THE INVESTMENT GRADE AND FUNDS' PORTFOLIO **ALLOCATION IN GREEK ASSETS**

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ABSTRACT

ENNADO The importance of investment funds for the global economy has increased in the aftermath of the global financial crisis. In the present paper, we focus on the case of Greece and the developments in investment funds' portfolios, with a special emphasis on the period before the sovereign credit rating upgrade of Greece to investment grade. By means of a differences-in-differences estimator, we find that, in the aftermath of the change in Greece's sovereign credit rating outlook to positive by the rating agency Standard and Poor's (S&P), investment funds increased their holdings of Greek sovereign bonds in relation to other comparable euro area sovereign bonds. Next, in a dynamic panel data model setup we find that this increase in investment funds' positions in Greek government bonds (GGBs) explains about 80% of the reduction in Greek sovereign bond spreads. Our results highlight the strong association between investment funds' portfolio allocation and the underlying assets' credit ratings, and provide incentives for continuing reforms that may lead to rating upgrades, as a means of increasing demand for Greek sovereign bonds and controlling the cost of debt. This is especially important when the monetary policy environment becomes tighter and interest rates, as well as the cost of funding, increase.

Keywords: Demand-based asset pricing; investment funds; sovereign bonds; credit ratings

JEL: F21; G12; G15; G24; H63

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Η ΕΠΕΝΔΥΤΙΚΗ ΚΑΤΗΓΟΡΙΑ ΚΑΙ ΟΙ ΤΟΠΟΘΕΤΗΣΕΙΣ ΤΩΝ ΕΠΕΝΔΥΤΙΚΩΝ ΚΕΦΑΛΑΙΩΝ ΣΕ ΕΛΛΗΝΙΚΟΥΣ ΤΙΤΛΟΥΣ

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ΠΕΡΙΛΗΨΗ

Η σημασία των επενδυτικών κεφαλαίων για τη χρηματοδότηση της παγκόσμιας οικονομίας έχει αυξηθεί πολύ τα χρόνια μετά την παγκόσμια χρηματοπιστωτική κρίση. Τα επενδυτικά κεφάλαια επενδύουν τα διαθέσιμά τους σε χαρτοφυλάκια αξιογράφων, σε στενή συνάφεια με τις πιστοληπτικές αξιολογήσεις των τελευταίων. Έτσι, οι αναβαθμίσεις των πιστοληπτικών αξιολογήσεων της ελληνικής οικονομίας και κυρίως η προοπτική για την αναβάθμιση στην επενδυτική κατηγορία οδήγησαν σε σημαντική αύξηση των τοποθετήσεων των επενδυτικών κεφαλαίων σε ελληνικά κρατικά ομόλογα. Συγκεκριμένα από το δ' τρίμηνο του 2022 έως το γ' τρίμηνο του 2023, η αξία των ελληνικών αξιογράφων στα χαρτοφυλάκια των διεθνών επενδυτικών κεφαλαίων αυξήθηκε κατά 7 δισεκ. ευρώ, ενώ, αν απομονωθεί η επίδραση της αύξησης των τιμών των μετοχών και των ομολόγων εκείνη την περίοδο, η αύξηση αυτή υπολογίζεται σε 5 δισεκ. ευρώ, εκ των οποίων 2,9 δισεκ. ευρώ αφορούν θέσεις σε μετοχές και 2,1 δισεκ. ευρώ θέσεις σε ομόλογα.

Στην παρούσα μελέτη εξετάζεται κατά πόσον οι αυξήσεις στις τοποθετήσεις των επενδυτικών κεφαλαίων σε ελληνικά ομόλογα ξεπέρασαν τη γενικότερη τάση στην αγορά και εκτιμάται η επίδραση της αυξημένης ζήτησης στις αποδόσεις των ελληνικών κρατικών ομολόγων. Τα ευρήματα υποδεικνύουν ότι η μεταβολή των προοπτικών της κρατικής πιστοληπτικής αξιολόγησης της ελληνικής οικονομίας σε θετικές από τον οίκο Standard and Poor's (S&P) τον Απρίλιο του 2023 οδήγησε σε σημαντική αύξηση των θέσεων των επενδυτικών κεφαλαίων σε ελληνικά κρατικά ομόλογα, η οποία ξεπέρασε τις εξελίξεις που παρατηρήθηκαν σε άλλα κρατικά ομόλογα της ζώνης του ευρώ. Η εξέλιξη αυτή εκτιμάται ότι οδήγησε σε μείωση στις αποδόσεις των ελληνικών κρατικών ομολόγων που αντιστοιχεί σε περίπου 80% της πτώσης των διαφορών αποδόσεών τους έναντι των γερμανικών ομολόγων αναφοράς.

Τα αποτελέσματα αυτά είναι σημαντικά για δύο λόγους. Αφενός, η αύξηση της ζήτησης ελληνικών αξιογράφων παρατηρήθηκε σε μια περίοδο κατά την οποία τα επενδυτικά κεφάλαια μείωναν τις θέσεις τους σε ομόλογα με χαμηλές πιστοληπτικές αξιολογήσεις. Αφετέρου, η μείωση στις αποδόσεις των ελληνικών κρατικών ομολόγων, που εξηγείται σε μεγάλο βαθμό από την αύξηση των θέσεων των διεθνών επενδυτικών κεφαλαίων, υπερκέρασε τις αυξητικές πιέσεις που παρατηρήθηκαν στα ομόλογα διεθνώς λόγω των αυξήσεων των επιτοκίων. Κατά συνέπεια, τα αποτελέσματα αυτά υπογραμμίζουν τη σημασία της αναβάθμισης στην επενδυτική κατηγορία της κρατικής πιστοληπτικής αξιολόγησης της ελληνικής οικονομίας, καθώς, εκτός των άλλων, επιφέρει αύξηση της ζήτησης για ελληνικά κρατικά ομόλογα και, ως εκ τούτου, σημαντική βελτίωση στο κόστος δανεισμού του Ελληνικού Δημοσίου.

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INTRODUCTION Т

Ever since the global financial crisis (GFC) of 2007-2009, the role of market-based financing of economic activity has become more important globally. The shift towards market-based financing can be attributed to several factors, including the weakness of the banking sector in the aftermath of the crisis, combined with central banks' increased attention to market developments.¹ Thus, market actors, such as investment funds, and analytical tools, such as credit ratings, have also gained in importance.

In the present study, we examine the effects of a credit rating upgrade on the cost of market funding through investment funds' holdings. In particular, we pursue the idea that key investors, such as investment funds, allocate their holdings across different bond issuers based on credit ratings and credit rating outlooks. As a result, ratings affect bond yields and the cost of funding of bond issuers by affecting investors' risk taking. We examine whether bond investment portfolios are affected by credit ratings and, then, to what extent changes in investment funds' portfolios affect sovereign bond yields. We use recent developments in Greece's sovereign credit rating to study the impact of ratings on investment funds' holdings and, subsequently, their effects on the cost of funding of public debt.

Sovereign credit ratings are an important determinant of the cost of funding of public debt in sovereign bond markets.² Their relationship with sovereign bond yields becomes even more important, as it may actually determine the sustainability of public debt: in particular, as shown by Ghosh et al. (2013) and Blanchard (2019), the main conditionality for public debt sustainability is a low level of interest rates, compared to the growth rate of the economy. Then, if, as shown in previous studies, some of which are cited herein, credit ratings determine the market risk premium demanded by investors as a compensation for sovereign credit risk, a linkage between credit ratings and debt sustainability is established: credit ratings affect sovereign risk premia, which then determine the path to debt sustainability.

Developments in Greece's sovereign credit rating, before its upgrade to investment grade in 2023 Q3/Q4, motivate our analysis. The case of Greece may provide evidence of the mechanics of portfolio rebalancing due to changes in credit ratings, with broader implications for public debt and financial stability. To this end, we make use of a granular dataset of interna-

^{(2010),} Aizenman et al. (2013), Malliaropulos and Migiakis (2018).





The views expressed in this article are of the authors and do not necessarily reflect those of the Bank of Greece. The authors are responsible for any errors or omissions.

See, among others, Altavilla et al. (2019) and Lo Duca et al. (2016). See, among others, Cantor and Packer (1996), Livingston et al.

tional investment funds' portfolio positions, at fund level, to assess trends and dynamics in their portfolio allocation. Then, we focus on the prospect of an upgrade of the sovereign credit rating of Greece to investment grade and make use of a detailed, security-level dataset of investment funds' portfolios. With this dataset we examine whether changes in investment funds' portfolio allocation towards Greek assets, due to the prospect of an upgrade of the sovereign rating to investment grade, affected sovereign bond yields.

In a nutshell, we find that after the rating agency S&P changed the outlook on its sovereign credit rating for Greece to positive, international investment funds increased their positions in Greek sovereign bonds and equities and this resulted in a substantial decrease in Greek sovereign bond yields. This development came at a time when investment funds globally rebalanced their portfolios towards safer investment positions. Next, we employ a demand-based asset pricing framework to examine the effects that changes in investment funds' holdings of Greek sovereign bonds have had on the yields of these bonds. To this end, we estimate the relationship between investment funds' portfolio holdings and Greek sovereign bond yields. Finally, by distinguishing the effects that the change in outlook to positive by S&P has had on investment funds' holdings of Greek sovereign bonds, we conclude that they account for about 80% of the total reduction in spreads. The implications of this finding are important: a permanent increase in funds' holdings may lower the cost of funding of Greek public debt, thus enhancing its sustainability.

The present study is structured as follows: Section 2 motivates the examination by outlining some stylized facts, as well as findings of previous studies on investment funds' portfolio allocation. Section 3 describes the dataset and provides some preliminary findings. Section 4 presents the findings of the empirical analysis. Finally, Section 5 concludes and discusses the implications of the present study.

2 INVESTMENT FUNDS: STYLISED FACTS

Investment funds are entities that pool individual investors' savings and allocate them collectively in portfolios of financial assets. Usually, these assets are securities issued and traded in financial markets. Investment funds intermediate between individual investors and the entities that require funding from markets. In order to distinguish their impact on financial intermediation from standard bank institutions, these entities are identified as "Non-Bank Financial Intermediaries" (NBFIs).

In recent years, the importance of investment funds has grown, in comparison to banks, as has market-based funding of the global economy. In particular, according to the Financial Stability Board, the size of the NBFI sector has grown two times since 2009, while 2022 marked the first year since the GFC, when the asset side of the NBFIs balance sheet declined somewhat (see Chart 1 below). Especially in the years up to 2017, the financial assets of NBFIs had grown at an average rate that was twice that of banks. As a result, the proportion of NBFIs' assets to total financial assets globally had grown to 49.8% by late 2021, up from 42.9% in 2008.

The non-bank financial intermediation sector is a very broad category, which comprises five sub-categories, according to the economic functions performed by NBFI entities. Grouping NBFIs according to their economic functions provides an overview of their activities. Table 1 outlines the separate sub-groups of the NBFI sector.

As shown in Table 1, investment funds belong to the sub-category "Economic function 1", as they consist of vehicles delegated with collectively managing the portfolios of individual investors (so-called "end investors"), while the ease of liquidating end-investor positions by redeeming the shares of the fund makes them susceptible to runs (IMF 2015). According to the Financial Stability Board, this category has grown much more rapidly than the remaining





NBFIs: by the end of 2022, the group of entities classified under "Economic function 1" constituted about 75% of the NBFI sector, up from just 44% at end-2008. At the same time, this development fostered the shift of the economy towards market-based funding. For example, Altavilla et al. (2019) find that as euro area banks tightened their credit standards following the GFC, economic entities, such as firms, established a stronger access to market funding.

Although this development was very important, as it provided an alternative to the constrained

bank financing at the time, it also made the world economy more vulnerable to changes in market conditions. For example, previous studies show that entities that are relying more on market-based funding are more prone to financial sector turmoil (see, e.g., Rajan 2005). Also, as highlighted in a study by the US Office of Financial Research (2013), investment funds focusing on short-term funding activities may be more vulnerable to shifts in liquidity preferences by investors. The period of the Covid-19 shock has provided a prominent example of such vulnerability. Vissing-Jorgensen (2021)

Sub-category	Definition	Entity types (indicative)			
Economic function 1	Collective investment vehicles susceptible to runs	Money market funds, fixed income funds, mixed funds			
Economic function 2	Loan provision based on short-term funding	Finance companies, leasing/factoring companies, consumer credit companies			
Economic function 3	Intermediation of market activities	Broker-dealer, securities finance companies			
Economic function 4	Facilitation of credit creation	Credit insurance companies, financial guarantors, monoline insurers			
Economic function 5	Securitisation-based credit intermediation	Securitisation vehicles, structured finance vehicles, asset-backed securities			
Source: Financial Stability Board (2023).					

Table | Economic functions of NBFIs



shows that large outflows from bond mutual funds resulted in sales of US Treasuries that ended up in yield spikes. The fact that this channel of transmission of funds' liquidity needs to asset prices affected bonds considered to be the benchmark of safe assets, i.e. US Treasuries, demonstrates the degree of vulnerability of investment funds' holdings to changing economic conditions.

In brief, following the GFC, the financial sector has shifted towards market-based funding, which is more direct relative to bank-based intermediation, with investment funds playing a key role in this development. Nevertheless, this development makes the global economy more prone to market shifts and can result in abrupt changes in asset pricing, possibly with negative repercussions for the funded entities.

There are several ways to classify investment funds. A very popular one is according to the purposes of the fund. Under this criterion, a pension fund is actually an investment fund that faces strict restrictions on how to manage its contributors' (i.e. future pensioners) funds, so that it prioritises safety; as a result, such investment allocation would include AAA bonds, shares in money market funds and real estate investment trusts. At the other extreme, a hedge fund in all likelihood is mandated to hedge other investments and, by doing so, it usually invests in "tail scenarios", i.e. scenarios with low probability. Thus, in contrast to a pension fund, a hedge fund would mainly introduce derivatives and alternative investments in its hypothetical portfolio or short positions in assets that are expected to lose their "safe asset" status (e.g. investment grade (IG) bonds that are about to be downgraded to non-IG).

Another way to classify funds is according to their holdings. Under this criterion, a fund holding mostly bonds would be classified as a "bond fund", whereas a fund that holds equities would belong to the "equity funds" class. In order to mark such a clear distinction, the proportions of the characteristic asset must be very large: for example, except for cash, a bond or an equity fund must invest roughly around ninetenths of its portfolio in the specific asset category in order to be characterised by it. On the other hand, when it comes to portfolios that include both debt and equity, the investment fund can be characterised as "mixed". To be clear, whereas a mixed fund may hold a 60-40 (or 50-50 or 70-30) mix of equities and bonds, equities may also be included in the portfolios of bond funds and bonds may be included in the portfolio of equity funds, but in these cases the proportion of the funds that are not allocated to the characterising asset (i.e. bonds and equities, respectively) is very low.

One of the most important factors that determines the portfolio allocation of an investment fund is its mandate. Mandates are legally binding documents that usually describe a riskreturn relationship that must be respected by the funds' investment managers, when allocating their clients' savings in financial markets. The risk parameter in this relationship is crucial: if a manager accumulates risk, e.g. in order to exceed the market return, but the investment fails, the fund may face lawsuits from its contributors. For example, when it comes to bond funds, credit ratings are one of the main determinants of portfolio allocation. Actually, according to findings by Baghai et al. (2023), bond mutual funds' mandates define their investment policies by using credit ratings at a rate of 94% for US funds and 65% for European ones, while around 89% of funds make use of the IG threshold as a key strategic allocation parameter. Thus, these findings imply that credit ratings may determine a large part of the long-term strategies of funds.

Additionally, funds proceed to changes in their portfolios for several reasons, e.g. due to changes in the risk profile of the underlying assets or due to search for yield. For example, rating changes may induce changes in the portfolios, so that the long-term strategic allocation is kept unchanged: a bond that is downgraded below the IG threshold may actually be sold, so that the overall ratio between IG and highyield (non-IG) bonds in the portfolio remains



unchanged. Alternatively, a change in the overall market conditions may alter the risk-taking attitude of funds, thus inducing changes in their portfolios. Indicatively, Giuzio et al. (2021) find that accommodative monetary policy shocks result in increased risk taking by funds, due to their search for yield. Also, Kaufmann (2023) associates the "hunt for yield" by investment funds with the loosening of monetary policy by the Fed, which spurred fund flows to financial markets worldwide.

3 DATA AND PRELIMINARY FINDINGS

3.1 DATA

In order to assess the portfolio allocation of bond funds, we collected fund-level data on the funds' portfolio holdings per asset type and on the basis of other characteristics for the period from 2018 Q4 to 2023 Q3. The source of data is Lipper for Investment Management and the frequency of our dataset is quarterly.³ The database covers around 120 thousand investment funds globally, with a total aggregate fund value of €54 trillion in 2023 Q3; as a result, in terms of aggregate fund market value, our dataset covers about 90% of the total market of regulated open-end investment funds, after excluding funds of funds (see International Investment Funds Association 2023).

This dataset provides information on the type and other characteristics of both the funds and the investments held in their portfolios, including the following: country of origin of the fund or asset; type of securities and other assets (e.g. cash, derivatives, REITs) held by the fund; credit quality (i.e. credit ratings) of the bonds and of their issuers; market value of the fund's holdings for each asset, etc.

Chart 2 shows some details about the investment funds in our dataset: the total value of their assets under management, their number and their geographical distribution. As can be seen in Chart 2, European- and US-domiciled funds together represent roughly around 75% to 80% of the total market, in terms of aggregate fund value. Nevertheless, they are outnumbered by their counterparts from other regions; as a result, we can conclude that EU

3 Other studies using Lipper as their source of data on portfolio holdings by investment funds include Bubeck et al. (2018).



Source: Lipper for Investment Management.

Notes: Panel a) illustrates the total value of the portfolios of the investment funds in our dataset, classified by domicile and grouped in three large geographical regions: US (light purple bars), euro area (light orange bars) and the rest of the world (light green bars). Panel b) illustrates the number of funds domiciled in each region (same colours for the three broad regions).







Note: Panel a) illustrates the distribution of portfolios of European funds and panel b) that of US funds, according to the credit ratings

of the securities in their portfolios (for credit ratings, we follow Lipper's definition of "debtor quality").

and, especially, US funds are much larger in average value terms than funds from other regions.

Furthermore, we can assess their strategic portfolio allocation, but also their portfolio rebalancing. Indicatively, we explore the portfolio allocation of investment funds domiciled in the EU and the United States by (a) the geographical origin and (b) the credit ratings of their assets.

As per the geographical distribution of the assets that investment funds have included in their portfolios in 2018 Q4-2023 Q3, we can see that about 80% (+/-2%) of the assets held in US funds' portfolios consist of securities issued in the US, while European funds hold about 45% (+/-3%) in securities issued in Europe and about 34% in US securities. The high tendency of US funds to hold US securities may be associated with the role of the dollar as the main global reserve currency or exchange rate risk concerns.⁴ At the same time, the high sovereign credit rating of the United States plays an important role in considering US Treasury bonds as a safe asset, which, in turn, has been

documented to be associated with increased demand by investors.⁵

Indeed, the role of credit ratings seems to be very important for the portfolio allocation of investment funds. As shown in Chart 3, both European and US funds hold a very large part of their portfolios in investment grade (IG) securities. In particular, 80% of the value of European investment funds' portfolios and about 88% of the value of US investment funds' portfolios correspond to IG investment holdings. This observation is in line with the frequency of the allocation described in their mandates.⁶ Moreover, it is also interesting that these relative holdings, i.e. holdings in the IG category vis-à-vis those in the high yield (HY) category, remained virtually unchanged during the period under examination, despite the large shocks that occurred in this period (i.e. Covid-19 shock, inflation surge and increase in

6 See Baghai et al. (2023).



⁴ See Longaric, P.A. and M.M. Habib, "The US dollar bias of USfixed income funds" (Box 2), in ECB, *The international role of the euro*, June 2021.

⁵ So much so that US Treasuries have been found to carry a "convenience yield" which is linked to their safe assets status; see, e.g., Engel (2020) and Acharya and Laarits (2023).

interest rates). Thus, it seems that there is a strong connection between investment funds' strategies and the credit ratings of their assets.

So, it is even more interesting to observe that since 2021 Q4⁷ both European and US investment funds have increased their positions in highly-rated securities at the expense of securities with lower credit rating. Specifically, European funds have increased their investment holdings of IG securities by 6 percentage points (pps), while reducing by equal amounts their holdings in non-IG/HY positions. Likewise, US funds have increased their investment positions in IG securities by 5 pps, while at the same time they have reduced their non-IG/HY holdings.

Thus, it seems that the period since the Fed signalled its gradual departure from an ultraaccommodative monetary policy stance is characterised by a portfolio rebalancing of both US and European investment funds away from riskier assets and towards highly-rated ones. The timing of the risk-off shift is also interesting: it implies that investment funds rebalanced their portfolios away from lowerrated, i.e. riskier, assets at the same time as central banks were about to shift their monetary policy stance towards less accommodative levels. As a result, in all likelihood, the reduction in lower-rated assets must be reflecting investment decisions by funds' managers to increase their holdings of higherrated assets in view of the stricter monetary conditions.

3.2 GREEK HOLDINGS OF INVESTMENT FUNDS

The issue of portfolio allocation of investment funds on the basis of the credit ratings of the underlying assets is even more interesting when it comes to Greece. In particular, on 21 April 2023, the credit rating agency Standard and Poor's (S&P) changed its outlook on the sovereign credit rating of Greece to positive. Given that the rating stood at BB+, this action signalled that, in the short term, S&P could upgrade Greece to investment grade, which it did on 20 October 2023. As a result, should there be a shift in investment funds' positions away from riskier assets and towards less risky ones, this could also be reflected in their holdings of Greek bonds and equities.

⁷ The fourth quarter of 2021 marks a point in time (December 2021) when the US Federal Reserve began tapering its asset purchases, following the Federal Open Market Committee's (FOMC) decision of 3 November 2021.







Chart 5 Adjusted values of Greek bonds and equities in investment funds' portfolios

Source: Bank of Greece calculations based on data from Lipper for Investment Management and LSEG. Note: The chart illustrates the total value of assets from Greece held by bond (panel a) and equity funds (panel b).

In particular, initially, when Greece's sovereign credit rating was below the IG category, any risk-off rebalancing of funds' portfolios would imply a reduction in funds' holdings of Greek assets. Indeed, as shown in Chart 4, this was the case during the period from 2021 Q4 to 2022 Q3: the total value of Greek assets under management in investment funds' portfolios decreased by about €3 billion. However, since 2022 Q4, this development started to reverse: just before the IG upgrade, in the beginning of 2023 Q4, the value of Greek assets in funds' portfolios increased by about €7 billion compared with 2022 Q3.

What drives this development? In particular, is this development due to market valuations of existing assets or to additions of Greek assets in investment funds' portfolios? Starting from the second question, we have isolated the pricing effects in bonds and equity shares and recalculated the value of investment funds' holdings.⁸ Thus, the two panels in Chart 5 below show developments in the value of Greek bonds (panel a) and equities (panel b), after deducting market pricing effects, since 2018 Q4.

As shown in Chart 5, even if we deduct the market valuation effects stemming from the price increases in the Greek stock and bond markets, there is an increase of about €5 billion in the Greek assets held by investment funds. This can be broken down into an increase of about €2.1 billion in the holdings of Greek bonds and €2.9 billion in the holdings of Greek equities in investment funds' portfolios. The fact that this development occurred at a time when investment funds reduced their exposure to non-IG holdings is important. So, even if we have not, yet, provided an answer to the question of why we observe an increase in investment funds' holdings of Greek assets, we know that the increase



⁸ The market valuation effects have been isolated by eliminating the cumulative return, since 2018 Q4, of Greek equity shares and bonds from the respective holdings of investment funds' portfolios. To do so, we used the composite price index of the Athens Stock Exchange and the price of the Greek 10-year sovereign bonds.





Average the chart mustrates the weights of an securities (panel a) of bonds only (panel b). The real line depicts the median weight of assets with a BBB rating, with the shaded area depicting the interquartile range in this category; the blue line depicts the weight of Greek assets. All weights have been standardised, according to the GDP of the underlying economies.

in the prices of Greek bonds and equities cannot explain in full this development.

In addition, it is interesting to note that investment funds' holdings of Greek assets increased relative to the holdings of other assets in the same rating category. In particular, as shown in Chart 6 above, the weights of Greek assets in investment funds' portfolios (i.e. funds' holdings) of Greek assets relative to their total holdings), adjusted for the Greek economy's size, have increased since 2022 Q4. By contrast, holdings of assets in the BB rating category, to which Greek sovereign bonds belonged before the upgrade, have decreased, while BBB-rated assets, as shown in Chart 6, have remained broadly stable.

The above stylised facts raise the question of whether the prospects of an upgrade of Greece's sovereign credit rating to investment grade help explain the increase of Greek asset holdings in investment funds' securities portfolios. To examine whether the change in the outlook of Greece's sovereign rating by S&P resulted in an increase in investment funds' holdings of Greek assets, we rely on estimations of a differences-in-differences (DiD) setup.

Next, we employ a demand-based asset pricing framework to examine the effects that changes in investment funds' holdings of Greek sovereign bonds have had on their yields. To this end, we estimate the relationship between investment funds' portfolio holdings and Greek sovereign bond yields and capture the effects the positive outlook by S&P has had on investment funds' holdings of Greek sovereign bonds.

4 EMPIRICAL ANALYSIS

4.1 DIFFERENCES-IN-DIFFERENCES

First, we examine whether the increase in the relative holdings of Greek sovereign bonds by investment funds is related to the change in



Greece's sovereign credit rating by S&P. To do so, we use the weights of each asset in investment funds' portfolios, relative to the total portfolio fund value, at each point in time. To formalise this, let us think of a portfolio consisting of two assets, A and B. Then, the market value (MV) of the fund (FMV) is given as the sum of the market value of assets A and B, as follows:

$$FMV_t = MV(A)_t + MV(B)_t \tag{1}$$

From equation (1), it is easy to produce weights, in market value terms, for each asset in the funds' portfolio, i.e. the weight of asset A (w_t^A) and the weight of asset B (w_t^B) at each point in time (t) will be given by the following relationship:

$$mw_t^i = \frac{MV(i)_t}{FMV}$$
(2)

where $i = \{A, B\}$. Now we may generalise, if we lift the assumption that the fund holds only two assets: for $i = \{1, 2, 3, ..., K\}$, the hypothetical fund may hold K assets. Weights that are calculated based on equation (2) inherently change due to both investment funds' allocation decisions and pricing effects. On the other hand, we have to isolate the latter effects, since our intention is to use weights in order to estimate the effects of funds' net demand on Greek sovereign bond yields. As a consequence, we calculate net weights, based on the funds' initial book values (BV), of positions i, at each point in time, with FBV_t giving the total value of the fund's portfolio value in book value terms:

$$w_t^i = \frac{BV(i)_t}{FBV_t}$$
(3)

Then, based on the above definition of weights of Greek sovereign bonds and all other assets in funds' portfolios, we can estimate the changes in the former in comparison to those of other assets.

To do so, we employ differences-in-differences (DiD) estimation techniques, in which the weights of GGBs, following the assignment of a positive outlook by the rating agency S&P, is the treated group. We also need to choose a "never treated" or "control" group, which by definition must be identical to the treated one, except for the property that will define the treatment. This restricts our choice to euro area sovereign bond holdings with a rating low enough to be comparable to GGBs, which have neither experienced a change in their rating, nor have been subject to other country-specific developments in the period under examination.

Based on these criteria, we end up with Portuguese government bonds (PGBs): apart from being subject to the same monetary conditions as GGBs, they have had a low IG rating, during the period under examination, which makes them comparable to GGBs. Additionally, during the period under examination, Portugal did not experience political developments similar to those that marked other low-rated IG euro area economies. So, the DiD estimator is given by the following relationship:

$$\hat{\delta} = (\overline{w}_{GGB}^{post} - \overline{w}_{GGB}^{pre}) - (\overline{w}_{PGB}^{post} - \overline{w}_{PGB}^{pre})$$
(4)

where *pre* and *post* denote the weights of Greek and Portuguese sovereign bonds (i.e. GGBs and PGBs, respectively) before and after the change in the outlook of the Greek sovereign credit rating to positive by S&P in April 2023. By using two-way fixed effects and controls, we estimate the DiD relationship as follows:

$$w_{i,j,t} = a_i + \beta T + \delta D_{i,t} + \gamma X_{i,j,t} + \varepsilon_{i,j,t}$$
(5)

In equation (5), the term $\delta D_{i,t}$ captures the deviation of weights on GGBs, after the assignment of the positive outlook, to what is expected by the remaining variables in the above structural relationship and by their own developments prior to the said assignment. We also introduce two-way fixed effects: a_i stands for the standard cross-section fixed-effects term and *T* captures time-fixed effects. Finally, $X_{i,j,t}$ is a vector of controls that includes bond-specific variables (with $_j = \{1, 2, 3, ..., N\}$ denoting the individual securities), such as the term-



to-maturity of each bond, in the funds' portfolios as well as global variables, such as the ECB's shadow rate, which reflects ECB's policies on interest rates, communication and asset purchases (Wu and Xia 2016). The bond-specific controls serve to isolate heterogeneity that may otherwise be reflected in the results. Additionally, the shadow rate captures developments such as the purchases of government bonds by the ECB, that may have affected Greek bonds differently from Portuguese ones. The results are summarised in Chart 7 below.

The estimation results show that, after the assignment of the positive outlook on Greece's sovereign credit rating by S&P in April 2023, GGBs' weights in investment funds' portfolios rose by about 0.8%, i.e. more than those of the control group. It should be noted that the control group includes weights on GGBs, before the change in outlook (not yet treated), and PGBs (never treated). Moreover, this result is net of any effects that may be linked to the ECB's monetary policy stance in the period under examination, which may have affected GGBs and PGBs differently.

The timing illustrated in Chart 7 implies that funds did not increase their holdings of Greek sovereign bonds at once: the first significant change in funds' holdings came in June 2023, i.e. 2 months after the change in outlook, and corresponded to an addition of GGBs in funds' portfolios exceeding by about 0.4% the addition of PGBs, under the same broader monetary and financial environment. The next significant additions of GGBs in funds' portfolios, equal to a little more than 0.4% of these portfolios' total value, took place in September 2023. This coincided with the 2-notch rating upgrade of the Greek sovereign credit rating by Moody's.

This means that, indeed, the positive change in the outlook of Greece's sovereign credit rating is likely to have sparked an increase in investment funds' positions in Greek sovereign bonds, relative to broader developments. The findings reported herein provide evidence of

Chart 7 Evolution of holdings of Greek vs Portuguese government bonds in view of the IG upgrade

(Change in the share of portfolios invested in Greek bonds in %)



Source: Bank of Greece econometric model. Notes: The above chart shows the two-way fixed effects coefficients of the differences-in-differences specification of the weights of investment funds' portfolios of Greek government bonds (GGBs), after the assignment of the positive outlook for the Greek sovereign credit rating by S&P (in April 2023). The control group (never treated) includes the weights of Portuguese government bonds and those of GGBs before the assignment of the positive outlook (not yet treated). The specification also includes bond-specific and market-wide controls, such as bond term-to-maturity and interest rate variables.

an association between the effects stemming from the change in the outlook of Greece's sovereign rating to positive and investment funds' holdings of GGBs. Of course, since there may be factors for which we do not have adequate controls (e.g. national elections in June 2023), we do not argue that these results offer adequate ground for claiming causal inference. However, they seem to suggest that there is a strong enough link between the outlook change and the increase in the funds' GGB portfolio, in comparison with the broader developments in the euro area.

4.2 EFFECTS OF INVESTMENT FUNDS' HOLDINGS ON GREEK SOVEREIGN BOND YIELDS

Next, we investigate whether such a positive change in investment funds' portfolios is eco-



nomically important. To do so, we rely on demand-based asset pricing à la Koijen and Yogo (2019) and, more specifically, on the bond-specific setup provided in Koijen et al. (2021). In particular, we specify yields as subject to rebalancing in investors' portfolios. We depart from the aforementioned study in that, instead of using the quantitative easing transactions as the trigger of the rebalancing, we use a time dummy marking the change in the outlook of Greece's sovereign credit rating. Specifically, we estimate the following relationship:

$$y_{i,j,t} = a_i + \theta w_{i,j,t} + \beta x_{i,j,t} + \gamma I_{i,t} + \varepsilon_{i,j,t}$$
(6)

where y denotes the yield at time t of bond j issued by sovereign i; w denotes the weights of bonds in investment funds' securities portfolios. Control variables, such as the \in STR, the ECB's shadow rate, the term spread between 10-year and 2-year OIS rates and the term-tomaturity of each bond are denoted by x. $I_{i,t}$ is an indicator (dummy) variable taking the value 1 for GGBs after the change in the outlook by S&P to positive for the Greek sovereign credit rating, and 0 otherwise. We also include a variable that reflects net demand effects in the Greek sovereign bond market, as noted in Koijen and Yogo (2019). In particular, the "demand" variable incorporates the aggregate holdings of GGBs by Greek banks and the Eurosystem, as a ratio to the total amount outstanding of GGBs in the market. Finally, a_i denotes the fixed-effects term.

The relationship represented by equation (6) allows to infer the effects of a given change in weights on the yields of the bonds included in our sample. At the same time, we also allow for residual effects, due to the positive outlook to be captured by the indicator variable $I_{i,t}$ and we also control for global and bondspecific developments. This specification is estimated based on a dynamic panel data model, with instruments appropriate for a large cross-section and few time observations (Arellano-Bover estimators), with robust standard errors. The results are presented in Table 2 below:

The results reported in Table 2 above confirm the intuition that an increase in funds' weights for a particular sovereign bond reduces its

Table 2 Funds' demand effects on bond yields						
Dependent variable: sovereign bond yields						
	(1)	(2)	(3)	(4)		
<i>y</i> ₁₋₁	0.123** (0.036)	0.258*** (0.045)	0.111** (0.037)	0.131*** (0.037)		
w	-0.444*** (0.050)	-0.509*** (0.045)	-0.418*** (0.049)	-0.442*** (0.052)		
Ι	-0.299*** (0.039)	0.008 (0.029)	-0.308*** (0.038)	-0.301*** (0.038)		
Demand	-0.424*** (0.112)	-0.630*** (0.325)	-0.368*** (0.111)	-0.426*** (0.112)		
€STR	0.248*** (0.024)		0.308*** (0.038)	0.241*** (0.025)		
Maturity (in years)	0.019*** (0.006)	0.014 (0.015)		0.019*** (0.006)		
OIS 10y-2y		-0.258** (0.099)	-0.057 (0.069)	-0.065 (0.070)		
Fixed Effects	Yes	Yes	Yes	Yes		
Obs.	552	552	552	552		

Notes: The table reports dynamic panel data estimations (Arellano-Bover estimator), with robust standard errors. Asterisks denote significance (10%: *, 5%: **, 1%: ***).

yields. In particular, a 1 pp increase in funds' weights reduces bond yields by 42-50 basis points (bps). As a result, the total average increase in GGB weights in investment funds' portfolios in the aftermath of the positive outlook assigned by S&P to Greece explains a reduction in GGB yields by 35-40 bps.

Is this corroborated by actual data? In order to fit the results into the developments of the period, we have to isolate the effect that rising interest rates had on government bond yields. To do so, we can use the yield differentials (i.e. spreads) of Greek sovereign bonds vis-à-vis euro area benchmark ones, assuming that both have been affected roughly to the same extent by monetary policy. That said, we observe that the spread against the German 10-year sovereign bond, just before the positive outlook assigned by S&P on 20 April 2023, stood at around 190-200 bps. In mid-October, i.e. just before the actual rating upgrade on 20 October 2023, it had fallen to 145 bps. Thus, our findings are very closely associated to the developments of the period, as they suggest that the 45-55 bps reduction in spreads is explained to a large extent by the increase in investment funds' holdings of Greek sovereign bonds.

From the remaining variables, we may draw intuitive results: a rise in base rates, reflected in the \in STR, has a positive and highly significant effect on yields, even though the passthrough is not on a one-on-one basis. This may stem from the fact that we have excluded from the sample securities with remaining maturities of below 1 year, so that our results are not distorted by short-term horizon pricing, with a particular relevance for bond yields. The \notin STR seems to be very closely correlated with the term spread (10y-2y) of OIS rates, as when both variables are included in the same specification the latter is not significant.

At the same time, the indicator variable $I_{i,t}$, reflects a further yield reduction of about 30 bps vis-à-vis what is captured by the remaining parameters. This, however, changes when, instead of the €STR, we include the term spread 10y-2y of OIS rates, an indication that both the IG and the term spread variable contain common information. This is probably specific to the period under examination, during which the initial optimistic expectations for a pause in interest rate rises by major central banks were revised, while the slope of the yield curve dived into more negative levels, as the prospects for euro area economic activity deteriorated. Additionally, the maturity variable, which is however a rough bond-specific determinant, is found to have a significant positive relationship with yields.

Finally, our results suggest that an increase in the demand from other investors, such as Greek banks or the Eurosystem, also has sizeable reduction effects on the yields of GGBs. These are estimated to deduct about 40-60 bps for every 1 pp increase in the GGB holdings of other investors. These effects are broadly in line with the ones reported in the extant literature about the effects of central bank asset purchase programmes on sovereign bond yields (e.g. Koijen et al. 2021; Malliaropulos and Migiakis 2023).

All in all, our panel data estimation results suggest that about eight-tenths (80%) of the reduction in GGBs' sovereign risk premium came as a result of the increase in investment funds' positions, relative to broader monetary and other euro area and country-specific developments. These findings are combined with the ones presented in Section 4.1, which imply that the increase in investment funds' positions in GGBs is associated, in a statistically significant way, with the positive change in Greece's sovereign credit rating outlook by S&P in April 2023. We, thus, conclude that the combination of the two findings suggests that (a) investment funds increased their positions in GGBs in view of a possible sovereign credit rating upgrade of Greece to investment grade, and (b) this had significant economic effects on the yields of Greek sovereign bonds, as it explains a very large part of the overall reduction in spreads.



5 CONCLUDING REMARKS

We have examined the effects of (a) sovereign credit ratings on portfolio allocation by investment funds, and (b) investment funds' portfolio rebalancing on sovereign bond yields. To do so, we focused on the case of Greece at the onset of the positive change in its sovereign credit rating in April 2023, which led to its upgrade to investment grade six months later. By focusing on the case of the sovereign credit rating of Greece, we find that ratings have significant effects on funds' portfolio allocation: the prospect of Greece regaining the investment grade status resulted in an increase in investment funds' portfolio holdings of Greek sovereign bonds, in relation to other monetary and financial developments during the same period. In its turn, this increase has had significant, both in statistical and economic terms, downward effects on Greek sovereign bond yields.

In particular, we find that the change in the outlook of the sovereign credit rating of Greece to positive by S&P, which denoted a high likelihood of an IG upgrade, created increased demand for Greek sovereign bonds by investment funds. Specifically, investment funds' weights on Greek sovereign bonds increased in total by about 0.8%.

Then, by employing dynamic panel data model estimation techniques, we find a negative and highly significant relationship between funds' portfolio weights and the yields of the underlying bonds; that is, when funds increase their holdings of a given bond, its yields decrease. Based on this result, we can estimate the reduction effects on Greek sovereign bond yields due to the increase in funds' holdings. We find that the above-mentioned rise in the weights of Greek sovereign bonds in funds' portfolios explains a reduction of about 35-40 bps in their yields or about 80% of the total reduction of spreads in the period under examination.

The implications of these findings are important: a permanent increase in funds' holdings may result in lowering the cost of funding for Greek public debt, thus enhancing its sustainability. Therefore, the prospect of an IG upgrade helped Greece to rein in its cost of funding. By achieving rating upgrades, Greece managed to gradually regain the IG status and, thus, increase the demand for its sovereign bonds. This insulated Greece's cost of funding from rising interest rates in a period of tightening monetary policies and financial conditions.



REFERENCES

- Acharya, V.V. and T. Laarits (2023), "When do treasuries earn the convenience yield? A hedging perspective", NBER, Working Paper No. 31863, November.
- Aizenman, J., M. Binici and M. Hutchison (2013), "Credit ratings and the pricing of sovereign debt during the euro crisis", *Oxford Review of Economic Policy*, 29(3), 582-609.
- Altavilla, C., M. Darracq Pariès and G. Nicoletti (2019), "Loan supply, credit markets and the euro area financial crisis", *Journal of Banking & Finance*, 109, 105658.
- Baghai, R.P., B. Becker and S. Pitschner (2023), "The use of credit ratings in the delegated management of fixed income assets", *Management Science*, 70(5), 3059-3079.
- Blanchard, O. (2019), "Public debt and low interest rates", *American Economic Review*, 109(4), 1197-1229.
- Bubeck J., M.M. Habib and S. Manganelli (2018), "The portfolio of euro area fund investors and ECB monetary policy announcements", *Journal of International Money and Finance*, 89, 103-126.
- Cantor, R. and F. Packer (1996), "Determinants and impact of sovereign credit ratings", Federal Reserve Bank of New York, *Economic Policy Review*, 2(2), 37-54.
- Engel, C. (2020), "Safe U.S. assets and U.S. capital flows", *Journal of International Money and Finance*, 102, 102102.
- Financial Stability Board (2023), Global monitoring report on non-bank financial intermediation 2023, 18.12.2023.
- Ghosh, A.R., J.I. Kim, E.G. Mendoza, J.D. Ostry and M.S. Qureshi (2013), "Fiscal fatigue, fiscal space and debt sustainability in advanced economies", *The Economic Journal*, 123(566), F4-F30.
- Giuzio, M., C. Kaufmann, E. Ryan and L. Cappiello (2021), "Investment funds, risk-taking, and monetary policy in the euro area", ECB, Working Paper No. 2605.
- International Investment Funds Association (2023), "Worldwide regulated open-end fund assets and flows", 2023 statistics 4th quarter (retrieved from <u>https://iifa.ca/page/industry_statistics</u> on 11.6.2024).
- International Monetary Fund (2015), "The asset management industry and financial stability", *Global Financial Stability Report*, Chapter 3, 93-135, April 2015.
- Kaufmann, C. (2023), "Investment funds, monetary policy, and the global financial cycle", *Journal of the European Economic Association*, 21(2), 593-636.
- Koijen, R.S.J. and M. Yogo (2019), "A demand system approach to asset pricing", *Journal of Political Economy*, 127(4), 1475-1515.
- Koijen, R.S.J., F. Koulischer, B. Nguyen and M. Yogo (2021), "Inspecting the mechanism of quantitative easing in the euro area", *Journal of Financial Economics*, 140(1), 1-20.
- Livingston, M., J. Wei and L. Zhou (2010), "Moody's and S&P ratings: Are they equivalent? Conservative ratings and split rated bond yields", *Journal of Money, Credit and Banking*, 42(7), 1267-1293.
- Lo Duca, M., G. Nicoletti and A. Vidal Martínez (2016), "Global corporate bond issuance: What role for US quantitative easing?", *Journal of International Money and Finance*, 60, 114-150.
- Longaric, P.A., K. Cera, G. Georgiadis and C. Kaufmann (2023), "Do global investment funds have a stabilizing effect on euro area government bond markets?", European Central Bank, *Financial Stability Review*, Chapter 2, 51-53, May 2023.
- Malliaropulos, D. and P. Migiakis (2018), "The re-pricing of sovereign risks following the Global Financial Crisis", *Journal of Empirical Finance*, 49, 39-56.
- Malliaropulos, D. and P. Migiakis (2023), "A global monetary policy factor in sovereign bond yields", *Journal of Empirical Finance*, 70, 445-465.

Office of Financial Research (2013), Asset management and financial stability, September 2013.

- Rajan, R.G. (2005), "Has finance made the world riskier?", *European Financial Management*, 12(4), 499-533.
- Vissing-Jorgensen, A. (2021), "The treasury market in spring 2020 and the response of the Federal Reserve", *Journal of Monetary Economics*, 124, 19-47.



Wu, J.C. and F.D. Xia (2016), "Measuring the macroeconomic impact of monetary policy at the zero lower bound", *Journal of Money, Credit and Banking*, 48(2-3), 253-291.

