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An Examination of the Diversification Benefits of SRI in a Portfolio Context

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Abstract

This paper examines diversification benefits of Socially Responsible Investment (SRI) in a portfolio context. SRIs have been documented with lower volatility, while not sacrificing returns as compared to mainstream shares. Two portfolios are formed from Australian investors' perspective using daily data from 1994 to 2012 and are compared against each other; one portfolio consisting of SRI with mainstream shares and bonds and another without SRI. Our results confirm the benefits of SRI in a portfolio with a higher efficient frontier and the SRI portfolio obtained higher risk-adjusted return with lower value-at-risk. The findings are useful to SRI investors and fund managers who have interest in diversifying their portfolios into SRI.

Keywords: socially responsible investments, portfolio, Australian perspective

1. Introduction

1.1 Introduction to SRI diversification

As more and more negative extreme events happening in financial market, investors are more concerning about their investment risks. During the Global Financial Crisis (GFC), the Australian stock market had a total loss of 18% from Quarter 1, 2007 to Quarter 3, 2008. In contrast, under normal market condition, from Quarter 1 to Quarter 4 2006, there was a 22% gain for Australian stocks (Erkens, Hung, & Matos, 2012). Even though these extreme events could be retrospectively explained, they are not predictable (Taleb, 2010). So it is important to plan ahead.

An effective way to reduce risk while maintaining the same return, according to the of modern portfolio theory (Markowitz, 1952), is to diversify into different investment assets. Bond markets have been the stock market diversifier for years. To further diversify investment portfolio risk, new investment asset class need to add into the traditional stock and bond portfolio.

According to the recent empirical researches, fast growing SRI (Socially Responsible Investment) has higher return and lower risk comparing with traditional stock market. This performance pattern makes SRI a good diversifier. So we have added SRI into a traditional investment portfolio consists of stocks and bonds to compare with the traditional investment portfolio itself. The out of sample simulation results of these two portfolios show SRI portfolio returns, Sharpe ratios are higher than the traditional portfolio. Efficient frontier for the SRI portfolio is higher than the traditional portfolio and the optimal portfolio put large weights on SRI. All these results show SRI has high diversification power for traditional investment portfolio for Australian investors. But there are only limited number of studies discuss the SRI diversification power. So our paper fills in the gaps from Australian point of view.

SRI refers to investment that takes into consideration of social, environmental, ethical and financial dimensions all together. However in practice, there is no general definition of what exactly is a socially responsible investment, and there is little consistency in terms of the measurement standards (Ali & Gold, 2002; Hamilton, Jo, & Statman, 1993; Hancock, 2005; Statman, 2000). In addition, the SRI usually take into consideration of the ecology, social, corporate and government criteria, which often include the local community engagement and shareholders' participation in the future corporation strategies (Renneboog, Ter Horst, & Zhang, 2006). Hence what is socially responsible varies to different people based on their own perspectives. In financial industry, there are mainly three ways to identify socially responsible investment, positive screening, negative screening and best-in-class approach.

Given the nature of SRI, governments around the world, for example, UK, Sweden, US, France, Germany and South Africa, are trying to promote this socially beneficial investment by regulations (Berry, Edgerton, & George, 2011). The Australian government is also implementing this by increasing the level of disclosure on investment

product[39] and encouraging better communication with clients[40]. Further the SRI is increasing fast; there is a 7% increase from $15.41 million in 2010 to $16.5 million in 2011, whereas the growth of total assets under management is only 1.8% for the same time period. The return comparison between SRI and mainstream stock funds are shown in Table 1. Both of the Australian share funds and overseas share funds returns from SRI beat corresponding mainstream funds for each investment period (Corporate Analysis. Enhanced Responsibility, 2011).

Table 4: Comparison between SRI and Mainstream Share Funds

	1 year	3 years	5 years	7 years
Australian Stock Funds				
Average SRI Fund	10.81	0.98	2.38	8.38
Average Mainstream Fund	10.09	0.17	1.65	7.63
S&P/ASX 300 Accumulation	11.90	0.26	2.37	8.38
Overseas Stock Funds				
Average SRI Fund	4.66	-2.15	-0.29	5.21
Average Mainstream Fund	4.24	-3.79	-4.99	-0.89
MSCI World ex Australia Index	2.66	-3.28	-5.15	-1.17
Balanced Growth Funds				
Average SRI Fund	9.80	2.19	2.81	7.00
Average Mainstream Fund	7.65	1.97	1.80	4.58

Table 1 extracted from the Responsible Investment Annual 2011 Report (Corporate Analysis. Enhanced Responsibility, 2011)

1.2 Relevant studies

There is no consistency in SRI performance studies; different methodologies, markets and sample periods give different study results.

As one of the earliest study on the Australian SRI, Tippet (2001) find SRI funds[41] performed worse than the general market. Both of the annual returns and the holding-period returns show that SRI funds and portfolio consist of SRI funds perform worse than the market index (All Ordinaries Accumulation Index). Ali and Gold (2002) state the exclusion of sinful industries suffers a financial sacrifice. Sinful industry proxy, ASX Alcohol and Tobacco Index outperforms the broad market by 9.8% per annum with a low, 51%, market sensitivity from December 1994 to December 2001. Another sinful industry proxy, the ASX Tourism and Leisure Index (gambling) underperforms the broad market by 3% per annum with a very strong correlation (95%) for the same time period. However the gambling proxy index has higher Sharpe ratios and reward ratios comparing with the broad market. Similarly, Chong, Her, and Phillips (2006) state the sinful fund could generate higher return. They have compared the risks and returns of an ethical fund (Domini Social Equity Fund), an unethical fund (Vice fund) and a benchmark (S&P 500) for the period from 16 September 2002 to 16 September 2005. Both traditional (Jensen's alpha, Sharpe ratio) and conditional (ARCH) methods show the SRI fund underperforms the unethical fund.

Despite these SRI underperformance studies, there are much literature state there is no statistically significant performance difference between SRI and conventional funds. Hamilton et al. (1993) suggest the market does not price socially responsible characteristics. Assigning NYSE as the benchmark, and using 32 SRI monthly data from January 1981 to December 1990, they find most of the alphas are not statistically significant. In addition, the return difference between SRI funds and conventional was not statistically significant either. Later, Statman (2000) extended the study by including more market indexes. The comparison of basic statistics between indexes showed that the SRI index, Domini Social Index (DSI), had higher return yet higher risk comparing with large

[39] Financial Service Reform Act 2001 and compulsory guidelines from Australian Securities and Investment Commission (ASIC).
[40] Best Practice Guidelines from ASIC since May 2005.
[41] Tippet (2001) applied 84 monthly returns from 30 June 1991 to 30 June 1998 from 3 SRI funds, Tower Life Ethical, the Australian Ethical Investment Trust and the Tyndall Ethical Balanced Investment Trust.

cap stocks index (S&P 500) and an index for all stocks (CRSP 1-10). Only 3 out of 31 Jensen's alphas are statistically different from 0 by assigning S&P 500 and CRSP 1-10 as benchmarks respectively.

Furthermore, R. G. Luther, Matatko, and Corner (1992) find the over- or under-performance is sensitive to the benchmark and data period used and the capital market capitalizations of socially responsible companies are smaller comparing with the general UK stock as a whole. R. Luther and Matatko (1994) try to use 9 UK ethical unit trusts for the period March 1985 to March 1992 to find suitable benchmark for studying SRI. By assigning FT All-share Index as a benchmark, eight of nine alphas are negative and none of them is statistically significant. After assigning Hoare Govett Smaller Companies indexes, all of the 9 Jensen's alphas are positive. However, only one of them is statistically significant. Even though these two indices highly correlated with each other, the regression estimate by using both indexes gave us the highest R -squares and $\bar{R}$-squares. Similar results are found in the fixed 32-months period. Results bring our attention to the small company effect in the SRI market.

The statistically insignificant difference between SRI and general investment was also found by taking various forms of risks into consideration. Sauer (1997) compared the monthly raw returns, Jensen's alpha (market risk) and the Sharpe performance index (total risk) between the Domini 400 Social Index, the S&P 500 Index and the CRSP Value Weighted Market Index for period 1 January 1986 to 31 December 1994. Results do not show any statistically significant difference. Results from corresponding funds[42] also confirm the ethical restraint did not deprive the performance. Some more extensive studies have been done by Bauer et al. (2007; 2005; 2006). Bauer et al. apply the Carhart 4-factor model on data from the United States, the United Kingdom, German, Australia and Canada. Only the German SRI performs worse than the conventional market, all others have no statistically significant difference. There is also a catching up phase for each of the SRI market studied.

Not only the unconditional methods proved the insignificant performance, but also the conditional method gave the same results. After the confirming the existence of heteroskedasticity in Domini Social Index 400 for period January 2003 to December 2003,Becchetti and Ciciretti (2009) applied the GARCH (1, 1) and asymmetric power ARCH to the data. Both of the models confirmed there is no statistically significant difference in the returns of SRI with conventional funds.

However among the literatures, there are only a few studies have been done to test diversification power of SRI. Kurtz (1997) states the socially responsible screening would result in selecting assets with similar unsystematic risk. Consequently the portfolio risk is not well diversified. This result is consistent with Waddock, Graves, and Gorski (2000). Waddock et al. (2000) affirms the non-financial asset selection criteria would lower economic returns. On the contrary, Hickman, Teets, and Kohls (1999) suggests that SRI has lower unsystematic risks. There are mainly two reasons behind it. Firstly, socially responsible corporations, unlike irresponsible corporations, were free of penalties and other occasional unethical punishment[43]. Secondly, social investors are sticker comparing with general investors, especially during high volatile period. This stability provides diversification opportunity for a portfolio.

Since currency exchange rate plays an important role in international diversification (Dominguez & Tesar, 2006), the Australian perspective is crucial for measuring Australian investors' benefit. Moreover, most the SRI studies had short sample periods and do not adequately cover the financial distress period. So in this paper, we study a longer time horizon and collect prices in Australian dollars.

2. Method

2.1 Research Methodology

According to Jorion (1985), there two major limitations of the classical mean-variance analysis. One limitation is the poor out-of-sample portfolio performance. Asset allocation is excessive sensitivity to variations of expected returns is another limitation. Therefore in order to better forecast the portfolio returns, Stein (1956) suggest to pool all the assets in the portfolio and do the analysis rather than doing the analysis individually for each asset. With the benefit of shrinking mean to a common value, the predicting procedure is less affected by the extreme observations. So in this study, there are two shrinking procedures used. One is to shrink sample return against the return of Global Minimum Variance (GMV) portfolio and another one is to shrink sample covariance matrix

[42] Taking additional screening and monitoring costs into consideration.
[43] Due the nature of socially responsible companies, they tend to disclose more information and have fewer scandals hide behind which make their stock performance more stable and therefore a good candidate for investment (Heinkel, Kraus, & Zechner, 2001; Merton, 2012).

towards constant correlation covariance matrix.

The estimator which shrink towards return of GMV is shown below (Jorion, 1986):

$$\hat{\mu}_j^e = (1-\Phi)\hat{\mu}^e + \Phi\hat{\mu}_{GMV}^e \qquad \text{Equation 1}$$

The weight (Φ) for the constant value is calculated as:

$$\Phi = \frac{n+2}{n+2+\frac{m(m-1)}{m-n-2}\left(\hat{\mu}^e - \hat{\mu}_{GMV}^e\right)\times\hat{\Omega}^{-1}\left(\hat{\mu}^e - \hat{\mu}_{GMV}^e\right)} \qquad \text{Equation 2}$$

with the $\hat{\mu}_{GMV}^e$ generated from the sample:

$$\hat{\mu}_{GMV}^e = \frac{I\times\hat{\Omega}^{-1}\hat{\mu}^{e\prime}}{I\times\hat{\Omega}^{-1}I} \qquad \text{Equation 3}$$

in which $\hat{\mu}_j^e$ is the shrinkage estimator; $\hat{\mu}^e$ is the sample return for the portfolio; $\hat{\mu}_{GMV}^e$ is the sample return for GMV which is the common constant for the shrinkage estimator. I is n × 1 vector of ones; n is number of assets; m is number of observations.

The shrinking process towards constant correlations covariance matrix $\hat{\Omega}_{Const}$ is demonstrated in the following equation (Ledoit, Wolf, & Empresa, 2003):

$$\hat{\Omega}_{Shrink} = \delta\hat{\Omega}_{Const} + (1-\delta)\hat{\Omega} \qquad \text{Equation 4}$$

in which the estimate $\hat{\Omega}_{Shrink}$ is the sample covariance matrix shrinking outcome. $\hat{\Omega}_{Const}$ is produced by averaging correlation across asset pairs.

For the purpose of overcoming the poor out-of-sample performance, we are not using the unchanged portfolio through the whole time horizon. Instead we use the out-of-sample optimisation which is also called walk-forward optimisation. This optimisation approach is similar to the real world practice because it takes the newly arrived information into the optimal portfolio formation (Modern Investment Technologies, 2008). Additionally the optimal portfolio weights are extracted from the frequent recalculations. Portfolio weights are decided by the in-sample period information, and results are calculated using the corresponding out-of-sample period data.

In order to overcome the normality distribution assumption, Value at Risk is widely used to capture the down side risk of a portfolio (Linsmeier & Pearson, 2000). Therefore Value at Risk to measure portfolio risk. Value at Risk is defined as the maximum loss for a portfolio over a given time horizon at a given probability level, the definition can be expressed as (Favre & Galeano, 2002):

$$\text{Value at Risk}(r_j) = F_{r_j}^{-1}(\alpha) = z_\alpha \qquad \text{Equation 5}$$

in which F(.) = distribution function.

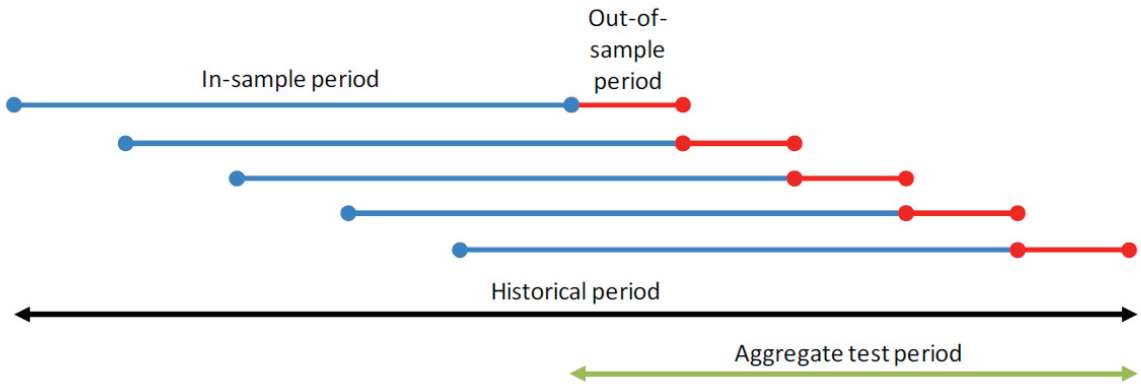
2.2 Model Specification

In this study, the in-sample period is 5 years with one year out-of-sample period. For example, the first set of portfolio weights are allocated based on the first in-sample 5-year period from 1994 to 1999. Then the out-of-sample performance is calculated from data in 1999. Next, the second set of in-sample period is from 1995 to 1999, and performance is measured by data from 2000. The same procedure repeats 13 times in this paper. Figure 1 shows a more intuitive explanation.

3. Results

3.1 Statistics and Data Analysis

We are using daily data[44] from 3 January 1994 to 7 August 2012, a total of 4,852 observations[45]. During the sample period, there are a large number of financial crises observed, the Asian Financial Crisis (1997), the bursting of the dot com bubble (2000), the September 11 terrorist attacks (2001), Enron fraud scandal (2001), Iraq war (2003), Sub-prime housing crisis (2007-2009), the Ponzi scheme of Bernard Mandoff (2008) and the European governments' crisis (2010).



Extracted from Modern Investment Technologies (2008)

Figure 1: Out-of-sample Optimisation

Figure 2 shows the indices movements; we can tell there is a huge drop down around GFC period for STOCKAU and SRIWORLD, bond markets are moving slightly to the opposite.

Table 2 shows us the summary statistics of market indices. Comparing the returns from Australian market with the corresponding world markets, Australian markets perform better. Maximum and minimum returns for the SRI and stock markets are similar between Australian and world performance. However the BONDWORLD has a much higher maximum return (10.3134) comparing with BONDAU (1.5513), and a much lower minimum return (-6.0620) relative to BONDAU (-2.0250). The skewness, kurtosis and Jarque-Bera tests tell us none of these indices are normally distributed. They are negatively skewed except for the WORLDBOND and all the indices are having thicker tails than a normal distribution. These non-normal fat tailed distributions are constant with what have been found by Müller, Dacorogna, and Pictet (1998). The fat tail is also an indication of crashes are happening more frequently than the forecast from normal distribution (Blanchard & Watson, 1983).

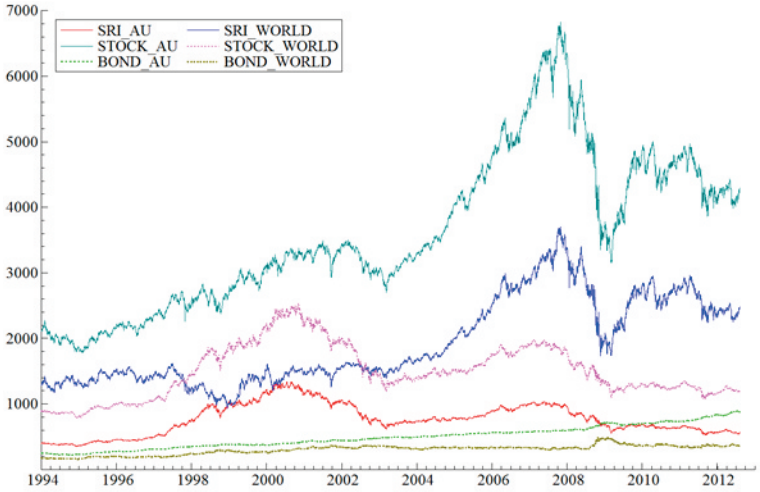


Figure 2: Indices movements

[44] Notably the data cited in this study are the returns calculated by the continuous returns formula $r_t=\ln(price_t/price_{t-1})*100\%$

[45] We are using ASX 200 and MSCI World Ex-Australia as proxies for Australian and world stock performance, labelled as $STOCK_{AU}$ and $STOCK_{WORLD}$; J.P. Morgan Australia Government Bond Index and J.P. Morgan Global Government Bond Ex-Australia Index are proxies for Australian and World bond market performance, labelled as $BOND_{AU}$ and $BOND_{WORLD}$; DJSI World Australia subset and DJSI World Excluding Australia are the SRI proxies, labelled as SRI_{AU} and SRI_{WORLD}. All data are collected in Australian dollars to cope with the Australian investors' perspective.

Table 5: Summary statistics on index returns

	SRIAU	SRIWORLD	STOCKAU	STOCKWORLD	BONDAU	BONDWORLD
Mean	0.0136	0.0071	0.0146	0.0062	0.0263	0.0141
Maximum	7.8377	7.2749	5.7244	6.0040	1.5513	10.3134
Minimum	-8.6891	-8.4959	-8.7043	-10.0946	-2.0250	-6.0620
Std. Dev.	1.2553	1.0210	0.9852	1.0011	0.3150	0.7946
Skewness	-0.1261	-0.2744	-0.4704	-0.3436	-0.1557	1.1391
Kurtosis	7.4899	7.0567	9.1074	7.9795	5.8363	20.6304
Jarque-Bera	4088.37	3387.86	7719.90	5108.38	1645.97	63888.93
P-value	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)

Notes to Table 2:

1. Skewness measures the asymmetry of the distribution of return around its mean. The skewness of a normal distribution is zero.
2. Kurtosis measures the peakedness or flatness of the distribution of return. The kurtosis of the normal distribution is 3. If the kurtosis exceeds 3, the distribution is leptokurtic and if less than 3 platykurtic relative to the normal distribution.
3. The Jarque–Bera statistic summarizes the skewness and kurtosis measures, and tests whether the return is normally distributed.
4. The tests are all on the returns level data.

If we only consider return and risk together, BONDAU is our best choice to put into a portfolio since it has the highest return and lowest risk. In contrast, SRI markets do not perform as well as bond markets. With the highest risk, SRIAU only provide us the forth-highest return. However, when we are measuring portfolio diversification power, correlation is also important Markowitz (1952). Table 3 shows us correlations among indices.

From Table 3 we know SRIAU has the highest correlation with STOCKAU (86.56%) and all the other correlations are relatively small. We also know that SRIAU is positively correlated to SRIWORLD and STOCKWORLD. But the correlations are not high, only 12.88% and 5.95%. The negative correlations between SRIAU with BONDAU (-15.54%) and BONDWORLD (-30.64%) indicate SRI would be a good diversifier for bond markets.

Table 6: Correlations among indices

	SRI_{AU}	**SRI_{WORLD}**	**$STOCK_{AU}$**	**$STOCK_{WORLD}$**	**$BOND_{AU}$**	**$BOND_{WORLD}$**
SRI_{AU}	1.0000					
P-value	-----					
SRI_{WORLD}	0.1288	1.0000				
P-value	(0.0000)	-----				
$STOCK_{AU}$	0.8656	0.1732	1.0000			
P-value	(0.0000)	(0.0000)	-----			
$STOCK_{WORLD}$	0.0595	0.8884	0.0953	1.0000		
P-value	(0.0000)	(0.0000)	(0.0000)	-----		
$BOND_{AU}$	-0.1554	0.0138	-0.1430	0.0394	1.0000	
P-value	(0.0000)	(0.3368)	(0.0000)	(0.0061)	-----	
$BOND_{WORLD}$	-0.3064	0.1301	-0.3213	0.2774	0.2639	1.0000
P-value	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	-----

3.2 Portfolio Weights Results and Discussion

According to results in Tables 4 and 5, the portfolio has SRI (Table 5) performs better than the stocks and bonds only portfolio (Table 4). The best performance for stocks and bonds only portfolio is 8.93%, while the best performance after including SRI increases to 10.65%. Average returns for these two portfolios are -4.28% and -1.24%, which is 3.04% higher after inclusion of SRIs. Further, portfolio with SRIs has a volatility of 11.29% that is lower than the traditional investment portfolio volatility, 13.37%. In terms of Value at Risk, the portfolio with SRI is lower for almost the entire sample period, except for year 2000. Sharpe ratios further support the inclusion of SRI.

We can see the portfolio without SRI performs better for some years, such as year 2000, 2006 and 2011; however the outperformance is minimal. After all, it is beneficial to have SRI included in the portfolio. The improvement after inclusion of SRI is shown in Figure 3. The efficient frontiers for these two portfolios are obtained by changing the investment portion of each asset, and the plotting the portfolio with the highest return for bearing the same risk, or having the lowest risk while getting the highest return Markowitz (1952). For example, for bearing the same 3.95% risk, the portfolio without SRI could get 2.15% return. While after adding SRI, return increases to 2.27%. The efficient frontier of portfolio has SRI remain higher than the other one. This phenomenon gives a strong indication on SRI diversification power. This diversification power of SRI is confirmed by Hickman et al. (1999)

Table 4: Performance and Weights of Bonds and Stocks Portfolio

	Average	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Panel A: Portfolio performance of Bonds and Stocks														
Returns	**-4.28%**	8.93%	-1.63%	-12.04%	-16.24%	-13.84%	5.07%	3.96%	8.06%	6.16%	-45.02%	-6.89%	0.72%	7.28%
Risk	**13.37%**	13.62%	16.96%	17.34%	12.74%	6.77%	3.37%	2.62%	9.92%	15.37%	30.44%	6.17%	2.38%	3.54%
Sharpe Ratio	**-0.32**	0.66	-0.10	-0.69	-1.27	-2.04	1.50	1.51	0.81	0.40	-1.48	-1.12	0.30	2.06
95% VaR	**1.24%**	1.37%	1.81%	1.87%	1.74%	0.83%	0.37%	0.34%	1.03%	1.56%	3.37%	0.75%	0.52%	0.61%
99% VaR	**1.76%**	1.97%	2.57%	2.63%	2.44%	1.15%	0.53%	0.50%	1.48%	2.23%	4.70%	1.07%	0.74%	0.88%
Panel B: Portfolio weights														
$BOND_{AU}$	**0.42**	0.10	0.02	0.10	0.00	0.29	0.90	0.90	0.26	0.10	0.10	0.90	0.86	0.90
$BOND_{WORLD}$	**0.10**	0.00	0.00	0.00	0.48	0.71	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.00
$STOCK_{AU}$	**0.24**	0.00	0.08	0.00	0.00	0.00	0.10	0.10	0.74	0.90	0.90	0.00	0.14	0.10
$STOCK_{WORLD}$	**0.25**	0.90	0.90	0.90	0.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 5: Performance and Weights after Inclusion of SRI

	Average	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Panel A: Portfolio performance after inclusion of SRI														
Returns	**-1.24%**	10.65%	-6.92%	-4.50%	-3.50%	-3.43%	6.35%	4.66%	3.03%	7.01%	-34.50%	-2.99%	0.90%	7.21%
Risk	**11.29%**	13.00%	21.00%	8.35%	5.00%	3.89%	3.64%	2.64%	7.08%	9.61%	26.99%	4.89%	2.52%	3.51%
Sharpe Ratio	**-0.11**	0.82	-0.33	-0.54	-0.70	-0.88	1.75	1.76	0.43	0.73	-1.28	-0.61	0.36	2.05
95% VaR	**0.87%**	1.27%	2.12%	0.86%	0.52%	0.41%	0.35%	0.25%	0.70%	0.94%	2.83%	0.51%	0.25%	0.33%
99% VaR	**1.23%**	1.81%	2.98%	1.21%	0.73%	0.57%	0.50%	0.36%	1.00%	1.35%	3.93%	0.71%	0.36%	0.48%
Panel B: Portfolio weights														
$BOND_{AU}$	**0.58**	0.20	0.06	0.60	0.50	0.71	0.74	0.85	0.58	0.45	0.24	0.87	0.86	0.90
$BOND_{WORLD}$	**0.04**	0.00	0.00	0.00	0.26	0.18	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00
SRI_{AU}	**0.14**	0.00	0.00	0.00	0.00	0.06	0.26	0.02	0.42	0.55	0.22	0.08	0.14	0.10
SRI_{WORLD}	**0.17**	0.80	0.90	0.37	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$STOCK_{AU}$	**0.06**	0.00	0.00	0.00	0.08	0.05	0.00	0.12	0.00	0.00	0.54	0.00	0.00	0.00
$STOCK_{WORLD}$	**0.00**	0.00	0.04	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

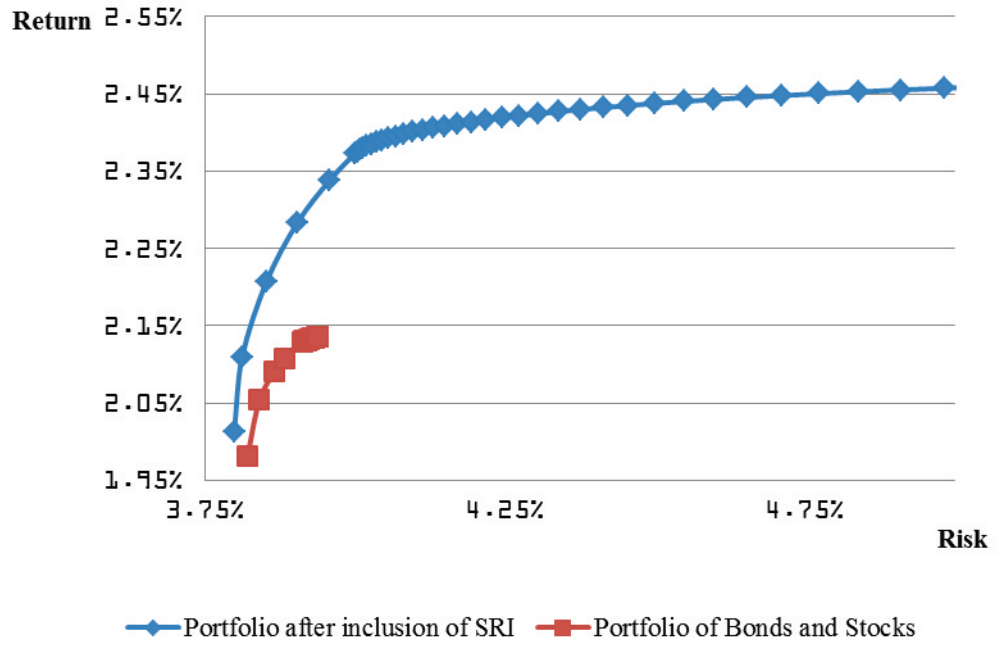


Figure 3: Efficient Frontier

Now we know SRI has its diversification power, Figure 4 and 5 show an intuitive pattern of portfolio weights changes over the years before and after inclusion of SRI.

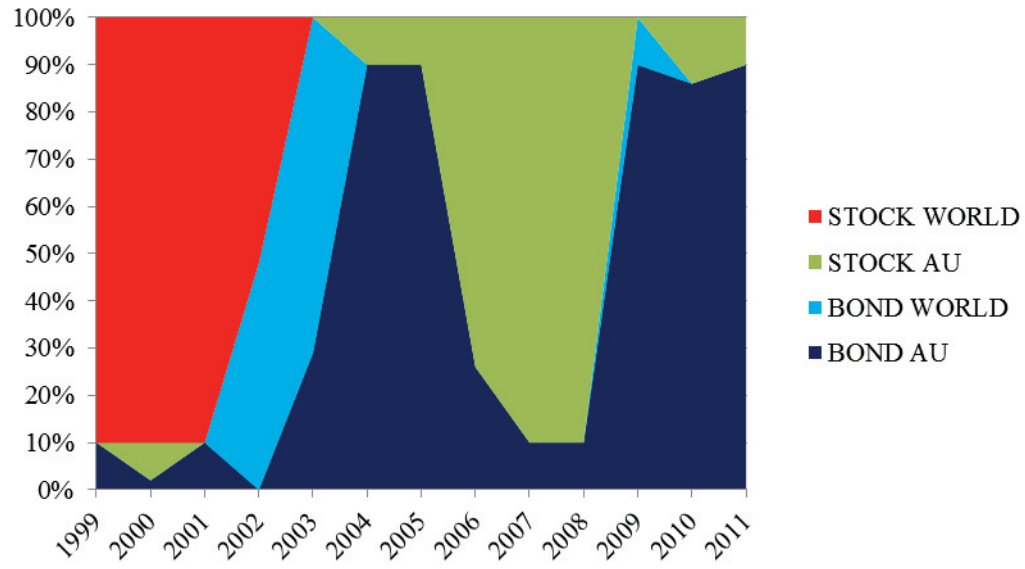


Figure 4: Portfolio Weights for Bonds and Stocks portfolio

In 2001, two un-anticipated events happened; the September 11 terrorist attack and Enron fraud scandal. The traditional portfolio loses 12.04% by investing 10% in $BOND_{AU}$ and 90% in $STOCK_{WORLD.}$ In contrast, the portfolio with SRI loses 4.50%, and it only invests 3% (it is 90% in previous case) into the general stock market. Also it puts more weights on $BOND_{AU}$ and SRI_{WORLD}. This change can be seen clearly from the graphs. In 2001, Figure 4 shows large part of red ($STOCK_{WOLRD}$) and a little dark blue ($BOND_{AU}$). While in Figure 5, it shows large portion of orange (SRI_{WORLD}), dark blue ($BOND_{AU}$) and only a very small part of red ($STOCK_{WORLD}$).

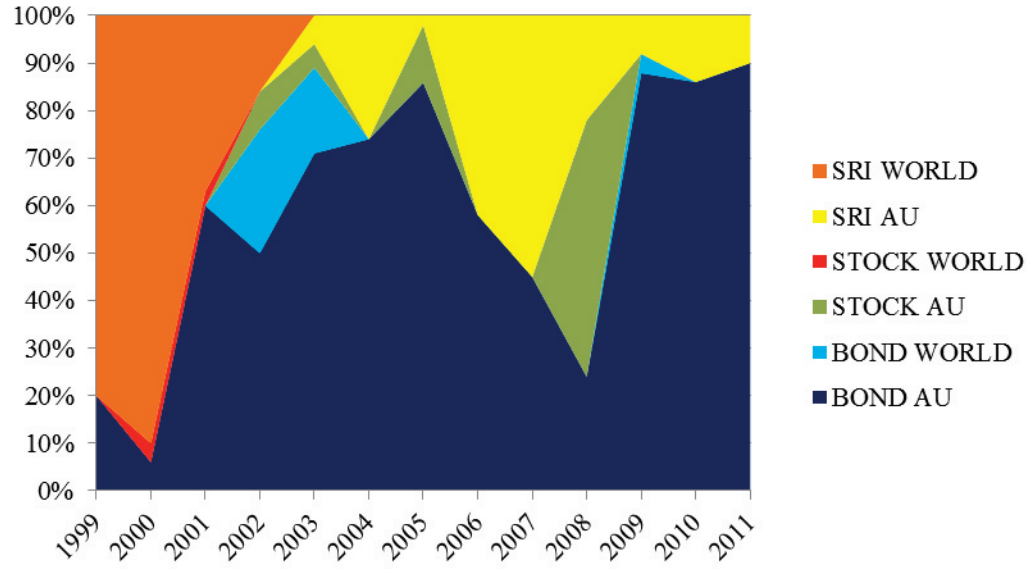


Figure 5: Portfolio Weights after Inclusion of SRI

Another example could be found in 2008, the middle of Global Financial Crisis. Before inclusion of SRI, we invest 90% into general stocks and this gives us a huge loss of -45.02%. However, the loss is reduced to -34.50% after including SRI into portfolio and the weight on general stocks is down to 54% and there are 22% invested into SRI (the portion of green reduced dramatically from Figure 4 to 5).

After including SRI into traditional portfolio, investments to $STOCK_{AU}$ and $STOCK_{WORLD}$ drop significantly and

investment to $STOCK_{WORLD}$ reduces to 0 (see Table 5). This implies the SRI markets have overtaken the general stock markets for better performance. At the same time, investment in $BOND_{AU}$ has increased from 0.42 to 0.58. This could be the explained by the negative relationship between SRI_{AU} and $BOND_{AU}$.

Another interesting pattern found from the portfolio weights is within the SRI markets prior to 2002, the optimal portfolio allocates all SRI investment to SRI_{WORLD}, however after 2003, all of the SRI investments are in SRI_{AU}. This suggests that there is a catch-up phase for Australian SRI market, which confirms the results from Bauer et al. (2006).

All the results show it is beneficial to include SRI into the portfolio. After having SRI in the investment portfolio, returns are higher and risks are lower. Therefore SRI does benefit investors with the power of diversification.

3.3 Conclusion

In order to test SRI diversification, we form two portfolios. One portfolio is the traditional investment portfolio consists of only stocks and bonds. Another portfolio has SRI in addition to traditional investment portfolio. Results show the second portfolio has higher return while lower risk. Further, the out-of-sample optimisation replaces world stock market with SRI markets to achieve higher efficient frontier. We also find there is a catch-up phase for Australian SRI. After 2002, Australian SRI operates better than the average SRI performance from other parts of the world. The findings from portfolio optimisation results suggest that the optimal portfolio allocate more into the Australian SRI marker after 2002. There are several implications for various stakeholders in society. Financial market investors could manage their investment portfolio with different weights of SRI according to their own acceptable level of risk. For corporations listed on stock exchange, findings from this study could assist them balance their financial and social responsibilities. Corporations taking their social responsibilities seriously could attract funding more easily compared to those only care about financial figures. Policy makers could also get a hint from the diversification power of SRI; they could make SRI a compulsory component in certain financial products.

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