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Full length Article

## Diversification and manager autonomy in fund families: Implications for investors

Laura Andreu, Ruth Gimeno, Cristina Ortiz \*

Accounting and Finance Department and Institute of Research in Employment, Digital Society and Sustainability, University of Zaragoza, Gran Via 2, 50.005 Zaragoza, Spain

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### ABSTRACT

This paper aims to investigate the consequences of investing in a single fund family for investors. In essence, we focus on the correlation among portfolio holdings of funds with effects in terms of under-diversification for mutual fund investors, especially, if they invest in the same fund family. We also explore the fund manager autonomy in portfolio holding allocation within families and determine the characteristics of those fund families with higher autonomy. Our results show that a higher correlation among funds not only implies that families offer a lower diversification to investors; it also has a negative effect on their performance. However, investors' performance benefits from a higher manager autonomy. Consequently, investors who select a single fund family could obtain higher returns in smaller fund families with considerable experience that do not belong to a banking or insurance group, as in the former, diversification and manager autonomy are higher.

### 1. Introduction

The development of the mutual fund industry has resulted in a large number of individual investors who participate in financial markets, delegating their portfolio management to fund managers who have become the main type of institutional investors (Chen and Qin, 2017). This is demonstrated by the €15.6 billion of Net Assets managed by 60,000 funds in the European Mutual Fund Industry (European Fund and Asset Management Association, EFAMA, 2018).

As documented over the years, portfolio diversification is one of the main benefits obtained from mutual funds by unsophisticated investors (Markowitz, 1952; Sharpe, 1964; Statman, 2004; and Goetzmann and Kumar, 2008, among others). However, Moreno and Rodríguez (2013) argue that mutual funds are not always well diversified. Therefore, investors should hold more than one mutual fund in order to reduce the idiosyncratic risk in a portfolio of funds.

In selecting mutual funds, researchers find that individual investors first seem to pick a fund family, and then they select the funds in which they invest. This mental process implies the concentration of their investments in a single mutual fund family (Massa, 2003). In order to reinforce the idea of investment in a single fund family, Gerken et al. (2018) find that investors who have previously invested in a particular family are significantly more likely to choose a fund from that same family when they decide to invest in mutual funds again. This can be explained by the fact that investors are able to move their money in and out of funds within a family at a lower cost (Clare et al., 2014). Therefore, as shown in literature, when building their diversified portfolio of funds, investors seem to pick

\* Corresponding author.

E-mail addresses: [landreu@unizar.es](mailto:landreu@unizar.es) (L. Andreu), [rgimeno@unizar.es](mailto:rgimeno@unizar.es) (R. Gimeno), [cortiz@unizar.es](mailto:cortiz@unizar.es) (C. Ortiz).

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funds within fund family they are familiar with. Hence, the main aim of this study is to further investigate investors' diversification and the implications in terms of performance of diversifying within a fund family or across families.

Deepening into the behaviour of fund families, [Elton et al. \(2007\)](#) find that mutual fund returns within a family tend to be highly correlated, and they argue that the increased correlation is primarily due to common stocks in portfolio holdings. [Chen et al. \(2004\)](#) also show that the fund performance is related to the fund family. According to [Elton et al. \(2007\)](#), fund managers within the same family have access to the same information, both external and internal research analyses, what results in similar portfolio holdings. In addition, the potential existence of guidelines from the family's top-management (i.e. investment directors) also generates similar portfolios and implies a reduction of the autonomy of managers ([Kacperczyk and Seru, 2012](#)).

Focusing on the decision-making process of mutual funds, fund managers' decisions are influenced by both, the personal characteristics of managers and external factors. Personal characteristics include managers' past experience ([Menkhoff et al., 2006](#); [Kempf et al., 2017](#)), their cognitive biases ([Cuthbertson et al., 2016](#)), their own intuition ([Brown and Davies, 2017](#)) and their level of familiarity with the stocks ([Pool et al., 2012, 2015](#)), among others. Some example of external factors are analyst recommendations ([Brown et al., 2014](#)), competition or co-operation with other managers ([Kempf and Ruenzi, 2008](#); [Simutin, 2013](#); [Evans et al., 2020](#)); the family management strategy, which may involve a centralised or decentralised decision making process ([Kacperczyk and Seru, 2012](#)).

Apart from the aforementioned factors, managers in the same family may also have some common features that lead them to hold more similar portfolio holdings than managers of different families. In this line, [Sevcenko and Ethiraj \(2018\)](#) also suggest that the existence of a monitoring relationship in the mutual fund companies allows new managers to know the company-specific skills.

Concerning the level of portfolio holding differentiation between funds within a family, previous literature reveals different positions. Some authors provide evidence that fund decisions' coordination within families allows to take advantage of the family resources and maximise its value ([Khorana and Servaes, 2004](#); [Elton et al., 2007](#); [Evans et al., 2020](#)). [Gerken et al. \(2018\)](#) also document the high importance of family reputation when investors select a family that is determined by the performance of all the funds within a family. In addition, [Casavecchia and Ge \(2019\)](#) note that fund managers who are part of families with a higher level of specialisation possess better stock-picking skills. However, [Massa \(2003\)](#) and [Khorana and Servaes \(2012\)](#) note that it is important that investors perceive each fund as a differentiated product for families to increase their family market share. In this line, [Mamaysky and Spiegel \(2002\)](#) consider that individual investors take advantage of research relating to the family when the portfolios of new funds differ as much as possible from existing funds in the fund family.

Although considerable effort has been devoted to examining the portfolio differentiation within families and its influence on the family market share, the economic and diversification implications for fund investors that concentrate their investment in one fund family remain more unknown.

In line with prior research, we firstly analyse the resemblance between portfolio holdings within the same family and between different families in order to conclude the diversification implications for investors who concentrate all of their fund investments in a single family. We address this resemblance with the portfolio overlap measure. Our hypothesis is based on the idea that the higher the level of portfolio overlap between two funds, the higher the resemblance between both funds and the lower the level of diversification for an investor who decides to invest in those two funds. Our preliminary analyses confirm the existence of a resemblance level among fund pairs of our sample of funds, especially when the funds belong to the same fund family as documented in [Elton et al. \(2007\)](#). Therefore, individual investors can achieve better diversification if they do not focus on a single family and distribute their fund investments across different families.

Secondly, given the importance of the fund family in the selection of mutual funds, we explore the heterogeneity among fund families in terms of the portfolio overlap and manager autonomy. The findings obtained show that the level of diversification between funds, or the level of manager autonomy are significantly higher in some families than in others. Consequently, in the following analysis, we investigate whether certain fund family characteristics could enhance the existence of portfolio overlap or fund manager autonomy. We identify families in which investors would be less affected by under-diversification if they decided to concentrate their funds in the same family. We find that larger families, which belong to a banking group and which do not have a considerable experience in the mutual fund market, show the highest portfolio overlap. However, the manager autonomy in portfolio allocation of stocks is higher in smaller fund families with wider experience that do not belong to a banking group.

Finally, assuming the results of [Massa \(2003\)](#) and [Gerken et al. \(2018\)](#) that investors tend to concentrate their mutual funds in a single fund family and the existence of some characteristics of the fund families that may have influence on the levels of portfolio overlap and manager autonomy; it is important to examine whether these two dimensions may impact on the performance of the fund family. Thence, we study whether the economic consequences for individual investors of concentrating all fund investments within a single fund family depend on the level of diversification and the manager autonomy of families. We find that a higher diversification and a higher autonomy of managers within families are positive factors for investors' performance.

Therefore, the findings seem to reveal that investors who concentrate all funds in the same family could obtain higher returns in smaller fund families with wide experience that do not belong to a banking group, because in these families the diversification and manager autonomy are higher.

Our paper is related to the literature that examines the resemblance among portfolio holdings. However, we contribute to the literature in several ways. First, we focus on the analysis at the fund family level by obtaining the portfolio overlap among mutual funds within each fund family. Secondly, we propose a new measure to define fund manager autonomy, which controls for the industry allocation that could obey analysts' consensus on the stock markets or family management strategies. Thirdly, we explore the economic consequences of concentrating all fund investments within a single fund family with certain characteristics due to their portfolio overlap and manager autonomy levels.

The findings of this study also have several implications for fund managers and fund families. Managers who work in management companies with a lower level of manager's autonomy in decision-making are less likely to stand out from others in this same company and therefore this limits their probability of promotion. Our study is also of interest for fund families because of the relation between past performance and future fund flows (Sirri and Tufano, 1998). In addition, this study is interesting for financial supervisors as a guide to their supervision towards the insurance of investor protection and the efficiency of the market. According to Delpini et al. (2019, 2020), a high similarity among mutual funds is a sign of an industry with a high systemic risk and fragility, and consequently, a high possibility of contagion and propagation of the market shocks.

The remainder of this paper is organised as follows. Section 2 describes the data. Section 3 presents the results of the portfolio overlap of fund pairs. Section 4 presents the results of the portfolio overlap and manager autonomy at the fund family level. Section 5 presents the results of the family characteristics that enhance these two dimensions. Section 6 presents the influence of portfolio overlap and fund manager autonomy on the individual investors' returns. Section 7 concludes.

## 2. Data

We study the correlation of portfolio holdings between fund pairs in the same family and different families and its influence on individual investors' performance and diversification in the Spanish equity mutual fund industry from December 1999 to June 2018. The review of previous literature reveals that there are several authors who have studied holdings concentration. Elton et al. (2007) examine the extent of overlap in stock holdings for US mutual funds from 1998 to 2002 and Pool et al. (2015) study portfolio overlap of actively managed US equity funds whose managers live in the same city from 1996 to 2010.

Our paper evaluates the extent of the overlap between fund portfolio holdings in the Spanish Euro equity official category. The Spanish Securities Exchange Commission (CNMV) establishes a classification of mutual funds according to the types of assets included in the portfolios. Euro equity funds must invest more than 75% of their portfolio holdings in equities, and at least 60% of the total equity exposure must be issued by companies of the Euro area. Our sample is free of survivorship bias as it includes both, funds that have already disappeared and surviving funds. ETFs, index funds and funds with less than two years of data were excluded. In addition, we also control for mergers and acquisitions of funds and fund families to detect when a fund becomes managed by a different family. Our final sample includes 276 Euro equity mutual funds managed by 108 management companies (that is fund families), of which 63 companies manage more than one fund.

The monthly portfolio holdings of mutual funds included in our sample were obtained from the CNMV and Morningstar. The CNMV provided monthly portfolios from 1999 to 2006 for research purposes. After 2006, CNMV provides quarterly holdings. Therefore, we complete these official reports with monthly information from Morningstar when it is available. We match both databases using the ISIN code of mutual funds and stocks and analyse a total of 24,561 portfolio holdings.

CNMV also provides information about the characteristics of mutual funds and of fund families such as the inception date of funds, the fees, the monthly prior-year gross and net return, and the fund family to which they belong. We also obtain the monthly size of each fund family as the sum of the total net assets of all fund categories within the family in the industry. Additionally, based on its governance structure, we distinguish between fund families that depend on a banking or insurance company (named hereafter as banking group for the sake of brevity) from others that do not (independent fund families). Finally, stock information is obtained from Datastream.

Panel A of Table 1 reports the summary statistics of our fund sample at different date points. It is noteworthy that the number of funds decrease over time. According to Climent (2013), this effect is related to the severe merging process caused by the strong reorganisation of the banking system in the Spanish market in recent years. Pertaining to the characteristics of funds and families, we observe that the average total net assets of funds (*Fund\_size*) is lower in December 2011 with respect to December 2005, which comes as no surprise given the global financial crisis. However, the trend of average fund size has recovered during the last years, reaching in June 2018 higher average size since December 2011. This recovery may be encouraged by low interest rates offered by bank deposits that have been replaced by mutual funds for many investors in recent years and the increase in investors' confidence in professional investment advice.

The value of monthly fees shown in Table 1 does not change significantly and the average number of stocks decreases slightly. Based on the prior-year gross return, we can see that it is lower in December 2011 compared to the other three date points due to the economic crisis.

Panel B of Table 1 reports the summary statistics of the fund families in our sample. In line with the evolution of the number of funds, we also observe a decrease in the number of fund families. In addition, although the percentages of families that belong to a banking or insurance group are remarkably higher, the weight of independent families increases slightly over the sample period, from 18.06% in December 1999 to 29.41% in June 2018. With respect to the concentration level, Panel B shows that the market share percentage of the four largest families is around 50% for the whole sample period, considering both the total assets in the industry and the assets within the Euro equity category of our sample. Hence, our sample is representative of the Spanish mutual fund industry. In addition, the normalised Herfindahl–Hirschman index (HHI) values of our study are similar to the figures presented by Ferreira and Ramos (2009), who examine mutual fund industry competition and concentration in 27 countries. These authors report that the HHI in the European markets ranges from 0.040 to 0.219. The Spanish industry has a higher HHI with respect to other European markets such as the United Kingdom (0.040), France (0.066); Italy (0.069) and Germany (0.071).

Panel C of Table 1 shows that the average size and the average age of funds are remarkably higher within the largest families compared with the smallest families. However, the differences in terms of the fees and prior-year returns are small. Regarding the number of stocks held in portfolio holdings, funds managed by the largest families seem to be more diversified in the early years of the

**Table 1**  
Summary Statistics of the sample.

		Dec1999	Dec2005	Dec2011	Jun2018
Panel A: Summary statistics of the mutual fund sample					
<i>#Funds</i>		139	165	126	89
<i>Fund_size</i>	Mean	84.68	76.78	35.01	148.63
	Q1	116.56	102.58	36.00	180.92
	Q5	7.68	8.88	4.78	18.68
<i>Fund_age</i>	Mean	4.14	8.04	13.15	17.77
	Q1	8.38	11.66	17.50	24.00
	Q5	1.32	4.53	8.79	12.64
<i>Fund_#stocks</i>	Mean	49.71	47.30	42.89	48.30
	Q1	59.00	57.00	53.00	58.00
	Q5	34.00	35.00	32.00	34.00
<i>Fund_fees</i>	Mean	0.17%	0.15%	0.16%	0.15%
	Q1	0.21%	0.19%	0.19%	0.18%
	Q5	0.12%	0.12%	0.14%	0.12%
<i>Fund_return</i>	Mean	10.78%	24.52%	-14.84%	3.95%
	Q1	15.81%	27.06%	-12.06%	8.37%
	Q5	3.47%	21.59%	-17.31%	-0.97%
Panel B: Summary statistics of the fund family sample					
<i>#Families</i>		72	69	56	51
<i>#Bank-families</i>		59 (81.94%)	56 (81.16%)	45 (80.36%)	36 (70.59%)
<i>#Independent-families</i>		13 (18.06%)	13 (18.84%)	11 (19.64 %)	15 (29.41%)
<i>Family_size</i>	Mean	1,947.82	2,858.46	2,283.66	5,167.97
	Q1	1,709.23	2,226.71	2,641.46	4,951.42
	Q5	81.36	9.88	5.78	19.68
	<i>HHI</i>	0.1453	0.1015	0.0810	0.0895
	<i>CR-4</i>	56.49%	54.40%	54.26%	52.93%
<i>Family_EuroEquity</i>	Mean	163.48	183.59	78.77	259.38
	Q1	126.30	195.06	77.28	259.87
	Q5	7.72	10.65	8.69	18.21
	<i>HHI</i>	0.1200	0.0762	0.1409	0.1065
	<i>CR-4</i>	55.91%	46.83%	58.18%	54.82%
<i>Family_age</i>	Mean	9.40	15.88	21.13	26.88
	Q1	12.07	18.87	25.53	31.58
	Q5	8.34	14.28	20.19	25.29
Panel C: Summary statistics of mutual funds by family					
<i>Average Fund_size</i>	Families_Q1	156.79	157.29	66.21	376.50
	Families_Q5	13.48	25.36	14.64	30.43
<i>Average Fund_age</i>	Families_Q1	4.66	6.62	14.96	21.73
	Families_Q5	4.18	7.92	12.53	14.93
<i>Average Fund_#stocks</i>	Families_Q1	69.59	51.65	36.31	48.88
	Families_Q5	38.75	41.64	44.76	51.44
<i>Average Fund_fees</i>	Families_Q1	0.15%	0.14%	0.17%	0.16%
	Families_Q5	0.16%	0.15%	0.16%	0.14%
<i>Average Fund_return</i>	Families_Q1	14.45%	26.84%	-18.11%	3.79%
	Families_Q5	4.70%	24.32%	-12.58%	3.28%

Panel A and Panel B report the summary statistics of mutual funds and fund families, respectively, at four date points: Dec1999, Dec2005, Dec2011 and Jun2018. Panel C reports the average summary statistics of funds by the largest families (Families\_Q1) and the smallest families (Families\_Q5) at these four date points. *#Funds* is the number of funds in our sample. *Fund\_size* is the monthly total net assets of funds in million euros. *Fund\_age* is the age of funds in years based on their inception date. *Fund\_#stocks* is the number of stocks in portfolio holdings. *Fund\_fees* is the management and deposit fee. *Fund\_return* is the prior-year gross return. *#Families* is the number of fund families in our sample, we distinguish between families that belong to a banking or insurance group (*bank-families*) and families that are independent (*independent-families*). *Family\_size* is the monthly total net assets of all funds managed by fund families in the Spanish industry in million euros. *Family\_EuroEquity* is the monthly total net assets managed by families in the Euro equity category in million euros. *Family\_age* is the age of fund families in years, obtained from the inception date of the oldest fund in the family. *HHI* is the normalised Herfindahl–Hirschman Index that ranges from 0 to 1. *CR-4* index is the market share percentage of the four largest families.

sample period. However, in December 2011 and June 2018, the diversification level is higher in the portfolio holding within the smallest families.

### 3. Resemblance of fund portfolio holdings

#### 3.1. Measure of portfolio overlap among mutual funds

The first objective of the paper is to analyse the correlation between two funds within the same family and the correlation across families and hence, investor diversification. We approach this correlation as the portfolio overlap between fund pairs. According to Elton et al. (2007) and Pool et al. (2015), we measure the pairwise overlap as the sum of minimum fraction in each stock  $k$  held by both funds in month  $t$ .<sup>1</sup>

$$\text{Portfolio overlap}_{i,j,t} = \sum_{k \in \Psi_{i,j,t}} \min(w_{i,k,t}; w_{j,k,t}) \times 100 \quad (1)$$

where *Portfolio overlap* <sub>$i,j,t$</sub>  is the portfolio overlap between funds  $i$  and  $j$  in month  $t$ .  $w_{i,k,t}$  is the portfolio weight of stock  $k$  in the fund  $i$  in month  $t$ .  $w_{j,k,t}$  is the portfolio weight of stock  $k$  in the fund  $j$  in month  $t$ .  $\Psi_{i,j,t}$  is the set of all stocks held by fund  $i$  and fund  $j$  in month  $t$ . The higher the portfolio overlap between two funds, the higher the correlation between two funds and the lower the diversification level for an investor who decides to invest in those two funds.

We also obtain the correlation between two funds at the industry and sector levels. Every stock is classified by sector and by industry according to FTSE Russel Industry Classification Benchmark (ICB) obtained from Datastream. To measure the portfolio overlap at the sector or at the industry levels, in Eq. 1  $k$  becomes the sector or the industry, respectively.

#### 3.2. Portfolio overlap results for fund pairs within a single family and across families

Panel A of Table 2 reports that the average portfolio overlap at stock level between any two funds in the sample is 30.50% during the sample period. Similarly, Elton et al. (2007) find that up to 34 % of total net assets are held in common stocks for funds with the same investment objective. However, we observe that the annual average portfolio overlap decreases from 32.17%–23.20% during the sample period. Regarding the sector and industry levels, Table 2 also reveals that the average overlaps are 58.89% and 66.14%, respectively, which as expected, are considerably higher than at the stock level. The results reveal a decrease in the average portfolio overlap that is lower at the sector and industry levels than at the stock level.<sup>2</sup>

Following Elton et al. (2007), we differentiate between the fund pairs where both funds belong to the same management company (that is in the same fund family) and the fund pairs in different families. These authors initially argue two positions. On the one hand, according to Khorana and Servaes (2004), they argue that the portfolio overlap of fund pairs in the same family could be lower than across families, suggesting that a fund family has incentives to offer non-correlated portfolio holdings to prevent investors from going outside of the family to seek a higher diversification between funds. On the other hand, Elton et al. (2007) also contemplate that there are reasons to expect that the portfolio overlap may be higher within fund families than outside of them due to the access to the same information or the extent of a family management strategy. Similarly, Chen et al. (2004) and Cici et al. (2018) show that most mutual funds operate as part of fund families; the latter make strategic decisions that have an influence on the operation and performance of their funds.

We analyse 994 fund pairs with 167,848 portfolio overlap observations where both funds are in the same fund family and 32,982 fund pairs with 1,549,658 portfolio overlap observations where both funds are in different fund families. We compare the portfolio overlap between both groups and our first null hypothesis tested is:

$H_0$ : There are no significant differences between the portfolio overlap of fund pairs within the same fund family and fund pairs in different families.

Table 2 shows that the value of portfolio overlap decreases from December 1999 to June 2018 and, its average for fund pairs within the same fund family and fund pairs in different families at stock level are 37.36% and 30.31%, respectively. This finding reveals a difference between both groups equal to 7.05%, which is statistically significant at the 1% level. This finding is consistent with financial literature (Elton et al., 2007; Pool et al., 2015). We also find a statistically significant difference between the overlap of fund pairs within the same family and the overlap of fund pairs in different families when we measure the overlap at sector and industry levels. The results obtained when focusing on the industry and the sector increase the robustness of our conclusions, given that by using the stock for stock comparison, we omit a potential overlap in sector or industry that can occur when stocks are different.

The higher portfolio overlap for fund pairs within the same fund family and its decreasing evolution over time, shown in Table 2, are corroborated when we study the characteristics of fund pairs with a higher portfolio overlap at the stock level in Appendix 2. Table A2 of Appendix 2 also provides evidence that the potential diversification is especially lower when investors invest in funds that

<sup>1</sup> For robustness purposes, we also obtain the portfolio overlap based on the measure used in Delpini et al. (2019) and Fricke and Fricke (2021), see Appendix 1 for more details.

<sup>2</sup> The annual results of portfolio overlap at the sector and at the industry levels are available upon request.

<sup>3</sup> The annual results of family portfolio overlap at the sector and at the industry levels are available upon request.

**Table 2**  
Overall results of the portfolio overlap at the fund pair level.

Year	Portfolio overlap	#fund pairs (same fund family)	#fund pairs (different fund family)	Portfolio overlap (same fund family)	Portfolio overlap (different fund family)	Mean-difference test
<b>Panel A: Stock</b>						
2000	32.17%	282	11,520	44.35%	31.88%	12.47%*** (0.000)
2001	30.95%	341	13,827	37.98%	30.76%	7.22%*** (0.000)
2002	30.20%	354	14,261	36.73%	30.05%	6.68%*** (0.000)
2003	32.23%	340	15,175	39.02%	32.08%	6.93%*** (0.000)
2004	33.57%	337	13,592	41.54%	33.37%	8.17%*** (0.000)
2005	33.07%	391	14,415	40.21%	32.87%	7.34%*** (0.000)
2006	31.27%	421	15,621	37.18%	31.11%	6.07%*** (0.000)
2007	29.27%	474	16,648	35.43 %	29.03 %	6.40%*** (0.000)
2008	30.70%	468	16,032	35.22%	30.49%	4.73%*** (0.000)
2009	29.27%	422	14,054	35.64%	29.02%	6.61%*** (0.000)
2010	27.61%	255	10,917	34.46%	27.39%	7.06%*** (0.000)
2011	27.74%	236	9864	34.92%	27.53%	7.39%*** (0.000)
2012	26.86%	193	7712	34.51%	26.64%	7.88%*** (0.000)
2013	26.14%	166	6289	33.09%	25.95%	7.14%*** (0.000)
2014	26.57%	97	4619	31.79%	26.45%	5.33%*** (0.000)
2015	27.05%	104	5203	31.79%	26.93%	4.85%*** (0.000)
2016	25.10%	93	4737	27.66%	25.04%	2.61%*** (0.000)
2017	23.12%	75	4260	28.71%	22.96%	5.75%*** (0.000)
2018	23.20%	65	4061	28.73%	23.08%	5.65%*** (0.000)
Dec1999-Jun2018	30.50%	994	32,982	37.36 %	30.31%	7.05%*** (0.000)
<b>Panel B: Sector</b>						
Dec1999-Jun2018	58.89%	994	32,982	64.18%	58.75%	5.43%*** (0.000)
<b>Panel C: Industry</b>						
Dec1999-Jun2018	66.14%	994	32,982	70.92%	66.61%	4.91%*** (0.000)

Panel A, Panel B and Panel C report the results of portfolio overlap at the stock level, at the sector level and at the industry level, respectively. This table shows, for each year, the overall average portfolio overlap and the number of fund pairs within the same fund family and the number of fund pairs in different families, as well as their average overlap. In this table, we present a yearly report of the number of fund pairs during the sample period, unlike in Table 1 where we present the total number only at four specific points during the sample period. The last column shows the results of the mean difference test between both specific averages with the *p*-value in parentheses. We apply the mean difference test for unpaired samples with different variance (in all cases the null hypothesis is rejected in the test of equal variance).<sup>3</sup> In all columns, the annual average is obtained with the monthly portfolio overlap data. The study period starts in December 1999 and ends in June 2018. \*\*\*, \*\*, and \* denote statistical significance at the 1%, 5%, and 10% level, respectively.

are among the largest, hold roughly the same high number of stocks in their portfolio, charge similarly high fees, are of similar ages and have similar prior-year gross returns.

#### 4. Portfolio overlap and manager autonomy of fund families

Giving that individual investors seem to concentrate all their fund investments within a single fund family, we firstly explore the heterogeneity across funds families in terms of portfolio overlap among their funds and secondly, in terms of manager autonomy on the selection of stocks within a specific industry.

##### 4.1. Portfolio overlap within each fund family

Our results show a higher correlation between fund pairs within the same family. Hence, in this section, we focus on portfolio holding similarities at a fund family level. Previous literature reveals evidence that the top-management strategies are not the same in all families, thus, we may think that neither is the correlation between their funds. Evans et al. (2020) contribute to the literature on heterogeneity in management strategies between families, reconciling evidence of the coexistence of cooperative families and competitive families in the US mutual fund industry. In this line, we examine whether there are families that have a significantly higher portfolio overlap between their funds. Therefore, we test the following null hypothesis:

$2H_0$ : There are no significant differences between the portfolio overlap of different fund families.

We calculate the monthly family portfolio overlap as the average portfolio overlap of fund pairs within this fund family.

$$\text{Family portfolio overlap}_{f,t} = \overline{\text{Portfolio Overlap}_{i,j,t}} \times 100 \quad (2)$$

where Family portfolio overlap<sub>f,t</sub> is the portfolio overlap within fund family *f* in month *t*. Portfolio Overlap<sub>i,j,t</sub> is the portfolio overlap

**Table 3**  
Family portfolio overlap.

Year	Family Overlap	Family overlap (TNA-weighted)	Family overlap (#funds-weighted)	Family Overlap (T1)	Family Overlap (T3)	Mean-difference test (T1-T3)
Panel A: Stock						
2000	39.06%	43.67%	41.30%	70.07%	13.50%	56.57%*** (0.000)
2001	36.59%	39.94%	37.39%	62.98%	15.04%	47.95%*** (0.000)
2002	34.98%	39.57%	35.64%	62.14%	12.55%	49.59%*** (0.000)
2003	36.05%	38.35%	36.93%	62.78%	14.78%	48.00%*** (0.000)
2004	38.13%	40.63%	39.10%	63.20%	18.13%	45.07%*** (0.000)
2005	34.19%	36.37%	36.78%	55.77%	16.82%	38.95%*** (0.000)
2006	32.29%	34.19%	34.55%	53.63%	15.19%	38.44%*** (0.000)
2007	30.71%	31.49%	32.39%	50.77%	15.53%	35.24%*** (0.000)
2008	30.19%	32.09%	33.66%	51.52%	16.08%	35.44%*** (0.000)
2009	30.94%	32.86%	33.62%	45.26%	18.65%	26.61%*** (0.000)
2010	27.73%	32.60%	32.61%	47.89%	19.14%	28.75%*** (0.000)
2011	28.18%	32.58%	34.41%	50.34%	19.95%	30.39%*** (0.000)
2012	32.88%	31.06%	33.08%	47.21%	16.81%	30.40%*** (0.000)
2013	37.19%	31.45%	32.11%	47.55%	15.80%	31.75%*** (0.000)
2014	35.47%	31.34%	30.92%	48.45%	15.10%	33.36%*** (0.000)
2015	35.23%	32.84%	31.21%	52.22%	15.14%	37.08%*** (0.000)
2016	38.12%	30.65%	27.57%	48.59%	14.20%	34.39%*** (0.000)
2017	35.49%	31.86%	28.30%	50.26%	13.71%	36.55%*** (0.000)
2018	33.83%	30.62%	28.63%	50.26%	13.97%	36.29%*** (0.000)
Dec1999-Jun2018	33.31%	34.57%	33.87%	55.55%	15.67%	39.89%*** (0.000)
Panel B: Sector						
Dec1999-Jun2018	62.46%	61.61%	62.73%	76.79%	49.63%	27.17%*** (0.000)
Panel C: Industry						
Dec1999-Jun2018	70.70%	69.84%	70.73%	83.52%	58.20%	25.32%*** (0.000)

Panel A, Panel B and Panel C report the results of portfolio overlap at the stock level, at the sector level and at the industry level, respectively. This table shows the average family portfolio overlap and the average family portfolio overlaps weighted by total net assets in Euro equity category and weighted by number of Euro equity funds, the average overlap of families that are in the top tercile (T1) and the average overlap of families that are in the bottom tercile (T3). The last column shows the result of a mean-difference test between T1 and T3 with the *p*-values in parentheses. We apply the mean-difference test for paired samples. In all columns, the annual average is obtained with the monthly portfolio overlap data. The study period starts in December 1999 and ends in June 2018. \*\*\*, \*\*, and \* denote statistical significance at the 1%, 5%, and 10% level, respectively.

between funds *i* and *j* in month *t* when both funds belong to the same fund family *f*.

Table 3 shows that the average family portfolio overlap is equal to 33.31% at the stock level and it is 62.46% and 70.70% at the sector and industry levels, respectively.<sup>4</sup> The findings also reveal that the family overlap at stock level decreases over time.

We also obtain the family overlap weighted by the total net assets in Euro equity category and the family overlap weighted by the number of funds managed in this category. The findings at stock level show the weighted averages are higher than the equal-weighted average overlap which reveals evidence that the largest families with the highest number of funds have a higher family portfolio overlap. To test our null hypothesis, we split families into terciles according to their family overlap. We find that the average family portfolio overlaps at stock level of fund families which are in the top tercile (T1) and of fund families which are in the bottom tercile (T3) are 55.55% and 15.67%, respectively, with a difference equal to 39.89% that is statistically significant at the 1% level. Therefore, we reject the null hypothesis that all fund families have the same portfolio overlaps between their funds. We obtain similar results when we measure the portfolio overlap at sector and industry levels.

#### 4.2. Manager autonomy within each fund family

Several studies have focused on the behaviours within fund families (Chen et al., 2004; Elton et al., 2007; Cici et al., 2018). They argue that most mutual funds operate as part of fund families which make strategic decisions that have an influence on the operations and performance of their own funds. However, these authors are implicitly considering the existence of coordination between decisions within fund families, focusing on the top management of a fund family, but neglecting the decisions at the individual level of

<sup>4</sup> Our panel data shows autocorrelation and heteroscedasticity. Hence, we require a methodology that corrects the standard errors to solve these issues. Prais-Winsten, Generalised Least Squares (GLS), FE and RE with robust standard errors models take into account autocorrelation and heteroscedasticity. To verify the robustness of our results, we estimate Eqs. 8 and 9 using these four models. Regarding the FE and RE models, the Hausman test indicates that the FE model is the preferred specification. However, the time-invariant independent variables will be ignored by this specification (in Eqs. 8 and 9 the *Bank* variable has not changed over the sample period in each family and hence, acting as a time-invariant variable) and in this case, the RE model may be a viable alternative (Hill et al., 2020).

fund managers (Kempf and Ruenzi, 2008). Fund managers make differential decisions that may provide a significantly different result (positive or negative) to investors allowing managers to promote themselves and stand out from others when the return is significantly positive. In this sense, Agarwal et al. (2009) indicate that managerial incentives depend on fund performance. Mason et al. (2016) also argue that fund managers' position, reputation and salary depend on their performance records.

Our hypothesis is based on the idea that the managers' decisions can be explained by both the influence of family top-management and the autonomy of fund managers. Kacperczyk and Seru (2012) consider the coexistence of two different family organisational structures: centralised and decentralised. They show that decentralised funds offer greater autonomy to their managers, as well as incentives and flexibility to produce more valuable information and thus, more benefits for investors than the centralised decision-making process.

We first compute the fund manager autonomy within families and then, we study whether the fund manager autonomy is the same in all fund families, being the null hypothesis:

$H_0$ : There are no significant differences in autonomy of managers between different fund families.

**Table 4**

Manager autonomy within fund families.

Panel A: Inter-family autonomy						
	family autonomy	family autonomy (TNA-weighted)	family autonomy (#funds-weighted)	family autonomy (T1)	family autonomy (T3)	Mean-difference test (T1-T3)
2000	48.66%	55.15%	49.76%	54.97%	42.16%	12.81%*** (0.000)
2001	48.66%	46.91%	44.86%	53.79%	43.63%	10.16%*** (0.000)
2002	47.20%	41.29%	42.49%	52.45%	41.53%	10.92%*** (0.000)
2003	47.94%	46.29%	45.90%	53.57%	41.77%	11.80%*** (0.000)
2004	48.90%	50.67%	47.60%	54.84%	42.43%	12.41%*** (0.000)
2005	48.71%	54.34%	49.23%	54.72%	41.91%	12.81%*** (0.000)
2006	48.83%	41.12%	42.71%	54.44%	43.50%	10.95%*** (0.000)
2007	47.96%	47.33%	43.67%	55.39%	42.91%	12.48%*** (0.000)
2008	47.79%	47.91%	48.04%	53.63%	41.85%	11.78%*** (0.000)
2009	46.84%	30.95%	49.53%	53.43%	40.98%	12.45%*** (0.000)
2010	50.38%	38.39%	49.85%	56.08%	44.52%	11.55%*** (0.000)
2011	50.36%	39.70%	47.10%	56.27%	44.59%	11.68%*** (0.000)
2012	49.79%	53.02%	48.47%	56.18%	44.00%	12.18%*** (0.000)
2013	51.48%	54.87%	48.38%	57.87%	45.90%	11.97%*** (0.000)
2014	52.42%	50.07%	48.90%	58.98%	46.41%	12.56%*** (0.000)
2015	51.88%	52.27%	50.01%	58.67%	45.54%	13.13%*** (0.000)
2016	52.71%	48.60%	50.46%	59.09%	46.35%	12.74%*** (0.000)
2017	53.06%	52.12%	51.68%	59.43%	46.46%	12.97%*** (0.000)
2018	52.63%	52.65%	51.73%	59.08%	45.75%	13.33%*** (0.000)
Dec1999-Jun2018	49.72%	47.47%	47.82%	55.03%	43.32%	11.71%*** (0.000)
Panel B: Intra-family autonomy						
	family autonomy	family autonomy (TNA-weighted)	family autonomy (#funds-weighted)	family autonomy (T1)	family autonomy (T3)	Mean-difference test (T1-T3)
2000	32.52%	31.51%	31.95%	51.54%	13.28%	38.26%*** (0.000)
2001	33.70%	31.93%	33.53%	49.98%	16.87%	33.10%*** (0.000)
2002	33.73%	30.70%	32.41%	52.38%	14.98%	37.40%*** (0.000)
2003	31.80%	30.88%	30.94%	47.80%	15.88%	31.92%*** (0.000)
2004	32.73%	31.91%	31.64%	47.96%	17.51%	30.45%*** (0.000)
2005	36.63%	33.97%	34.11%	50.74%	22.49%	28.24%*** (0.000)
2006	37.89%	35.18%	35.18%	54.93%	22.03%	32.90%*** (0.000)
2007	36.37%	36.87%	33.87%	56.71%	21.93%	34.79%*** (0.000)
2008	37.04%	37.10%	36.37%	55.55%	20.86%	34.69%*** (0.000)
2009	38.14%	32.10%	36.34%	52.79%	24.32%	28.47%*** (0.000)
2010	38.75%	33.70%	37.82%	53.21%	25.18%	28.03%*** (0.000)
2011	37.10%	32.69%	35.95%	52.61%	23.53%	29.08%*** (0.000)
2012	39.37%	33.07%	37.61%	54.41%	26.95%	27.45%*** (0.000)
2013	39.67%	34.15%	38.34%	55.74%	26.26%	29.48%*** (0.000)
2014	42.05%	38.96%	41.02%	56.27%	27.49%	28.78%*** (0.000)
2015	42.17%	40.91%	41.38%	56.51%	26.79%	29.72%*** (0.000)
2016	45.20%	42.82%	44.72%	58.19%	29.75%	28.44%*** (0.000)
2017	46.19%	42.49%	45.70%	60.34%	29.42%	30.92%*** (0.000)
2018	45.54%	43.24%	44.63%	60.08%	29.43%	30.65%*** (0.000)
Dec1999-Jun2018	38.02%	35.26%	36.80%	53.26%	21.64%	31.61%*** (0.000)

This table shows the average autonomy of managers within fund families, the average weighted by total net assets in Euro equity category and by number of Euro equity funds, the average within families that are in the top tercile (T1) and in the bottom tercile (T3). Panel A reports the results of inter-family autonomy and Panel B reports the results of intra-family autonomy as defined in Equations 6 and 7. The last column shows the result of a mean-difference test between T1 and T3 with the p-values in parentheses. In all columns, the annual average is obtained using the monthly data. \*\*\*, \*\*, and \* denote statistical significance at the 1%, 5%, and 10% level, respectively.

In line with [Elton et al. \(2007\)](#) who argue that a common family approach could result in similar exposures to various industries, we consider the portfolio overlap at the industry level as the approach of the general investment outline. Then, within this investment strategy, managers can choose specific stocks that are held in portfolio holdings. We evaluate this choice capacity on a twofold approach depending on whether the general investment outline corresponds to the whole fund sample or whether it corresponds to each fund family. Firstly, we compare for each fund pair  $i$  and  $j$  in month  $t$  the excess overlap (Excess Overlap) at the industry level (Portfolio Overlap (industry)) over the stock level (Portfolio Overlap (stock)) as follows:

$$\text{Excess Overlap}_{i,j,t} = \text{Portfolio Overlap (industry)}_{i,j,t} - \text{Portfolio Overlap (stock)}_{i,j,t} \quad (3)$$

Note that the higher the excess overlap at the industry level over the stock level, the higher the level of autonomy of these two fund managers in the selection of stocks within a certain industry. The reason being that their portfolios at the stock level are more different than at the industry level. Even if they have a similar general investment outline, the resulting portfolios differ in terms of stocks when they select different specific stocks.

Secondly, we obtain the fund manager autonomy for each fund  $i$  in each month  $t$  with the average of its excess overlap values following two different approaches. In the first approach (Fund manager autonomy inter-family), the general investment outline corresponds to the whole fund sample and hence, the fund manager autonomy for each fund  $i$  is obtained with all the excess overlap values regardless of whether fund  $i$  is compared with funds within its same family  $f$  or with funds of other families. In the second approach (Fund manager autonomy intra-family), the general investment outline corresponds to the fund family and thus, the fund manager autonomy for each fund  $i$  is obtained with the excess overlap values of the comparisons with other funds that belong to the same family  $f$ .

$$\text{Fund manager autonomy inter-family}_{i,t} = \overline{\text{Excess Overlap}_{i,t}} \quad \forall i \neq j \text{ and } \forall i \in f \quad (4)$$

$$\text{Fund manager autonomy intra-family}_{i,t} = \overline{\text{Excess Overlap}_{i,t}} \quad \forall i \neq j \text{ and } \forall i, j \in f \quad (5)$$

Thirdly, we obtain the level of autonomy for each fund family  $f$  with the average of the fund manager autonomy values of all funds within the family, both at inter level (Inter-family autonomy) and intra level (Intra-family autonomy) as follows:

$$\text{Inter-family autonomy}_{f,t} = \overline{\text{Fund manager autonomy inter-family}_{i,t}} \quad \forall i \in f \quad (6)$$

$$\text{Intra-family autonomy}_{f,t} = \overline{\text{Fund manager autonomy intra-family}_{i,t}} \quad \forall i \in f \quad (7)$$

To examine whether the autonomy of managers is similar for all fund families, we also split families into terciles based on these measures. [Table 4](#) shows that we reject the null hypothesis in the mean-difference test between the average autonomy of managers within families that are in the top tercile ( $T1$ ) and the average of those that are in the bottom tercile ( $T3$ ). Therefore, our findings indicate that the autonomy is significantly higher in some families than others, regardless of the level of autonomy measure used.

We also observe that, in general, both the average weighted by total net assets and the average weighted by number of funds are lower than the equal-weighted average. This result reveals that the autonomy of managers is higher in smaller families. This could be explained by the fact that smaller families have less resources to obtain both internal and external reports on specific stocks from which fund managers' decisions can be addressed.

## 5. The fund family characteristics that enhance portfolio overlap and manager autonomy

Once we find that there are fund families with a significantly higher portfolio overlap among their funds and a significantly higher autonomy of their managers to pick stocks, we examine the family characteristics that enhance both dimensions.

### 5.1. Characteristics of fund families with higher portfolio overlap

We apply the following panel data model to examine the family characteristics that enhance portfolio overlap.<sup>5</sup>

$$\text{Family portfolio overlap}_{f,t} = f(\text{Bank}_{f,t}; \text{Family\_size}_{f,t}; \text{Family\_age}_{f,t}; \text{Family\_}\% \text{EuroEquity}_{f,t}; \varepsilon_{f,t}) \quad (8)$$

where Family portfolio overlap<sub>f,t</sub> is the portfolio overlap within fund family  $f$  in month  $t$  at stock level. Bank<sub>f,t</sub> takes a value equal to 1 when a fund family  $f$  depends on a banking or insurance company according to its governance structure. Family\_size<sub>f,t</sub> is the log-

<sup>5</sup> Previous literature has documented several factors and reasons that influence the bank-affiliated funds' decisions to increase their holdings of the parent banks' stocks. [Golez and Marin \(2015\)](#) document that fund managers serve the interest of the owners of asset management firms (the banks) with the aim of supporting their stock prices, especially, at the time of large price drops. In this sense, [Gil-Bazo et al. \(2020\)](#) show that the bank-affiliated funds support the prices of bonds issued by their parent banks during the Global Financial Crisis, GFC, in 2008 and the European sovereign debt crisis in 2011. [Gómez-Bezares and Przychodzen \(2018\)](#) also argue that the significant positive tendency for their bank-affiliated to buy the parent banks' equity funds is motivated by both external pressure and individual taste.

normal of total size of fund family  $f$  in month  $t$ .  $\text{Family\_age}_{f,t}$  is the age of fund family  $f$  obtained from the inception date of the oldest fund in the family.  $\text{Family\_EuroEquity}_{f,t}$  is the percentage of the assets under management in the Euro equity category with respect to the total assets under management in the industry within fund family  $f$  in month  $t$ .

*Bank*: Tykvová (2006) indicates that private independent fund companies typically concentrate in particular industries and establish networks in this industry within company. Therefore, we believe that there may be a higher family portfolio overlap within the independent fund families for a high degree of specialisation.

*Family\_size*: is measured as the total assets under management within a family. According to Chen et al. (2004), the size of a fund erodes fund performance. However, Zhao (2004) argues that mutual fund families obtain benefits by charging fees to investors in all funds and, therefore, they have incentives to take action with the objective of increasing the investor inflows and therefore of maximising the total assets under management. In addition, based on these findings, we consider that fund families have incentives to offer new funds although these funds are similar to existing funds in order to increase the total assets under management, while avoiding having very large funds.

We also include the interaction between *Bank* and *Family\_size* in order to distinguish larger fund families which belong to a banking group from the remaining families. We consider that within these families, the managers can have access to a high number of internal and external information reports because in this way the entire fund family benefits from the resources. In addition, based on the results of Table 3, which show that the TNA-weighted average is higher than the equal-weighted average overlap, we could expect the coefficient of this interaction to be positive and significant because the largest families belong to banking groups. Furthermore, our hypothesis is based on the idea that when we focus on the ownership of their own stocks by banking groups, the overlap is greater in fund families belonging to this banking group than in other families belonging to other banking groups. In this line, Massa and Rehman (2008) provide evidence that the ownership of an asset management company can have a significant impact on the portfolio holdings of funds.<sup>6</sup>

*Family\_age*: we consider that families start with fewer resources and less ability to control the information of a large number of stocks and thus, our hypothesis is that the family portfolio overlap may be higher in families with a short experience in the fund market.

*Family\_EuroEquity*: we also include the weight of the Euro equity funds category within each family. Following the resources-based theory of the companies (see e.g. Silverman, 1999 cited by Casavecchia and Ge, 2019), the fund families with a greater focus on a certain category could possess more institutional advantages from experience and learning. In this line, Van Nieuwerburgh and Veldkamp (2010) argue that private information acquisition through specialized learning results in a higher degree of asset concentration. Kacperczyk et al. (2005) also show that a higher degree of industry concentration is a measure of informational advantages. Therefore, the weight of the Euro equity funds category within a fund family may influence the family portfolio overlap. Specifically, our hypothesis is that the overlap may be higher in families with a higher weight in this category.

The results of the different models applied in Table 5 are robust.<sup>7</sup> The findings reveal evidence that the family portfolio overlap is higher in families which do not belong to a banking or insurance company, in line with the conclusions of Sahlman (1990) and Barry (1994) about the higher degree of specialisation of private independent fund management companies. However, when we include the interaction between the dummy variable *Bank* and the variable *Family\_size*, we find a higher family overlap in the larger bank families; these are the families which belong to larger banking groups. These results confirm our null hypothesis that these larger families may have interest in offering new funds, even when these new funds have similar portfolio holdings as existing funds. With this practice, the fund families would prefer to avoid very large funds in cases where size erodes performance. In addition, large banking groups usually have the stock of their banks listed in stock exchange. When we focus on the overlap in portfolios of stocks of banking groups, we find a statistically significant overlap in the family which belongs to this specific group than in the rest of the families which belong to other banking groups.<sup>8</sup> These results are very valuable in the Spanish mutual fund industry due to the high concentration of total net assets in few fund families and the high dependence on the banking sector compared with other European markets as documented in previous studies (Ferreira and Ramos, 2009; Ferreira et al., 2013). According to data reported by Inverco (2018), the top 10 and top 5 fund management companies manage more than 75% and 40% of the total fund assets, respectively, as opposed to other fund industries such as the UK market, where the top 10 and top 5 management companies represent 45% and 26% of the total fund assets (The Investment Association, 2019). In addition, 87% of Spanish funds are managed by banking groups, this percentage of funds notably higher with respect to other European countries such as France (23%); the United Kingdom (25%); Portugal (38%); Italy (50%) and Germany (69%) according to EFAMA (2018).

Table 5 also shows that the family overlap is higher in younger families, which may have fewer resources, and less ability to control information. Finally, the results show that the family portfolio overlap is higher in families with a higher weight in the Euro equity category. In line with previous studies on fund family specialisation (Kacperczyk et al., 2005; Van Nieuwerburgh and Veldkamp, 2010; Casavecchia and Ge, 2019), the top management of these families may allocate more resources to this category from which all of the family managers could benefit.

<sup>6</sup> In order to deal with possible endogeneity concerns, we also define Eqs. 8, 9 and A.2 with independent variables lagged by one month. The results obtained are robust and are available upon request.

<sup>7</sup> In the first, second and third largest fund families according to total net assets under management in the Spanish industry which belong to a banking group, we find that the family overlap in their banking group stock is equal to 4.23%, 4.56% and 2%, respectively. In all cases, the overlap is statistically significantly higher than in the rest of families belonging to other groups.

<sup>8</sup> We obtain that the correlation coefficient between the variable Excess Family portfolio overlap<sub>f,t</sub> and Excess Intra-family autonomy<sub>f,t</sub> is negative and low, specifically, this is equal to -0.012.

**Table 5**  
The fund family characteristics that enhance portfolio overlap.

	Prais-Winsten Coefficient	GLS Coefficient	Prais-Winsten Coefficient	GLS Coefficient	FE (robust standard errors) Coefficient	RE (robust standard errors) Coefficient
Constant	0.113*** (0.000)	-0.025 (0.627)	0.729*** (0.000)	0.479*** (0.000)	0.190*** (0.001)	0.112*** (0.003)
Bank	-0.123*** (0.000)	-0.076*** (0.000)	-0.828*** (0.000)	-0.684*** (0.000)		-0.126** (0.016)
Family_size	0.026*** (0.000)	0.033*** (0.000)	-0.024** (0.034)	-0.007 (0.468)	-0.064** (0.034)	-0.061** (0.035)
Bank x Family_size			0.056*** (0.000)	0.478*** (0.000)	0.097** (0.026)	0.099** (0.013)
Family_age	-0.004*** (0.000)	-0.005*** (0.000)	-0.004*** (0.000)	-0.005*** (0.000)	-0.005** (0.045)	-0.006** (0.037)
Family_%EuroEquity	0.040** (0.039)	0.074*** (0.006)	0.062*** (0.001)	0.074*** (0.003)	0.272** (0.012)	0.280* (0.082)
R-squared	23.74%		24.34%		8.17%	8.14%
Wald	118.18*** (0.000)	93.33*** (0.000)	169.88*** (0.000)	119.26*** (0.000)	124.52*** (0.000)	124.70*** (0.000)
Hausman Test						26.12*** (0.000)
#Observations	5667	5667	5667	5667	5667	5667

This table shows the results obtained by estimating Eq. 8, from December 1999 to June 2018, using Prais-Winsten, GLS, FE and RE with robust standard errors. The dependent variable is Family portfolio overlap $_{f,t}$  that is the portfolio overlap within fund family  $f$  in month  $t$  at the stock level and the independent variables are: Bank $_{f,t}$  that takes a value equal to 1 when a fund family depends on a banking or insurance company for its governance structure. Family\_size $_{f,t}$  is the log-normal of the total size of fund family  $f$  in month  $t$ . Bank $_{f,t}$  x Family\_size $_{f,t}$  is the interaction between the dummy variable Bank $_{f,t}$  and the variable Family\_size $_{f,t}$ . Family\_age $_{f,t}$  is the age of fund family  $f$  in month  $t$  obtained from the inception date of the oldest fund in the family. Family\_%EuroEquity $_{f,t}$  is the percentage of the assets under management in the Euro equity category with respect to the total size of fund family  $f$  in month  $t$ . The  $p$ -values are reported in parentheses. \*\*\*, \*\*, and \* denote statistical significance at the 1%, 5%, and 10% level, respectively.

## 5.2. Characteristics of fund families with higher manager autonomy

In order to detect the family characteristics that enhance the autonomy among fund managers within a family, we apply the same panel data model as for family portfolio overlap. Specifically, we use the following model.

$$\text{Intra-family autonomy}_{f,t} = f(\text{Bank}_{f,t}; \text{Family\_size}_{f,t}; \text{Family\_age}_{f,t}; \text{Family\_}\% \text{EuroEquity}_{f,t}; \varepsilon_{f,t}) \quad (9)$$

where Intra-family autonomy $_{f,t}$  is the autonomy level of managers within fund family  $f$  in the portfolio holding allocation as defined in Eq. 7. The independent variables are defined as in Eq. 8. We suggest that in the large fund families that belong to a banking group, the top-management may have a greater influence on the selection of stocks within a specific industry, because the top-management may have a higher level of stock information obtained in other areas of analysis within the group. Jordan et al. (2012) find that bank-affiliated institutional investors follow strongly the recommendations issued by their own analysts. In addition, large families have more resources and more analysts; this could have a significant influence on the trading decisions of fund managers. Therefore, our hypothesis is that there is less fund manager autonomy in the portfolio holding allocation within larger families which belong to banking groups.

The results of the different models applied in Table 6 are robust. The findings report evidence of a lower fund manager autonomy in the portfolio holding allocation within larger families which belong to a banking group. Additionally, we also analyse the effect of family age on the manager autonomy. The results of Table 6 show a higher autonomy in stock-picking within a specific industry for older fund families. This finding is in line with the study of Kozubíková et al. (2016) who test whether the time spent in the market of a company influences the autonomy of employees. They report that the older companies tend to provide a higher freedom and flexibility to develop and implement new ideas and initiatives due to the high company's positioning and stability within the market.

**Table 6**  
The fund family characteristics that enhance the manager autonomy.

	Prais-Winsten Coefficient	GLS Coefficient	Prais-Winsten Coefficient	GLS Coefficient	FE (robust standard errors) Coefficient	RE (robust standard errors) Coefficient
Constant	0.525*** (0.000)	0.488*** (0.000)	0.261 (0.345)	0.218** (0.019)	0.529*** (0.005)	0.273** (0.033)
Bank	0.129*** (0.000)	0.088*** (0.000)	0.431*** (0.000)	0.418*** (0.000)		0.108*** (0.006)
Family_size	-0.025*** (0.000)	-0.023*** (0.000)	-0.004 (0.550)	-0.002 (0.827)	0.058** (0.015)	0.053** (0.017)
Bank x Family_size			-0.024*** (0.002)	-0.025*** (0.001)	-0.084** (0.016)	-0.086*** (0.005)
Family_age	0.007*** (0.000)	0.007*** (0.000)	0.007*** (0.000)	0.007*** (0.000)	0.002** (0.017)	0.003** (0.013)
Family_%EuroEquity	0.023 (0.119)	0.068*** (0.002)	0.014 (0.348)	0.055** (0.015)	0.100 (0.343)	-0.094 (0.335)
R-squared	50.56%		50.55%		14.27%	14.22%
Wald	351.44*** (0.000)	197.97*** (0.000)	351.27*** (0.000)	187.85*** (0.000)	123.90*** (0.000)	119.90*** (0.000)
Hausman Test						27.68*** (0.000)
#Observations	5667	5667	5667	5667	5667	5667

This table shows the results obtained by estimating Eq. 9, from December 1999 to June 2018, using Prais-Winsten, GLS, FE and RE with robust standard errors. The dependent variable is Intra-family autonomy<sub>f,t</sub> which is the autonomy level of managers within fund family *f* in month *t* and the independent variables are: Bank<sub>f,t</sub> that takes a value equal to 1 when a fund family depends on a banking or insurance company for its governance structure. Family\_size<sub>f,t</sub> is the log-normal of the total size of fund family *f* in month *t*. Bank<sub>f,t</sub> x Family\_size<sub>f,t</sub> is the interaction between the dummy variable Bank<sub>f,t</sub> and the variable Family\_size<sub>f,t</sub>. Family\_age<sub>f,t</sub> is the age of fund family *f* in month *t* obtained from the inception date of the oldest fund in the family. Family\_%EuroEquity<sub>f,t</sub> is the percentage of the assets under management in the Euro equity category with respect to the total size of fund family *f* in month *t*. The *p*-values are reported in parentheses. \*\*\*, \*\*, and \* denote statistical significance at the 1%, 5%, and 10% level, respectively.

## 6. Performance of investors in a single fund family

Following previous literature that reveals evidence that individual investors usually concentrate all of their fund investments in a single fund family (Massa, 2003; Gerken et al., 2018), and considering our results, which show that some characteristics of the fund families have an influence on the levels of portfolio overlap and manager autonomy. In this section, our objective is to test whether the initial selection of fund family plays an important role in investors' performance. We hypothesize that the level of overlap of the funds and manager autonomy in the portfolio holding allocation within a fund family could influence that performance because these dimensions are different among fund families depending on their characteristics. Elton et al. (2007) argue that investors are negatively affected when they pick a fund family with a high correlation between its funds. Kacperczyk and Seru (2012) also show that, compared with funds from families with a centralised decision-making process, funds from decentralised families offer greater autonomy to their managers, as well as incentives and flexibility to produce more valuable information and thus, resulting in more benefits for investors. Therefore, we suggest that individual investors could obtain benefits from a higher level of management autonomy in a setting in which fund managers freely pick stocks within each industry.

To examine whether the family portfolio overlap and the fund manager autonomy within a family influence the performance of the fund and thus, the results for investors who decide to invest in it, we apply the following FE model according to the result of Hausman test:

$$\text{Excess Family return}_{f,t} = \alpha_{f,t} + B_1 \text{Excess Family portfolio overlap}_{f,t} + B_2 \text{Excess Intra-family autonomy}_{f,t} + \varepsilon_{f,t} \quad (10)$$

where Excess Family return<sub>f,t</sub> is the difference between the average daily net return of all funds in fund family *f* and the average daily net return of the rest of funds that are in other families different from family *f* on day *t*. Excess Family portfolio overlap<sub>f,t</sub> is the difference between the average portfolio overlap of family *f* and the average portfolio overlap of all families. Excess Intra-family autonomy<sub>f,t</sub> is the difference between the average autonomy in family *f* and the average autonomy from all families.

In Eq. 10, the independent variables of each fund are included as the deviation from the average of all funds in our sample.<sup>9</sup> We apply this model with daily return data, and we consider the constant monthly portfolio overlap data on every day of the month.

Table 7 shows the results of Eq. 10. The findings reveal that the excess portfolio overlap in a family with respect to all funds in our sample has a statistically significantly negative influence on investors' returns whereas, the excess fund manager autonomy has a

<sup>9</sup> For robustness purposes, we also apply the Kruskal-Wallis nonparametric test to examine the existence of differences between the portfolio overlap of fund pairs from the same family and from different families. The statistical significance of the results is the same. Note that this test has also been applied in Tables 3 and 4.

**Table 7**  
Family portfolio overlap, fund manager autonomy and investors' return.

	Coefficient
Constant	−0.001*** (0.001)
Excess Family portfolio overlap	−0.008** (0.027)
Excess Intra-family autonomy	0.013** (0.044)
Hausman Test	6.24**
R-squared	6.37%
Wald	62.30*** (0.000)

This table shows the results obtained by estimating Eq. 10, from December 1999 to June 2018, using FE with robust standard errors, which is supported by the Hausman test. The variable Excess Family return $_{f,t}$  is the difference between the average daily net return of all funds in fund family  $f$  and the average daily net return of the rest of funds that are in other families different from family  $f$  on day  $t$  and the independent variables are detailed hereafter. Excess Family portfolio overlap $_{f,t}$  is the excess of portfolio overlap of fund family  $f$  with respect to the average portfolio overlap of all funds on day  $t$  and Excess Intra-family autonomy $_{f,t}$  is the difference between the average autonomy of managers in family  $f$  and the average autonomy of managers of all families. Net return data is provided daily, and we consider that the monthly portfolio overlap data is constant during all the month. The  $p$ -values are reported in parentheses. \*\*\*, \*\*, and \* denote statistical significance at the 1%, 5%, and 10% level, respectively.

significantly positive influence. Individual investors who concentrate their funds in a single family with a high family portfolio overlap have under-diversified their fund investment decisions, as we found in previous sections, and they obtained a lower return. However, investors seem to benefit from a lower similarity between fund portfolio holdings and a higher degree of fund manager autonomy in the portfolio holding allocation within a family. Fund managers have more incentives and flexibility to add value to the fund management within families where there is a higher level of autonomy in the portfolio holding allocation according to [Kacperczyk and Seru \(2012\)](#). Therefore, in view of the fact that individual investors concentrate their investment in a single family ([Massa, 2003](#); [Clare et al., 2014](#); [Gerken et al., 2018](#)) we conclude that the initial selection of a fund family is a crucial decision for investors' performance.

## 7. Conclusions

Earlier literature finds that individual investors concentrate their fund investment decisions in a single fund family and thus, the potential diversification and performance of investors are restricted to this selected fund family. This paper investigates whether the consequences of this fund concentration depend on the portfolio overlap among portfolio holdings as well as the manager autonomy within a family.

Overall, we find a higher resemblance among portfolio holdings of fund pairs within the same fund family than across families. However, we also find significant differences among fund families both in terms of the portfolio overlap and manager autonomy. These results could be explained by their different characteristics because some family characteristics enhance these two dimensions. Specifically, the resemblance is higher in larger families which belong to a banking group and do not have wide experience in the fund market. These families could have incentives to offer two twin funds rather than one large one in order to prevent the fund size from eroding its performance, while taking full advantage of their mutual fund analysts. Less experienced families, however, would have fewer resources to have full financial markets coverage. In addition, we find a higher autonomy in portfolio holding allocation within stock sectors in smaller fund families with wide experience that do not belong to a banking group.

Regarding the economic implications for individual investors who concentrate their mutual funds within a single family whose characteristics enhance portfolio overlap or manager autonomy, we find that a higher resemblance between portfolio holdings not only causes fund families to offer a lower diversification to individual investors, it also has a significantly negative economic effect on them. However, individual investors seem to benefit from a higher autonomy in portfolio holding allocation. Therefore, we conclude that investors could have incentives to concentrate all the fund investments in these families in which the potential diversification and fund manager autonomy are higher. These results are also interesting for the top management of mutual fund family because of the positive relation between past performance and future fund flows. Given that we find that diversification and manager autonomy have a positive impact on the investors' performance, the top management of fund families could consider encouraging diversification of portfolios between funds within the same family as well as manager's autonomy in decision-making.

Although academics show that investors often concentrate all of their fund investments in the same family, we suggest that investors could improve their diversification level by selecting funds across families, given that the portfolio overlap between fund pairs in different families is lower. In this line, it would be interesting for future research to examine whether there are family pairs that have a significant similarity and to study the characteristics of these families.

Finally, the conclusions of this study have economic consequences, particularly for the Spanish mutual fund market due to the high similarity level among portfolios within the largest banking groups. Because of the high concentration of total net assets in few fund families and dependence on banking sector, these findings are interesting for industry regulators because a large proportion of

individual investors could have their fund investments under-diversified. Nevertheless, the decreasing trend in the portfolio overlap over time could be an indication of an improvement in the efficiency within families and of a reduction in the systemic risk and fragility of the market.

### Author statement

**Laura Andreu:** Conceptualization, Visualization, Writing – Review & Editing, Supervision

**Ruth Gimeno:** Conceptualization, Software, Formal analysis, Writing – Original Draft

**Cristina Ortiz:** Conceptualization, Methodology, Writing – Review & Editing, Supervision

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### Appendix 1 Robustness analyses of the portfolio overlap

Following the studies of [Delpini et al. \(2019\)](#) and [Fricke and Fricke \(2021\)](#), we adopt the cosine similarity between funds  $i$  and  $j$  to measure the portfolio overlap between the two portfolios as follows:

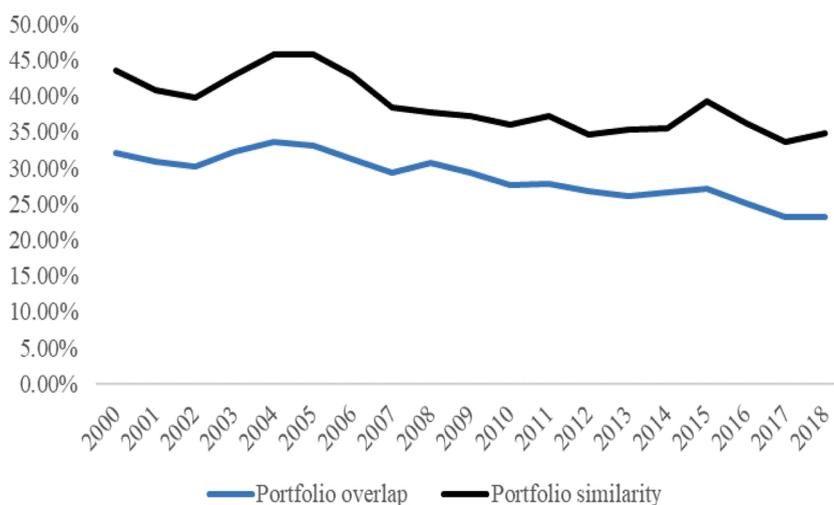
$$\text{Portfolio Similarity}_{i,j,t} = \frac{\sum_{k=1}^K w_{i,k,t} w_{j,k,t}}{\sqrt{\sum_{k=1}^K (w_{i,k,t})^2} \sqrt{\sum_{k=1}^K (w_{j,k,t})^2}} \quad (\text{A.1})$$

**Table A1**

Overall results of the portfolio similarity measure at the fund pair level.

Year	Portfolio similarity	#fund pairs (same fund family)	#fund pairs (different fund family)	Portfolio similarity (same fund family)	Portfolio similarity (different fund family)	Mean-difference test
Panel A: Stock						
2000	43.51%	282	11,520	54.89%	43.24%	11.65%*** (0.000)
2001	40.78%	341	13,827	44.79%	40.68%	4.11%*** (0.000)
2002	39.72%	354	14,261	44.21%	39.62%	4.59%*** (0.000)
2003	42.80%	340	15,175	48.98%	42.67%	6.32%*** (0.000)
2004	45.71%	337	13,592	52.40%	45.54%	6.85%*** (0.000)
2005	45.74%	391	14,415	52.48%	45.55%	6.93%*** (0.000)
2006	42.80%	421	15,621	47.06%	42.68%	4.37%*** (0.000)
2007	38.36%	474	16,648	43.00%	38.18%	4.82%*** (0.000)
2008	37.73%	468	16,032	39.23%	37.66 %	1.57%*** (0.000)
2009	37.16%	422	14,054	41.78%	36.99%	4.79%*** (0.000)
2010	36.06%	255	10,917	42.13%	35.87%	6.26%*** (0.000)
2011	37.31%	236	9864	45.98%	37.06%	8.92%*** (0.000)
2012	34.73%	193	7712	46.81%	34.37%	12.44%*** (0.000)
2013	35.26%	166	6289	42.92%	35.05%	7.87%*** (0.000)
2014	35.59%	97	4619	44.09%	35.39%	8.69%*** (0.000)
2015	39.31%	104	5203	45.05%	39.16%	5.89%*** (0.000)
2016	36.21%	93	4737	40.60%	36.12%	4.48%*** (0.000)
2017	33.61%	75	4260	41.38%	33.46%	7.92%*** (0.000)
2018	34.80%	65	4061	43.38%	34.63%	8.74%*** (0.000)
Dec1999-Jun2018	40.94%	994	32,982	46.69%	40.79%	5.90%*** (0.000)
Panel B: Sector						
Dec1999-Jun2018	69.40%	994	32,982	74.71%	69.26%	5.46%*** (0.000)
Panel C: Industry						
Dec1999-Jun2018	75.60%	994	32,982	79.91%	75.48%	4.43%*** (0.000)

Panel A, Panel B and Panel C report the results of portfolio similarity measure at the stock level, at the sector level and at the industry level, respectively. This table shows, for each year, the overall average portfolio similarity and the number of fund pairs within the same fund family and the number of fund pairs in different families, as well as their average overlap. In this table, we present a yearly report of the number of fund pairs during the sample period, unlike in [Table 1](#) where we present the total number only at four specific points during the sample period. The last column shows the results of the mean difference test between both specific averages with the  $p$ -value in parentheses. We apply the mean difference test for unpaired samples with different variance (in all cases the null hypothesis is rejected in the test of equal variance). In all columns, the annual average is obtained with the monthly portfolio similarity data. The study period starts in December 1999 and ends in June 2018. \*\*\*, \*\*, and \* denote statistical significance at the 1%, 5%, and 10% level, respectively.



**Fig. A1.** Evolution of the portfolio overlap and portfolio similarity among fund pairs.

This figure represents the evolution of the annual average of the portfolio overlap and the portfolio similarity among Spanish Euro equity funds obtained from monthly values from January 2000 to June 2018.

where  $Portfolio\ Similarity_{i,j,t}$  is the value of the portfolio similarity between funds  $i$  and  $j$  in month  $t$ ;  $w_{i,k,t}$  is the portfolio weight of stock  $k$  in fund  $i$  in month  $t$ ;  $w_{j,k,t}$  is the portfolio weight of stock  $k$  in fund  $j$  in month  $t$ . The magnitude of this metric depends on two factors: the number of common stocks and the weights attached to common stocks.

Table A1 provides the average portfolio similarity obtained in Eq. A.1. These results provide evidence of a higher similarity levels among portfolios than those reported by the portfolio overlap measure (Eq. 1). Nevertheless, the Pearson correlation coefficient between both measures is equal to 89.19%, 94.41% and 90.93% for the portfolio overlap at the stock, sector and industry levels, respectively. These correlation coefficients are statistically significant at 1%. Table A1 also reports a statistically significant higher similarity level in fund pairs within the same fund family than in fund pairs from different families. Fig. A1 shows the evolution of the portfolio overlap and the portfolio similarity levels over time. As can be observed, both measures report a similar evolution over time.

For robustness purposes, we also apply the similarity measure to the fund family analyses. The Pearson correlation coefficient between the family portfolio overlap values and the family portfolio similarity values is equal to 84.42% (statistically significant at the 1% level). The findings also lead us to reject the null hypothesis that all fund families have the same portfolio overlap between their funds. Finally, we obtain similar results on the characteristics of fund pairs with the highest portfolio overlap and the characteristics of fund families that enhance portfolio overlap among their funds. The results are available upon request.

## Appendix 2 Characteristics of fund pairs with higher portfolio overlap

In order to determine the characteristics of fund pairs with higher portfolio overlap at the stock level, we estimate the following random effects (RE) model according to the result of Hausman test.

$$Portfolio\ overlap_{i,j,t} = f(Fund\_size_{i,j,t}; Fund\_age_{i,j,t}; Fund\_stocks_{i,j,t}; Fund\_fees_{i,j,t}; Fund\_return_{i,j,t}; Fund\_family_{i,j,t}; Time_t; \varepsilon_{i,j,t}) \quad (A.2)$$

where the dependent variable is the Portfolio overlap $_{i,j,t}$  between funds  $i$  and  $j$  in month  $t$  at the stock level and the independent variables are dummy variables. In order to define these dummy variables, we calculate the percentile rank of each characteristic for all the funds in our sample every month  $t$  ( $Fund\_size$ ;  $Fund\_age$ ;  $Fund\_stocks$ ;  $Fund\_fees$ ;  $Fund\_return$ ), and we determine the quintile into which funds  $i$  and  $j$  are. For each characteristic, we include four dummy variables: *Same* takes a value equal to 1 when, in month  $t$ , funds  $i$  and  $j$  are in the same quintile and 0, otherwise. *BothQ1* takes a value equal to 1 when, in month  $t$ , funds  $i$  and  $j$  are in the top quintile. *BothQ5* takes a value equal to 1 when, in month  $t$ , funds  $i$  and  $j$  are in the bottom quintile. *Opposite* is equal to 1 when in month  $t$ , either fund  $i$  or fund  $j$  is in the top quintile and in the other is in the bottom quintile. As a robustness test for the results in Table 2, the model also controls for whether or not a pair of funds belong to the same fund family.  $Fund\_family_{i,j,t}$  is equal to 1 when funds  $i$  and  $j$  in month  $t$  are in the same fund family and 0, otherwise. In addition, we include the variable  $Time_t$  in order to test the pattern of the portfolio overlap over time.  $Time_t$  ranges from 1 in the first month to 223 in the last month.

*Fund\_size*: is measured as the total net assets. According to Kacperczyk and Seru (2007), larger funds enjoy a greater reputation and pay higher wages, employing managers who are more skilled. Therefore, our hypothesis is based on the idea that managers of larger funds may have common information because they have more resources to access this information, and consequently, the portfolio overlap would be higher in fund pairs where both funds are among the largest.

*Fund\_age*: is determined from mutual fund inception. Some authors argue that young funds are at a disadvantage as they might

suffer from lack of market experience (Agnesens, 2013; Ben Belgacem and Hellara, 2011). Chevalier and Ellison (1997) show that young funds behave differently from old funds with respect to the flow-performance relationship. Thus, the incentives of fund manager to alter the riskiness of portfolio is also different in both fund groups. In this line, we suggest that the fund age may influence the investment style and the management decisions by mutual fund managers.

*Fund\_#stocks*: we obtain the number of stocks from portfolio holdings. Our intuition is based on the idea that the similarity of number of stocks held may be related to the portfolio overlap in a fund pair. Kacperczyk et al. (2005) find that managers of more diversified funds (that is with higher number of different stocks) hold a portfolio that closely resembles the total market portfolio. However, concentrated funds, which are the funds with a lower number of stocks, follow distinct investment styles. In accordance with these authors, we think that the portfolio overlap may be higher for the fund pairs in which both funds have a high number of stocks.

*Fund\_fees*: we include the management and the deposit fees of each fund. According to the previous literature, the effect of fund fees on managerial ability and fund behaviour is not clear. Prather et al. (2004) find a positive impact of fees on performance if these expenses are to support research. Gil-Bazo and Ruiz-Verdú (2009) find that fund performance worsens with increasing fund management fees, while Chen et al. (2004) argue that there is no relationship between management fees and fund performance. We suggest that fund fees may be related to a greater research effort and, therefore, managers of funds with higher fees have a higher level of information that leads them to make similar decisions in their portfolio holdings.

*Fund\_return*: is the prior-year gross return. Previous literature has documented that fund managers may have different reactions to extreme returns. On the one hand, managers of funds with a high past performance, may close positions influenced by the disposition effect (Cici, 2012). On the other hand, managers of funds that show the lowest past returns may start to make different decisions or may follow a risk-shifting strategy to improve their outcome and thus avoid withdrawals of funds by investors (Chen et al., 2010), because their reputations and salaries may depend on their performance record (Massa and Patgiri, 2009). Yet others may continue to make

**Table A2**  
Portfolio overlap and characteristics of mutual funds.

		Coefficient
Fund_size	Constant	0.309*** (0.000)
	Same	-0.001 (0.432)
	BothQ1	0.021*** (0.000)
	BothQ5	-0.010*** (0.000)
	Opposite	-0.002** (0.027)
Fund_age	Same	0.005*** (0.000)
	BothQ1	-0.015*** (0.005)
	BothQ5	-0.031*** (0.000)
	Opposite	0.000 (0.666)
Fund_#stocks	Same	0.012*** (0.000)
	BothQ1	0.009*** (0.000)
	BothQ5	-0.021*** (0.000)
	Opposite	-0.016*** (0.000)
Fund_fees	Same	0.010*** (0.000)
	BothQ1	0.015*** (0.000)
	BothQ5	-0.008*** (0.000)
	Opposite	0.000 (0.784)
Fund_return	Same	0.010*** (0.000)
	BothQ1	-0.009*** (0.000)
	BothQ5	-0.001 (0.279)
	Opposite	-0.010*** (0.000)
Fund_family		0.068*** (0.000)
Time		-0.003*** (0.000)
#Observations		1,374,463
Wald		2,241.69*** (0.000)
R-squared		6.22 %
VIF		1.23

This table shows the results obtained by estimating Eq. A.2, from December 1999 to June 2018, using RE with robust standard errors, which is supported by the Hausman test. The dependent variable is the Portfolio Overlap $_{i,j,t}$  at the stock level and the independent variables are dummy variables. We calculate the percentile rank of each fund-month for each characteristic (*Fund\_size*, *Fund\_age*, *Fund\_#stocks*, *Fund\_fees* and *Fund\_return*) and we determine the quintile into which mutual funds are. For these characteristics, the model includes four dummy variables: *Same* takes a value equal to 1 when fund *i* and *j* are in the same quintile in month *t*. *BothQ1* takes a value equal to 1 when funds *i* and *j* are in the top quintile in month *t*. *BothQ5* takes a value equal to 1 when fund *i* and *j* are in the bottom quintile in month *t*. *Opposite* is equal to 1 when either fund *i* or fund *j* is in the top quintile and the other is in the bottom quintile in month *t*. *Fund\_family* $_{i,j,t}$  is equal to 1 when, in month *t*, funds *i* and *j* are in the same family. *Time* $_t$  ranges from 1 in the first month to 223 in the last month. The *p*-values are reported in parentheses. \*\*\*, \*\*, and \* denote statistical significance at the 1%, 5%, and 10% level, respectively.

similar decisions influenced by their cognitive biases or top-management strategies.

Time: we include this variable to test the statistical significance of the evolution of portfolio overlap over time because we observe a decreasing pattern in Table 2 and also, because the financial sector has suffered an intense restructuring process during the last years that may have influenced this phenomenon.

Table A2 shows the results of Eq. A.2. The coefficient of the dummy variable *Fund family* is positive and statistically significant, showing that the portfolio overlap is higher for fund pairs within the same family than for fund pairs in different families. This result is in line with the findings of Elton et al. (2007) and Pool et al. (2015) who argue that this is due to shared analysts and other shared stock-selection resources. Regarding the Time variable, the results provide evidence of a significantly negative pattern over time.

Focusing on the fund characteristics, we find that when two funds have very different sizes, or both are among the smallest funds; their portfolio overlap is significantly lower. In this line, Pool et al. (2015) also find that the overlap between funds that have different sizes is lower, statistically significant at the 1% level. However, we also find that in a pair where both funds are the largest, the portfolio overlap is significantly higher. These results are in line with our hypothesis that managers of large funds may have common skills and access to a common higher level of information.

According to the age variable, we find that portfolio overlap is significantly higher in fund pairs with similar ages, but when these funds are not among neither the youngest nor the oldest funds. The oldest funds, which have sufficient experience in the market, could develop their own portfolio holding strategy allocation. While the youngest funds, which face the challenge of getting market share, have incentives to offer differentiated portfolios as much as possible from those existing funds according to Mamaysky and Spiegel (2002) and Khorana and Servaes (2012).

Table A2 also shows that the portfolio overlap is significantly higher (lower) in fund pairs that have the highest (lowest) number of stocks held in portfolio holdings and the highest (lowest) fees. Regarding the number of stocks variable, the result is in line with the conclusion of Kacperczyk et al. (2005) who argue that managers of more diversified funds hold portfolios that look like the total market portfolio and more concentrated funds follow distinct investment styles.

With respect to the fees variable, the results could be explained by the relationship between fund fees and a greater research effort. Thus, managers of funds with higher fees have a higher level of matching information that leads them to make similar decisions.

In relation to the prior-year gross return, we find that the portfolio overlap is higher in fund pairs that have similar prior-year gross returns, but we do not observe this result in cases where fund pairs have the highest or lowest prior-year gross return. These results confirm our hypothesis that fund managers' reactions to an extreme performance may be different and consequently, the portfolio overlap between their funds is lower.

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