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Return Predictability in Australian Managed Funds

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Abstract

We examine return predictability of Australian managed funds in twenty-four categories by using twenty-nine macroeconomic indicators. The time-series regression results suggest that coal price, GDP, and Treasury bill rate have predictive power over fund returns.

Key words: managed fund; return predictability; Australian market

JEL classification: G12; G14; G17

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1. Introduction

The scale of the Australian managed funds industry has grown rapidly in recent years. The annual growth rate in assets under managed funds has been greater than double digits since 1994. Australian managed funds industry now is the fourth largest in the world in terms of absolute size and has the largest assets in the Asia-Pacific region (Deloitte, 2014). Unlike many other countries, Australian's three-pillar approach for retirement income policy has created a highly inelastic demand curve for assets management services. The latest figures show that the managed funds industry has $2,622.2 billion funds under management (Australian Bureau of Statistics, 2015). The performance of managed funds, given the size of their stake and their important role in the finance industry, has long been of interest to financial

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practitioners and academics, particularly with the continuing lack of consensus on past performance as a guide for future performance.

Despite the lack of evidence for performance persistence, a recent study by Gupta and Jithendranathan (2012) revealed that Australian investors base their investment decisions primarily on the past performance of funds. Empirical studies demonstrate that the performance of funds can be improved by incorporating public information variables (Ferson and Schadt, 1996; Sawicki and Ong, 2000). Thus, if investors allocate investments only based on past performance, disregarding other factors, this investment strategy is considered risky. Without a holistic examination of other factors, such an investment strategy may have the potential to expose the Australian economy to unanticipated retirement liabilities. Studies, mainly motivated by the Arbitrage Pricing Theory (APT; Ross, 1976), also document that macroeconomic variables have predictive power for stock returns (Fama, 1990; Chen et al., 1986). An important question then emerges: Do economic variables have the potential to predict managed fund returns?

Wang et al. (2017) is one of very few studies that have attempted to seek the answer. Wang et al. use principal component analysis to investigate the relationship between Australian managed funds and macroeconomic variables. However, they have not investigated the relationship between managed fund returns and specific economic variables. We are therefore motivated to extend this issue by investigating whether there are discernible patterns in the relation between Australian managed fund returns and specific macroeconomic variables that capture the state of the economy, both domestic and international, with the aim of establishing whether those macroeconomic variables can be used to predict Australian managed fund returns.

Our study contributes to the existing body of literature investigating domestic and international macroeconomic variables to predict managed fund returns. Any relation uncovered will contribute to the existing body of literature by challenging the past performance issue attributed to Australian investors. Further, any findings of our study have the potential to add value from the practitioner's perspective. Since managed funds investors always have to reallocate investments between funds, they need to know which economic factors may affect their fund returns. The outcome of this study may refine investors' ability to improve managed fund returns by monitoring the changes in economic conditions.

Our time-series regression results show that there are a few variables that have predictive power over fund returns by using fund returns data from the third quarter of 1998 to the first quarter of 2013. They are, specifically, coal price, GDP, and Treasury bill rates of the US, UK, Japan, and China. Moreover, fund returns seem to have a negative relationship with these variables. A possible explanation for the observed interesting negative relationship between coal price and fund returns is the influence of coal price changes on consumer discretionary spending. Coal provides reliable and affordable electricity for Australian households and businesses. A rise in coal prices affects electricity bills and performance of related assets in terms of costs, which would limit the amount of discretionary funds available to households and businesses. This may lead to low fund returns. The relationship between GDP and fund returns needs to be considered alongside changes in monetary policy. Funds may perform well during periods of weak economic growth, at least in the short run, if accompanied by an easing of monetary policy. In terms of the Treasury bill rates of the US, UK, Japan, and China, it is plausible that lower investment returns from those four countries cause a larger amount of foreign investment shift to Australia, and consequently fund returns increase; on the other hand, rising interest rates in those countries encourage a larger amount of foreign investments to flow out of Australia, thus reducing fund returns. Further, among the twenty-four fund categories, returns of the capital guaranteed, cash, and diversified fixed interest are more predictable than other categories when we consider variables in the context of Australia only, the categories of Australian property, capital guaranteed, and cash are more predictable using international variables.

The rest of the paper is organised as follows. Section 2 reviews the relevant literature. Section 3 describes the data and their summary statistics. Section 4 introduces the methodology. Section 5 presents the results. Section 6 concludes the paper.

2. Literature Review

Many issues in managed funds have been addressed within the US context, yet there are relatively few studies in the context of Australia. In general, early studies have focused on whether past performance can be used as a guide to their future performance, also referred to as “performance persistence”. A number of US studies of managed funds report evidence of performance persistence over a short period (Droms and Walker, 2001; Hendricks et al., 1993), as well as a longer period (Brown and Goetzman, 1995; Grinblatt and Titman, 1992). However, several studies argue that the persistence can be attributed to factors such as momentum (Carhart, 1997), survivorship bias (Brown et al., 1992), and fund objectives (Sauer, 1997).

Within the context of Australia, it seems that studies do not support performance persistence. In one of the first studies to investigate the managed funds industry, Bird et al. (1983) evaluates the performance of Australian superannuation funds. This study finds no evidence that both the funds and the managers perform consistently over time. The funds would have improved their performance by simply investing the flexible component of their investment funds in the shares of the small number of companies included in the index rather than pursuing more complex strategies. Hallahan (1999) finds that there is evidence to support performance persistence for fixed interest funds, but it is ambiguous for multi-sector funds. Drew et al. (2002) find that prior annual performance has little influence on future fund returns on raw and risk-adjusted return basis. Selecting funds based on persistence strategy results in underperformance of the industry and in passive returns for the retail superannuation investors. Bilson et al. (2005) find that performance persistence is sensitive to fund objectives and performance model choices.

Notwithstanding the lack of consensus for performance persistence, investors appear to make their investment decisions on the assumption that performance persists. Numerous studies document an asymmetric (convex) relationship between US managed funds flow and past performance (Ippolito, 1992; Sirri and Tufano, 1998). Because investors react to new information disproportionately about product quality in the managed funds industry where the expected payoffs are higher, funds that outperform the market experience a more positive flow response than those that underperform. Several studies attribute this asymmetrical relationship to the "smart money" effect (Gruber, 1996).

However, Australian empirical evidence does not unanimously support this well-documented asymmetrical fund flow-performance relationship. Sawicki (2000) examines the influence of past performance on investors' choice of managed investment funds in the Australian wholesale managed funds industry and find a positive relationship between funds flow and prior performance. This finding also suggests that Australian institutional investors are more willing to reward recent winners as well as disciplining recent losers. Sawicki and Finn (2002) confirm the existence of the "smart money" effect in Australia. Further, their results indicate the size and age effects where investors respond more strongly to the recent performance of small (young) funds than to the recent performance of large (old) funds. On the contrary, Gharghori et al. (2007) fails to find supporting evidence for the smart money effect. Frino et al. (2005) find that past performance positively correlates with future net cash flow. Their study further separates net cash flows into inflows and outflows, and the result demonstrates a positive relationship between past performance and inflows, and a negative relationship between past performance and outflows. In addition, their study finds that the cash flows appear to persist over time. Gupta and Jithendranathan (2012) investigate fund flow-performance relationship within various subsets of the managed funds industry in Australia, and found that investors' investment decisions are primarily based on the past performance of funds, with the retail segment showing a higher level of influence of past performance compared to the wholesale segment.

Empirical literature indicates that stock returns are predictable using public economic variables such as dividend yield (Fama and French, 1988), earnings yield (Campbell and Shiller, 1988), and interest rate (Fama, 1990). If investors use these market indicators to update their assessments of expected returns, it is natural to ask whether the performance of managed funds relies on variables that capture the state of the economy. Several studies also demonstrate that using conditioning information, such as short-term interest rate, term structure, and dividend yield, improves the performance of funds (Ferson and Schadt, 1996). However, only a few studies investigate the relation between managed fund returns and variables that capture the state of the economy. For example, Chu (2011) explores the cointegration and causality of the Net Asset Values (NAV) of Hong Kong equity funds, the local stock market index (HSI), and selects three Hong Kong macroeconomic variables: inflation rate (CPI), money supply (M2), and short-term interest rate (HIBOR). By using the bivariate cointegration analysis approach of Engle and Granger (1987), the results indicate that the fund NAV responds to HSI and CPI, but not to M2 and HIBOR. While the multivariate cointegration analysis approach of Johansen and Juselius (1990) confirms that the fund NAV is cointegrated with HIS and CPI. Further, a Granger-causality test is conducted to specify the dynamic interactions of the variables. The findings demonstrate that HIS, CPI, and M2 have Granger-causal relations with the fund NAV, but HIBOR does not. This finding is also confirmed by a multivariate error correction model. These results suggest that movements in selected macroeconomic variables can be used to predict the movement of the fund NAV. Jank (2012) investigates the relation between mutual fund flows and the real economy. The findings support the theory that the positive co-movement of flows into equity funds and stock market returns is explained by a common response to macroeconomic variables. By using regression, Bivariate Vector Autoregression, and forecasting regression, Jank (2012) finds variables that predict the real economy and equity premium, in particular, dividend-price ratio, default spread, T-bill rate, and consumption-wealth ratio are related to fund flows and can account for the correlation between fund flows and market returns.

Our study is motivated by the issue that Australian investors make investment decisions based only on the past performance, and disregard other factors. Using economic variables to predict fund returns is a relatively new area of research, and there is no published study investigating this issue. We are intended to fill the gap by investigating macroeconomic variables from Australia and overseas markets, and establishing whether those variables have the potential to predict managed fund returns.

3. Data and Summary Statistics

We obtained the quarterly managed funds data from *The Plan for Life* for the sample spanning from 1998Q3 through 2013Q1. The funds are categorized into 24 different categories, which are based on the description provided by the vendor. In order to avoid survivorship bias, we use all available data from the 152 fund families that operated during the period. Following Gupta and Jithendranathan (2012), the fund-level rates of return (ROR) are calculated as follows:

$$ROR_{i,t} = \frac{Net\ earnings\ after\ tax_{i,t}}{Size_{i,t-1} + \frac{1}{2}\ NF_{i,t}} \tag{1}$$

where $Size_{i,t-1}$ is the funds under management for the i^{th} fund for the quarter *t-1*, and $NF_{i,t}$ is the net fund flows for the i^{th} fund for the quarter *t.* To calculate the average returns for each fund category, a value-weighted index of individual fund returns is formed.

Table 1 reports summary statistics (Panel A) and correlation matrix (Panel B) of the 24 fund returns. Panel A reports the mean, standard deviation, minimum, maximum, and the first-order autocorrelation coefficient for each fund category's return; Panel B reports the correlation matrix. Australian equity small companies come up with the highest return of 2.8% per quarter, while overseas-American shows the lowest return of -0.1% per quarter. The overall average quarterly return is about 1.1%. The standard deviation ranges between 0.002 and 0.102, with an average of 0.047. The correlation between the return and the standard deviation shows that all but one return (Australian fixed interest) exhibit positive serial correlation, many of which have a high serial correlation. The pairwise correlations in Panel B show that some groups of funds are highly correlated. Specifically, the returns of alternatives, Australian equity, Australian equity small companies, managed balanced, managed growth, and managed stable are highly and positively correlated with each other. On the other hand, overseas fixed interest and currency appear to be least correlated with other funds.

Table 1. Summary Statistics and Correlations of Fund Returns

Panel A: Summary Statistics of Funds Returns

Fund Category	Mean	Std.dev	Min	Max	ρ(1)
Grand Total	0.011	0.035	-0.097	0.091	0.26
Alternatives	0.012	0.030	-0.081	0.075	0.09
Australian Equity	0.020	0.068	-0.163	0.188	0.17
Australian Equity Small Companies	0.028	0.085	-0.251	0.205	0.22
Australian Fixed Interest	0.012	0.009	-0.007	0.028	-0.02
Fixed Rate	0.010	0.002	0.004	0.014	0.53
Australian Property	0.016	0.023	-0.079	0.064	0.60
Australian Property Securities	0.011	0.089	-0.358	0.243	0.40
Capital Guaranteed	0.010	0.002	0.006	0.014	0.82
Cash	0.010	0.002	0.007	0.014	0.77
Diversified Fixed Interest	0.010	0.021	-0.087	0.080	0.32
Managed Balanced	0.011	0.038	-0.113	0.096	0.23
Managed Growth	0.011	0.042	-0.122	0.107	0.23
Managed Stable	0.010	0.018	-0.052	0.058	0.30
Mortgage	0.012	0.003	0.004	0.016	0.81
Overseas - American	-0.001	0.076	-0.193	0.197	0.01
Overseas - Asia Pacific	0.017	0.097	-0.201	0.280	0.04
Overseas - European	0.003	0.081	-0.228	0.236	0.03
Overseas - Fixed Interest & Currency	0.013	0.014	-0.022	0.042	0.15
Overseas - Global	0.003	0.071	-0.159	0.183	0.12
Overseas - Global Small Companies	0.012	0.094	-0.202	0.253	0.05
Overseas - Japan	0.012	0.093	-0.213	0.255	0.26
Overseas - Property	0.006	0.102	-0.450	0.224	0.27
Mixed Portfolios	0.009	0.039	-0.112	0.108	0.27
Average	*0.011*	*0.047*			

Note: Panel A reports the mean, standard deviation, minimum, maximum and the first-order autocorrelation coefficient of 24 fund categories' returns.

Panel B. Correlation Matrix between Fund Returns

Fund Categories		[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]	[16]	[17]	[18]	[19]	[20]	[21]	[22]	[23]	[24]
Grand Total	[1]	1																							
Alternatives	[2]	0.87	1																						
Australian Equity	[3]	0.97	0.84	1																					
Australian Equity Small Companies	[4]	0.90	0.75	0.90	1																				
Australian Fixed Interest	[5]	-0.21	-0.29	-0.29	-0.32	1																			
Fixed Rate	[6]	-0.25	-0.07	-0.31	-0.22	0.16	1																		
Australian Property	[7]	0.54	0.46	0.48	0.44	0.17	0.11	1																	
Australian Property Securities	[8]	0.70	0.47	0.63	0.59	0.26	-0.16	0.77	1																
Capital Guaranteed	[9]	0.04	0.04	-0.01	0.08	0.07	0.52	0.22	0.02	1															
Cash	[10]	-0.16	-0.12	-0.19	-0.25	0.17	0.34	0.15	-0.16	0.53	1														
Diversified Fixed Interest	[11]	0.58	0.40	0.52	0.54	0.25	-0.26	0.46	0.74	0.00	-0.21	1													
Managed Balanced	[12]	0.99	0.89	0.96	0.89	-0.21	-0.24	0.53	0.68	0.06	-0.14	0.59	1												
Managed Growth	[13]	1.00	0.88	0.96	0.89	-0.22	-0.24	0.54	0.69	0.06	-0.12	0.57	1.00	1											
Managed Stable	[14]	0.96	0.81	0.92	0.84	0.01	-0.26	0.62	0.80	0.03	-0.13	0.70	0.96	0.96	1										
Mortgage	[15]	0.07	0.08	0.07	0.03	0.04	0.29	0.27	0.05	0.68	0.70	-0.03	0.08	0.08	0.09	1									
Overseas-American	[16]	0.68	0.71	0.58	0.53	-0.28	0.08	0.18	0.23	0.20	0.03	0.14	0.70	0.70	0.57	0.06	1								
Overseas-Asia Pacific	[17]	0.62	0.64	0.57	0.59	-0.46	-0.14	0.07	0.16	-0.02	-0.21	0.12	0.62	0.62	0.48	-0.03	0.62	1							
Overseas-European	[18]	0.74	0.73	0.65	0.64	-0.23	-0.05	0.26	0.38	0.16	0.00	0.24	0.75	0.75	0.67	0.10	0.80	0.65	1						
Overseas-Fixed Interest & Currency	[19]	0.05	-0.09	-0.01	0.02	0.59	-0.19	0.23	0.44	-0.19	-0.27	0.60	0.04	0.03	0.24	-0.25	-0.21	-0.23	-0.14	1					
Overseas-Global	[20]	0.85	0.84	0.76	0.73	-0.33	-0.07	0.29	0.39	0.13	-0.08	0.32	0.86	0.87	0.75	0.04	0.91	0.77	0.90	-0.16	1				
Overseas-Global Small Companies	[21]	0.79	0.80	0.69	0.69	-0.36	-0.06	0.24	0.35	0.10	-0.12	0.32	0.80	0.80	0.68	0.01	0.85	0.72	0.83	-0.12	0.94	1			
Overseas-Japan	[22]	0.41	0.41	0.37	0.38	-0.37	0.03	-0.10	0.00	0.01	-0.18	-0.02	0.40	0.42	0.28	-0.08	0.55	0.62	0.54	-0.26	0.65	0.62	1		
Overseas-Property	[23]	0.81	0.69	0.72	0.74	-0.03	-0.15	0.50	0.74	0.06	-0.16	0.70	0.82	0.81	0.83	-0.01	0.55	0.47	0.62	0.23	0.69	0.65	0.25	1	
Mixed Portfolios	[24]	1.00	0.86	0.97	0.90	-0.19	-0.27	0.54	0.72	0.02	-0.20	0.60	0.99	0.99	0.97	0.05	0.65	0.59	0.72	0.08	0.83	0.78	0.39	0.80	1

Note: Panel B reports the correlation matrix of 24 fund categories' returns.

To gain a holistic view of the relation between managed fund returns and economic variables, 29 economic variables are selected as explanatory variables. The selection of variables is ultimately subjected to criticism on the basis of subjectivity and the arbitrary nature of the selection process, though this is an unavoidable problem associated with this kind of research (Fama, 1990). Quarterly data are downloaded from *DataStream* in Australian dollars. We further divide the 29 explanatory variables into three sets of variables for the analysis: common variables, Australian macroeconomic variables, and international variables. For the set of common variables, five variables are considered: the Australian dollar exchange rate and the price indices of each of the four commodities, oil, gold, iron, and coal. Eight Australian macroeconomic variables are considered: stock market price, gross domestic product, short-term interest rate, long-term interest rate, money supply, inflation, unemployment rate, and industry production. We also consider the stock market prices, the gross domestic product, the short-term interest rate, and the long-term interest rate from four Australian major trade partners: the US, UK, Japan, and China. The details of economic variables are described in Appendix A.

Since asset-pricing theories do not prescribe which underlying economic forces drive the asset price, we select macroeconomic variables that are essentially motivated by existing literature. We acknowledge that the choice of variables is bound to be arbitrary. However, we focus on variables that have been examined in the previous studies. For common variables, the linkage between exchange rate and stock market prices is established by the purchasing power parity (PPP). Changes in exchange rates are adjusted to reflect the only relative inflation level when PPP holds. However, PPP does not generally hold, and deviations from PPP are found in a number of industrial countries (Frenkel, 1981). Numerous studies have investigated the relation between exchange rate and the performance of the stock market (Ma and Kao, 1990; Mukherjee and Naka, 1995). Commodities comprise a significant part of the economy; thus, the price of commodities impact companies directly or indirectly (Zapata et al., 2012). The relationship between commodity prices and stock returns has been well investigated (Gorton and Rouwenhorst, 2006). Oil and gold have attracted considerable attention in particular. Extensive literature has documented the impact of oil and gold prices on stock market returns: oil affects the cost of the company and gold is considered as an alternative investment to other asset classes (Baur and Lucey, 2010; Kilian and Park, 2009). In addition, since Australia is the world's largest exporter of iron ore and coal, the prices of iron and coal will also be selected in this study (Australian Department of Foreign Affairs and Trade, 2010).

Regarding Australian macroeconomic variables, the local stock market index is selected, as stocks comprise one of the major asset classes, and studies also demonstrate a strong linkage between time-series returns on market indices and other stock portfolios returns (Chen et al., 1986; Bilson et al., 2005). Research has documented the relationship between real activities, such as GDP and industrial production, and stock market returns: economic activity affects stock prices by affecting company's cash flows (Schwert, 1990). Interest rate is found to be one of the key determinants of stock prices. Research shows that interest rates and market returns are related (Abdullah and Hayworth, 1993). This relationship is often attributed to changes in the discount rate. Therefore, local treasury bill and treasury bond rates are selected to represent the short and long term interest rates.

Money supply is another macroeconomic factor related to stock returns through their effects on economic activities (Asprem, 1989). Inflation has also been found to explain market returns. The general expectation is that an increase in inflation will raise the discount rate, and consequently reduce the value of the firm (Fama, 1981). This study includes CPI because it is a commonly used and widely recognized measure of inflation. Labour cost is a risk factor that affects company profitability, and therefore stock market returns as a whole. Several studies have investigated the effect of unemployment rate, which is a proxy for labour cost, on stock returns (Park, 1997). Thus, unemployment rate is selected in this study. The relation between international factors and stock market returns is documented by the international asset pricing model (Ferson and Harvey, 1993). Thus, in this study, we consider stock market price, GDP, short-term interest rate, and long-term interest rate from four Australian major trade partners: the US, UK, Japan, and China.

Following Sawicki and Ong (2000), quarterly returns for each variable are derived from the original data and calculated as:

$$\Delta PI_i = ln(\frac{PI_{i,t}}{PI_{i,t-1}}) \tag{2}$$

where $PI_{i,t}$ is the price level of i^{th} variable at quarter t, and $PI_{i,t-1}$ is the price level of i^{th} variable at quarter *t-1*. Table 2 reports summary statistics for the log difference of 29 explanatory variables. Among the 29 predictors, 17 have a positive mean. Iron price shows the highest mean of 4.1% per quarter, followed by the oil price and GDP (China) of 3.0% per quarter. The most negative means are from the treasury bills and treasury bonds. The treasury bill (Japan) has the highest standard deviation of 1.122. The correlation between the return and the standard deviation shows that 20 predictors demonstrate positive serial correlation, with some being highly serially correlated.

Table 2. Summary Statistics for Predictor Variables

Variable	Mean	Std.dev	Min	Max	ρ(1)
Common Variables					
Australian Dollar Exchange Rate (Against the U.S. dollar)	-0.008	0.064	-0.155	0.182	0.10
Oil Price	0.030	0.188	-0.790	0.358	-0.00
Gold Price	0.029	0.060	-0.074	0.155	-0.07
Iron Price	0.041	0.131	-0.222	0.540	0.04
Coal Price	0.020	0.143	-0.560	0.341	0.41
Australian Variables					
Australian Stock Market Price	0.009	0.076	-0.253	0.194	0.19
Australian GDP	0.016	0.010	-0.021	0.035	0.37
Australian Treasury Bill	-0.009	0.099	-0.499	0.223	0.42
Australian Treasury Bond	-0.008	0.098	-0.326	0.250	-0.05
Australian Money Supply	0.024	0.015	-0.034	0.064	0.21
Australian CPI	0.020	0.291	-0.909	0.685	0.15
Australian Unemployment	-0.004	0.092	-0.151	0.323	-0.21
Australian Industry Production	0.005	0.012	-0.025	0.039	0.18
International Variables					
US Stock Market Price	0.004	0.095	-0.251	0.220	0.03
UK Stock Market Price	0.000	0.088	-0.210	0.181	-0.05
Japan Stock Market Price	-0.006	0.107	-0.248	0.179	0.015
China Stock Market Price	0.010	0.162	-0.458	0.452	0.21
US GDP	0.010	0.008	-0.020	0.024	0.53
UK GDP	0.004	0.008	-0.025	0.019	0.70
Japan GDP	0.002	0.011	-0.041	0.025	0.28
China GDP	0.030	0.203	-0.355	0.290	-0.56
US Treasury Bill	-0.073	0.466	-2.102	1.253	0.04
UK Treasury Bill	-0.053	0.246	-1.351	0.610	0.18
Japan Treasury Bill	-0.022	1.122	-2.803	3.135	-0.30
China Treasury Bill	-0.011	0.194	-0.734	0.403	0.31
US Treasury Bond	-0.013	0.071	-0.198	0.127	0.16
UK Treasury Bond	-0.017	0.084	-0.217	0.197	0.32
Japan Treasury Bond	-0.016	0.171	-0.304	0.759	-0.17
China Treasury Bond	0.008	0.116	-0.280	0.300	-0.05
Average	*0.001*	*0.153*			

Note: The table reports the mean, standard deviation, minimum, maximum and the first-order autocorrelation coefficient for 29 explanatory variables.

4. Method

We used a linear regression method to test the predictability of managed fund returns. To examine the implication of the single-predictor-variable model for the predictability of returns on the managed fund portfolio, the regression equation is as follows:

$$ROR_{i,t+1} = \alpha_{i,t+1} + \beta_i \Delta PI_t + \varepsilon_{i,t+1} \quad (3)$$

where $ROR_{i,t+1}$ is the i^{th} fund return over the next quarter, $\alpha_{i,t+1}$ is an intercept, ΔPI_t is a predictor variable at time t, β_i is the factor loading of i^{th} fund on the predictor, and $\varepsilon_{i,t+1}$ is an error term in quarter *t+1*. As some predictor variables predict future returns only over longer horizons (Cochrane, 2011), the predictive model for one-period returns in Equation (3) can be easily extended to a model for returns over multiple periods. We can write the predictive regression over a *K*-quarter period as follows:

$$ROR_{i,t+k} = \alpha_{i,t+k} + \beta_i \Delta PI_t + \varepsilon_{i,t+k} \quad (4)$$

where $ROR_{i,t+k}$ is the i^{th} fund return over the next *K*-quarter period (*K*=1, 2, 4, 12), $\alpha_{i,t+k}$ is an intercept, ΔPI_t is a predictor variable at time *t*, β_i is the factor loading of i^{th} fund on the predictor, and $\varepsilon_{i,t+k}$ is an error term in quarter $t+k$.

We were particularly interested in whether the slope coefficient (β_i) was significantly different from zero. The Hodrick standard errors can account for the autocorrelation in the long-horizon returns, using a forecasting variable with high persistence (Hodrick, 1992), and they also have better small sample properties than other standard errors (Ang and Bekaert, 2007). However, Ang and Bekaert (2007) showed that at long horizons, Newey-West (1987) *t*-statistics are almost consistently higher than Hodrick *t*-statistics, which are computed using standard errors that remove residual correlations induced by return summation over long horizons. Therefore, we will present both sets of *t*-statistics, as Ang and Bekaert (2007) note that while Newey-West *t*-statistics can over-reject the null hypothesis of no predictability at long horizons, Hodrick *t*-statistics retain the correct size in small samples.

5. Empirical Results

Three sets of explanatory variables (common variables, Australian macroeconomic variables, and international variables) are used for the time-series regression specified in Equations (3) and (4) separately. Overall, 2,784 regressions were conducted. For the sake of brevity, we only report the summarised results with a number of rejection (at 5% significant level) for all regression models (see Table 3). All regression results, including the adjusted R^2 statistics, Newey-West (1987) adjusted *t*-statistics, and *t*-statistics computed using Hodrick's (1992) type 1B standard errors (both are used to examine slope significance and therefore predictability), are available upon request.[1]

Table 3. Return Predictability Summary

Panel A1: The New-West *t*-test at *K* horizon (the 5% significant level)

	Common Variables					Australian Variables							
Code	AUD	Oil	Gold	Iron	Coal	Stock	GDP	T-Bill	T-Bond	M3	CPI	UR	IP
GL	2	-1,-2			-2	-12	-1,-2,-4,-12	-4			-12		-12
AL					-2		-2,-4,-12				-12		-12
EQ	2	-1,-2			-1,-2	-12	-2,-4	-2,-4	-4		-12		-12
ES	2	-1,-2,-4,-12	-2	-1	-1,-2	-12	-2,-12	-2,-4,-12					-12
FI		1						1,2		1,2,4,12			1,2
FR					1,2		1	1,2,4		-12	1,2,4		
PR						1		1,2,4					
PS	2	-2	-12				-1,-2,-4,-12	-4					
CG						2,4	1,2	1,2,4	2		1,2,4,12	-1,-4,12	
CA		1,2,4,12			1,2,4	4,12	1,2,4,12	1,2,4,12		1	4	-4,-12	
DF					-2,-4	-12	-1,-2,-4,-12	-4,-12		-1,-2,-4,-12			
MB		-1			-2	-12	-2,-4,-12				-12		-12
MG		-1			-2	-12	-2,-4,-12				-12		-12
MS	2				-2	-12	-1,-2,-4,-12				-12		-12
MO					1,2	4	2,4	1	2			-4	
OU							-4,-12						-4
OA		-1,-4			-1,-2,-4		-2,-4	-2,-4			-12		
OE					-2		-1						-4
OF							-1,-2,-4,-12			-1,-2,-4,-12			
OG					-2,-4	-12	-1-2,-4,-12				-12		-12
OS					-2,-4	-12	-2,-4,-12						
OJ				-1	-1,-2								
OP		-1,-12			-2,-4	-12	-1,-2,-4,-12	-12			-12		
MI	2	-1,-2			-2,-4	-12	-1,-2,-4,-12	-4			-12		-12

Note: The table presents the summarised predictive regression results of Newey-West *t*-statistic rejections for the common variables and Australian variable at *K*-horizon with the 5% significant level. *K* denotes the return horizon in quarters in the regression (*K*=1, 2, 4, 12). For the common variables, five variables are considered: the Australian dollar exchange rate (AUD) and the price indices of each of the four commodities, oil, gold, iron, and coal. Eight Australian macroeconomic variables are considered: stock market price (Stock), gross domestic product (GDP), short-term interest rate (T-Bill), long-term interest rate (T-Bond), money supply (M3), inflation (CPI), unemployment rate (UR) and industry production (IP). Negative sign indicates a negative relationship, otherwise, indicates a positive relationship. The regression sample period is from 1998Q3 through 2013Q1.

Panel A2: The New-West *t*-test at *K* horizon (the 5% significant level) [continued]

	Stock Market Price				GDP				Treasury Bill				Treasury Bond			
Code	US	UK	JP	CHN	US	UK	JP	CHN	US	UK	JP	CHN	US	UK	JP	CHN
GL				-12					2	-4		-2,-4				
AL				-12					2							
EQ		-12		-12					2	-4		-1,-2,-4	-12	-12		
ES		-12	-12	-12						-4		-1,-2,-4	-12	-12		
FI					-12				1	-12						
FR					1,2,4	2,4				1,2,4			12			
PR			2,4		1,2,4,12	1,2,4,12	1,2,4,12		1,2,4,12	1,2,4						
PS									1,2,4	-1,-2,-4				-4		
CG	4,12	4	2,4,12	1,2,4	1,2,4,12	1,2,4,12	2			1,2,4,12			4	2,4		
CA	4,12	4	4,12	4	1,2,4,12	2,4,12	2,4,12			1,2,4,12	1,2,4	2		2	12	
DF					-12	-12	-12			-1,-2,-4,-12		-12				
MB				-12					2	-4		-2,-4				
MG				-12					2	-4		-2,-4				
MS				-12					2	-4		-2,-4				
MO			4,12	2,4	1,2,4,12	1,2,4,12			12	2,4,12	2			1,2,4		
OU							2		2	-4						-4
OA				-12			-1			-4		-1,-2,-4	-12			-2
OE			4	-12					1,2,12			-1,-2				-1,-2
OF					-4,-12	-4,-12			1	-4,-12						
OG				-12					2	-4		-1,-2,-4		-12		
OS				-12					2	-4		-1,-2,-4		-12		
OJ		-12	-12	-1,-2,-4,-12								-1,-2,-4	-12			
OP			-12	-12					1,2	-1,-2,-4,-12				-2		-2
MI				-12					2	-4		-2,-4				

Note: The table presents the summarised predictive regression results of Newey-West *t*-statistic rejections for the international variable at *K*-horizon with the 5% significant level. *K* denotes the return horizon in quarters in the regression (*K*=1, 2, 4, 12). For the international variables, we consider the stock market prices, GDP, the short-term interest rate (measured by treasury bill), and the long-term interest rate (measured by treasure bond) from four Australian major trade partners: the US, UK, Japan (JP), and China (CHN). Negative sign indicates a negative relationship, otherwise, indicates a positive relationship. The regression sample period is from 1998Q3 through 2013Q1.

Table 3. Return Predictability Summary (Continued)

Panel B1: The Hodrick *t*-test at *K*-horizon (the 5% significant level)

	Common Variables					*Australian Variables*							
Code	AUD	Oil	Gold	Iron	Coal	Stock	GDP	T-Bill	T-Bond	M3	CPI	UR	IP
GL		2			-2,-4		-1,-2,-4				-2		-12
AL					-2,-4		-2,-4,-12						-12
EQ	2	-1,-2	2		-2,-4		-1,-2,-4		-4		-2		-12
ES		-1,-2,-4,-12	2	-1	-2,-4	-12	-1,-2						-12
FI		1					-12	1,2		-1,-2,-4			1,2
FR		2			1,2,4		1,2,-12	1,2,4	4,12		1,2,4,12		
PR			-12	-12		1,2,4		1,2,4		-2,-4,-12			-12
PS		-2	-12	-4			-2,-4,-12		1	-2,-4			
CG		2				2,4,12	1,2,4	1,2,4,12	2,4		1,2,4,12	-1,-2,-4,-12	-12
CA	-12	1,2,4,12	2,4		1,2,4	4	1,2,4,12	1,2,4,12	4,12	1	2,4	-4,-12	4
DF		4			-4		-1,-2,-4,-12	-12		-1,-2,-4	-4,-12	12	
MB					-2,-4		-2,-4				-2,-12		-12
MG					-2,-4		-2,-4				-12		-12
MS					-2,-4		-1,-2,-4			-2,-4	-12		-12
MO		2,12		-12	1,2	4,12	2,4,12	1,2,4,12	2,4		4,12	-2,-4,-12	-12
OU													-12
OA		-1,-4			-1,-2,-4		-2,-4	-2,-4			-2,-4,-12		-12
OE							-1						-4,-12
OF						-12	-1,-2,-4,-12			-1,-2,-4	-4	4,12	
OG					-2,-4		-2,-4				-12		-12
OS					-2,-4	-12	-2,-4						-12
OJ				-1	-1,-2								-12
OP		-2,-12			-4	-12	-2,-4				-12	12	-12
MI		-1,-2			-2,-4		-1,-2,-4				-2		-12

Note: The table presents the summarised predictive regression results of Hodrick *t*-statistic rejections for the common variables and Australian variable at *K*-horizon with the 5% significant level. *K* denotes the return horizon in quarters in the regression (*K*=1, 2, 4, 12). For the common variables, five variables are considered: the Australian dollar exchange rate (AUD) and the price indices of each of the four commodities, oil, gold, iron. and coal. Eight Australian macroeconomic variables are considered: stock market price (Stock), gross domestic product (GDP), short-term interest rate (T-Bill), long-term interest rate (T-Bond), money supply (M3), inflation (CPI), unemployment rate (UR), and industry production (IP). Negative sign indicates a negative relationship, otherwise, indicates a positive relationship. The regression sample period is from 1998Q3 through 2013Q1.

Panel B2: The Hodrick *t*-test at *K*-horizon (the 5% significant level) [continued]

	Stock Market Price				*GDP*				*Treasury Bill*				*Treasury Bond*			
Code	US	UK	JP	CHN	US	UK	JP	CHN	US	UK	JP	CHN	US	UK	JP	CHN
GL				-12				-4,-12	2	-4	-12	-2,-4	-12			-2,-4,12
AL			2	-12				-4	2,4		-12			-12		12
EQ								-4	2		-12	-1,-2,-4	-12			-2,12
ES								-4,-12			-12	-1,-2,-4	-12	-12		-2
FI									1,2	-12						
FR	2,4		4		2,4	1,2,4		4		1,2,4	-12	-12	4,12			2,4
PR	4	2,4	2,4	-12	1,2,4,12	1,2,4,12	1,2,4,12	-12	1,2,4,12	1,2,4	2,4,-12	-12	4	4	4	12
PS				-12				-2,-4,-12	1,2,4	-1	-12	-12		-4	4	-2,12
CG	2,4,12	2,4,12	2,4,12	1,2,4	1,2,4,12	1,2,4,12	1,2,4	4	4,12	1,2,4,12	4	-12	2,4,12	1,2,4		-12
CA	4,12	4,12	4,12	4	1,2,4,12	2,4,12	2,4,12	4,12	4,12	1,2,4,12	1,2,4,12	1,2,4	12	2,12	4,12	
DF	-12		-12						1	-1,-2,-4,-12	-12	-12				
MB				-12				-4	2	-4	-12	-2,-4	-12	-12		-2,-4,12
MG				-12				-4,-12	2		-12	-2	-12			-2,-4,12
MS				-12				-4,-12	1,2		-12		-12			12
MO	12	4,12	4,12	2,4	1,2,4,12	1,2,4,12	12	4,12	12	2,4,12	2,4,12		2,4	1,2,4	1,2,4,12	12
OU					1,2		2		2							
OA										-4		-1,-2	-12			-2,12
OE				-12					1,2,4,12			-1,-2				-2,12
OF			-12				-12	-4	1,-12	-4,-12	-12					
OG				-12				-4	2,4	-4		-1,-2,-4		-12		-2,-4,12
OS								-4	2,4	-2,-4	-12	-1,-2,-4		-12		12
OJ				-1,-2,-4				-4		-1	-4	-1,-2,-4		-4		12
OP			-12	12					1,2	-1,-2,-4,-12	-12		-12	-2,-4,-12		-2,-4
MI				-12				-4,-12	2	-4	-12	-2,-4	-12	-12		-2,-4,12

Note: The table presents the summarised predicative regression results of Hodrick *t*-statistic rejections for the international variable at *K*-horizon with the 5% significant level. *K* denotes the return horizon in quarters in the regression (*K*=1, 2, 4, 12). For the international variables, we consider the stock market prices, GDP, the short-term interest rate (measured by treasury bill), and the long-term interest rate (measured by treasure bond) from four Australian major trade partners: the US, UK, Japan (JP), and China (CHN). Negative sign indicates a negative relationship, otherwise, indicates a positive relationship. The regression sample period is from 1998Q3 through 2013Q1.

5.1 Common Variables

In the first set of regressions, five variables – the Australian dollar exchange rate (AUD), oil price (Oil), gold price (Gold), iron price (Iron), and coal price (Coal) – are used to predict the return of managed funds across 24 different investment categories. First, the Newey-West and the Hodrick testing results generally agree with each other. Second, with a few exceptions, AUD, Gold, and Iron appear to provide very limited information on the future fund returns since the slope of the common variables is generally insignificant and the associated adjusted R^2 is mainly negative. On the other hand, Oil and Coal seem to contain non-trivial information in predicting the fund returns – in some cases, the adjusted R^2 can be 0.2 or even higher. In particular, 17 out of 24 future fund returns are predictable via Coal with K=2 quarter. Although market participants consider oil price as a proxy for future demand for energy, relatively little work has been done on coal price despite the importance of coal as a source of energy (Ratti and Hasan, 2014). Understanding the importance of coal price having predictive power over fund returns is crucial to investors and fund managers for pursuing profitable investment strategies. Third, using coal price as a predictor, the significance of the predictive power tends to concentrate on K=1, 2 and 4 quarters but seldom on K=12. In most cases, when coal price increases the fund return drops. Fourth, ES (Australian Equity Small Companies) is the only fund category whose return is predictable by Oil, Coal, Gold, and Iron for most horizons.

5.2 Australian Macroeconomic Variables

In the second set of regressions, eight Australian macroeconomic variables – the stock market price (Stock), the Australian GDP (GDP), the Treasury bill (T-Bill), the Treasury bond (T-Bond), the money supply (M3), the Australian consumer price index (CPI), the Australian unemployment rate (UR), and the Australian industry production index (IP) – are used to predict the return of managed funds. Again, the Newey-West and the Hodrick tests generally reach similar results. However, there are cases in which the testing disagrees significantly, especially in longer horizon regressions. Taking IP with K=12 for example, the Hodrick test rejects the null of no predictability in 17 cases, but the Newey-West test rejects only 8. We note that the regression sample size becomes smaller with larger K, which might explain such a conflicting testing result. Among 8 macro variables, GDP appears to be the most capable of predicting fund returns, followed by Stock, CPI, T-Bill, and IP. T-Bond, M3, and UR have some predictive power in only a few occasions. For GDP, the predictive power is high at K=2 and 4 quarters. The adjusted R^2 tends to be highest at K=2 (i.e., more than half of the regressions at K=2 are, with the adjusted R^2, above 10%). On the other hand, the predictive power of Stock, CPI, and IP tends to be more sizeable at long horizon (K=12). Among the 24 fund categories, the returns of OU (Overseas-American) and OJ (Overseas-Japan) seem to be the least predictable using the Australian macro variables. In fact, OJ cannot be predicted with any variables. On the other hand, CG (Capital Guaranteed) and CA (Cash) appear to be the most predictable. Interestingly, among the 8 overseas investment categories, only two – PR (Australian Property), and OJ (Overseas-Japan) – are not predictable by Australian GDP. Also, among those are predictable by GDP, most are with a negative sign – only 4 are with a positive sign: FR (Fixed Rate), CG, CA, and MO (Mortgages).

5.3 International Variables

In the third set of regressions, 4 international variables – the stock market price (Stock), GDP, treasury bill (T-Bill), and treasury bond (T-Bond) from four major Australian trade partners, which include the US, UK, Japan, and China – are used to predict the return of managed funds. First, as before, the Newey-West and the Hodrick tests generally consent, but there are many cases (especially with K=4 or 12) where the two tests disagree considerably (e.g., Japan and China T-Bonds at K=12, China GDP at K=4 and 12). In these cases, the Hodrick test tends to reject more often than the Newey-West test. Theoretically, the Hodrick test is more reliable than its Newey-West counterpart in cases with relatively small sample size. Second, among the 4 macro variables, T-bill appears to be the top predictor, followed by GDP and T-Bond. However, all of the 24 returns are predictable at some horizons with at least two T-bill rates. Third, among the 4 countries, the US and UK variables seem to link to the future Australian fund returns more than those of other countries. Fourth, regarding the adjusted R^2, the fund returns of PR , CG, CA , and MO are highly predictable when the US GDP is used in the regression – the adjusted R^2 is generally 0.2 or higher in these cases.

6. Concluding Remarks

This study is the first to examine the return predictability of 24 Australian managed funds categories by using economic variables during the period from the third quarter of 1998 to the first quarter of 2013. Among the economic variables, three sets of explanatory variables (common variables, Australian macroeconomic variables, and international variables) are used for time-series regressions. Five common variables are selected: the Australian dollar exchange rate (against the US dollar) and price indices for oil, gold, iron and coal commodities. Eight Australian macroeconomic variables are selected: stock market price, gross domestic product, short-term interest rate, long-term interest rate, money supply, inflation, unemployment rate, and industry production. For international variables, we consider the stock market prices, GDP, Treasury bill rates, and Treasury bond rates from four Australian major trade partners: the US, UK, Japan, and China.

The results from the time-series regression tests suggest that, within common variables, Oil and Coal prices appear to have predictive power of fund returns, especially coal prices that predict 19 out of 24 fund returns with $K=2$ quarter. For Australian macroeconomic variables, GDP, stock market prices, short-term interest rate, CPI, and industry production seem to have more predictive power than the other variables have. However, GDP gives more interesting results than the other variables; its predictive power also tends to be more significant at longer horizons. For international variables, Treasury bill demonstrates significant predictive power, which is concentrated at medium horizons. The US and China variables show more significant results than the other two countries. Another interesting finding is that a negative relationship between coal price, GDP, Treasury bill rate, and the fund return has been discovered in most cases.

Among the 24 fund categories, the returns of Capital Guaranteed, Cash, Diversified Fixed Interest, and Mortgage funds are more predictable than others when common and domestic variables are considered, while the returns of Australian Property, Capital Guaranteed, Cash and Mortgaged funds are more predictable than others when international variables are considered.

Regarding limitations, the challenge for predicting fund performance by economic variables is pervasive. Since there are different types of economic systems around the globe, using macroeconomic variables to predict managed fund returns will not work the same in every nation. For instance, coal price can be used to predict fund returns in Australia, but may not for the US or China. Another challenge is how to convince investors to stay with the disciplined strategy during market downturns. Nonetheless, as coal price, GDP, and Treasury bill rate demonstrate relative predictive power over Australian fund returns, a deep understanding of these findings will have practical and economic implications for Australian investors and policy makers. By monitoring the changes in economic variables, possibly, fund managers can improve risk-adjusted returns for their members, and policy makers can develop effective regulatory regimes for the managed funds industry.

Notes

1. We also conduct the Breuch-Pagan LM test to examine if each of the regression errors is serially correlated. It is found that some funds show serial correlation in nearly all settings (e.g., cash and capital guaranteed) while others are showing either some (e.g., managed growth) or no error serial correlation (e.g., alternatives and overseas funds). Since the usual standard errors are inconsistent in the presence of autocorrelation, following the literature (e.g., Ang & Bekaert, 2007), the Newey-West standard errors and the Hodrick standard errors are employed in the paper. These standard errors are consistent as long as the errors are stationary and the tests based on them are valid.

Appendix A. Description of Macroeconomic Variables

Variable	Description
Common Variables	
Australian Dollar Exchange Rate	Measured by Australian dollar value to US dollar value.
Oil Price	Measured by West Texas Intermediate Spot Cushing Oil prices
Gold Price	Measured by London Bullion Market prices
Iron Price	Measured by World Iron Price Index
Coal Price	Measured by Australia Commodity Prices: Coal
Australian Variables	
Stock Market Prices	Measured by Standard and Poor's/Australian Stock Exchange 200
Gross Domestic Product	Measured in millions of local currency.
Short-term Interest Rate	Measured by treasury bills rate.
Long-term Interest Rate	Measured by 10-year government bond yield.
Money Supply	Measured by M3.
Inflation	Measured by the consumer price index.
Industrial Production	Measured by industrial production index.
Unemployment Rate	Measured by local unemployment rate.
International Variables	
US Stock Market Price	Measured by Standard and Poor's 500 Composite.
UK Stock Market Price	Measured by FTSE 100.
Japan Stock Market Price	Measured by TOPIX.
China Stock Market Price	Measured by Shanghai Stock Exchange A Share.
US GDP	Measured by billions of local currency.
UK GDP	Measured by millions of local currency.
Japan GDP	Measured by billions of local currency.
China GDP	Measured by hundreds of millions of local currency.
US Treasury Bill	Measured by 3-month US treasury bill rate.
UK Treasury Bill	Measured by 3-month treasury bill tender rate.
Japan Treasury Bill	Measured by treasury bills rate.
China Treasury Bill	Measured by 3-month treasury bond trading rate.
US Treasury Bond	Measured by 20-year treasury yield.
UK Treasury Bond	Measured by 3-month treasury bill rate.
Japan Treasury Bond	Measured by 10-year bearing government bonds.
China Treasury Bond	Measured by 10-year government benchmark bid yield.

Note: The table presents the description of macroeconomic variables, which includes five common variables, eight Australian variables, and sixteen international variables.

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