Preliminary

Family firms and investments

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1. Introduction[1]

A vast literature studies the behavior and performance of (mainly listed) family firms, trying to assess whether they are better or worse performers of other firms, under a number of respects. Even if not entirely conclusive, these contributions show that family firms might be more profitable/have higher market valuation, but only under certain conditions (typically when they are managed by the founder).

Here we concentrate on one aspect that has been in some cases taken for granted but only recently directly analyzed and which might shed some understanding on the dynamics of family firms behavior, i.e. whether their investments are more or less reactive to uncertainty. Family firms might be in general more risk averse than other firms since typically a higher share of the owner's wealth is invested in its firm; hence their investments might be more sensitive to uncertainty.

The question is particularly relevant in Italy, a country which has experienced a limited growth over the last 10 years, both as compared to the past and to international competitors. One of the hypotheses that have been advanced is that the concentrated control structure prevailing in Italy has limited the necessary control transfers and the investments needed for the restructuring of some sectors and companies. The extremely common family ownership structure might be one reason of this behavior; it might be also the source of an inadequate investment behavior and performance.

Hence we believe our contribution is twofold. On the one hand we investigate whether it might be that a better or worse performance of family firms is due to their "dynamic" behavior in response to different uncertainty environment; on the other we draw some light on the unsatisfactory performance of Italian firms starting from the second half of the 1990s. If family

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firms are more risk averse and hence more reactive to uncertainty, this might explain their insufficient reaction with respect to restructuring needs in a changing environment.

2. Family firms in the literature

2.1 Theories on family firms

In the literature (see e.g., Bertrand and Schoar, 2006, for a survey) family firms are alternatively considered an "efficient device", which allows to obtain a superior performance, or are as "culturally determined" objects, whose values may induce certain behavior of the founder (or heirs) implying to forego financial returns in order to maximize her overall utility.

According to the first set of theories, family firms may have a longer term horizon, entailing less short termism and myopia and maximizing longer term results. They might also ensure better incentives and stricter (and less costly) monitoring on management. Secondly, family ties might be a substitute for well working formal institutions: the controlling family might not be willing to release control if private benefits are high and possibly difficult to appropriate when dispersing ownership. Finally, within the family the transmission of knowledge might be easier; this might be true especially in sectors of activity closer to artisan-like production and less in fields where an external education is more relevant (or where technological innovation matters).

On the other hand, family firms might emerge due to "cultural values", not necessarily associated to efficiency. These might induce an "excessive" desire to keep control within the family, with a long term commitment to the survival of the company. As a large share of the owner's wealth might be invested in the firm she might be characterized by a high risk aversion, inducing her to avoid decisions that might affect the firm's survival or the stability of control.

Furthermore, if the founder is mainly interested in keeping the company within the family, this might induce her to select her successor among (the rather small set of) her heirs rather than on the market, with negative effects on efficiency (Panunzi and Shleifer, 2003).

2.2 Empirical evidence on performance of family firms

The first issue in the empirical literature is the definition of family firm: Miller et al. (2007) show how many different definitions have been used in the literature, ranging from "organizations controlled and usually managed by multiple family members, often from multiple generations" to "founding family or founding individual". In most cases the analyses are referred to listed companies.

Even if comparisons are based on varying definitions, there is convergence on the fact that family firms appear extremely common in most countries[2]: in Europe, Barontini and Caprio (2006) find that 53% of their sample of listed companies (which excludes UK) is controlled by a family, with Finland and the Netherlands having the lowest percentages (less than 35%) and Italy and Belgium the highest. But also in the US they are relevant (Anderson and Reeb, 2003).

Results on family firms performance are not homogenous. Claessens et al. (2002) for Southeast Asian countries, Morck et al. (2000) for Canada, Cronqvist and Wilsson (2003) for Sweden find that family firms perform worse. Bertrand and Schoar (2006) show that the strength of family ties (as measured in the World Values Survey) is associated with a larger fraction of total market value controlled by families, but also with lower levels of per capita GDP, fewer publicly traded firms and a smaller average size of firms. Family firms also seem to be associated with weaker managerial practices (Bloom and Van Reenen, 2006 and Bandiera et al., 2008, for the Italian case).

On the other hand, Khanna and Palepu (2000) for India, Sraer and Thesmar (2007) for France and Barontini and Caprio (2006) for continental Europe find a better performance for family firms. In particular, Barontini and Caprio show that (listed) family firms tend to use more than other firms control-enhancing mechanisms, but controlling for their adoption (which is found to be wealth reducing) shows that family firms outperform the others.

A number of (more recent) analyses have concentrated on a specific period in the life of family firms, i.e. the transfer of ownership to heirs. In general, the evidence converges in finding that a better performance of family firms is associated to the founder, whereas heirs' controlled firms typically show a worse performance.

More related to our analysis, Cucculelli (2007) examines the responsiveness of company sales to changes in market demand for different ownership structures in European firms (approximately 8.000 firms over the period 1995-2004). He finds that family firms – even if they outperform other types of owners in terms of profitability measures - show a lower than average growth rate of sale and that their sensitivity to industry shocks is lower than other types of firms. He concludes that family firms are less able to seize market opportunities than firms with industrial and financial company ownership. Finally, Barba Navaretti et al. (2008) show that Italian family firms export less than others and, according to the authors, this might be associated to their higher risk aversion.

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2 See e. g., Bertrand and Schoar (2006), Barontini and Caprio (2006).

3. Empirical strategy

Building on Guiso and Parigi (1999) and on Bontempi et al. (2007) we want to analyze whether family firms' investment behaviour is more sensitive to uncertainty than non family firms.

As typically the entrepreneur has a large share of its wealth invested in the family firm, we expect that her risk aversion is higher than in cases of dispersed ownership or other control structures.

Our analysis is complementary to that of Michelacci and Schivardi (2008), which shows that a higher number of family firms in an economy is associated to a worse reaction to idiosyncratic risk and somehow to that of Barba Navaretti et al (2008) where family firms are shown to export less (because they are supposedly more risk averse).

3.1 The datasets used

Our dataset is constructed from three main sources: the Survey on Investment in Manufacturing (SIM), the Company Accounts Data Service (CADS), and the breakdown by sector of the National Account data (NA). The main source is SIM, annually conducted by the Bank of Italy on a sample of Italian manufacturing firms. By considering the whole sample of firms in the period 1996-2007, the total number of observations is 32925 (company-year cases), of which 26040 belong to the manufacturing sector. However, the questionnaire for firms with less than 50 employees does not include the section on uncertainty so we are forced to ignore these firms and the non-response cases, ending with a sample of 12130 observations of manufacturing firms.

The SIM database is very rich and contains many pieces of original information that cannot be found in other sources. This is the case of investment plans, expected demand and the range between its minimum and maximum growth rate expected one year ahead (henceforth, the min-max range); questions about liquidity constraints, etc. (regarding the SIM database, see Banca d'Italia, 2008).

To compute a proxy for uncertainty we use the min-max range of the expected growth rate of demand. Let ${}_t g_{it+1}$ be the growth rate of the i^{th} company's demand at constant prices for $t+1$ as perceived in t and SAL_{it} the value at current prices of the i^{th} company's sales in t; both variables can be found in the SIM. The expected one-year-ahead level of sales at constant prices is ${}_tY_{it+1} = \left(1+{}_tg_{it+1}\right)\, Y_{it}$, where $Y_{it} = \dfrac{SAL_{it}}{PY_{it}}$ and PY_{it} is the individual sales' deflator, both from SIM.[3]

If we define the uncertainty about the future demand growth rate, $u\left({}_t g_{it+1}\right)$, as the min-max range

[3] Individual sales' deflators are obtained by applying the SIM growth rate for year t to the previous year NA deflator level of the sector to which the firm belongs. We use NA sector deflator levels when SIM growth rates are not available.

of the expected growth rate at constant prices reported by the SIM respondents[4], we may define uncertainty according to $u\left({}_{t}Y_{it+1}\right)=u\left({}_{t}g_{it+1}\right)Y_{it}=\left({}_{t}g_{it+1}^{max}-{}_{t}g_{it+1}^{min}\right)Y_{it}$, which may be seen as a simplification of the one proposed by Guiso and Parigi (1999).[5]

The SIM database is far from being complete for the aims of the present study as it does not contain some relevant variables, such as the capital stock and the cash flow; however, these pieces of information can be found in the CADS database. After merging the two datasets, the total number of available observations for the empirical analysis drops to 12002. Notwithstanding the loss of observations, the final sample appears to be a fairly satisfactory representation of the composition of Italian manufacturing firms by size, manufacturing sector and geographical location (see Table A1.1 in Appendix A1).

In the SIM a specific question has been asked in 2006 and 2007 requesting the firm to identify itself as a "family" or "non family" firm, the first being a firm that is directly or indirectly controlled by an individual or a group of individuals linked by family relationships. We believe this is a better definition than most of those in the literature, which rely on proxies based on the characteristics of the direct owners of the company. Starting from the 2006-2007 dataset it was possible to classify previous years companies thanks to a further information collected in 2007, i.e. whether the firm did not change control since its foundation and in case it did, whether before the change it was a family or non family firm. We complemented this information with that on direct ownership, since it might matter for our analysis whether the family firm belongs to a group structure (hence its direct owner is not an individual but another company), which might imply a reduced risk aversion. We also use other information on the control structure of the firms, relating to the presence of shareholders' agreements or by-laws clauses stabilizing control; to the concentration of ownership; to the stability of control.

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[4] In the survey on 2005 the min max range was substituted for a more complex question on the firms' whole probability distribution of the expected growth rate of demand, as in the survey on 1993 used by Guiso and Parigi (1999). In order to obtain a time series for the whole period 1996-2007, we have computed a min-max version for 2005 by assuming that it corresponds by firm, to the amplitude of a 90% normal confidence interval around the average expected growth of future demand. Both mean and standard deviation are obtained from the subjective probability distribution by respondent firm. This hypothesis has been validated by regressing (without intercept) the available min-max ranges of 2004 and 2006 against the 2005 standard deviation. The estimates - 3.12 and 3.37 respectively - corroborate the amplitude of a 90% interval centered around the mean which, for a normal distribution, would be equal to $2\times1.65=3.3$; R^2 coefficients are both larger than 40%, suggesting the good explanatory ability of the assumption.

[5] Since not all firms with more than 49 employees report the min-max range, we run a probit regression of non-response probability against time dummies and a set of observable characteristics, such as industry, location, type of ownership, size, and share of exported production. The only significant effect concerns public and large firms, which are less likely to report the min-max range, hopefully because the respondents are not close enough to the top management to provide a suitable answer. Therefore, the loss of information due to non-responses should prevent large measurement errors for the min-max range.

3.2 Descriptive evidence: family firms in Italy

In the 2006 sample over 70 per cent of Italian firms (with more than 50 employees) are family firms (see Table 1). Obviously, they are more common among smaller firms (only 30 per cent of those with more than 1000 employees define themselves as family controlled) and slightly less spread in the Centre-North. As expected they are especially strong in more traditional sectors (textile-clothing comes first) and least common in the energy and chemical sectors.

The governance structure of family and non family firms differs. Ownership concentration is lower among family firms: the largest shareholder has a lower share, with a second and third (typically components of the family) having relatively large shares. Possibly because of this, control stabilizing mechanisms – such as shareholders' agreements and bylaws restricting share transfers - are more frequent.

Finally, also the characteristics of the head of the company differ. In family firms they are in fewer cases foreign or female and, whereas the average age does not differ, the level of education does: among family firms it is less frequent that the head of the company has a degree or has attended specialization courses.

3.3. The econometric analysis

In this Section we present our empirical strategy to shed some light on the link between firms' corporate structure and investment. The starting point is the assumption that the specific ownership of a firm may affect its investment decision through the different reactions to the uncertainty of its product demand.

A vast empirical literature has been devoted the analysis of the investment-uncertainty relationship with the general result that it is negative and significant. The intensity of the link is however dependent from the interplay of different assumptions about the degree of competition on the product market, as well as the technological characteristics of the production function (constant versus non-constant returns to scale) and of its inputs (essentially labour and capital). More specifically, in highly competitive markets and/or with perfectly flexible inputs firms are supposed to be less sensitive to uncertainty; actually, in perfectly competitive markets the sign of the investment-uncertainty relationship may even become positive (the so called Hartman-Abel effect). The opposite applies for firms with some degree of market power and/or more irreversible or less flexible inputs.

Following Guiso and Parigi (1996, 1999) and more recently Bontempi et al. (2007) we specify an empirical model based on the idea that investment decision is irreversible and that the demand threshold triggering investment rises with uncertainty. Abel and Eberly (1994, 1996, and

1997) show that the optimal trigger point is equal to the user cost of capital adjusted to account for irreversibility and uncertainty. In particular, uncertainty raises the value of the user cost and so reduces the responsiveness to demand of both the decision to invest and the amount of the investment. This set up appears to be particularly suitable for the analysis of the effects of corporate structure. Under the assumption that the control structure is directly related to risk aversion, the trigger point should be higher for family firms, especially when the firms are directly controlled by an individual (i.e. not through other companies).

Let $mvp = a(K/y)^{-1/\gamma}$ be the marginal value product of capital evaluated at the current level of the stock of capital, K, and of demand *y*; *a* is a constant and $0 < \gamma < 1$ a parameter. Let $c(u)$ be the user cost of capital which, under irreversibility, is positively influenced by uncertainty about future demand, *u*.

With no adjustment costs and ignoring depreciation, the firm's optimal capital stock is $K^* = y(c(u)/a)^{-\gamma}$ and the corresponding investment policy is: $I = K^* - K > 0$ if $mvp > c(u)$ or $K < y(c(u)/a)^{-\gamma}$. When $mvp \le c(u)$, or $K \ge y(c(u)/a)^{-\gamma}$, investment should be zero. This case is a natural test of the irreversibility theory but it is very difficult to implement because of the extreme rarity of observations with zero investment (lower than 3 per cent of the total number of our observations). This occurs especially when using data on total investment, which is an aggregate of different types of capital goods, such as structures, equipment and so on: firms may plan zero investment in structures as well as positive investment in other categories.[6] However, the virtual absence of zero-investment observations should not alter the relationship between uncertainty and the user cost of capital that is at the root of our analysis of investment decisions.

We therefore concentrate on the case $mvp > c(u)$, so that $K^* = y(c(u)/a)^{-\gamma}$. In this context and with panel data, the investment rate can be shown to be a function of demand, uncertainty and the inherited capital stock according to the following empirical equation:

$$(1) \qquad \frac{{}_tI_{it+1}}{K_{it}} = \mu_i + \tau_t + \alpha_1 \frac{{}_tY_{it+1}}{K_{it}}\left[1 + \alpha_2 \frac{u\left({}_tY_{it+1}\right)}{K_{it}}\right] + \alpha_3 \frac{I_{it}}{K_{it-1}} + \xi' Z_{it} + \varepsilon_{it+1}$$

where subscripts *i* and *t* respectively indicate the i^{th} company (*i* = 1, 2, …, N) and the year *t* (*t* = 1, 2, …, T). K_{it} is the stock of capital measured at the end of *t*; ${}_tI_{it+1}$ and I_{it} respectively represent the investment planned at year *t* for the following year and the realised investment in *t*; ${}_tY_{it+1}$ is the level

[6] Bloom et al. (2003, 2007) studies the irreversibility theory with aggregation effects. Guiso and Parigi (1999) present some estimates for three different types of capital goods, equipment, structures and vehicles, confirming the results obtained for the total aggregate; more recently, Bontempi *et al.* (2004) extend the fundamental *q* approach to the case of two capital inputs: equipment and structures.

of demand expected at the end of year t for the following year; $u\left({}_tY_{it+1}\right)$ represents the firm's uncertainty about demand in $t+1$ as perceived in t. All previous variables are measured at constant prices. Z_{it} is a vector of additional controls to account for exceptional events, such as extraordinary operations, and ε_{it+1} is the stochastic error term measuring shocks to investment plans in $t+1$. Detailed definitions and data sources are in Appendix A1.

Fixed effects μ_i and τ_t refer to firms and time; they account for individual unobservable characteristics influencing the investment-uncertainty relationship and for a degree of dependency over time across companies due to collectively significant effects. For this, they limit the biases due to the omission of unobservable time-invariant individual effects and of collectively significant macroeconomic effects (hence almost invariant for all companies), such as industry-wide shocks, macroeconomic cyclical effects and widespread optimism-pessimism.

Parameters α_1, α_2 and α_3 are scalars, ξ is a vector. While α_1 is always expected to be positive, according to the irreversibility literature the *a priori* sign of α_2 should be negative and significant; however, if the Hartman-Abel set-up applies, α_2 should be positive or not significantly different from zero.

In model (1) the dynamic nature of the investment decision is represented by a positive α_3 parameter measuring the effect of the lagged realized investment (i.e. the actual implementation of the plans in $t-1$ for year t, which is not the lagged dependent variable) to approximate the effects of the adjustment costs, delivery lags, and so on. However, since the available time span of twelve years (from 1996 to 2007) enables assessing for the existence of more complex dynamic adjustments, we included in the model also the proper lagged dependent variable, exploiting the information about the investment plans made in $t-1$ for t). In this way, equation (1) becomes:

$$(2) \qquad \frac{{}_tI_{it+1}}{K_{it}} = \mu_i + \tau_t + \alpha_1 \frac{{}_tY_{it+1}}{K_{it}}\left[1+\alpha_2 \frac{u\left({}_tY_{it+1}\right)}{K_{it}}\right] + \alpha_3 \frac{I_{it}}{K_{it-1}} + \beta_1 \frac{{}_{t-1}I_{it}}{K_{it-1}} + \xi' Z_{it} + \varepsilon_{it+1}$$

If in equation (2) the restriction $\alpha_3 + \beta_1 = 0$ is valid, firm investment plans for $t+1$ are supposed to be not only a function of future demand but also of the gap between past plans and realizations: $\frac{{}_{t-1}I_{it}}{K_{it-1}} - \frac{I_{it}}{K_{it-1}}$. In other terms, firms are assumed to devise plans so as to include a share β_1 of the unrealized plans in the previous period, see Eisner (1978). In the context of rational investment plans, tested in Guiso and Parigi (1999), the gap is driven only by news which here we assume to feed back to future plans.[7] As such, the exclusion of this term from the planned investment relationship in equation (1) should not affect the α_1, and α_2 parameter estimates.

4. Main estimation results

Before estimation, the model in (2) can be further generalised by taking into account medium and long run effects of uncertainty (see Eberly and van Mieghem, 1997, and Bloom et al., 2007), alternative functional forms and other investment determinants.

Since the interaction between uncertainty and expected demand actually might actually capture second-order term in the Taylor approximation of a non-linear relationship between investment plans and expected demand, the inclusion of the squared expected demand (scaled by capital stock) tests for evidence of non-linearity - through the β_2 parameter in equation (3) - in the relationship between investment plans and expected demand.

Furthermore, it could be that uncertainty on one-year-ahead demand growth has an additional direct (*i.e.* not passing through demand) effect on investments. To account for this, we also included in our specification alternative measures of uncertainty (such as the min-max range of demand growth), summarised with the u_{it} term in equation (3) below, to check for the net impact effect on planned investments of various levels of uncertainty. A priori, the sign of β_3 parameter is uncertain, while the α_2 parameter captures the cautionary effects of uncertainty.

Another possible objection to the specification of equation (2) is that the negative effect of uncertainty on investment arises because it actually proxies for credit constraints: if credit constraints are due to the company's inherent riskiness, riskier firms may be more liquidity-constrained and so plan less investment. This interpretation is assessed by adding a measure of the firm's cash flow net of dividend paid, CF_{it}, to proxy for liquidity constraints.

After these extensions, equation (2) becomes:

$$\frac{{}_tI_{it+1}}{K_{it}} = \alpha_i + \tau_t + \alpha_1 \frac{{}_tY_{it+1}}{K_{it}}\left[1 + \alpha_2 \frac{u\left({}_tY_{it+1}\right)}{K_{it}}\right] + \alpha_3 \frac{I_{it}}{K_{it-1}} + \beta_1 \frac{{}_{t-1}I_{it}}{K_{it-1}} + \beta_2 \frac{{}_tY^2_{it+1}}{K_{it}} + \beta_3 u_{it} + \beta_4 \frac{CF_{it-1}}{K_{it-1}} + \xi' Z_{it} + \varepsilon_{it+1} \tag{3}$$

We label equation (3) as the general model, and report its estimation results in the first three columns of Table 3, respectively for the family (F) and the non-family (NF) sample, and for the union of the two subsets (F&NF).[8]

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[7] In a more extended framework, equation (2) can be interpreted as the planned investments relationship of a (two-equations) vector equilibrium correction model explaining both sides of the adjustment process between plans and actual investments; as far as the adjustment model for actual investment is concerned, see, Bloom et al. (2003, 2007).

Being a dynamic panel model, we apply the GMM estimators proposed by Arellano and Bond (1991) by instrumenting not only the lagged dependent variable but all other determinants as well; a detailed comparison of alternative estimators is in the Appendix A.2.

Moving from the general model estimates in columns (1)-(3) to an intermediate step where only model (2) parameters are estimated, it is evident that all the extensions listed above, squared demand effects, uncertainty levels, and credit constraints, are not significant for both the F and the NF subsamples (and their union), as documented by p-values of the null hypothesis that $\beta_2 = \beta_3 = \beta_4 = 0$ well above 0.05 (see the last row of Table 3). It is worth noting that all the diagnostic test in Table 3 suggest the congruence of our model with data.

At the intermediate level, columns (4)-(5), there appear to be remarkable differences among the estimates of the core parameters in equation (2) according to the family and non-family samples. This is particularly true for the uncertainty effect estimate (α_2), which is higher in absolute terms and significant in the F subsample, while it is not in the NF one.

Our results show that uncertainty on future demand has a strong negative effect on the investment plans made by family firms, as predicted by investment models based on irreversibility, but not on those made by non-family firms.[9] Quantitatively, a decrease of uncertainty from the third to the first quartile of its subsample distribution induces an increase of planned investments by about 2% of the median family firm, while the investment plans of non-families do not react to such uncertainty change. In the union (F&NF) sample, the low α_2 estimates - though statistically significant - lead to a mere 0.25% increase in investment plans due to the same uncertainty decrease.

As far as dynamic effects are concerned, we see from column (7) that family firms seem to adjust their investment plans on the basis of the gap between planned and realized investments in the previous year: in addition to the direct effect of the expected demand interacted with uncertainty, family firms investment plans embody about 40% of the last-year gap. On the other

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[8] Additional sensitivity analyses were conducted by including in model (3) the uncertainty measure in differences, further lags of the cash flow variable and alternative credit rationing indicators as suggested by Guiso and Parigi (1999). Since parameter estimates of these variables are largely not significant while the other model's estimates do not depart from the baseline results in Table 3, they are not reported but available upon request.

[9] It could be argued that the strong reactivity of family firms plans to uncertainty could be due either to a large share of irreversible investments or to high market power. In order to assess the effect of the inclusion of irreversibility and market power on our model estimates in column (4) of Table 3 we split the F sample in subsamples of family firms above/below the average price-cost margins (PCM) and of family firms with reversible/irreversible capital. The estimation results of our model (2) in the four runs are substantially in line with the estimates reported in Table 3 for F sample, suggesting that the strong reactivity of family firms investment plans to uncertainty is not merely due to the omission of other relevant determinants, such as market power and degree of reversibility of capital. Finally, also the estimates of model (2) in which we interacted uncertainty and PCM variables deliver not significant estimates for the PCM parameter. Similar results are also obtained for the NF and F&NF cases. Detailed outputs are available upon request.

hand, non-family firms, column (8), follow a sort of autoregressive behavior: more than 10% of their future plans is explained by the level of their past plans. This might be taken as a sign that family firms have a longer horizon perspective to which they tend to adhere.

Previous results about family firms behavior may be further qualified by investigating the determinants of investment plans in subsamples of family firms where the largest shareholder is an individual with different degrees of ownership concentration (measured on the basis of the share of the largest owner). Focusing the analysis specifically on family firms where the largest direct shareholder is an individual (about 58% of all the 620 family firms in our sample) allows to take into account those cases where it is more likely that the owner has invested a large share of her wealth in the firm she manages (whereas for a family firm which is controlled through other companies – e.g. a pyramid - it might be more likely that each single owner has managed to diversify her investments).

As before, we follow a general-to-specific modeling approach, starting from the general equation (3) estimated in the first four columns of Table 4, to the specific models in the last four. In each of the two blocks, we estimated parameters using *(a)* all the data for family-firms directly controlled by an individual (in columns 1 and 5); *(b)* only the data for family-firms directly controlled by an individual and with the first owner share below 60% (columns 2 and 6); *(c)* only the data for family-firms directly controlled by an individual and with the first owner share above 60% (columns 3 and 7).

Though 60% is the average share of the largest owner in our sample, the choice of such value might be arbitrary. For this reason, in columns (4) and (8) we investigated an alternative way in which this variable could interact with uncertainty in affecting investment plans. In analogy with Domowitz et al. (1986), we address the influence of "changes" in ownership concentration by adding an interaction between uncertainty and variations in ownership concentration, X_{it}:

$$(4) \quad \frac{{}_tI_{it+1}}{K_{it}} = \mu_i + \tau_t + \alpha_1 \frac{{}_tY_{it+1}}{K_{it}}\left[1 + \left(\alpha_2 + \omega\, X_{it}\right)\frac{u\left({}_tY_{it+1}\right)}{K_{it}}\right] + \alpha_3 \frac{I_{it}}{K_{it-1}} + \beta_1 \frac{{}_{t-1}I_{it}}{K_{it-1}} + \beta_2 \frac{{}_tY_{it+1}^2}{K_{it}} + \beta_3 u_{it} + \beta_4 \frac{CF_{it-1}}{K_{it-1}} + \xi' Z_{it} + \varepsilon_{it+1}$$

In the simplest case, column (4) for the general equation (4) and column (8) for the restricted (specific) model, we set X_{it} =share of largest shareholder, entailing the assumption of a linear relationship between the size of the (negative) uncertainty effect on plans and that share. The assumption that the uncertainty effect grows in absolute value with the share requires that $\omega < 0$.

As for the case of F *vs* NF in Table 1, all the restrictions from the general to the specific models are never rejected, and the diagnostic tests support the proposed specification. As far as the outcomes for the specific models are concerned, in column (5) we observe a stronger reactivity of investment plans to uncertainty for family firms whose largest shareholder is an individual, $\hat{\alpha}_2 = -0.0853$, than what has been found for all family firms ($\hat{\alpha}_2 = -0.0603$, see column (7) in Table 3); correspondingly the semi-elasticity of plans to uncertainty more than doubles, from 2.00 to 4.67. As expected, the likely larger financial involvement of the largest shareholder leads to a substantial increase in her reactivity to uncertainty.

From columns (6) and (7) in Table 4 it appears that also ownership concentration matters: if the largest owner share is above 60%, we obtain $\hat{\alpha}_2 = -0.1075$ and the process of adjustment of future plans to past realizations becomes not significant. Given the small sample size on which these estimates are based, it is probably more informative to analyze the results in the last column of Table 4, where the parameters of equation (4) are estimated over the larger sample as in column (5), after having imposed the usual (not rejected) zero restrictions on the general model. In this context, the effect of uncertainty on plans for family firms managed by a person is allowed to vary over time and across individuals by following the relationship: $\hat{\alpha}_{2,it} = -0.0668 - 0.0961 * \textit{largest shareholder}$, where $\hat{\omega} = -0.0961$ is significantly negative at 10%. Hence ownership concentration might be taken as a further proxy of the share of the owner's wealth invested in the company: when this increases, sensitivity to uncertainty increases.

The result is confirmed also for different specifications. Besides linear (*LIN*), we also explored alternative uncertainty/share relationships by setting the X_{it} explanatory variable equal to the inverse (*INV*) and the logarithm (*LOG*) of *v522*. The alternative patterns of the uncertainty effect on investment plans with respect to growing shares of the first owner are reported in top-down plots of Figure 1 for *(a) LIN*, *(b) INV* and *(c) LOG* relationships, together with the two α_2 estimates in the below/above 60% subsamples, see columns (6) and (7) of Table 4. Though the 5% statistically significant case is reached only for the inverse relationship reported in panel (b), results always point to a substantial increase of investment plans reactivity to uncertainty for higher shares of the first owner.[10]

Overall, our results support the hypothesis that family firms investment plans are a decreasing function of uncertainty on future demand, whereas non-family firms plans are usually not affected by uncertainty (unless the share of the first owner is greater than 96%, i.e. close to the

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[10] In not reported experiments, we accomplish the same exercises for the non-family firms (NF) subsample. The split the 556 NF in two subsamples (below/above 96%, corresponding to the third quartile of the *v522* distribution for NF) leads to a significant estimate of α_2 in the sample of firms with *v522* > 96%: $\hat{\alpha}_2 = -0.0315$; while the complementary subset of firms shows a largely not significant estimate. Despite significant, it is worth noting that this point estimate of α_2 is less than half the corresponding point estimate in the F subsample.

only-owner case). For family firms directly controlled by an individual, investment plans show a remarkably growing reactivity to uncertainty as the share of the first owner grows.

4.1 Some extensions: the "founder" effect

We also checked whether some "specificities" in ownership and control structure might have affected our results or might help to qualify them. In order to relate with the literature that a positive "founder" effect on the firms' performance, we tested whether a stable control since the foundation affects the responsiveness of family firms to uncertainty; results are in Table 5.

When the controlling agent is the founder as defined in the survey on 2002 (see column 2 in Table 5), uncertainty has a stronger effect on investment plans than that in the whole sample of family firms (in column 1, where the same results as in the first column of Table 3 are reported to ease comparisons). This might be due to a stronger desire of keeping the control of the firm that may induce a higher risk aversion. This result is interesting especially if compared with those in the literature finding that founder family firms are better performers than the others: founder family firms might be in general more profitable (due to the specific ability of the founder) but might be somehow too risk averse. When we consider cases where the controlling agent is not the founder (see column 3) the small number of available data affect the precision and accuracy of the estimates. It should be further investigated whether this result is affected by the age of the founder.

In order to check for the robustness of this finding, in column (5) we also reported the estimation results when the controlling agent of the family firms managed by an individual is the founder as defined in the survey on 2006. Again, a stronger elasticity of uncertainty to investment plans emerges with respect to that in the sample of family firms managed by an individual (in column 4, where the same results as in the first column of Table 4 is reported).

Other measures of the stability of control (such as the presence of shareholders' agreements or bylaws restricting share transfers) do not seem to affect results, implying that it is not stability per se which increases or reduces the responsiveness to uncertainty (results available upon request).

5. Conclusions

In this paper we offer some (preliminary) qualifications of the specificities of investment behavior of family firms (defined as those who are directly or indirectly controlled by an individual or a family).

a) As compared to non family firms their investment are more sensitive to uncertainty in expected demand, possibly due to their higher risk aversion.

b) This is confirmed by the stronger reactivity when control is directly exercised by an individual or a family rather than through another company (which might allow some form of diversification) and by an even stronger effect when direct ownership concentration is higher.
c) The investment behavior of family firms might be interpreted as sticking to a long term horizon, given that they embody a significant share of the previous year gap.
d) Finally a "founder controlled" family firm seems to be more reactive to uncertainty as compared to non founder family firms. This however might be due to different factors, one of which might be the age of Italian controlling agents (but currently the limited number of observations make it difficult to test the hypothesis with sufficient precision).

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Table 1

RELEVANCE OF FAMILY FIRMS IN ITALY (2006)

	% of firms
N. of firms	71.10
Employment	55.1
Revenues	39.1
Size (by employees)	
50 – 100	76.8
100 – 200	69.7
200 – 500	61.5
500 – 1000	50.4
> 1000	30.4
Area	
North – Center	70.1
South – Islands	79.7
Sectors	
Food Tobacco	77.1
Textile – clothing	80.9
Chemicals	53.5
Non met. Minerals	74.0
Mechanical	72.9
Wood, paper	73.9
Extraction, energy	31.3

Table 2

CHARACTERISTICS OF FAMILY *VS* NON FAMILY (2006)

	Family firms	Non family firms
Largest shareholder	62.6	82.5
2^{nd} largest shareholder	18.1	8.1
3^{rd} largest shareholder	8.0	2.4
Median n. of shareholders	3	2
% of shareholders' agreement	12.8	10.8
% of bylaws restricting transf. of shares	49.8	36.5
Head of firm:		
Nationality		
Italian	97.0	88.9
Eu	1.9	9.1
Rest of world	1.1	2.0
Gender		
Male	99.3	93.1
Female	0.7	6.9
Education		
Middle school	9.1	5.3
Secondary	45.5	35.1
Degree	40.9	49.8
Post degree	3.8	5.4
Specialization	0.8	4.4
Age	56.9	55.3

Table 3

FROM GENERAL-TO-SPECIFIC MODELLING APPROACH (1)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
model:		general			intermediate			Specific	
sample (2):	F	NF	F&NF	F	NF	F&NF	F	NF	F&NF
α_1	**0.0171**	**0.0090**	**0.0099**	**0.0190**	**0.0050**	**0.0073**	**0.0183**	**0.0049**	**0.0072**
	0.0051	0.0040	0.0037	0.0056	0.0020	0.0030	0.0055	0.002	0.0031
α_2	**-0.0488**	**-0.0069**	**-0.0095**	**-0.0592**	**-0.0142**	**-0.0213**	**-0.0603**	**-0.0141**	**-0.0215**
	0.0188	0.0101	0.0082	0.0172	0.0167	0.0093	0.0173	0.0166	0.0091
α_3	**-0.3046**	**-0.0138**	**-0.2396**	**-0.3589**	**0.0128**	**-0.2754**	**-0.4121**		**-0.2879**
	0.1651	0.0513	0.1793	0.1671	0.0555	0.2007	0.1225		0.0747
β_1	**0.4266**	**0.1271**	**0.2675**	**0.4494**	**0.1206**	**0.2853**	**0.4121**	**0.1259**	**0.2879**
	0.1147	0.0246	0.0910	0.1052	0.0256	0.0987	0.1225	0.0094	0.0747
β_2 (3)	**-0.0002**	**-0.0100**	**-0.0086**						
	0.0160	0.0063	0.0055						
β_3	**-0.0901**	**0.1399**	**-0.1549**						
	0.1045	0.1300	0.1068						
β_4	**0.0368**	**0.0193**	**0.0254**						
	0.0249	0.0214	0.0184						
Elasticity to:									
exp. demand				**0.80**	**0.19**	**0.30**	**0.77**	**0.18**	**0.29**
				0.23	0.07	0.12	0.23	0.07	0.12
uncertainty(4)				**2.04**	**0.10**	**0.25**	**2.00**	**0.10**	**0.25**
				0.87	0.13	0.16	0.83	0.13	0.16
N	613	554	1167	620	556	1176	620	556	1176
Tbar	3.6	3.5	3.6	3.6	3.6	3.6	3.6	3.6	3.6
N×T	2228	1952	4180	2258	1987	4245	2258	1987	4245
AC: (5)									
- 1st order	0.0022	0.0507	0.0011	0.0016	0.0480	0.0011	0.0108	0.0477	0.0016
- 2nd order	0.2732	0.7109	0.3846	0.3318	0.7437	0.4141	0.5396	0.7623	0.5335
Hansen (6)	0.6256	0.2368	0.2112	0.3414	0.2317	0.1802	0.3232	0.2412	0.1461
R^2 (7)	0.193	0.074	0.097	0.171	0.098	0.101	0.141	0.098	0.097
F-test (8)				0.4520	0.2486	0.1061	0.2681	0.2259	0.1906

(1) See equation (3). In bold, the GMM-dif estimates, see Arellano and Bond (1991); below there are the heteroschedasticity-consistent standard errors. (2) F = family firm; NF = non-family firm; F&NF = union of the two subsets. (3) Being the explanatory measured in millions, estimates must be divided by 10^6. (4) % change of planned investments due to a reduction of uncertainty - for the median firm - from the third to the first quartile of the corresponding sub-sample distribution. (5) AC = p-values of the residual autocorrelation tests, see Arellano and Bond (1991). (6) P-values of the overidentifying restriction *J*-test, see Hansen (1982). (7) Squared correlation of actual and fitted data. (8) P-value of the joint parameters restrictions to the corresponding general model in the first three columns.

Table 4

MODELLING THE BEHAVIOR OF FAMILY FIRMS MANAGED BY A PERSON THROUGH PROPERTY CONCENTRATION (1)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
model:		General				specific		
sample: (2)	FM	FMB	FMA	FMI	FM	FMB	FMA	FMI
α_1	**0.0342**	**0.0256**	**0.0954**	**0.0376**	**0.0298**	**0.0236**	**0.0802**	**0.0355**
	0.0104	0.0108	0.0300	0.0121	0.0104	0.011	0.026	0.0125
α_2	**-0.0878**	**-0.0889**	**-0.1225**	**-0.0757**	**-0.0853**	**-0.0865**	**-0.1075**	**-0.0668**
	0.0138	0.0165	0.0264	0.0106	0.0175	0.021	0.031	0.0120
ω				**-0.0750**				**-0.0961**
				0.0577				0.0553
α_3	**-0.3525**	**-0.3155**	**0.0733**	**-0.3905**	**-0.3831**	**-0.3583**		**-0.3871**
	0.1914	0.1933	0.1140	0.1889	0.1304	0.146		0.1233
β_1	**0.2974**	**0.2823**	**0.1249**	**0.3097**	**0.3831**	**0.3583**	**0.1329**	**0.3871**
	0.1102	0.1268	0.1069	0.1076	0.1304	0.146	0.0813	0.1233
β_2 (3)	**-0.0113**	**-0.0037**	**-0.3301**	**-0.0158**				
	0.0110	0.0134	0.1758	0.0110				
β_3	**-0.0107**	**0.0442**	**0.2996**	**0.0283**				
	0.1353	0.1285	0.1813	0.1454				
β_4	**0.0704**	**0.0986**	**-0.0247**	**0.0422**				
	0.0585	0.0737	0.0537	0.0469				
Elasticity to:								
exp. demand					**1.34**	**1.05**	**3.89**	**1.61**
					0.47	0.49	1.25	0.56
uncertainty(4)					**4.67**	**3.69**	**17.70**	**7.44**
					1.69	1.65	8.90	2.35
N	359	252	107	352	387	279	108	385
Tbar	3.25	3.35	3.03	3.21	3.24	3.32	3.05	3.24
N×T	1167	843	324	1130	1254	925	329	1249
AC: (5)								
- 1st order	0.0329	0.0640	0.0135	0.0270	0.0526	0.0892	0.0170	0.0435
- 2nd order	0.2290	0.2140	0.6072	0.2081	0.3095	0.2851	0.5649	0.2984
Hansen (6)	0.552	0.777	0.974	0.632	0.849	0.795	0.621	0.729
R^2 (7)	0.119	0.129	0.216	0.122	0.153	0.155	0.221	0.149
F-test (8)					0.1848	0.2296	0.2231	0.2752

(1) See equation (3), unless otherwise indicated. In bold the GMM-dif estimates, see Arellano and Bond (1991); below there are the heteroschedasticity-consistent standard errors. (2) FM = family with a managing person; FMB = FM with the share of the first owner below 60%; FMA = FM with the share of the first owner above 60%; FMI = model in which the share of the first owner interacts with the uncertainty effect, equation (4). (3) Being the explanatory measured in millions, estimates must be divided by 10^6. (4) % change of planned investments due to a reduction of uncertainty - for the median firm - from the third to the first quartile of the corresponding sub-sample distribution. (5) AC = p-values of the residual autocorrelation tests, see Arellano and Bond (1991). (6) P-values of the overidentifying restriction *J*-test, see Hansen (1982). (7) Squared correlation of actual and fitted data. (8) P-value of the joint parameters restrictions to the corresponding general model in the first four columns.

Table 5

FAMILY FIRMS AND CONTROL SINCE FOUNDATION [1]

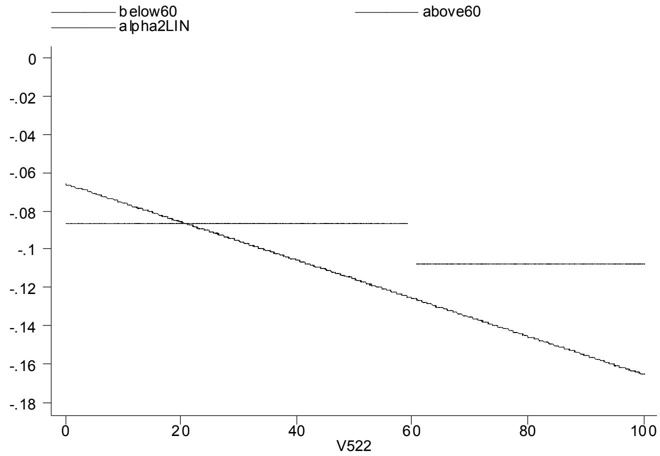
	(1)	(2)	(3)	(4)	(5)
sample: [(2)]	F	FF	FNF	FM	FMF
α_1	**0.0183**	**0.0243**	**0.0058**	**0.0298**	**0.0491**
	0.0055	0.0090	0.0086	0.0104	0.0166
α_2	**-0.0603**	**-0.0714**	**-0.2676**	**-0.0853**	**-0.0761**
	0.0173	0.0206	0.3020	0.0175	0.0104
α_3	**-0.4121**	**-0.4523**	**-0.2508**	**-0.3831**	**-0.3642**
	0.1225	0.1053	0.0865	0.1304	0.1464
β_1	**0.4121**	**0.4523**	**0.2508**	**0.3831**	**0.3642**
	0.1225	0.1053	0.0865	0.1304	0.1464
Elasticity to:					
exp. demand	**0.77**	**1.14**	**0.24**	**1.34**	**2.30**
	0.23	0.42	0.37	0.47	0.78
uncertainty[(3)]	**2.00**	**4.22**	**2.76**	**4.67**	**7.74**
	0.83	2.02	1.59	1.69	3.01
N	620	112	81	404	233
Tbar	3.6	4.1	4.3	3.2	3.2
N×T	2258	463	345	1294	746

([1]) In bold the GMM-dif estimates of equation (3), see Arellano and Bond (1991); below there are the heteroschedasticity-consistent standard errors. ([2]) F = family firms (as in column 1 of Table 3); FF = family firms controlled by the founder (from the survey on 2002); FNF = family firms controlled by following generations of the founder (from the survey on 2002); FM = family with a managing person; FMF = FM controlled since foundation ([3]) % change of planned investments due to a reduction of uncertainty - for the median firm - from the third to the first quartile of the corresponding sub-sample distribution.

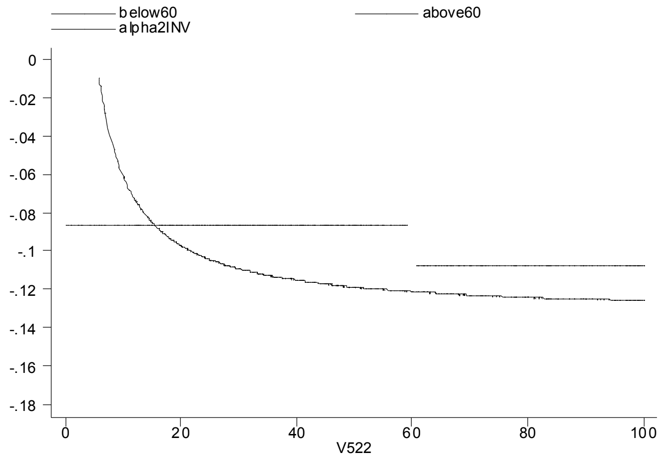
Figure 1

THE RELATIONSHIP BETWEEN UNCERTAINTY EFFECT ON PLANS AND THE % SHARE OF THE FIRST OWNER (*v522*)

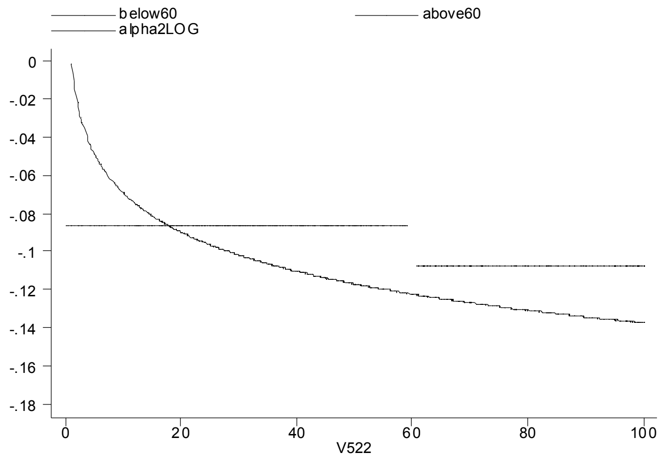
(a) linear relationship: $\hat{\alpha}_{2,it} = -0.0668 - 0.0961 \times v522_{it}$



(b) inverse relationship: $\hat{\alpha}_{2,it} = -0.1332 + 0.0072 / v522_{it}$



(c) logarithmic relationship: $\hat{\alpha}_{2,it} = -0.1374 - 0.0295 \times log\, v522_{it}$



Note. $\hat{\alpha}_{2,it}$ is reported along the vertical axes, *v522* along the horizontal ones. The lines are traced on the basis of $\hat{\alpha}_2$ estimates in columns (6) and (7) of Figure 4.

Appendix A1: Data sources and definitions

A1.1 – Effective and planned investments

From the SIM source, both effective and planned investments at current prices are available, disaggregated in three types of goods: structures, machinery and equipment; vehicles; non-residential buildings. For the i^{th} company (i = 1, 2, …, N, N = 4860) at year t (t = 1, 2, ..., T, T = 9, from 1996 to 2007), we indicate with INV_{it}^{j} and ${}_{t}INV_{it+1}^{j}$ the level of effective investment realised in t, and of the investment planned in t for $t+1$, respectively; the superscript j (= m or f) indicates the type of good. In this paper we choose to analyse the behaviour of investment in structures, machinery, equipment and vehicles ($j = m$), compared with that of buildings ($j = f$).[11]

The corresponding data at constant (1995) prices are obtained in the following way.

INV_{it}^{j} are deflated using the corresponding NA sectoral investment prices PI_{st}^{j} for all the companies belonging to s^{th} industry: $I_{it}^{j} = \frac{INV_{it}^{j}}{PI_{st}^{j}}$.[12]

The investment price for $t+1$ as perceived in t and used to deflate ${}_{t}INV_{it+1}^{j}$ is defined as: ${}_{t}PI_{it+1}^{j} = (1+{}_{t}\pi_{it+1}^{j})PI_{st}^{j}$, where ${}_{t}\pi_{it+1}^{j}$ is the expected inflation of the j-type investment price (estimated from the SIM source)[13], and PI_{st}^{j} are the sectoral NA data defined above. Therefore, we obtain constant-prices planned investment as ${}_{t}I_{it+1}^{j} = \frac{{}_{t}INV_{it+1}^{j}}{{}_{t}PI_{it+1}^{j}}$.

A1.2 – Stock of capital

The data on capital stocks, at constant prices, are constructed as described in Bontempi et al. (2007)

A1.3 – Dummy and other control variables

Time. Time dummies classify observations along time: $\tau_t = 1$ if the observation refers to time t, zero otherwise. Therefore, τ_t dummies can be estimated in panel models but not in cross-sections, and their presence allows for a degree of dependency across companies in the panel due to collectively significant effects.

Extraordinary operations. Three dummy variables equal to 1 if the company has been subject in t to: de-merger, business combination, and merger.

Zeros in the model's explanatory variables. Two dummy variables, equal to 1 when expected demand and effective lagged investment are respectively zero. Note that zeros in the

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[11] SIM database reports, for each year in the sample, both preliminary and final investment figures. Given that the paper focuses on the explanation of planned investments for $t+1$, we prefer to use preliminary data because they are the only investment figures available in t, i.e. at the time new investments are planned. From statistical analyses, it turns out that preliminary and final data coincide for the large majority of cases (85 per cent for m goods and 91for f goods).

[12] Manufacturing activity is disaggregated into 13 sectors.

[13] From SIM, only the total-investment expected inflation, ${}_{t}\pi_{it+1}$, is available. Data for ${}_{t}\pi_{it+1}^{j}$ are estimated by exploiting the sectoral NA inflation differential of j-type investment with respect to the total $m+f$, i.e.: ${}_{t}\pi_{it+1}^{j} = {}_{t}\pi_{it+1} + (\pi_{st+1}^{j} - \pi_{st+1})$, where $\pi_{st+1}^{j} = \frac{PI_{st+1}^{j} - PI_{st}^{j}}{PI_{st}^{j}}$ is the j-type investment price inflation rate, and the total investment price inflation is defined as $\pi_{st+1} = \frac{PI_{st+1} - PI_{st}}{PI_{st}}$.

min-max range of growth in expected demand are not marked with a dummy (as we did for demand and investment), because we interpret such result as "absence of uncertainty".

Credit rationing indicator. It is equal to 1 if the firm is credit-constrained. It is constructed using the answers to three questions on access to credit provided by the firms in the SIM sample. Specifically, firms are asked whether (i) at the current market interest rate they wish a larger amount of credit; (ii) they would be willing accept a small increase in the interest rate charged in order to obtain more credit; (iii) they have applied for credit but have been turned down. A company is classified as credit-constrained if, given a positive answer to either question (i) or (ii), it also answered "yes" to question (iii).

Reversibility indicator. The reversibility of the installed capital goods may be represented by an indicator based on transactions in the secondary market and on leased investment (*reverst*). It is a dummy variable equal to one if in t the i^{th} firm purchased or sold investment goods in the second-hand market or leased them, zero otherwise. Leased investment is considered reversible because normally, as part of the leasing contract, the client acquires the option to return the good. As a consequence, leasing companies only finance the purchase of goods that enjoy large second-hand markets. Given that the question about leased investment has been dropped since the 2003 survey, we constructed a second reversibility indicator (*REV*) at company level by collapsing annual *reverst* data by firm. *REV* is equal to one if collapsed *reverst* is bigger than 1, i.e. if the firm operated for at least two years either on the second-hand or the leasing markets during the sample period. Alternatively, we imputed missing *reverst* data on the basis of a probit model whose regressors are the usual dummy variables, see e.g. Bontempi et al. (2007, Section 3).

Cash flow, net of dividends paid. It is a no-dummy control variable. Individual data at current prices are from CADS database: CD_{it} = cash flow (item 9.14) minus dividends (item 7.6). In order to obtain data at constant prices, CD_{it} has been deflated using PY_{st} (the by-industry production deflator from NA, see e.g. Bond and Meghir, 1994): $CF_{it} = \frac{CD_{it}}{PY_{st}}$. In analogy with explanatory effective investment in $t\text{-}1$, in our model the cash flow regressor has been scaled by lagged stock of capital.

Table A1.1

PERCENTAGE COMPOSITION OF FIRMS BY SIZE, INDUSTRY AND LOCATION

	Population [1] >20	Population [1] >50	Our sample [2]
Manufacturing sectors:			
Textiles, clothing, leather, footwear	19.07	16.91	17.49
Chemicals, rubber and plastics	9.40	11.90	10.81
Metals, mech./elect. eng., motors, vehicles	43.74	45.24	48.38
Food, timber, furniture, paper and other	27.79	25.95	23.32
Total	*100.00*	*100.00*	*100.00*
Geographical location:			
North-West	37.65	42.72	38.37
North-East	31.69	31.53	15.17
Centre	16.78	14.80	26.76
South and Islands	13.88	10.95	19.70
Total	*100.00*	*100.00*	*100.00*

([1]) Italian firms with a size of more than 20 and more than 50 employees in 2002 (source ISTAT, 2005). ([2]) 12002 firm-year observations of our basic sample.

Appendix A2: Econometric issues

The econometric issue to be tackled is that of endogeneity coming from two potential sources: (a) panel-dynamics and (b) endogenous or predetermined other explanatory variables.

As far as dynamic is concerned, GMM estimators are typically used to obtain consistent parameter estimates in the context of dynamic single equations with panel data. However, GMM may be subject to large finite-sample biases when available instruments are weak (see e.g. Bond, 2002); this problem specifically occurs when data are highly persistent. Investigating the time series properties of the individual series of interest is therefore recommended. For this, Table A2.1 reports alternative estimates of the simple AR(1) specification for the main series in our model.[14]

Table A2.1

ALTERNATIVE AR(1) PARAMETER ESTIMATES FOR THE MAIN VARIABLES OF INTEREST [1]

Estimators [(2)]:	OLS	FE	FD	GMMd	GMMs
Variables:					
investment plans	**0.4969**	**0.3277**	**-0.3196**	**0.3659**	**0.4686**
	0.0825	0.1337	0.0574	0.1042	0.0915
AC1 [(3)]	0.387		0.470	0.006	0.003
AC2 [(3)]	0.158		0.745	0.287	0.228
Hansen [(4)]				0.101	0.158
realized investments	**0.1898**	**-0.0272**	**-0.3981**	**-0.0149**	**0.1257**
	0.0271	0.0289	0.0360	0.0527	0.0668
AC1 [(3)]	0.367		0.594	0.002	0.000
AC2 [(3)]	0.144		0.003	0.434	0.291
Hansen [(4)]				0.380	0.185
expected sales	**0.9050**	**0.6352**	**0.0971**	**0.3959**	**0.4292**
	0.0168	0.0459	0.0656	0.1027	0.0884
AC1 [(3)]	0.080		0.946	0.011	0.002
AC2 [(3)]	0.965		0.439	0.319	0.316
Hansen [(4)]				0.596	0.502
uncertainty of future demand	**0.5887**	**0.3285**	**0.0182**	**0.2793**	**0.4253**
	0.0984	0.0281	0.1760	0.0935	0.0754
AC1 [(3)]	0.452		0.449	0.360	0.176
AC2 [(3)]	0.585		0.294	0.283	0.272
Hansen [(4)]				0.058	0.099

([1]) Below the estimates (in bold), the corresponding heteroskedasticity-consistent standard errors. ([2]) OLS = pooled OLS; FE = OLS within; FD = first differenced OLS; GMMd = first differenced GMM, see Arellano-Bond (1991); GMMs = GMM system, see Blundell-Bond (1998). ([3]) AC*k* = p-values of the residual k^{th} order autocorrelation tests, see Arellano-Bond (1991). ([4]) P-values of the overidentifying restriction *J*-test, see Hansen (1982).

[14] All the estimates in this paper are performed using the Stata *xtabond2* procedure, see Roodman (2008).

Since all the four series are found to be not very persistent, difference GMM cannot be considered *a priori* affected by relevant downwards biases.

On the other side, extra moment conditions of system GMM can further lead the estimates to be biased towards OLS because of the overfitting problem and lack of identification; see e.g. Ziliak (1997). In this context, the comparison of the consistent GMM estimators to simpler estimators like OLS levels and within/first-differenced OLS, which are likely to supply biased in opposite directions the parameter of the lagged dependent variable in short T panels, can help in detecting these biases. For this, Table A2.2 reports alternative estimates of the general model (3) using the data for the panel of family firms used in the main text. Results using other samples are available upon request.

Table A2.2

ALTERNATIVE ESTIMATES FOR THE GENERAL MODEL PARAMETERS (1)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
estimators (2):	OLS	FE	FD	GMMd	GMMd3	GMMds	GMMs	GMMs3
α_1	**0.0028**	**0.0032**	**0.0227**	**0.0171**	**0.0164**	**0.0133**	**0.0047**	**0.0044**
	0.0013	0.0013	0.0067	0.0051	0.0049	0.0047	0.0026	0.0022
α_2	**-0.0616**	**-0.0633**	**-0.0341**	**-0.0488**	**-0.0487**	**-0.0538**	**-0.0889**	**-0.0870**
	0.0639	0.0547	0.0165	0.0188	0.0190	0.0228	0.0421	0.0363
α_3	**-0.1004**	**-0.1058**	**-0.0425**	**-0.3046**	**-0.3165**	**-0.3180**	**-0.3264**	**-0.3042**
	0.0762	0.0801	0.0601	0.1651	0.1699	0.1551	0.1452	0.1523
β_1	**0.5291**	**0.5048**	**-0.2624**	**0.4266**	**0.4323**	**0.4357**	**0.4967**	**0.5009**
	0.1016	0.1089	0.0372	0.1147	0.1142	0.1010	0.0968	0.0970
β_2 (3)	**0.0015**	**0.0019**	**-0.0105**	**-0.0002**	**0.0004**	**-0.0013**	**0.0087**	**0.0053**
	0.0027	0.0030	0.0168	0.0160	0.0158	0.0227	0.0088	0.0065
β_3	**-0.0173**	**-0.0192**	**0.0030**	**-0.0901**	**-0.1047**	**-0.1047**	**-0.1309**	**-0.0817**
	0.0349	0.0346	0.0462	0.1045	0.1048	0.1053	0.1080	0.1129
β_4	**0.0329**	**0.0330**	**0.0328**	**0.0368**	**0.0371**	**0.0355**	**0.0425**	**0.0428**
	0.0128	0.0128	0.0188	0.0249	0.0249	0.0254	0.0232	0.0218
N	835	835	613	613	613	835	835	835
Tbar	3.9	3.9	3.6	3.6	3.6	3.9	3.9	3.9
N×T	3336	3336	2228	2228	2228	3336	3336	3336
AC: (4)								
- 1st order	0.374		0.021	0.002	0.002	0.002	0.002	0.002
- 2nd order	0.168		0.954	0.273	0.269	0.285	0.257	0.228
Hansen (5)				0.626	0.611	0.632	0.357	0.299
Diff-test (6)						0.234	0.003	0.015

(1) Equation (3) estimates using the sample of the family-firms. Below the alternative estimates (in bold) there are the heteroschedasticity-consistent standard errors. (2) OLS = pooled OLS; FE = OLS within; FD = first differenced OLS; GMMd = first differenced GMM (lags from t-2); GMMd3 = first differenced GMM (lags from t-3); GMMds = first differenced GMM and also GMM-levels for sales only (lags from t-2); GMMs = GMM system (lags from t-2); GMMs3 = GMM system (lags from t-3). (3) Being the explanatory measured in millions, estimates must be divided by 10^6. (4) AC = p-values of the residual autocorrelation tests, see Arellano and Bond (1991). (5) P-values of the overidentifying restriction *J*-test, see Hansen (1982). (6) Test for the extra moment conditions exploiting levels.

Results are quite clear-cut. The estimates in the first three columns are biased by the omission of significant individual effects (OLS) and the endogeneity of at least the lagged dependent variable. In this context, as discussed in Bond (2002), the β_1 OLS estimate is upwards biased while the FD one is underestimated. In the columns (4)-(6) the first differenced GMM estimates do not reject neither the second order autocorrelation nor the overidentification hypotheses, in addition the estimate of the lagged dependent variable parameter always falls inside the OLS/FD range of opposite-sign bias. In the last two columns, the GMM system estimates reject the overidentification test for the incremental moment conditions in levels and, in general, show estimates qualitatively similar to those of (biased) OLS probably because overfitting.

Despite we consider the difference GMM estimates more reliable than the others, it is worth noting the robustness of the finding about the significantly negative effect of uncertainty on investment plans.