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Spending Policies of Italian Banking Foundations

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November 2018

Abstract

Italian banking foundations are important institutional investors and not-for-profit institutions in Italy. Foundations finance their activities with the returns they get by investing their endowments on the financial markets. The financial management of foundations has to meet two conflicting aims: maintaining a consistent and sufficient spending level in the short run and preserving the real value of the endowment fund in the long run. During the financial crisis, the tension between these aims has strongly emerged. This paper is about the results of an analysis of the spending decisions of ten main foundations, from 2004 to 2016, based on balance sheet and market value data. We propose an error-component model that allows to evaluate the relative importance of spending stability versus preserving the endowment value. Our estimates reveal that, on average, foundations followed stable spending policies across the financial crises, as they did not change their long-term rate of consumption of assets but gradually started to smooth spending over the short term. Because their granting activity sharply declined from 2008 to 2012, the joint effect of these decisions was to persistently reduce spending until 2016. This conservative stance, if carried over beyond the short-term, may violate intergenerational neutrality.

Keywords: Foundations, spending rules, panel data, error component model

JEL Codes: C23, G11, G23

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1. Introduction

Italian foundations of banking origin are private institutions operating in the non-profit sector, whose resources for socially useful interventions derive from the management of assets that, at the time of their creation, were represented by the shareholdings in the capital of Italian banks. These bodies, in fact, originate from the process of privatization of public credit institutions, started with Law n. 218 of 30 July 1990 (the so called 'Amato Law' after the name of the then Italian Prime Minister) and the related implementing decrees. Through this important regulatory intervention, the banking activity of the savings banks ('*Casse di Risparmio*' and *Monti di Credito*' in Italian) and credit institutes of public law was separated and allocated to joint-stock companies, ruled by the Civil Code and banking regulations. Therefore, the original institutions were transformed into no-profit public entities – the current foundations of banking origin – with the attribution of the entire shareholding of the banking company. The shareholding in the capital of the transferee bank therefore represented the foundations' initial assets, destined to the realization of purposes of public interest and social utility.

In 1990, the year of approval of the Amato Law, there were 82 savings banks, with an average size, calculated in terms of intermediated funds, equal to 3,912 billion Italian Lire; a size that reflected the (mainly) local nature of credit activity, similar and in competition with that of cooperative credit banks (known as '*Banche Popolari* and *Casse rurali* '). The dimensional and territorial scale of public-law credit institutions was different. They included the three large southern banks (Banco di Napoli, Banco di Sicilia and Banco di Sardegna), as well as Banca Nazionale del Lavoro, Monte dei Paschi di Siena and Istituto Bancario San Paolo di Torino. These six institutions, together with the three banks of national interest, represented the most important component of the banking system in terms of total assets. At the end of 1990 the average size of the six public law institutes was 44,099 billion Italian Lire, eleven times the average figure of the savings banks.

The current distribution by size and geography of the 88 foundations that emerged from that process shows how, even today, their link with the history of the Italian banking system is resistant; even more, it emphasizes how foundations have maintained a local identity, becoming independent from the consolidation and reorganization processes that have affected Italian banks. At the end of 2016, only 12 foundations reported assets worth more than one billion euro - representing more than 68 percent of the total system - while 30 were those that did not exceed 100 million euro – 3 percent of the total. The geographical distribution was concentrated in central and northern Italy; in fact, the foundations operating in the south and in the islands were only 11, with a total assets equivalent to just 5 percent of the total system.

The evolution of the relationship between foundations and banks was accompanied and prompted by changes in the regulatory framework, which saw three important interventions in the first two decades of their life. The first, in 1994 (Law No. 474/94 and the enforcing 'Dini directive', after the name of the then Minister of Economy and Finance) abolished the initial obligation to hold control of the transferring banks and introduced tax incentives to encourage diversification of assets. In 1998, the 'Ciampi Law' (Law No. 461/98, named after the successor of Mr. Dini), which is still today the legislative frame of reference for foundations, introduced the obligation to sell the controlling shares in the capital of the transferring banks by the end of 2005, from which, subsequently, foundations with net assets less than € 200 million and those based in regions with special status were exempted. The last intervention in terms of diversification is the one included in the Memorandum of Understanding signed on 22 April 2015 by ACRI (the Italian Savings Banks Association, which gathers all 88 foundations of banking origin) and the Ministry of Economy and Finance. The Protocol provides for the limitation to 33 percent of total assets invested in financial instruments attributable to a single issuer – with both amounts expressed at fair value. Thanks to this agreement, whose implementation must take place over a three-year or five-year period, depending on whether transferring bank shares are listed or unlisted, the conditions have been set to accentuate the diversification process that had characterized the financial activity of foundations until the outbreak of the financial crisis. In fact, in the years of the crisis, with the need to recapitalize the Italian banking system, various foundations interrupted the diversification process and contributed significantly to the subscription of capital increases initiated by their reference banks. It was an intervention that, while on the one hand has allowed the bailout of the banks most exposed to the crisis, on the other has accentuated the riskiness of the foundations' financial portfolios and has often affected their profitability and activities. In this sense, Table 1 shows some statistics that allow the assessment of the evolution of approved grants, of net income and of their ratio, before and during the financial crisis, for the total of 88 foundations.

Table 1
Grants and net income of all Italian banking foundations by periods

Periods	2004-08	2009-16
Grants (Euro mln.)		
Percentile 25	1.8	1.5
Mean	16.1	11.9
Median	4.0	3.1
Percentile 75	9.6	8.4
Net income (Euro mln.)		
Percentile 25	2.6	1.0
Mean	30.1	13.6
Median	6.4	3.9
Percentile 75	18.2	10.3
Grants on Net income (%)		
31.8	31.8	22.4
Mean	45.6	50.1
Median	58.3	71.4
Percentile 75	90.3	103.3

Source: Authors calculations on ACRI data

The average annual value of grants decreased by 26 percent (366 million euro in total each year for all foundations) during the period and the average net income by 55 percent (totaling 1,458 million euro for all foundations); median values have recorded smaller but still very significant declines – 22 and 39 per cent, respectively. This compared to a cumulative inflation rate between 2004 and 2016 equal to 22.5 percent. The increase in the ratio of grants to net income, whose median has risen from 58 to 71 percent, reveals that foundations have tried to protect, at least in part, the level of grants from the uncertainty of the returns to their financial assets. The cost of this effort was inevitably dumped into net asset value which, at balance sheet values, was on average 527 million euro up to 2008 and 493 million euro later; a 6.5 percent drop at system level.

Because of these considerations, we believe that it is worth investigating and better understanding the impact of the crisis on the financial management of foundations. The subject lends itself to be tackled from the points of view of the spending decisions of foundations and their implications for the conservation of endowments. The main questions to be answered are the following: were foundations spending policies sustainable over time without compromising assets values? To what extent did they ensure stable grants? How did foundations combine grant-stabilization strategies with long-run spending objectives based on expected returns on their investments?

To our knowledge, forty years after Italian banking foundations were born, there is not an important body of specific research that has dealt with these issues. To date, researchers have enough data in terms of detail and temporal depth to start filling this gap. The purpose of this work is to address the theme of foundations spending policies. To this end, we have reconstructed the time-series of values and market returns of the financial assets of ten major Italian banking foundations between 2004 and 2016, integrating them with balance sheet data that the Italian Savings Banks Association has collected every year since 2000. At the end of 2016 these ten foundations represented, as a whole, a large part of the Italian system, both in terms of total assets, which amounted to 28.5 billion euro, for a 61.5 percent share of the total system, and in terms of grants, over 389 million, or 63 percent of the total. We are aware that this is not a statistically representative sample of the whole panorama of foundations, but nonetheless we believe that its overall size allows us to develop important reflections at a systemic level.

The rest of this paper is structured as follows. Section 2 frames the meaning of our research with respect to what exists in the relevant literature and to the specific characteristics of foundations. Section 3 describes how and why we have constructed the data necessary for our analyses. In Section

4 we illustrate the econometric techniques that we have used, present and comment the estimation results. Section 5 concludes[1].

[1] The authors are grateful to the Fondazione Cassa di Risparmio di Modena, which contributed to the realization of this research by financing the project 'The asset management of the foundations of banking origin'.

2. Background

As far as we know, almost thirty years after Italian banking foundations were born, there is no significant body of research that has systematically dealt with the issue of their spending behavior. This fact is rather surprising given the importance that the system of foundations for the welfare of their reference communities and for supporting national banks during the financial crisis.

A remarkable exception is the empirical study of Cardinal and Panza (2006) which presents the results of a sample survey involving the governing bodies of 250 European foundations between 2004 and 2005. Of the foundations involved, 40 were Italian; the authors do not indicate what was their nature, but it is reasonable to assume that most were of banking origin. The majority of respondents, in Italy as in the rest of Europe, declared that the main tasks of financial management are the conservation of assets and the generation of income to finance spending. This shows that, at the time, the fundamental tension between asset protection and spending was well perceived by the governing bodies of Italian foundations. On the other hand, respondents' opinions about long-term goals and spending decisions were geared towards assuming that investment performance – not only income, but also capital gains and losses – is not a relevant factor in making spending decisions. This indicates that there was little concern of the stringent relationship between return on investments and spending, while criteria such as income – from dividends, coupons and interest – and the actual needs for spending were favored; this evidence, as highlighted by the authors, was particularly strong in in Italy.

We believe that there are substantial motivations that explain the attitudes that emerged from the study of Cardinal and Panza (2006) – which unfortunately was not repeated during or after the financial crisis, as it could have brought out useful indications regarding the possibility that such attitudes have changed over time. In the first place, the history of foundations, not only and not particularly in Italy, dates back to centuries ago (Acharya and Dimson, 2007). At the time, the assets of foundations consisted mainly of land and estates and either generated rental income or profits from their direct exploitation. The value of such assets was little variable over time; it is therefore, we would say, natural that they were kept exclusively for the income they produced and that, consequently, this income was the only available resource to finance the activities of foundations.

The second reason is probably linked to the specific origins of Italian banking foundations. As highlighted in the previous section, such foundations derive from the process of privatization of local credit institutions and of some banks of national interest; these were the entities from which foundations have inherited their mutualistic purposes and their mission of supporting families, businesses and institutions operating in the areas of art, culture, research and social projects (Acri, 2018). These aspects have consolidated the priority assigned to spending objectives, both in the legislation and in the vision of the governing bodies. Finally, in their first years of life and, in fact, up to the 'Ciampi Law' of 1998, foundations had a clear connotation of 'treasurers' of the shareholdings they received by the banks. Most likely, this made it distant from the logic of financial management the possibility that the uses of their endowments would be modified with respect to the *status quo*; a circumstance which later found reinforcement in the fact that income distributed by the transferee banks was more than sufficient to finance the activities of the foundations themselves (Clarich and Pisanischi, 2001), at least until the outbreak of the financial crises.

Contrary to what happens in the Italian research landscape, the theme of spending policies and, more generally, of the financial management of foundations, has long been widely explored in Anglo-Saxon literature. In the United States and in the United Kingdom, endowment funds of private universities are institutional investors with characteristics similar to those of Italian banking foundations. The purpose of endowment funds is to provide, over time, financial resources that, alongside the fees paid by students, public subsidies and revenues from research activities that can be sold on the market, support the current expenses and investments of the parent universities. Therefore, Italian banking foundations share with university endowments the objective of preserving the real value of the assets alongside that of permanently and consistently providing an amount of resources which is appropriate to the needs of their beneficiaries.

However, there are important differences between Italian banking foundations and university endowments, since the latter originate from contributions from families and businesses, from which they continue to be nourished through the donations they currently receive; such circumstance does not belong to the Italian foundations, whose origin is public and for which it is atypical to benefit from donations. Furthermore, at the end of 2017, the overall size of the 88 Italian banking foundations in terms of assets was just over 46 billion euro (ACRI, 2018a). Data gathered from 809 U.S. colleges and universities for the 2017 Nacubo-Commonfund Study of Endowment (Nacubo, 2018) show that their overall size was 566.8 billion dollars in terms of endowment assets. At the same time, the average size of Italian banking foundations was 452 million euro, compared to 705 million dollars for endowment funds. Finally, endowment income constitutes only a fraction, albeit growing, of universities' operating budgets.

The financial management of university endowments has been the subject of considerable research since the mid-1970s. The most influential contribution that highlights the two crucial aspects of endowment management – spending and endowment conservation – is owed to James Tobin (1974) who pointed out that: (1) there is a trade-off between conservation of assets and (stabilization of) spending, and (2) what counts in the economic definition of profitability is not only accounting income – dividends, coupons and interest – but total return, which also takes into account the capital gains and losses at market values. In the words of Tobin:

> *« The trustees of an endowment institution are the guardians of the future against the claims of the present. Their task is to preserve net assets among generations. The trustees […] assume the institution to be immortal. They want to know, therefore, the rate of consumption from endowment which can be sustained indefinitely […] Consuming endowment income so defined means in principle that existing endowment can continue to support the same set of activities that is now supporting. […] Sustained consumption rises to encompass and enlarge the scope of activities when, but not before, capital gifts enlarge the endowment. »*

Consistently with Tobin's concept of 'intergenerational neutrality' for institutions that aim to produce stable contributions to their beneficiaries over time, endowments and foundations as well should provide a smooth flow of real income and current consumption should not arise from the prospect of further revenue sources that have not yet materialized. Therefore, the short-term payout response to shocks that hit the assets of institutions should be small and endowments should respond symmetrically to positive and negative shocks.

Back in the late 1970's, James Tobin, who then acted as the trustee of Yale University's endowment, together with economists Williams Brainard, Richard Cooper and William Nordhaus, conceived the first decision-making rule that links current spending to its past level and to the value of the endowment fund (Swensen, 2009). Today, it is known as the 'Yale-Stanford Rule'. This rule stipulates that current spending shall be equal to the weighted sum of previous year spending and a of target spending rate applied to the market value of endowment assets at the end of the previous year. The result is increased by the inflation rate of the basket of goods and services that are typically purchased by universities. The weight on past spending is called 'smoothing'. The higher is smoothing, the more spending is stabilized from one year to the next and the more any variations of the value of the assets (in real terms) are discharged on the endowment. Therefore, when smoothing is high, current spending is stabilized at the expense of the opportunities for future spending, as we extensively explain in Appendix 2. The target spending-rate is the level of constant consumption of assets that is expected to be sustainable over the long-term, to foreseeable market and inflation conditions; in Appendix 2, we show that the dynamic equilibrium of an endowment is achieved when this rate is set as the difference between the expected total rate of return in investments and the expected inflation rate.

The rule was first adopted by the endowment of Yale in the late 1960's. After the financial market shocks of the 1970's, in 1982 the rule was revised to the current version in 1982 – described above; the smoothing parameter was set to 0.7 and the target spending-rate to 4.5 percent. Since then, Yale changed the smoothing and target-spending parameters only three times: in 1992 and 1995, the target rate was increased to 4.75 and to 5 percent, in 2004 this was increased to 5.25 and the smoothing parameter set to 0.8. Such changes were motivated by substantial variations of Yale's investment style or of market conditions, and by permanent variations operating budget support; indeed, changing the rule infrequently is believed to be necessary for the enforcing of budgetary balance (Yale Investment Office, 2004 and 2018).

These concepts have been expanded in the later literature on endowment funds, which considers their assets as a form of precautionary savings that can be tapped by universities when other revenues are unexpectedly low. For Dybvig (1999) the portfolio and spending decisions should be inspired to the notion of expenditure protection over time; therefore, endowments should immunize a portion of their wealth through low-risk investments and allocate the remainder to risky assets. Black (1976) and Merton (1992) emphasize the idea of endowments as a form of self-insurance for universities, with the key role to smooth out the effects of temporary declines to their revenues. Specifically, Merton analyzes a dynamic portfolio choice model in which endowment payouts are only a part of a university's overall revenue stream; he notes that, when the markets are incomplete, universities should adjust current payout rates in response to both endowment shocks and other revenue shocks. In this strain of the literature, the role of endowments as self-insurance funds implies a conservative payout behavior during rising markets, thus engaging in precautionary saving, and a more aggressive spending during bad times.

However, there is evidence that endowments do not always stick to stable rules. Brown, Dimmock, Kang, and Weisbenner (2014) note that the majority of university endowments use a spending policy that sets payout amounts as a fraction of an average of past endowment market values, therefore only partially implementing the Yale-Stanford rule, with the effect that past shocks are gradually incorporated into payout decisions over several years. The authors also provide evidence that endowments asymmetrically reduce payouts by overriding their stated payout policies after negative, but not positive, market shocks. This behavior, which the authors call 'endowment hoarding', translates negative endowment shocks to universities budgets operation quite quickly.

Contrary to the idea of a stable application spending policies, Brown and Tiu (2013) find that endowments adjust them quite often. Almost half of the endowments in their sample did adjust the rule at least once from 2003 to 2011, while a quarter of them did it every year. They also find that, for large endowments, changes in payouts are more likely to follow low past returns and payouts.

3. Data

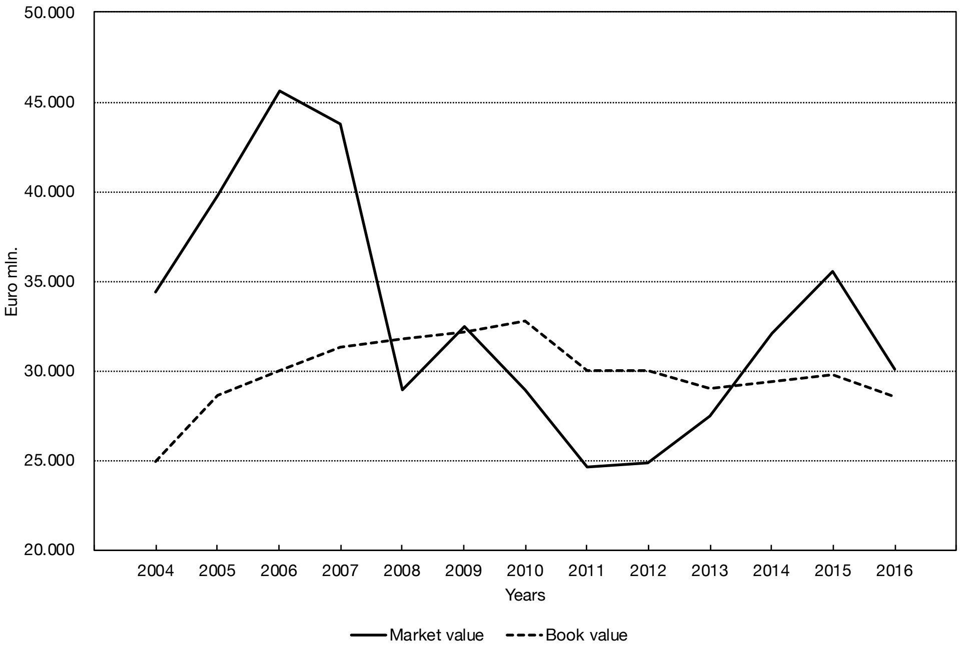
Because of the arguments presented in the previous section, it is clear that the analysis of foundations' spending policies cannot disregard the valuation at market values of net assets and of total investment returns. This assessment cannot be carried out directly on the basis of only the balance sheet and income statement data of foundations. In fact, the accounting rules that define the representation of the economic management of foundations allow to report some components of the financial portfolio as fixed assets, without recognizing any changes in their market price occurred during the fiscal year. This applies not only to some unlisted financial assets, but also to some of those traded on the markets, the principle being that they are long-term investments held for the income they produce (*e.g.* dividends and coupons) and not for potential capital gains. Furthermore, banking foundations are granted the possibility of adjusting the value of their shareholdings in the transferee banks without charging or crediting the income statement.

As a consequence, a correct evaluation of economic income that acknowledges the profits and losses accrued during the fiscal year requires an assessment of the current market values of fixed assets that make up the financial investment portfolios of foundations. The information necessary for this valuation can be found in the notes to financial statements that report the market values at the end of each year for listed securities and fair values for unlisted ones.

In order to get a realistic representation of net assets and of the profitability of investments, we collected data at market values of the financial assets of the main ten Italian banking foundations at fiscal year-end. In 2016 these foundations represented 61.5 percent of total assets (at book value) of the Italian banking foundations system, for a total of 28.5 billion euro, and 63 percent of all grants, for over 389 million euro. Market data were integrated with balance sheet data, which we obtained from the Acri database. This allowed us to build the historical series of net asset values and total returns of the ten foundations between 2004 and 2016[2].

In figure 1 we show the evolution of the total assets expressed in terms of market and book value, respectively, for our sample. From this picture, it is apparent how the two measures differ, both in their levels and in their variations over the 2004-16 period. Indeed, the impact of the financial crisis on total assets at market value is clearly visible already from 2007, when the subprime crisis started. The effect of the Eurozone debt crisis is clearly visible from 2010 to 2011. On the other hand, the book value of total assets does not decrease until year 2011, when most foundations actually started to recognize the losses that they suffered over the 2007-2011 period; also notice that, as after 2011 some foundations recorded certain investment positions formerly represented as variable assets to fixed ones, the revaluation of total assets from 2013 to 2015 does not shows at book values.

Figure 1
Total assets of ten main foundations at market and book values (2004-16)



The overall picture is that the wealth of the ten foundations declined significantly over the whole period. The market value of total assets was 34.4 billions euro at the end of 2004, dropped to a minimum of 24.7 billions by 2012, then recouped to 30.1 billions by the end of 2016; this is more than four

[2] In Appendix 1 we provide details of the calculations we carried out to compute total assets and total returns at market values.

billions euro less than in 2004, with a decline of about 12.5 percent. This was a large dent in the assets of foundations in the aftermath of the financial crises, which does not show at book values.

Table 2
Real grants, returns and net assets at market values for ten main foundations (2004-16)

Year	Grants		Net returns		Net assets	
	Euro mln.	YoY %	Euro mln.	MW %	Euro mln.	CGR %
2004	699	–	–	–	34,239	–
2005	1,072	53.2	3,427	9.4	38,775	13.3
2006	1,130	5.5	6,266	15.2	43,472	12.1
2007	1,203	6.5	-868	-2.1	41,056	-5.6
2008	569	-52.7	-13,122	-39.0	26,153	-36.3
2009	758	33.3	3,939	14.4	28,667	9.6
2010	643	-15.1	-2,678	-10.0	25,063	-12.6
2011	303	-52.9	-974	-4.3	20,719	-17.3
2012	450	48.6	878	4.3	20,142	-2.8
2013	409	-9.2	3,606	17.1	21,919	8.8
2014	663	62.2	4,501	18.9	25,800	17.7
2015	434	-34.6	3,141	11.6	28,244	9.5
2016	318	-26.7	-2,815	-10.7	24,272	-14.1
Mean	665	1.5	442	2.1	29,117	-2.8
Mean 2004-08	935	3.1	-1,074	-4.1	36,739	-6.5
Mean 2009-12	539	3.5	291	1.1	23,648	-6.3
Mean 2013-16	456	-2.1	2,108	9.2	25,059	4.8

Note: 'YoY %' is the percent annual variation, 'MW %' is the money-weighted rate of return, 'CGR %' is the percent annual growth rate. Adjustments for inflation are based in the Oecd Consumer Price Index for Italy with base 2004.

Using balance sheet data, we also calculated operating costs and grants for each of the ten foundations, the sum of which is total spending in each year. Table 2 shows the average annual values of grants, returns and net assets for our sample in the 2004-2016 period, expressed in real terms. Up to year 2008, the annual average of all foundations' grants was 935 million euro at 2004 prices; this sharply declined to 539 million euro over the 2009-2013 period, a 42 percent drop, when the effects of the financial crises displayed on net assets and net total returns were negative on average and very volatile. From 2013 onwards, average annual net assets recovered slightly, but by the end of 2016 they were still ten billion euro lower than in 2004. However, average grants continued to decline, sliding by 15 percent to 456 million euro.

Therefore, foundations seem to have significantly reduced their activity after the beginning of the financial crises, perhaps reacting to the reduction in net assets that it implied and to an increased uncertainty of investment returns. This picture becomes clearer when one looks at the evolution of the components of total spending over time and at how much of available financial resources the latter absorbed.

Table 3
Mean of grants, operating costs and total spending for ten main foundations by periods

Means by period	Grants		Operating costs		Total spending		
	Euro mln.	% of Total	Euro mln.	% of Total	Euro mln.	% on Net assets	% on Net income
All years	73.4	88.4	8.2	11.6	81.6	2.5	76.6
2004-08	97.3	92.8	6.9	7.2	104.2	2.7	68.7
2009-12	61.3	86.1	8.9	13.9	70.1	2.6	79.3
2013-16	55.6	85.2	9.1	14.8	64.8	2.1	83.8

Note: Means are per foundation per year. Net assets is at market value, net income is at book value.

Table 3 shows, along with per-foundation average annual grants, operating costs and total spending, this time at current prices, the ratios of spending to net assets and net income by period. Over the entire period, about 88 percent of total spending is attributable to grants and 12 percent to operating costs. The latter, however, are the most rigid component of spending. In fact, compared to the substantial reduction in grants from 2008 to 2012, operating costs tended to increase. The compression of spending during the crisis, from 104 to 70 million euro on an annual average, did not immediately determine a fall of its incidence on net assets, which was just 0.1 percent lower than before; however, as net income at book value fell more than net assets because of the reduction in interest, dividends, coupons and, in some cases, of the recognition of capital losses, the incidence of spending on it actually increased, from 69 to 79 percent. From 2013 onwards, grants continued to decline, reaching an average of 56 million euro, while operating costs did not, being stable at about 9 million euro. As net assets recouped from the 2012 levels, the spending rate on them further fell to 2.1 percent.

All of these elements suggest that, with the unfolding of the financial crises, there has been a change in the spending policies of Italian banking foundations, which became more gradually more conservative. This stance seems to have persisted after year 2012, implying a sizeable reduction of grants. In the next section, we examine these issues in more detail, trying to infer, by analyzing the data we have collected, how such a change actually happened.

4. Model and results

For any foundation, let *S* be spending, *V* be the value of net assets, *t* be a time index for years and *P* be one plus the inflation rate in year (*t* – 1). Then, the Yale-Stanford rule equation is:

$$S(t)/P(t-1) = xS(t-1) + (1-x)zV(t-1)$$

where the smoothing and target spending-rate parameters are, respectively:

$$0 \leq x \leq 1, \quad 0 < z \ll 1$$

so that current year spending shall be set by the inflation-adjusted weighted sum of last year spending and of sustainable assets consumption in the long-run.

Regardless of foundations really following the Yale-Stanford model, this can be used, beyond its original *normative* purpose, as a *positive* tool for investigating how much importance they actually put to spending stabilization versus preserving the real value of assets and how sustainable their spending targets are in the long-run. Indeed, as smoothing decreases from one to zero, the rule represents approaches that vary between the polar cases of complete stabilization of spending, regardless of the value of assets, and of complete endowment conservation, regardless of the need to stabilize spending. Also, very high values of the target spending rate are likely to make an institution's activity less sustainable over time, while very low ones may imply that assets will be hoarded and future beneficiaries preferred to current ones, thus violating intergenerational neutrality.

To investigate the evolution of foundations spending policies, we have developed a simple linear regression model that allows us to estimate the average values of smoothing and target spending parameters of the Yale-Stanford rule for the ten foundations in our sample. The derivation of the model is as follows. First, divide the Yale-Stanford equation above by net assets at time (*t* – 1):

$$S(t)/[V(t-1)P(t-1)] = (1-x)z + S(t-1)/V(t-1)$$

Let *y* be the left-hand side term, that is spending scaled by net assets and adjusted for inflation, and *s* be spending scaled by net asset:

$$y(t) = (1-x)z + xs(t-1)$$

Then we define:

$$\beta_0 = (1-x)z, \quad \beta_1 = x$$

and allow current spending to depend on last year returns, beyond what the rule already posits through the lag of *V*, so as to control for foundations deviating from it in ways consistent with the findings Brown and co-authors (2014). Now let *i* be an index that runs across foundations; the transformed spending equation is:

$$y(i,t) = \beta_0 + \beta_1 s(i,t-1) + \beta_2 r(i,t-1)$$

In our linear regression model for spending, we add a composite error term to this equation:

$$\epsilon(i,t) = \mu(i) + \eta(i,t)$$

which is meant to represent any factor that may determine current spending beyond what the Yale-Stanford rule and the possible dependence to past returns, account for. Here, we allow for both a foundation-specific component and an idiosyncratic component. We assume that the error components have zero mean, that they are not correlated one-another, serially or across foundation and that they have constant variances:

$$Var[\mu(i)] = \sigma_\mu^2 \ , \quad Var[\eta(i,t)] = \sigma_\eta^2$$

for all *i* and *t*. These features imply that the composite error is such that:

$$E[\epsilon(i,t)] = 0$$

$$Var[\epsilon(i,t)] = \sigma_\mu^2 + \sigma_\eta^2$$
$$E[\epsilon(i,t), \epsilon(j,s)] = 0$$

for all $i \neq j$ and $s \neq t$, and

$$E[\epsilon(i,t), \epsilon(i,s)] = \sigma_\mu^2$$

so that errors are serially correlated for any foundation – but not across them.

From any consistent estimator of the linear regression model parameters we can consistently estimate the smoothing parameter *x* and the target spending-rate *z* as:

$$x = \beta_1, \quad z = \frac{\beta_0}{1 - \beta_1}$$

We can also compute approximate confidence intervals by the delta-method (Fox and Weisberg, 2019). Finally, we can check for foundations not deviating systematically from the spending rule by testing for $\beta_2 = 0$.

Getting consistent estimators for our regression is complicated by the fact that lagged spending and net assets are determined by the foundation-specific error component, which then is sequentially correlated with them. This is for two reasons: first, under the Yale-Stanford rule current spending depends on the first lag of spending; second, net assets depend on spending and returns, as:

$$V(t) = V(t-1)R(t) - S(t)$$

where *R* is the one plus the return on net assets[3]. Therefore, we cannot maintain that the error term is mean-independent, because:

$$E[\mu(i)|s(i,t-1), r(i,t-1)] \neq 0 \implies E[\epsilon(i,t)|s(i,t-1), r(i,t-1)] \neq 0$$

[3] For more on this, please refer to Appendix 2.

This situation is basically the same that has been extensively explored in the literature about inference for dynamic models with panel data, such as Anderson and Hsiao (1981), Arellano and Bond (1991), Holtz-Eakin (1991). From this, we know that we can estimate the first-differenced version of the regression equation:

$$\Delta y(i,t) = \beta_1 \Delta s(i,t-1) + \beta_2 \Delta r(i,t-1) + \Delta\epsilon(i,t)$$

by the (Generalized) Method of Moments, forming moment conditions from the sequential uncorrelation of the first differences of error terms with past lags of the explanatory variables and of their first-differences, that is:

$$E[s(i,t-k)\Delta\epsilon(i,t)] = 0$$
$$E[\Delta s(i,t-k)\Delta\epsilon(i,t)] = 0$$

for $k > 2$, and similarly for r and Δr.

However, this approach has some serious drawbacks. First, because of the form of our model, estimating the intercept of the regression equation is crucial for identifying the target spending-rate parameter z, but the intercept is wiped-out when we take the first-difference of the regression equation. Second, consistency of moment estimators in dynamic models is achieved as the cross-sectional dimension of the panel sample grows to infinity. This is problematic in our case, since our sample consists of just ten foundations; furthermore, the number of foundations in the sample cannot conceptually be thought as potentially growing very large, because the population of Italian banking foundations itself is limited to 88 institutions which, by the way, have always been the same since they were established in 1990[4]. Finally, the large-sample properties of such estimators are well known to be quite poor in moderate samples, in terms of bias, efficiency and convergence of sampling distributions when past lags of the endogenous variable do not correlate much with its current first-difference or when the variance of the individual

[4] For a similar argument, the time-series process of foundations spending history is limited to 29 years to date, which also conceptually hinders us using macro-econometric methods for panel data where inference is based on the time dimension extending for a long time in the past, such as those discussed in Pesaran and co-authors (1996, 1999).

error component is large, to the point that least-squares based estimators, although biased for *any* sample size, may be preferred (Blundell and co-authors, 2002). In our model, this means that if foundations do not smooth-out spending a lot, *i.e.* x is close to zero, or if foundation-specific random effect are important, then inference based on the first-difference regression equation is likely to be unreliable.

Notice that if foundation-specific random effects are not important and the idiosyncratic error component is not serially correlated, then the least squares estimator of the transformed spending equation is consistent along both the cross-sectional the time-series dimensions, and that under the constant variance and cross-uncorrelation assumptions, it is efficient. Therefore, under these conditions, we will prefer least squares than Generalized Method of Moments, because the latter is less efficient and may have large bias in our sample; then, deciding whether foundation-specific effects are to be taken care of or not makes a difference to our estimation strategy. We do this by the Holtz-Eakin (1988) testing procedure, which is based on the results of two Generalized Method of Moments estimators of the first-difference equation. Shortly, consider the following moment conditions:

1. $E[s(i,t-k)\Delta\epsilon(i,t)] = 0, \text{ for } k > 2$
2. $E[s(i,t-k)\epsilon(i,t)] = 0, \text{ for } k > 1$

and the hypotheses:

$$\text{H}_0\text{: } \mu(i) = 0 \text{ for all } i$$
$$\text{H}_1\text{: } \mu(i) \neq 0 \text{ for at least one } i$$

Under the null hypothesis, both conditions are valid, while under the alternative only the first is. Then, testing for foundation-specific effects reduces to testing the overidentifying restrictions of the estimator which uses both condition versus the estimator which uses only the first.

We make all analyses on our panel data-set of N = 10 foundations over T = 11 years – from 2005 to 2016, as 2004 is lost because of the lagged explanatory variables. As we are interested in investigating whether the spending decisions of foundations changed over time, we estimate several regression equations, where we either restrict parameters to be the same in all years, or we allow them to change over certain periods. The more general version maintains that the average smoothing and target spending-rate could have changed from 2005-08, before the effects of the financial crises materialized, to the critical 2009-12 period and over the aftermaths of the crises, beyond 2012. A second version of the equations pools the last two periods together, so that parameters are allowed to be different over the 2005-08 and 2009-16 periods only. For all three versions, we either control for lagged returns or we do not. Therefore, we estimate six different models, where current (inflation adjusted) spending depends on past spending, target spending-rate and: (1) past returns, (2) past returns and three periods, (3) nothing else, (4) three periods, (5) past returns and two periods and (6) two periods.

We run the Holtz-Eakin (1988) test for models 1 and 2, which are the more general, using a maximum of five lags to form the moment conditions. In both instances, we confidently do not reject the null hypothesis that foundation-specific effects do not matter. The value of the test for the pooled model is 0.504 and its p-value equals 0.918; for the model where parameters are allowed to change over three periods, the outcomes are 4.567 and 0.713.

Having not rejected that foundation-specific random effects are not significant for the dynamics of spending, we assume that errors are idiosyncratic and we estimate the parameters of the Yale-Stanford equation by least-squares. This is consistent and efficient under the assumptions that errors have are not serially- or cross-correlated and have constant variance over time and across foundations[5]. In table 4 we provide the results of our analyses for the first two specifications explained above. We show estimates and confidence intervals of the spending policy equation parameters where we allow them to change over the 2005-08, 2009-12 and 2013-16, and we control for lagged returns. Diagnostic tests for serial correlation, non-constant variance and contemporaneous correlation of the errors across foundations are shown at the bottom of the table; in the last line shows an F-test of the

[5] We carried out all analyses in the `R` environment (R Core Team, 2019). For panel data models we used the `plm` package (Croissant and Millo, 2008; Millo, 2017). `plm` test statistics methods have dependencies to the `car` package (Fox and Weisberg, 2019) and the `lmtest` package (Zeileis and Hothorn, 2002).

hypothesis that policy parameters do not change over time by testing the restrictions on the by-periods equation that transform it in the pooled model.

Table 4
Estimates of spending policy parameters by three periods controlling for returns

Parameters	1. Pooled			2. By periods		
	Estimate	5%	95%	Estimate	5%	95%
Smoothing	0.207	0.024	0.389	0.038	-0.182	0.257
Target return	2.642	2.387	2.896	2.867	2.473	3.261
Lag of return	-0.004	-0.010	0.002	-0.005	-0.011	0.001
Smoothing 2009-12				0.222	0.008	0.435
Smoothing 2013-16				0.487	0.223	0.750
Target return 2009-12				2.718	2.251	3.186
Target return 2013-16				2.878	2.129	3.628
Test	Statistic	P-value	Model	Statistic	P-value	Model
Serial correlation	2.191	0.845	N = 10	2.180	0.796	N = 10
Heteroscedasticity	0.675	0.714	T = 11	8.627	0.196	T = 11
Cross-dependency	59.693	0.070	NT = 110	65.503	0.036	NT = 110
Model significance	3.803	0.025	DoF = 2	2.558	0.024	DoF = 6
Pooled vs. By period	Statisitic = 1.874		P-value = 0.121		DoF = 4	

Note: Least squares estimates of spending policy parameters with 90 percent confidence intervals. The delta-method is used for computing confidence (Fox and Weisberg, 2019). Serial correlation is tested by the Durbin-Watson statistic, following Wooldridge (2002); Heteroscedasticity test is Breusch and Pagan's (1979); cross-dependency is tested according to Breusch and Pagan (1980) Lagrange-multiplier approach. For all three tests, errors are not correlated and have constant variance under the null hypothesis, so rejection casts doubt on the assumptions of the model which justify using least squares. The hypothesis that parameters are constant over the 2005-16 period is tested by the Wald procedure (Fox and Weisberg, 2019).

The pooled estimates of the smoothing and target-spending are 0.21 and 2.64 percent; this is close to the average spending rate on net assets for all years shown in table 3 and has a tight confidence interval – 2.39 to 2.90 percent. According to these results, foundations seem not to have smoothed spending a lot: besides the low value of the point estimate, the confidence interval extends very close to zero on the lower side; however, the higher side is about 0.39, so our estimate is not very precise. Lagged return does not have a significant partial effect on spending, neither by the magnitude of the estimated parameter, nor from the statistical point of view, because its confidence interval is very tight about zero. Our estimates from the by-periods equation provide evidence that target spending did not change much over time, since point estimates are in the 2.72 to 2.88 percent range. Here, confidence intervals are less tight than in the pooled equation, their width varying from about 0.8 to 1.5 percent; also, the three intervals overlap to a large extent, so that we cannot claim that target spending changed over time beyond what sampling error can justify. This is not so for smoothing, which is close to zero from 2005 to 2008 and gradually grows to 0.49 over the 2013-16 period; also, confidence intervals, although overlapping to some extent, gradually shift towards larger values. As for the pooled equation, there seem to be not any partial dependence of spending on lagged returns.

Diagnostic tests do not signal any serial correlation or heteroscedasticity in the errors, but we cannot reject their contemporaneous cross-correlation. Then, it is possible that least squares are not fully efficient, which may motivate the low precision of the smoothing estimator. This may also explain why the F-test of the hypothesis that policy parameters do not change over time is quite small and its p-value is 0.121, so that the claim that smoothing differs by periods is not very strong[6].

The evidence that we gather from estimating specifications (3) to (6) are not significantly different from the above and are reported in Appendix 3.

Taking care of limitations of our estimators, we nevertheless believe that our estimates provide some useful insights about foundations' spending policies, on how they reacted to the financial crises and on their long-term sustainability. First, on average it seems that foundations did not significantly change their attitude about long-term consumption of assets during or after the financial crises. This is the strongest claim we can make from the analyses above, and also a remarkable one because, regarding this aspect, spending policies of foundations were stable in times of financial turmoil. Furthermore, the estimated value of target spending-rates looks sensible, at least with

[6] One may argue that we should have allowed smoothing to change but target spending to be constant over periods. This solution is, however, troublesome because even if we forced the intercept of the 'by period' equation to be the same for all periods, the estimate of target spending could nevertheless change, as it depends on the smoothing parameter. Furthermore, doing so would violate the principle of marginality, which states that, in general, it is wrong to estimate main effects of explanatory variables where the variables interact but delete main effects that are marginal to them (Nelder, 1977). Nevertheless, when we have tried to impose the restriction that the intercept of the equation is the same over periods, any significant difference both in the estimates of parameters, in the F-Test for poolability and in the outcome of the cross-dependency test has not emerged. We also considered adding a time-specific random effect to our model, but this has made not any significant difference too. While the results of these trials are not reported here, they are available upon request from the authors.

respect to the investment opportunities which has unfolded from 2008 onwards, when interest rates were low, risky-asset returns quite uncertain and inflation moderate. We believe that the average target spending rates of about 3 percent which we estimate is consistent with long-term sustainability as it is consistent with sensible expectations of long-run expected returns,

Second, it seems that foundations did not link current spending to past spending very much, even though we have some evidence that smoothing gradually increased on average after 2008. Indeed, our point estimates are in the zero to 0.5 percent range, far below the 0.7 to 0.8 values which belong to Yale endowment, as well as to several other university funds in the United States. The main implication of this finding is that foundations mainly transferred temporary shocks that hit net assets to current spending and, because operating costs were quite rigid, in particular to current grants. We believe that this may explain the sharp decline of foundations granting activity from 2009 to 2012. Also, the increase of smoothing after 2012 may explain why spending stayed low and did not recover by 2016.

Finally, the lack of significance of lagged returns in both equations suggest that foundations did not systematically set spending according to the performance of their investments beyond what was its impact on net assets. Therefore, we have not any significant evidence of foundations systematically 'hoarding' their wealth by acting asymmetrically to shocks that hit their assets, contrary to what Brown and co-authors (2014) have found for university endowments in the United States. However, it shall be pointed out that because spending policies seem to have veered towards smoothing, the joint effect of grant reduction during the crises and its persistence afterwards seems to have set a quite conservative stance in foundation spending policies which is likely to trade-off the welfare of their current beneficiaries for that of future ones, thus violating intergenerational neutrality.

4. Concluding remarks

Banking foundations are important institutional investors and non-profit operators on the national scene. They derive the resources for their activities from investing their wealth on the financial markets and have a long-term mission. Therefore, the financial management of foundations is characterized by two antithetical objectives: the maintenance of adequate levels of spending in the short term and the conservation of net assets over the long term. The tension between these goals has emerged strongly during the financial crisis.

We estimate the smoothing and target spending rate parameters that describe the spending decisions of ten major Italian banking foundations between 2005 and 2016 by a linear regression model based on the Yale-Stanford rule and using net assets and returns at current market values.

Our analysis shows that foundations spending targets were mainly set with respect to net assets values, overshadowing the stabilization of spending in the short-term. The target rate of consumption of net assets was stable at about three percent over time, a level which is consistent with sustainable spending in the long-term. However, we find some evidence that, in the aftermath of the financial crises, foundations gradually started to smooth spending, albeit to a limited extent compared to what is common for university endowments in the United States.

Overall, spending policies seemed to be quite stable from 2005 to 2016, possibly except for a change towards linking current spending to past spending and not principally to the past value of net assets. Because the financial crises greatly reduced the real value of foundations' net assets, an increase in smoothing since 2013 may explain why spending remained low until 2016 if compared to the pre-crises' levels. We think that, if this may be justified on the grounds of a prudent financial management over the short-term, keeping this stance in the long-term can reduce the grant making activity of foundations excessively and conflict with the principle of intergenerational neutrality.

We believe that our research, which is the first to systematically tackle the topic of the spending policy of Italian banking foundation, has interesting prospects for future development. First, the extension of the sample to a greater number of foundations, possibly smaller than those considered here, can improve the understanding of the phenomenon and reveal possible differences in spending policies between small and big foundations. Indeed, as the size of foundations increase, they benefit from economies of scale both in operating expenses and in the management of their assets; also, big foundations often have professional skills and specialized investment offices to manage their portfolios, while small foundations do not and must outsource this activity to external advisors who may not always provide services suited to their specific needs.

Second, we deem it will be interesting to extend the analysis to the management of foundations investment portfolios, an aspect that is complementary to spending policy decisions. Indeed, target spending-rates and smoothing should depend on the expected return and risk profile of foundations investments; for example, institutions whose portfolios' returns are stable in the short-run can afford to smooth spending to a larger extent than those whose returns are volatile (Swensen, 2009).

Finally, as we acknowledge that some of our conclusion have limited scope because of the lack of precision of some of our estimates, a further effort shall be made in trying to improve them. We think of two ways for doing so. First, contemporaneous cross-correlation of regression errors which emerged from our analyses, shall be modelled explicitly: one way to di this is by seemingly-unrelated regression equations models (Zellner, 1968). Second, the estimation of spending policy parameters can be done by imposing prior constraints on their admissible value, as we know that smoothing must be in the zero to one range and that the target spending-rate must be positive and is likely not to exceed by much a sensible expectation of long-term real returns, say five percent. While this prior information cannot be handled correctly with classical econometric methods, it surely is with Bayesian ones, – at the price of a heavier computational cost (Gelman and co-authors, 2013). In this direction, we think that hierarchical models for panel data, such as those described by Chib (2008), may be a tool for improving inference.

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Appendix 1 – Calculation of total returns and spending

The methodology for calculating total returns on financial assets at market values is as follows:

1. We calculate the change of the market value of financial assets between the beginning and end of each fiscal year;

2. This change reflects both the change in market value of incumbent investments and the change in the holdings of financial assets during the fiscal year, so that we subtract the variation of assets at book values to the result of point 1;

3. Since the change in assets at book values already considers some revaluations made during the period, the latter must be added to the result of Point 2 (specifically: 'Risultato delle gestioni patrimoniali individuali', 'Rivalutazione (svalutazione) netta di strumenti finanziari non immobilizzati', 'Rivalutazione (svalutazione) netta di immobilizzazioni finanziarie' and 'Plus / minusvalenze da alienazione di immobilizzazioni finanziarie');

4. Finally, the result of Point 3 is added to current income deriving from dividends and interests, realized gains and losses deriving from the trading in non-fixed financial assets.

Tax returns on dividends, interest expense and other financial charges, costs and charges for asset management, and trading commissions are deducted from returns. Therefore, the returns used in this work are total net returns. Based on the value of financial assets at market prices, net assets were also expressed at market values.

Operating costs are total charges reported in the income statement, net of charges related to financial management – as these are already discounted from returns – of provisions and amortization.

Grants are the sum of those approved during the year and of grants financed by funds set aside in previous years: they are the effective grants of foundations in the fiscal year.

Appendix 2 – The Yale-Stanford Rule

The Yale-Stanford rule sets spending for the current year on the basis of spending and of the value of net assets in the previous year, adjusted to account for price changes. We define:

- S annual spending
- V net assets (year-end)
- P annual price growth factor (one plus annual inflation rate)
- t time index in {0, 1, 2, 3, …}
- x smoothing parameter in [0,1]
- z target spending rate parameter in (0,1)

then, the Yale-Stanford rule equation is:

$$S(t) = xS(t-1)P(t-1) + (1-x)zV(t-1)P(t-1)$$

If the smoothing parameter x is equal to one, then the rule requires that spending be kept constant in real terms, regardless of the value of net assets; if x is equal to zero, then the rule requires that the spending in real terms be equal to the constant fraction z of the value of net assets. In general, the target spending parameter z sets the ratio of spending and net assets over the long term – in steady state conditions. This makes it possible to establish whether the spending policy is sustainable over the long term. Let R be the annual capitalization rate of net assets so that

$$V(t) = V(t-1)R(t) - S(t)$$

Then, plugging-in S from the Yale-Stanford equation we get:

$$V(t) = V(t-1)R(t) - xS(t-1)P(t-1) - (1-x)zV(t-1)P(t-1)$$

Let's define:

- G the annual growth factor of net assets
- q the spending-to-net assets ratio (at beginning of year)

Then, we divide the last equation by $V(t-1)$ and obtain:

$$G(t) = R(t) - (1-x)zP(t-1) - xq(t-1)P(t-1)$$

In steady-state conditions, P and R are equal to their long-term values and G is constant as well. So, the steady state of the former equation is (superimposed bar means 'steady-state value'):

$$\bar{G} = \bar{R} - z\bar{P} + (z - \bar{q})x\bar{P}$$

In the long-run, the current spending rate q and the target spending rate z are the same by definition, therefore:

$$\frac{\bar{G}}{\bar{P}} = \frac{\bar{R}}{\bar{P}} - z$$

The left-hand side of this equation is the ratio between the annual variation factor of the net assets value and the annual variation factor of prices. If spending is exactly sustainable, that is, such as to maintain constant the expected real value of net assets, then:

$$\bar{G} = \bar{P}$$

From this, the sustainability condition for spending is:

$$1 + z = \frac{\bar{R}}{\bar{P}}$$

For small values of the numerator and the denominator, this can be approximated as:

$$z \approx \bar{R} - \bar{P}$$

If the target spending rate equals the real return on net assets, then spending is exactly sustainable; if it is higher, net assets increases over time, while, if it is lower, they decrease*.

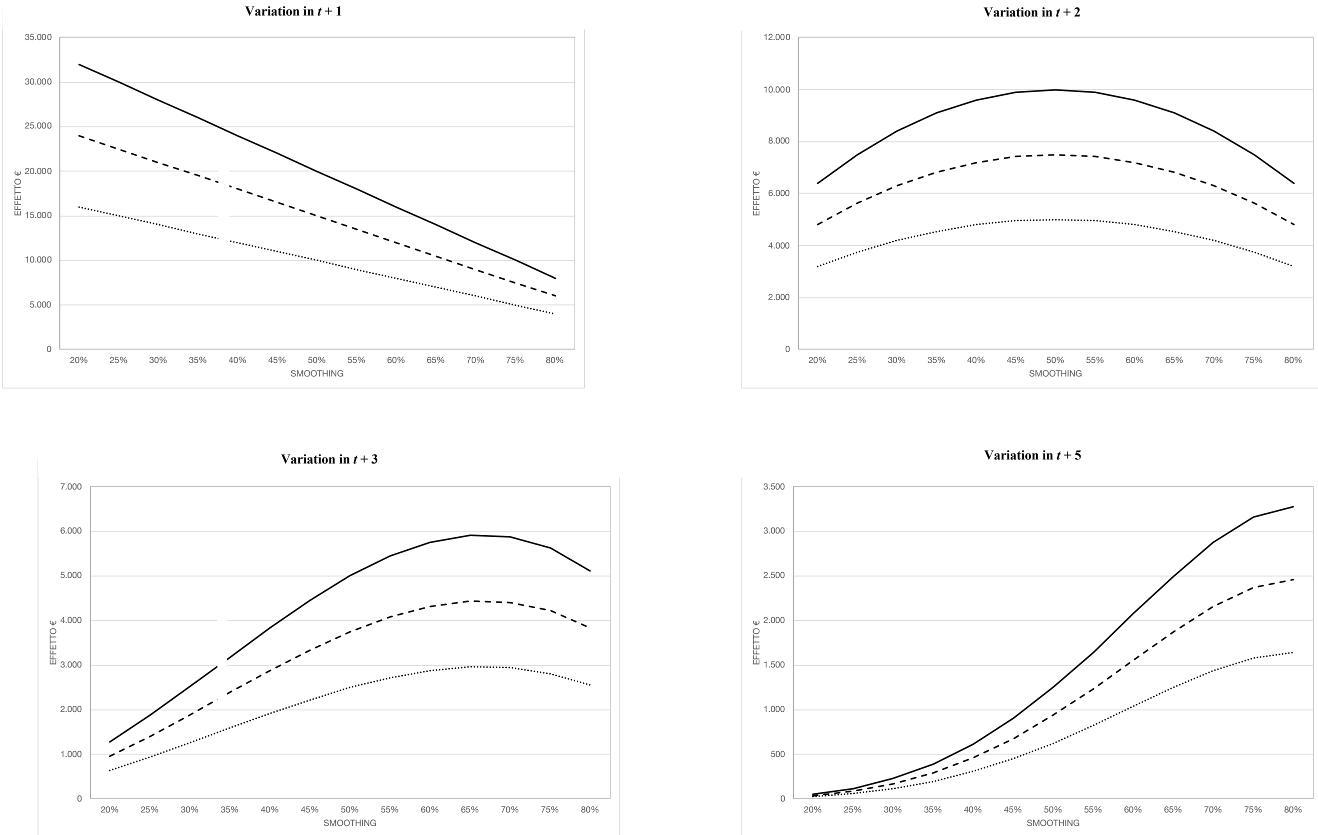
Parameters x and z have the further function of regulating the extent to which past changes in real net assets have an impact on current spending. This is evident by solving the Yale-Stanford rule equation recursively by brute-force:

* Note that if x = 1 then the target spending rate z becomes irrelevant. Nevertheless, the sustainability conditions are still valid for long-term *effective* spending.

$$
\begin{aligned}
S(t) =& xS(t-1) + (1-x)zV(t-1) \\
=& (1-x)z[V(t-1) + xV(t-2)] + x^2 S(t-2) \\
=& \cdots = (1-x)z \sum_{h=1}^{H} x^{h-1} V(t-h) + x^H S(t-H)
\end{aligned}
$$

The effect of a temporary shock hitting V on S declines geometrically over time. As an example, Figure A1 illustrates the magnitude of this effects for different values of the x and z parameters at one, two, three and five years after the shock. Note that the effects get smaller over time but, given the same target spending rate, higher values of the smoothing parameter – i.e. more attention to stabilizing spending in the short-term – mean that they persist for longer, as they entail proportionally greater reductions in future net assets values. For given smoothing parameter, as the target spending increases, the effects of a shock to V on spending increase in every future year.

Figure A1
Effects of current variations of net assets on future grants according to the Yale-Stanford rule



NOTE: The graphs are plotted for a change of one million euro in the value of net assets due to the volatility of investments or a shock on the level of the price index. The solid lines refer to a target spending rate of 4 percent, the dashed lines of 3 percent and the dotted lines of 2 percent. The four panels, from top to bottom and from left to right, show the current effects of variations occurring at one, two, three and five years.

Appendix 3 – Further estimation results

The tables in this appendix display the estimation results of specifications (3) to (6) of the linear regression equation.

Table A1
Estimates of spending policy parameters by three periods

Parameters	3. Pooled			4. By periods		
	Estimate	5%	95%	Estimate	5%	95%
Smoothing	0.256	0.086	0.426	0.120	-0.080	0.320
Target return	2.643	2.371	2.915	2.845	2.413	3.278
Smoothing 2009-12				0.254	0.042	0.465
Smoothing 2013-16				0.544	0.287	0.801
Target return 2009-12				2.750	2.259	3.241
Target return 2013-16				2.889	2.039	3.739
Test	Statistic	P-value	Model	Statistic	P-value	Model
Serial correlation	2.112	0.717	N = 10	2.074	0.596	N = 10
Heteroscedasticity	1.037	0.309	T = 11	10.248	0.069	T = 11
Cross-dependency	62.785	0.049	NT = 110	64.537	0.030	NT = 110
Model significance	6.144	0.015	DoF = 2	1.693	0.157	DoF = 8
Pooled vs. By period	Statisitic = 1.693		P-value = 0.157		DoF = 4	

Note: Least squares estimates of spending policy parameters with 90 percent confidence intervals. The delta-method is used for computing confidence (Fox and Weisberg, 2019). Serial correlation is tested by the Durbin-Watson statistic, following Wooldridge (2002); Heteroscedasticity test is Breusch and Pagan's (1979); cross-dependency is tested according to Breusch and Pagan (1980) Lagrange-multiplier approach. For all three tests, errors are not correlated and have constant variance under the null hypothesis, so rejection casts doubt on the assumptions of the model which justify using least squares. The hypothesis that parameters are constant over the 2005-16 period is tested by the Wald procedure (Fox and Weisberg, 2019).

Table A2
Estimates of spending policy parameters by two periods controlling for returns

Parameters	1. Pooled			5. By periods		
	Estimate	5%	95%	Estimate	5%	95%
Smoothing	0.207	0.024	0.389	0.068	-0.151	0.286
Target return	2.642	2.387	2.896	2.869	2.459	3.279
Lag of return	-0.004	-0.010	0.002	-0.006	-0.012	0.000
Smoothing 2009-16				0.289	0.087	0.491
Target return 2009-16				2.652	2.309	2.994
Test	Statistic	P-value	Model	Statistic	P-value	Model
Serial correlation	2.191	0.845	N = 10	2.240	0.887	N = 10
Heteroscedasticity	0.675	0.714	T = 11	3.246	0.518	T = 11
Cross-dependency	59.693	0.070	NT = 110	67.591	0.016	NT = 110
Model significance	3.803	0.025	DoF = 3	2.885	0.026	DoF = 4
Pooled vs. By period	Statisitic = 1.902		P-value = 0.154		DoF = 2	

Note: Least squares estimates of spending policy parameters with 90 percent confidence intervals. The delta-method is used for computing confidence (Fox and Weisberg, 2019). Serial correlation is tested by the Durbin-Watson statistic, following Wooldridge (2002); Heteroscedasticity test is Breusch and Pagan's (1979); cross-dependency is tested according to Breusch and Pagan (1980) Lagrange-multiplier approach. For all three tests, errors are not correlated and have constant variance under the null hypothesis, so rejection casts doubt on the assumptions of the model which justify using least squares. The hypothesis that parameters are constant over the 2005-16 period is tested by the Wald procedure (Fox and Weisberg, 2019).

Table A3
Estimates of spending policy parameters by two periods

Parameters	3. Pooled			6. By periods		
	Estimate	5%	95%	Estimate	5%	95%
Smoothing	0.256	0.086	0.426	0.174	-0.219	0.370
Target return	2.643	2.371	2.915	2.841	2.375	3.307
Smoothing 2009-16				0.333	0.133	0.532
Target return 2009-16				2.646	2.277	3.015
Test	Statistic	P-value	Model	Statistic	P-value	Model
Serial correlation	2.112	0.717	N = 10	2.111	0.694	N = 10
Heteroscedasticity	1.037	0.309	T = 11	3.624	0.305	T = 11
Cross-dependency	62.785	0.049	NT = 110	66.751	0.019	NT = 110
Model significance	6.144	0.015	DoF = 2	2.781	0.045	DoF = 3
Pooled vs. By period	Statisitic = 1.095		P-value = 0.338		DoF = 2	

Note: Least squares estimates of spending policy parameters with 90 percent confidence intervals. The delta-method is used for computing confidence (Fox and Weisberg, 2019). Serial correlation is tested by the Durbin-Watson statistic, following Wooldridge (2002); Heteroscedasticity test is Breusch and Pagan's (1979); cross-dependency is tested according to Breusch and Pagan (1980) Lagrange-multiplier approach. For all three tests, errors are not correlated and have constant variance under the null hypothesis, so rejection casts doubt on the assumptions of the model which justify using least squares. The hypothesis that parameters are constant over the 2005-16 period is tested by the Wald procedure (Fox and Weisberg, 2019).

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