependent. However, the finding of significant financial effects from cash flow and liquidity as well as the borrowing ratio and net indebtedness terms for Spain is worth noting. This may well point to the existence of some other "credit channel" in Spain such as via the balance sheet channel whereby firms' investment decisions are influenced by the status of their balance sheet. Estrada and Vallés (1998) find evidence of related financial variables in influencing fixed investment among Spanish manufacturing firms (see also Vermeulen (2002) for an industry-level study).

The cash flow term, $(CF/K)_{it-1}$, considered in column 2 is also significantly smaller for the Spanish sample than was the case for the UK evidence, but is statistically significant. The estimate implies that a 10 percentage point increase in cash flow would help finance additional inventory investment of only 0.15 percentage points. What of the more direct role of monetary policy on inventory investment via influencing borrowing costs? First, evidence is again found for a significant role for borrowing costs in shaping inventory investment, as was also the case for the UK firms. But second, the effect is somewhat weaker in the case of the Spanish firms. The estimates in Table 3, point to a coefficient on the br_{it-1} term of around -0.04, around half of that for the UK sample of firms. This implies that on the evidence here UK inventory investment is more sensitive to monetary policy through its direct influence on borrowing costs than is the case in Spain. Again this is not consistent with the view that financial effects upon inventory investment should be stronger in a financial system where firms are more bank dependent as in Spain. At this point, it should be emphasised that, as highlighted by Ramey and West (1999), many other studies typically restricted to using aggregate data for the US have failed to find a direct role for monetary policy in influencing inventory investment despite the belief among policy-makers that such an effect holds.[18]

The sample of Spanish firms examined above from the Bank of Spain survey data are clearly very different from the quoted companies in the UK. The most obvious difference

concerns the size of companies. In order to provide a comparison of sets of companies that are more similar along these lines, Table 4 presents subsample evidence for the Spanish sample. Fortunately, the size of the Spanish dataset is ample enough to facilitate this exercise. Spanish companies with at least 100 employees (that is, on average during the company's sample period) are considered. Over 90 per cent of the UK sample meet this criterion. The focus of discussion is the following questions. First, do the weaker liquidity effects, contrary to the implication of the bank dependence hypothesis, also hold for this subset of firms? The results suggest that this is the case as the liquidity term m/K_{it-1} is in fact even weaker attracting a coefficient (robust standard error) of 0.004 (0.013) for this larger sample of Spanish firms. Second, does the weaker relation between inventory investment and borrowing costs continue to hold? The results, at least in terms of the point estimates point in this direction, with the specification that includes the control for cash flow producing a coefficient (standard error) on the br_{it-1}term of -0.052 (0.028). This compares to an estimate for the UK sample of -0.088 (0.017). Third, is cash flow itself significant for the larger firms? The results suggest that this is not the case. The cash flow term on the margin of significance in some of the specifications but there is not a clear impression of strong cash flow effects among large Spanish firms. Cash flow appears to matter more for small than large firms, as has tended to be found in studies of fixed investment-cash flow effects. Chatelain *et al.* (2001) found evidence of significant cash flow effects on fixed investment in Spain, but this was not estimated to be stronger for larger than smaller firms. Note that the estimates reported do not suggest the presence of second-order serial correlation and the Sargan test for instrument validity is also insignificant.[19]

Table 4 also represents results for the large Spanish firms separately for those in the manufacturing and retail sectors. The results suggest that liquidity is more important among the retail companies whilst the cash flow term is insignificantly different from zero. The financial pressure term, br_{it-1} is insignificant for the sample of large retail companies although the number of cross-section units for these regressions, at 182, is somewhat small for GMM estimation and this may be a factor. The point estimate is similar to that previously described for the samples of Spanish firms, the insignificance of the term being accounted for by an increase in the standard error. The interesting difference between the manufacturing

and retail (large) Spanish firms, concerns the relation between inventories and sales. The short-term procyclicality of inventories with sales seems to be somewhat stronger for retail companies than for manufacturing firms.

III. Conclusions

This paper has examined the inventory adjustment of firms in the UK and Spain. This has been motivated by two related issues. First, at the company-level, inventories offer an important means of adjustment in the presence of financial pressure. With the mean ratio of inventories to annual sales at around 20 per cent, inventory management is an important activity for manufacturing and retail firms. But there have been relatively few studies, particularly for the UK and Spain, that consider inventory adjustment. Second, at the macroeconomic level, monetary policy-makers attach great significance to inventory adjustment over the business cycle.

Observed patterns in the raw data have also merited attention. The paper has uncovered a steady downward trend in the ratio of inventories to sales, across the cross-sectional distribution of firms in the UK but absent in Spain. This suggests that improvements in inventory management methods, which may also have implications for the business cycle (Filardo, 1995; Kahn *et al.* 2001), have been witnessed in the UK but may not have been widely experienced in Spain.

Of special importance in the context of both micro- and macro-implications of inventory investment, is the hypothesis that inventory investment is influenced by purely financial factors such as liquidity or cash flow. A monetary contraction will affect the demand for interest-sensitive sectors most. This will have certain adverse cash flow and liquidity consequences for companies in such sectors. The existence of cash flow and liquidity effects on inventory investment implies that such companies' inventory investment is thereby restricted which exacerbates the initial impact of the monetary contraction.

The paper has found evidence of such effects for both countries. The paper has also considered, for the first time for these two countries, a more direct role for inventories to be influenced by monetary policy, namely through the level of debt-servicing costs. Monetary

policy-makers themselves identify this as an important channel through which policy operates (Monetary Policy Committee, 1999), but empirical evidence of this channel has been elusive (Blinder and Maccini, 1991; Kashyap *et al.* 1994).

Evidence of such direct effects from monetary policy on inventory investment has been found for both countries. For the most comprehensive data available in each country, which in the case of Spain includes a large number of small to medium-sized companies, suggested a larger sensitivity in the case of the UK firms. Restricting the analysis of the Spanish companies to those of a similar size to their UK counterparts continued to suggest smaller effects in Spain. But the results confirm that inventory adjustment is an important form of adjustment for companies in response to financial pressure–and an important mechanism for the transmission of monetary policy through the corporate sector in both countries. The existence of financial effects on inventories raises the possibility that part of this transmission mechanism is through non-standard (ie. non-classical) means. One possible mechanism is the bank lending channel and closely related bank-dependence hypothesis.

The analysis has been carried out for firm's based in two countries with significantly different financial systems, with the Spanish system being more clearly 'bank-based'. A comparison of results, and in particular of the sensitivity of inventories to financial pressure and liquidity effects, has been motivated by a consideration of the 'bank-lending hypothesis' and bank lending channel of monetary policy in influencing inventories according to Kashyap *et al.* (1994). This hypothesis suggests that such financial effects should be stronger where companies are more reliant on banks as providers of finance. Previous attempts to consider this hypothesis have been plagued by the issue of identifying those companies which are more bank-dependent for exogenous reasons. This paper has argued that the greater dependence of companies upon banks as a source of finance in Spain reflects the less well-developed financial markets that exist and hence a higher cost of funds from alternative sources. This is exogenous to such companies. The comparison of the financial pressure effects in the two countries suggested that these were weaker in Spain, contrary to the bank-dependence hypothesis but consistent with other evidence (Hernando and Martínez-Pagés, 2001; Angeloni *et al.* 2002) which suggests the weakness of the bank-lending channel in Spain. There are two possible explanations for this. First, Spanish banks have traditionally had signficant liquidity buffers

that have allowed them to cope with interest rate shocks without altering credit supply (Hernando and Martínez-Pagés, 2001). A second possible explanation is the direct involvement of many banks in the governance of Spanish companies. These points notwithstanding, the finding of significant financial effects on the inventory investment behaviour of firms in both countries may suggest the existence of other, non-classical, components to the transmission mechanism operating through inventory investment.

Notes

1. Lovell (1994) also laments the lack of studies on inventories that have directly addressed this question. Moreover this is despite the fact that as far back as Hawtrey (1928), a monetary policy effect on inventories was identified as the primary means through which monetary policy had its effect on the economy.

2. Guariglia and Schiantarelli (1998) also present evidence concerning inventory investment and financial constraints for UK firms.

3. For example, *The Financial Times* (January 8, 2002, p.1) refers to the Governor of the Bank of England, singling out adjustment of inventories in the US as evidence that growth had bottomed out.

4. Of course, the classification used here referring to the Spanish financial system as bank-based does not imply that *all* companies in Spain are bank-dependent but merely that this is more likely given the differences in the financial system compared to that of the UK.

5. The data were kindly provided by Nick Bloom and Steve Bond.

6. Further details of the database are provided in Banco de España (2000). Examples of previous studies using the data at the firm-level include Alonso-Borrego (1998) in a study of labour demand and Alonso-Borrego and Bentolila (1994) in a study of fixed investment.

7. See also Hernando and Martínez-Pagés (2001) for an overview of the Spanish financial system. They comment that "The Spanish financial system is clearly bank-dominated".

8. Sample means provide a similar pattern to that present in the medians. The median figures appear more indicative of the 'typical' UK and Spanish firm than the means given skewness in many variables although gross outliers have been removed from the data.

9. In the UK (Spain) the mean inventory-sales ratio is 0.197 (0.181) in manufacturing and 0.151 (0.163) in the retail sector.

10. Filardo (1995) considers how a decline in the inventory-sales ratio in the US could reduce the amplitude of the business cycle, using aggregate US data.

11. It is possible that this finding of a declining inventory-sales ratio may reflect inflation-related effects. Allowing for separate deflators for inventories and sales is not possible in the UK however, owing to the absence of an inventories deflator. Use of a manufacturing goods deflator in its place did not affect this pattern of results. In the regression analysis, any common inflation effects are taken into account through the year dummies. Kahn *et al* (2001) examine the aggregate inventory-sales ratio for the US and note that the decline witnessed particularly since the early 1990s is similar whether using nominal ratios or the ratios of two chain-weighted series.

12. The changing composition of firms over time (by industry for instance) is a possible factor accounting for variation in the inventory-sales ratio over time. But restricting the two country datsets to companies that are present for the whole sample periods continues to suggest a declining inventory-sales ratio in the UK but not in Spain. This is also the case for the common sub-period 1985-2000. Nevertheless some composition effects will be present in such descriptive analysis which is likely to help account for the median inventories/sales ratio in Spain being less than that in the UK throughout the sample period.

13. Nominal short-term interest rates in Spain were in the range 12 to 16 per cent (annual averages) in the period from 1985 to 1990 from which point they were reduced

steadily to reach 4 per cent by 2000 with Spain being one of the euro area economies at January 1st 1999.

14. The cash flow term is statistically significant when the borrowing ratio term is omitted. Cash flow effects in inventory investment for UK manufacturing firms are considered by Small (2000), but the results here suggest that the borrowing ratio term does a better job of measuring financial pressure type effects than cash flow.

15. Data for finished goods inventories alone are also available for a subset of 619 companies from 1983. The resulting regressions were also similar to those reported in Table 2, with minor exceptions. In sum, these results showed a significant effect from the borrowing ratio term, br_{it-1}; whilst the cash flow term included alongside or instead of this term was insignificant, the liquidity term, m/K_{it-1} was statistically significant. The specification corresponding to that of column 4 produced a coefficient (robust standard error) on br_{it-1} of -0.177 (0.045), with insignificant test statistics for the M_2 and Sargan statistics.

16. This is best thought of as a company-specific change in 'financial pressure' that is *equivalent to* a change in the policy rate by this amount.

17. Indeed, it is suggested by Angeloni *et al.* (2002) that of all the euro area countries, the evidence (which does not include studies of inventories) most consistently points to a classical interest channel as being a valid description of the transmission mechanism for Spain. Although the finding that inventories are less sensitive to liquidity in Spain than in the UK is interepreted as consistent with that overall conclusion, the finding of significant liquidity and cash flow effects should also be noted.

18. The specification tests that accompany the results suggest the absence of second-order serial correlation but the Sargan test statistic tends to return a significant value. Using deeper lags as instruments resulted in similar point estimates but slightly larger standard errors and the Sargan test statistic remained significant. In view of the Monte Carlo evidence of Blundell *et al.* (2000) which questions the usefulness of this Sargan test in the context of this estimator (ie. it tends to over-reject the null hypothesis) the results reported are the preferred set. Consistent with this, Nickell and Nicolitsas (1999) report significant Sargan test statistics for all of their reported estimation results.

19. For further comparability the UK sample was restricted to the same sample period as that for the Spanish data. This provided the same qualitative pattern of results to that previously described.

Table 1: Sample medians

		UK Quoted Firms		Spanish Firms	
		all	1985-00	all	large
$\Delta \ln H$	Inventory growth	0.022	0.020	0.007	0.010
H/S	Inventory/sales	0.166	0.149	0.137	0.136
S	Sales	56.433	66.378	7.111	30.008
$\Delta \ln S$	Sales growth	0.034	0.042	0.018	0.027
B/K	Debt/capital stock	0.250	0.270	0.531	0.447
$(B-m)/K$	Net debt/capital stock	0.147	0.142	0.371	0.356
CF/K	Cash flow	0.196	0.222	0.248	0.336
m/K	Liquidity	0.083	0.114	0.111	0.050
I/K	Investment	0.115	0.120	0.094	0.096
br	Borrowing ratio	0.134	0.134	0.257	0.228
Manufacturing	Sector	0.730	0.728	0.729	0.845
Retail	Sector	0.270	0.272	0.271	0.155
companies		926	540	3,905	1,141
observations		12,116	6,863	35,428	11,131

Notes: Table shows sample medians, except for manufacturing and retail dummies which are proportions. Sales are in £mn (1995 prices) for UK firms and Emn (1995 prices) for Spanish firms. The subsample of large Spanish firms are those with employment of 100 or more.

Table 2: Inventory Investment by UK Firms

$\Delta \ln H_{it}$	[1]	[2]	[3]	[4]	[5]	manuf.	retail
$\Delta \ln s_{it}$	0.408 (0.066)	0.468 (0.062)	0.472 (0.061)	0.492 (0.055)	0.501 (0.065)	0.517 (0.052)	0.545 (0.071)
$\Delta \ln s_{it-1}$	0.103 (0.051)	0.099 (0.044)	0.079 (0.045)	0.060 (0.041)	0.075 (0.046)	0.059 (0.041)	-0.018 (0.053)
$ln(H/s)_{it-1}$	-0.132 (0.024)	-0.145 (0.024)	-0.160 (0.023)	-0.165 (0.023)	-0.165 (0.025)	-0.175 (0.026)	-0.150 (0.023)
m/K_{it-1}	0.053 (0.020)		0.050 (0.019)				
CF/K_{it-1}		0.097 (0.040)		0.066 (0.037)		0.050 (0.042)	0.086 (0.051)
br_{it-1}			-0.090 (0.018)	-0.088 (0.017)	-0.098 (0.018)	-0.082 (0.020)	-0.132 (0.030)
$(B-m)/K_{it-1}$					-0.051 (0.022)		
Year effects	yes	yes	yes	yes	yes	yes	yes
M_2 (p-value)	0.379	0.653	0.952	0.730	0.843	0.719	0.329
Instruments	t-3..t-5; Δt-2	t-3..t-5; Δt-2	t-3..t-5; Δt-2	t-3..t-5; Δt-2	t-3..t-5; Δt-2	t-2..t-5; Δt-1	t-2..t-5; Δt-1
Sargan (p-value)	0.274	0.108	0.053	0.072	0.104	0.059	0.750
Firms	926	926	926	926	926	654	272
Observations	11,190	11,190	11,190	11,190	11,190	8,189	3,001

Notes: Estimation by GMM-SYSTEM estimator using the robust one-step method (Blundell and Bond, 1998; Arellano and Bond, 1998). Sargan is a Sargan Test of over-identifying restrictions. M_2 is a test of second-order serial correlation in the first-differenced residuals, asymptotically distributed N(0,1) (Arellano and Bond, 1991). Asymptotic robust standard errors reported in parentheses. The dependent variable is the change over the year in log inventories. See Table 1 for variable definitions.

Table 3: Inventory Investment by Spanish Firms

$\Delta \ln H_{it}$	[1]	[2]	[3]	[4]	[5]
$\Delta \ln S_{it}$	0.174 (0.085)	0.227 (0.085)	0.224 (0.078)	0.258 (0.077)	0.244 (0.077)
$\Delta \ln S_{it-1}$	0.038 (0.014)	0.036 (0.015)	0.033 (0.014)	0.032 (0.015)	0.036 (0.014)
$ln(H/S)_{it-1}$	-0.103 (0.013)	-0.107 (0.013)	-0.105 (0.013)	-0.108 (0.013)	-0.106 (0.013)
m/K_{it-1}	0.020 (0.004)		0.019 (0.004)		
CF/K_{it-1}		0.015 (0.004)		0.012 (0.004)	
br_{it-1}			-0.050 (0.017)	-0.039 (0.018)	-0.045 (0.017)
$(B-m)/K_{it-1}$					-0.018 (0.004)
Year effects	yes	yes	yes	yes	yes
M_2	0.135	0.103	0.118	0.100	0.135
Instruments	t-2..t-4; Δt-1	t-2..t-4; Δt-1	t-2..t-4; Δt-1	t-2..t-4; Δt-1	t-2..t-4; Δt-1
Sargan	0.000	0.000	0.002	0.003	0.000
Firms	3,905	3,905	3,905	3,905	3,905
Observations	31,523	31,523	31,523	31,523	31,523

Notes: Estimation by GMM-SYSTEM estimator using the robust one-step method (Blundell and Bond, 1998; Arellano and Bond, 1998). Sargan is a Sargan Test of over-identifying restrictions. M_2 is a test of second-order serial correlation in the first-differenced residuals, asymptotically distributed N(0,1) (Arellano and Bond, 1991). Asymptotic robust standard errors reported in parentheses. The dependent variable is the change over the year in log inventories. See Table 1 for variable definitions.

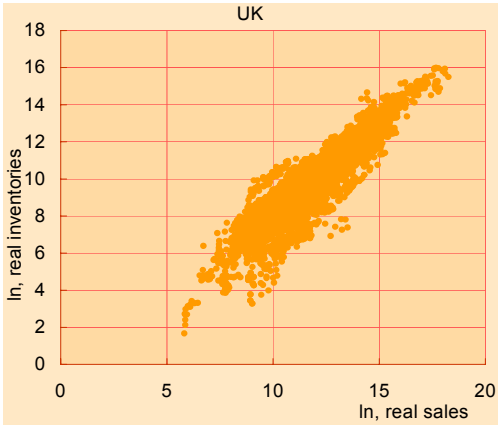
Table 4: Subsample evidence for Spanish firms

$\Delta \ln H_{it}$	all large	all large	large manuf.	large manuf.	large retail	large retail
$\Delta \ln S_{it}$	0.190 (0.083)	0.206 (0.084)	0.114 (0.079)	0.112 (0.077)	0.438 (0.104)	0.380 (0.127)
$\Delta \ln S_{it-1}$	0.070 (0.027)	0.067 (0.028)	0.069 (0.028)	0.067 (0.028)	0.005 (0.103)	-0.020 (0.104)
$ln(H/S)_{it-1}$	-0.132 (0.029)	-0.141 (0.027)	-0.058 (0.020)	-0.119 (0.025)	-0.193 (0.057)	-0.191 (0.063)
m/K_{it-1}	0.004 (0.013)		0.007 (0.014)		0.035 (0.011)	
CF/K_{it-1}		0.001 (0.008)		-0.004 (0.008)		0.031 (0.021)
br_{it-1}	-0.057 (0.029)	-0.052 (0.028)	-0.060 (0.029)	-0.061 (0.029)	-0.045 (0.068)	-0.034 (0.069)
Year effects	yes	yes	yes	yes	yes	yes
M_2	0.074	0.151	0.153	0.187	0.326	0.357
Instruments	t-2..t-4; Δt-1	t-2..t-4; Δt-1	t-2..t-4; Δt-1	t-2..t-4; Δt-1	t-2..t-4; Δt-1	t-2..t-4; Δt-1
Sargan	0.106	0.091	0.087	0.218	0.981	0.990
Firms	1,141	1,141	959	959	182	182
Observations	9,990	9,990	8,451	8,451	1,539	1,539

Notes: Large companies defined as those with employment at or above 100 employees. Estimation by GMM-SYSTEM estimator using the robust one-step method (Blundell and Bond, 1998; Arellano and Bond, 1998). Sargan is a Sargan Test of over-identifying restrictions. M_2 is a test of second-order serial correlation in the first-differenced residuals, asymptotically distributed N(0,1) (Arellano and Bond, 1991). Asymptotic robust standard errors reported in parentheses.

FIGURE 1

Inventories and sales



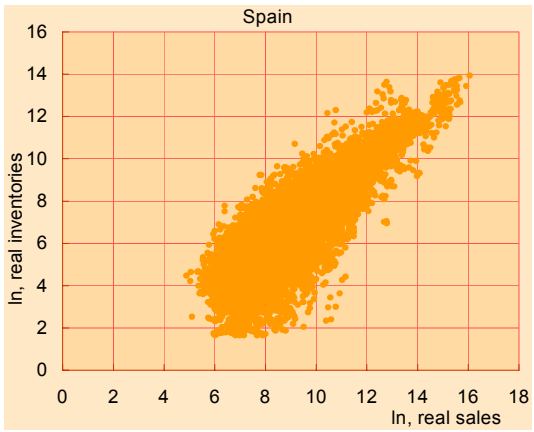
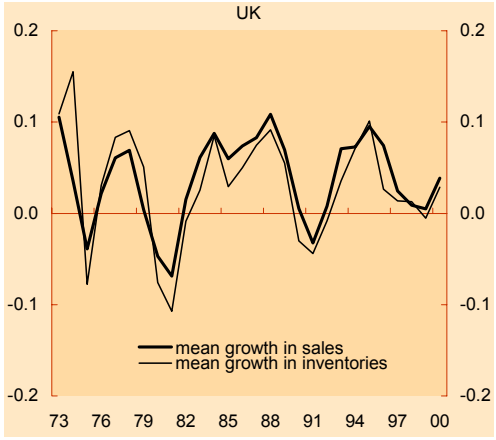


FIGURE 2

Growth in inventories and sales



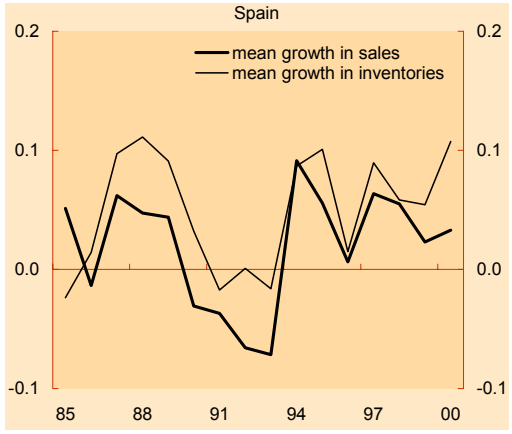


FIGURE 3

Inventory-sales ratio

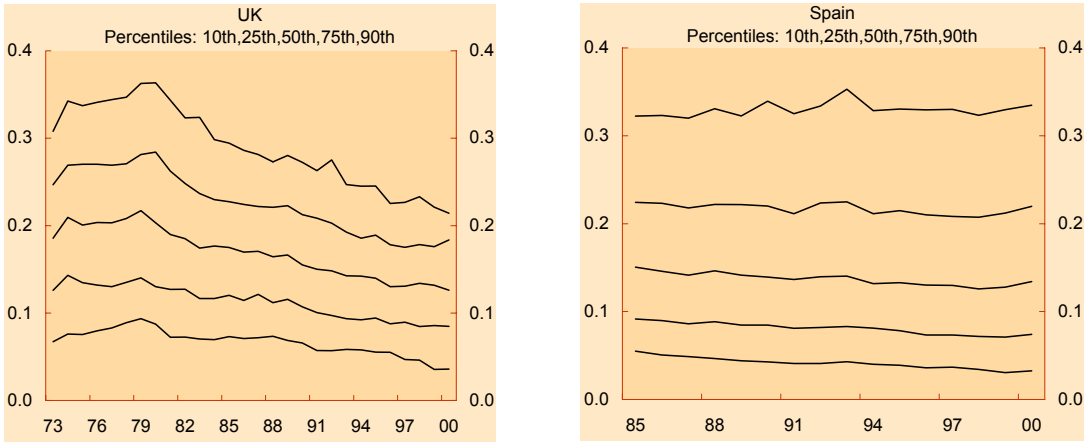


FIGURE 4

Inventory growth and liquidity

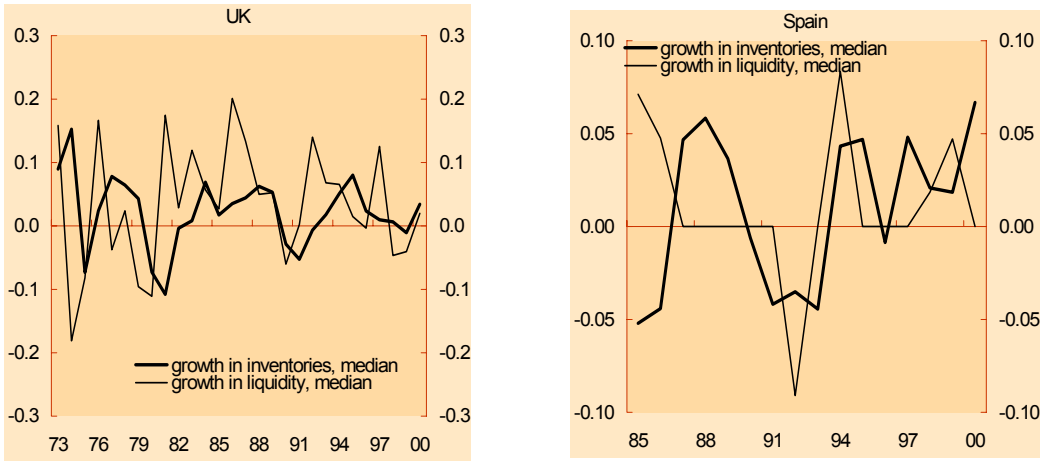
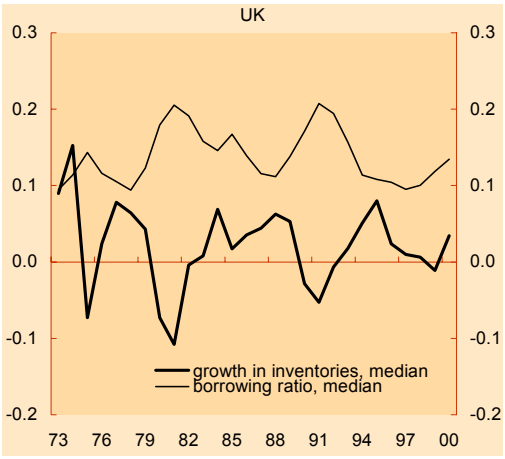
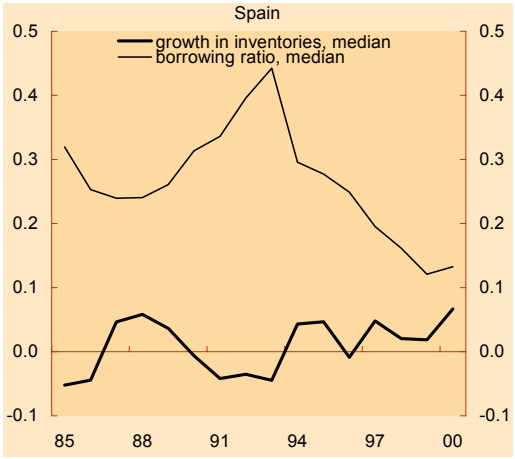


FIGURE 5

Inventory growth and borrowing ratio





Data Appendix

A. UK Firms

Table A.1 tabulates the number of time-series observations per company.

Table A.1: Panel structure (UK firms)

No of records	5	6	7	8	9	10	11	12	13	14	15	16	
Companies	74	88	73	84	73	57	39	45	31	38	32	36	
No of records	17	18	19	20	21	22	23	24	25	26	27	28	Total
Companies	23	29	19	15	13	13	22	14	23	23	36	26	926

Variable Construction

Inventories

Finished goods, raw materials and work-in-progress. It is stated net of any provisions for obsolete stocks. (Datastream Item 364). Data on finished goods alone are available for a subset of firms (Datastream Item 365). Real inventories are deflated by the GDP deflator. As noted in the text, a deflator for inventories is not available in the UK. An attempt to separately deflate inventories was made using the price index for manufacturing (ONS Code: PLLU) as discussed in the text.

Liquidity (m/K)

Liquid assets are given by cash and equivalent (Datastream Item 375) , normalised on capital stock measured at replacement cost.

Debt (B/K)

Total loan capital (DS321) plus borrowing repayable in less than 1 year (DS309) divided by replacement cost of capital stock, K (see below). Net debt $(B - m)$ subtracts cash and equivalent (DS375) from the numerator.

Capital stock (K)

Capital stock is measured on a replacement cost basis. The procedure employed uses a perpetual inventory method as has been used in a number of company accounts panel data studies. $K_{t+1} = K_{it}(1-\delta)\frac{P_t}{P_{t-1}} + I_{it}$ where δ is the rate of depreciation assumed to be 0.08 and P is the price of investment goods. I is investment. For the company's first observation, the replacement cost is assumed equal to the historic cost total of net fixed assets (DS339), adjusted for inflation.

Investment (I)

Owing to changes in company accounts definitions in 1991, a different method for calculation is used pre- and post-1991. Up to 1991, investment is calculated as Total new fixed assets (DS435) less sales of fixed assets (DS423). From 1991, this is calculated as total payments for fixed assets of the parent (DS1026) plus those of any subsidiaries (DS429).

Cash flow (CF)

Profit after tax and preference dividends (DS182) plus depreciation of fixed assets (DS136).

Borrowing ratio (br)

Interest payments (DS153) divided by cash flow. Where companies have a negative value for the denominator their borrowing ratio is set equal to 1.

Real Sales (S)

Total company sales (DS104), deflated by the GDP deflator.

B. Spanish Firms

Table A.2 tabulates the number of time-series observations per company.

Table A.2: Panel structure (Spanish firms)

No of records	5	6	7	8	9	10	11	12	13	14	15	16	Total
Companies	744	591	419	345	276	219	221	221	211	209	141	308	3,905

Inventories

Total inventories deflated by the GDP deflator.

Liquidity (m/K)

Liquid assets are given by cash and equivalent, normalised on capital stock.

Debt (B/K)

Total outstanding debt divided by capital stock, K (see below). Net debt ($B - m$) subtracts cash and equivalent from the numerator.

Capital stock (K)

This is given by the sum of fixed assets at replacement cost (calculated by the Central de Balances (CBA) of the Bank of Spain) and working capital less provisions.

Cash flow (CF)

Post-tax profit plus depreciation of fixed assets.

Borrowing ratio (br)

Interest payments divided by cash flow. Where companies have a negative value for the denominator their borrowing ratio is set equal to 1.

Real Sales (S)

Total company sales, deflated by the GDP deflator.

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