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DIPARTIMENTO DI
ECONOMIA E DIRITTO

MACRO ASSET ALLOCATION WITH SOCIAL IMPACT INVESTMENTS

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Introduction

- **Social Impact Investments** (SII) are an asset class that can be used for portfolio allocation.
- The Mission Alignment Working Group (MAWG, 2014) finds that SII are **anticyclical** ➔ useful for portfolio diversification.
- Consequently, SII can interest investors concerned by their social impact ("impact-first" investors), but also "standard" investors interested by the risk-return portfolio performance (**"financial-first" investors**, as categorized by Freireick and Fulton, 2009).
- Aim of the paper: to compare the **out-of-sample performance of portfolios including or not a Social Impact Finance Stock Index** (built by us).

Literature review

- Some money managers are starting to treat impact investment as an asset class, often including it within "alternatives" (MAWG, 2014).
- Alternative investments have been proven to be an opportunity.
- There are a number of studies devoted to investigating the characteristics of alternative investments as portfolio components
  - Real estate
  - Private Equity
  - Fine Art
  - Socially Responsible Investments (SRI)

Literature review

Real Estate	▪ **Kuhle (1987):** data from 26 REITs and 42 common stocks; no significant performance benefits of REITs in a stock portfolio. ▪ **Lee and Stevenson (2005)** and **Chiang and Ming-Long (2007):** significant role for diversification over different time horizons and enhancement of the efficient frontier.
Private Equity	▪ **Chen et al. (2002):** low correlation coefficient (0.04) between venture capital and stocks, suggesting an allocation of 2% (for the minimum variance portfolio) to 9% (in the maximum Sharpe Ratio portfolio) for mixed asset portfolios. ▪**Schmidt (2004):** unique dataset of 642 US private equity funds and bootstrap simulations of several pure and mixed asset portfolios; result suggest a wide range of optimal portfolio weightings between 3% and 65% depending on the strategic investment goal.
Fine Art	▪ **Baumol (1986), Frey and Pommerehne (1989), Candela and Scorcu (1997)** and **Pesando and Shum (1999)**: fine art investments suitable only for those investors primarily addressing the aesthetic dividend deriving from the asset. ▪ **Campbell (2005, 2005b):** fine art assets hold up better during market crisis periods, therefore, improving portfolio diversification, increasing returns and lowering volatility.
SRI	▪ **Bello (2005), Adler and Kritzman (2008), Renneboog et al. (2008)**: no differences compared to traditional investments; in some cases, investors pay for ethics. ▪ **Nofsinger and Varma (2014):** socially responsible funds outperform during periods of market crises, thus, adding value for those investors seeking downside risk protection.
SII	▪ **AAWG (2014)**: first attempt to propose a portfolio which also includes SII; investors may achieve the same financial return while improving portfolio diversification, at the cost of some increase in illiquidity. ▪ **La Torre et al. (2017)**: by applying Markowitz (1952, 1959) and Sharpe (1963) methodology to alternative samples, including or not SII, they show that in terms of Sharpe Ratio non-impact portfolios outperform SII portfolio, as a consequence of their higher financial returns for the same level of risk. However, their analysis is very market-specific.

Sample Selection

- To select our sample of SIF, we start out with the full list of companies reported on wikipositive.org
- We include only firms that are listed on a stock exchange and are compliant with at least 4 out of the 5 main criteria outlined in OECD (2015).
  - Social Target Areas
  - Beneficiary context
  - Degree of publicness
  - Delivery organization intent
  - Measurability of Social Impact
- We also add 11 SIF that are admitted to the London Social Stock Exchange (SSX)
- Overall we have complete information for 50 SIF (at most 47 at the same time).

Macro assets

- Three macro asset classes represented by the following three indices, all computed in local currencies:
  - Social Impact Finance Stock Index (**SIFSI**);
    - built using closing prices for each SIF stock included;
    - including the securities as they are listed in Thomson Reuters Datastream, without the first ten days of listing following the MSCI methodology;
    - weighting each constituent by applying the free float rate to the market capitalization, as done by MSCI.
  - Morgan Stanley Capital International All Country World Index (**MSCI ACWI**).
  - Morningstar Global Government Bond Index (**MGGBI**).
- Data provider: Thomson Reuters Datastream.

Descriptive statistics

Index	Mean	Std. dev.	Skewness	Ex. Kurt.
SIFSI	0.035%	1.020%	-0.074	5.808
ACWI	0.033%	0.983%	-0.272	9.115
MGGBI	0.014%	0.169%	-0.096	1.957

- Stock indices have similar mean (SIFSI even slightly higher) and standard deviation of the returns on the whole period.
- Bond index presents, as expected, lower levels of return and risk.
- SIFSI seems safer than MSCI ACWI because of higher skewness and lower kurtosis, that is a lower probability of crashes.

Portfolio allocation

- **Portfolios:**
  - Portfolio 1: MSCI ACWI + MGGBI;
  - Portfolio 2: SIFSI + MGGBI;
  - Portfolio 3: SIFSI + MSCI ACWI + MGGBI.
- **Period**: January 1st 2002 to September 30th 2018.
  - Out-of-sample: 60 months of 22 working days each (1320 observations).
- **Assumptions**:
  - no transaction costs;
  - no savings decisions and intermediate consumption;
  - constant relative risk aversion (CRRA) utility function.

Portfolio allocation methodologies

Three different methodologies:

- **Naïve**: equally divided (50%-50% or 33% each).
- **GARCH-copula model** (Riccetti, 2013)
  - Mean expected return: unconditional (historical);
  - Shocks: GARCH(1,1), with error terms extracted from a multivariate distribution with Skewed-t marginals and Student-t copula function (higher likelihood than Clayton and Normal copulas).
- **Mean-variance optimization** (Markowitz, 1952)
  - Mean expected return: unconditional (historical);
  - Shocks: GARCH(1,1), with error terms extracted from a multivariate Normal distribution.

Performance evaluation

The comparison among the performances of the portfolios is evaluated in terms of:

- **final capitalization** (equivalent to overall return);
- **Sharpe ratio** = mean/standard deviation of returns (Sharpe, 1963);
- **CRRA utility**: $U(\gamma) = (1 - \gamma)^{-1} (P_0 R_{port})^{(1-\gamma)}$
  - for investors with *different level of risk aversion* γ = 2, 5, 10, 15.
- **Forecast premium** (compared to 33% portfolio) with a fourth-order Taylor approximation of the CRRA utility function:

$$\theta = (m_m - m_e) - \frac{\gamma}{2}(m^2_m - m^2_e) + \frac{\gamma(\gamma+1)}{3!}(m^3_m - m^3_e) - \frac{\gamma(\gamma+1)(\gamma+2)}{4!}(m^4_m - m^4_e)$$

where m are the non central moments of order i: m^i = mean(r^i).

Results γ = 2

Final amount	Copula allocation	Mean-variance allocation	Naïve allocation
ACWI + MGGBI	2.2035	Defaulted	1.4006
SIFSI + MGGBI	1.9920	**3.8550**	1.5029
ACWI+SIFSI+MGGBI	2.0657	3.7695	1.5679

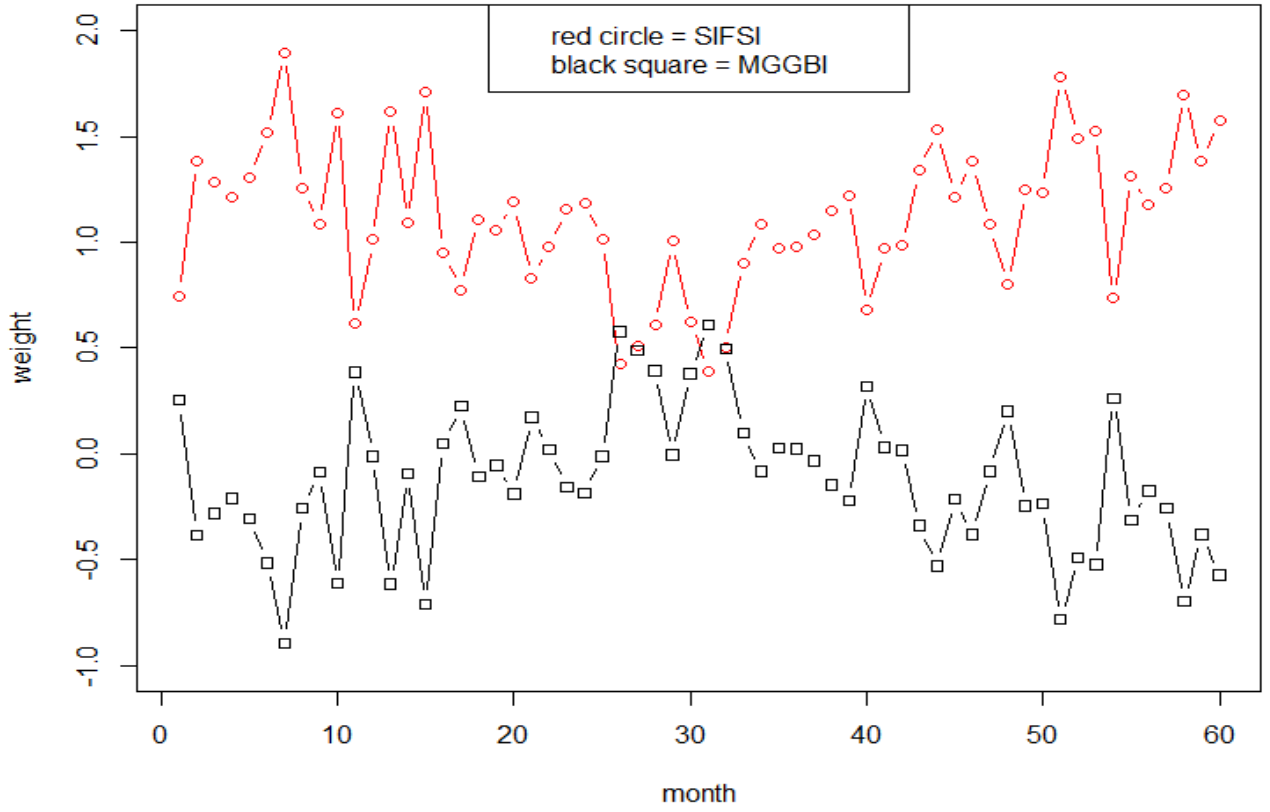
Sharpe ratio	Copula allocation	Mean-variance allocation	Naïve allocation
ACWI + MGGBI	0.2025	Defaulted	0.3758
SIFSI + MGGBI	0.2407	0.2580	0.3143
ACWI+SIFSI+MGGBI	0.1901	0.2228	0.3522

Forecast premium	Copula allocation	Mean-variance allocation
ACWI + MGGBI	0.256%	Defaulted
SIFSI + MGGBI	0.280%	**0.921%**
ACWI+SIFSI+MGGBI	0.148%	0.211%

Results γ = 5

Final amount	Copula allocation	Mean-variance allocation	Naïve allocation
ACWI + MGGBI	1.6013	2.1575	1.4006
SIFSI + MGGBI	1.4892	2.0798	1.5029
ACWI+SIFSI+MGGBI	1.5537	2.2183	1.5679
Sharpe ratio	**Copula allocation**	**Mean-variance allocation**	**Naïve allocation**
ACWI + MGGBI	0.2461	0.2345	0.3758
SIFSI + MGGBI	0.2809	0.2801	0.3143
ACWI+SIFSI+MGGBI	0.2311	0.2335	0.3522
Forecast premium	**Copula allocation**	**Mean-variance allocation**	
ACWI + MGGBI	-0.100%	-0.204%	
SIFSI + MGGBI	-0.109%	**0.123%**	
ACWI+SIFSI+MGGBI	-0.152%	-0.243%	

Mean-variance weights, γ = 5



Results γ = 15

Final amount	Copula allocation	Mean-variance allocation	Naïve allocation
ACWI + MGGBI	1.3318	1.4994	1.4006
SIFSI + MGGBI	1.2854	1.4502	1.5029
ACWI+SIFSI+MGGBI	1.3217	1.5225	1.5679
Sharpe ratio	**Copula allocation**	**Mean-variance allocation**	**Naïve allocation**
ACWI + MGGBI	0.3581	0.3242	0.3758
SIFSI + MGGBI	0.3098	0.3465	0.3143
ACWI+SIFSI+MGGBI	0.3314	0.3065	0.3522
Utility	**Copula allocation**	**Mean-variance allocation**	**Naïve allocation**
ACWI + MGGBI	-0.06803	-0.06840	-0.06752
SIFSI + MGGBI	-0.06849	-0.06803	-0.06825
ACWI+SIFSI+MGGBI	-0.06817	-0.06850	**-0.06745**

Conclusions

- Investors with low risk aversion (γ = 2 or 5): the utility is maximized when the mean-variance allocation (the relatively riskiest model) is applied to a portfolio that uses the SIFSI and the bond index (without the overall stock market index, that is the riskiest index in terms of skewness and kurtosis).
  - Very large weight of SIFSI: sometimes above 100%, with short selling of the bond index.
- Investors with strong risk aversion (γ = 10 or 15): the utility is maximized with a naïve allocation including all indices.
  - Weight of SIFSI is 33.33%, much larger than the capitalization of the SIF stocks compared to the whole stock market.
- Investing in SIF stocks is an effective way to **improve the portfolio performance for investors with different level of risk aversion.**