The state of monetary policy and industrial asset allocation: the Ghanaian perspective

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Abstract

Purpose – The purpose of this paper is to investigate whether asset allocation across various industries listed on the Ghana Stock Exchange (GSE) varies across different monetary policy states.

Design/methodology/approach – This paper adopts the Markov Chain technique to split monetary policy into three different states. The authors further adopt the Markowitz portfolio optimization technique to find the minimum variance and optimum portfolio for the industries listed on the GSE.

Findings – The finding reveals a dynamic asset allocation, which varies the industry’s weight mix across the various monetary policy states enhance excess returns compared to the static asset allocation. Specifically, the authors find risk-return trade-off among industries listed on the GSE. Financial and Food and Beverage industries portfolios record high returns relative to the Government of Ghana 91-day Treasury bill. The Food and Beverage portfolio is the only portfolio that records relatively high excess returns across all the monetary policy states. The authors also find that, during expansionary state (high monetary policy rates) of the monetary policy, investors are to allocate about 69 and 30 percent of their investment into food and beverages and financials, respectively. Corner solution is found in the transient state where 100 percent of wealth is allocated to financial to obtain the optimum portfolio. The optimum portfolio in the contraction state assigns 52 percent to financials and 42 percent to manufacturing. In summary, the result supports the dependence of investors’ asset allocation decisions on monetary policy.

Practical implications – Therefore, the authors propose an investment strategy which is dynamic and takes into consideration the monetary policy states rather than static asset allocation which maintains the same industry weight mix over the investment period.

Social implications – In sum, the authors interpret the result as support for the dependence of investors’ asset allocation decisions on monetary policy. In Ghana, an increase in the monetary policy appears to support industries listed on the equity market. The result also gives knowledge about investors’ asset allocation decisions on the GSE, which is practical balanced source of information for investors’ risk and return choices. For a prudent monetary policy framework, the monetary policy committee should monitor industries listed on the GSE. The result from the analysis has also an implication for investors, portfolio managers and fund managers to consider the state of the monetary policy in Ghana when making investment decisions.

Originality/value – The study differs from earlier research on asset allocation by breaking new grounds on two levels. First of all, based on the notion that different industries have different exposures to monetary policy states, the authors extend the portfolios by grouping the equities listed on the GSE into their industrial sectors. Second, the authors examine how investors’ optimal portfolio allocation may change depending on the state of monetary policy.

Keywords Asset allocation, Monetary policy, Ghana Stock Exchange, Dynamic asset allocation, Static asset allocation, Industry portfolios

Paper type Research paper

1. Introduction

Works by Merton (1971, 1973) acknowledge that moving investment opportunities across different economic regimes can affect optimal portfolio choices. In effect, investment opportunities are time-varying, and investors may seek to protect their exposure to consumption shocks and hold assets that can perform very well in all economic conditions. Monetary policy rate which is an indicator of economic conditions has the tendency to influence risk-taking behavior of economic agents. That is, an excess low monetary policy regime can trigger high return seeking
among households, institutional investors and financial intermediaries. This high-yield search can have an impact on asset allocations, since different asset classes respond differently to economic states. Investors normally keep to asset allocation practices such as diversification and asset class correlations. However, different assets may perform differently in different economic conditions. Hau and Lai (2016) indicate that excessive low monetary policy rates induce risky asset allocation by various players in the economy. In addition, they indicate that a monetary policy rate framework generally provides a nominal rate anchors to the economy. This means that monetary policy is a variable that policymakers can use to tie down the price level, and it has been used in the past by central banks to peg currency, thus link the value of the domestic currency to the value of the currency of a low-inflation country.

The Ghanaian economy has experience significant structural and institutional changes since the implementation of the Structural Adjustment Program in 1983. This is reflected in the liberalization of the financial system, elimination of price, interest rate and exchange rate controls, substantial degree of financial deepening and innovation within the banking sector system, opening of capital and current account, adoption of flexible exchange rate dynamics as well as the use of market determined indirect instrument of monetary policy. The monetary policy framework has shifted from monetary targeting to inflation targeting dynamics (formally introduced in 2007), using interest rates as the main policy instrument. Therefore, it is (very) necessary to investigate how investors can integrate monetary policy influences on asset allocations. Investors need to respond to the monetary policy states by placing more weight on assets that behave well in a certain monetary policy regime and less weight on assets that perform badly. Ghanaian institutional investors, portfolio and fund managers may hold different classes of equities (industry classes), fixed-income securities and government short term securities according to their return expectation and risk tolerance levels. However, contingent on good economic foresight, investors may abandon short term government securities and replace them with government bonds and the various equity industry class assets. Thus, investors must orient their investment toward alternatives that have the potential to deliver higher expected returns within the same risk target for the entire investment portfolio. The essence of the monetary policy in/for state-based asset allocation is to generate portfolios that can withstand various economic states. Investments over a long term are exposed to several economic dynamics; therefore, traditional investment policies such as the static and benchmark-based strategies have the potential to deliver sub-optimal returns. The aim is to help long-term investors in Ghana to take advantage of both upwards and downward monetary policy states in their investment decisions. Let me reiterate that the study will expose the potential benefits of moving away from static asset allocation strategies to a more and advantageous strategy of weighing assets by considering the state of the monetary policy.

Earlier studies such as Klos (2004) considered risky asset in experimental allocations at different time horizons and found no significant difference between the allocations. On the other hand, Mensah et al. (2013) divided the stocks on the Ghana Stock Exchange (GSE) into Financial and Non-Financial stocks portfolio and found that investors need to allocate more of their assets to non-financial portfolios for higher returns. The above studies relied on the static asset allocation technique. However, this study is unique and differs from the earlier research such as Mensah et al. (2013) by contributing on two levels. First, based on the notion that different industries have different exposures to monetary policy states, we extend the assets by grouping the equities listed on the GSE into their industrial sectors. Second, the paper establishes how an investor’s optimal portfolio allocation may vary in different monetary policy states. We find that different industries on the GSE respond to different monetary policy states. Our analysis supports an asset allocation policy that is anchored on the state of the monetary policy.

The subsequent sections are organized as follows: In Section 2, we review the literature on dynamic based asset allocation; Section 3 discusses the data and methodology, Section 4 proceeds with the results and finally Section 5 concludes the study and summaries the findings.
2. Literature review

GSE Annual Report and Financial Statement (2015) indicates that seven out of the eleven banks listed on the GSE have recorded a negative return which has led to the loss of millions of Ghana Cedis since the beginning of the year. However, general knowledge in/on investment points at the fact that investors will look out for safe assets when they are expecting a different economic cycle. Therefore, the implication of investors’ attitude toward assets in different monetary states is indeed a concern. Campbell and Viceira (1999) and Campbell et al. (2003) document that investment prospects vary over time, and investors may seek to hedge their exposure to consumption shocks or hold on to assets that do not perform poorly during economic downturns. On the same note, Brinson et al. (1991) and Ibbotson and Kaplan (2000) stress that an asset allocation decision is the key, and it determines about 80–90 percent of return variations. Though they are of the view that risk and return characteristics of various asset classes vary over time across different economic cycles, mostly in practice, static asset allocation, which is mainly fixed allocation of different asset classes dominate. The static asset allocation strategy assumes fixed risk/return characteristics, which culminate into a portfolio with constant weights.

Van Vliet and Blitz (2008) in their paper identify four states in their economic cycle and find that these states show time variation in the risk and return properties of asset classes. They also find time variation in the traditional static strategic asset allocation portfolio and propose a dynamic strategic asset allocation approach which has the potential to enhance expected return as well. They indicate that their proposed approach is found to be robust to variations in the variable composition of the state model and can easily be extended to different economic variables and/or additional assets. Similarly, Dahlquist and Harvey (2001) show that a popular way to make the most out of a time variation in returns is to apply a tactical asset allocation overlay on the portfolio. Petre (2015) defines dynamic asset allocation as the process of applying time varying expected to excess returns and/or expected risk with a medium term time horizon. He assessed the applicability of the dynamic asset allocation strategy for long term institutional investors, reviewed different forms of implementations seen in practice and discussed key requirements and governance challenges in an institutional context. He further noted that a strategic asset allocation decision represents the key driver of the results for long term institutional investors. However, in practice, these decisions translate into a static asset allocation with fixed allocation to narrowly defined assets classes which do not react to the time varying expected, as both return and risk move by changes in the economic environment.

The endogenous risk hypothesis whereby economic players look to take up more risk when interest rate are high has been endorsed by policy makers. It has been argued that the central banks must pay attention to asset prices in inflation and possibly drop the speculative behavior by increasing interest rates. Many policy makers before the recent financial crises were of the view that asset price bubbles were too hard to find or were beyond the control of monetary policy (Bernanke and Gertler, 1999; Kohn, 2006, 2008). Even though empirical evidence is still scarce, the above notion of central banks paying attention to asset prices in inflation states has gained policy supports. This view does not hold only for any future design of monetary policy but also for assessing the degree to which a monetary policy should account for the observed asset price inflation (Borio and Lowe, 2002; Cecchetti et al., 2000). We focus on how different classes of assets listed on the GSE respond to different states of monetary policy rates.

Monetary policy could contribute to the gradual formation of credit risk and bank instability. Quite a number of scientific papers have explored how an expansionary monetary (low interest rates) policy can contribute to financial instability. Recent papers corroborate the findings that a loose monetary policy affects the risk levels of loans granted by banks. A paper by Gambacorta (2009) investigates the link between low interest rates and bank risk-taking. He finds that low interest rates over an extended period cause an increase in banks’ risk-taking. In addition, Ioannidou et al. (2015) studied the risk-taking channels of the monetary policy in Bolivia and
found that a lower policy rate stimulates the granting of riskier loans to borrowers with a poor credit history, lower ex ante internal ratings and a weaker ex-post performance. In effect, banks have the tendency to compromise their internal credit risk analysis on their customers when interests are low. Jiménez et al. (2014) also studied the effect of monetary policy on credit risk and found that lower overnight interest rates forced (lowly) poorly/inadequately capitalized banks to lend to ex ante risky firms and by extension commit larger loan volumes with fewer collateral requirements. Following up on the same low interest rate and risk-taking behavior of banks phenomenon, Altunbas et al. (2014), in their paper, investigated the relationship between short-term interest rates and bank risk among banks operating in the European Union and in the USA. They found evidence that a low interest rate over an extended period of time contributed to an increase in banks’ risk. Maddaloni and Peydró (2011) used a unique data set of the European- and the US banks’ lending standards, and they found that monetary policy rates soften borrowing standards for households and corporate loans. By softening standards, they meant mortgages were amplified by securitization activities, weak supervision of banks’ capital and the holding on to low monetary policies for an extended period.

Specifically, and more related to our work, Thorbecke (1997) measured monetary policy by innovations in the US federal funds rates and non-borrowed reserves, by narrative indicators and by an event study of federal reserve policy changes. In all cases, he found that an expansionary policy which goes with low monetary policy increases securities ex-post stock returns. Rigobon and Sack (2004) noted that estimating the response of asset prices to changes in monetary policy is complicated by the endogeneity of policy decisions and the fact that both interest rates and asset prices react to numerous other variables. They developed a new estimator that is based on the heteroskedasticity that exists in high-frequency data. Their results indicate that an increase in short term interest rates results in a decline in stock prices and in an upward shift in the yield curve that becomes smaller at longer maturities. In ascertaining the average reaction of stock market and understanding the economic sources of the reaction, Bernanke and Kuttner (2005) who adapted a methodology by Campbell and Ammer (1993), found that the effect of unanticipated monetary policy actions on the expected excess returns accounts for the largest part of the response of stock prices. Bjoornland and Leitemo (2009) estimated the interdependence between the US monetary policy and S&P 500 using the structural vector autoregressive model. They found a great interdependence between the interest rate setting and real stock prices. To be specific, they indicated that real stock prices immediately fall by 7 to 9 percent due to a monetary policy shock that raises the federal funds rate by 100 basis points.

Our paper differs from the above by assessing how different industries on the GSE react to different monetary policy regimes. Further, we do not concentrate on how banks behave during low monetary policy periods, but we rather investigate how various industries behave during different monetary policy regimes. Different industries will give a fair cross-sectional representation of the economy rather than banks alone. In addition, considering different monetary policy rate regimes will provide deeper understanding of how assets respond to these regimes rather than just a one-sided low monetary policy rate. We also assess how investors could efficiently optimize their investment portfolios by the reallocation of assets across different monetary policy states.

Our result, even though coming from an under developed market, is consistent with the earlier works on monetary policy research, which explored the relationship between nominal rates changes and asset prices in developed markets. Specifically, works by Thorbecke (1997), Rigobon and Sack (2004), Bernanke and Kuttner (2005) and Bjoornland and Leitemo (2008) find that an expansionary (contractionary) monetary policy influences stock prices positively (negatively). The results from our paper are also consistent with the extant finance literature on asset price effects of a portfolio shift. The paper establishes that asset allocation has been determined by monetary policy conditions.
3. Data and methodology

We consider monthly price data of all stocks listed on the GSE from January 2000 to December 2014. Holding period returns are computed for each stock, and they are grouped to form equally weighted portfolios based on industrial classifications by the GSE. We also consider the monthly 91-day Ghana Government T-bills and the GSE composite index (GSE-CI) for benchmark purposes. We followed the GSE industrial classification to group stocks into portfolios under the following: Financials, Distribution, Food and Beverages, ICT, Mining, Agriculture and Manufacturing. The ICT, Mining and Agriculture industries were dropped from the analysis for several reasons, including, but not limited to, single stock in a portfolio, thin trading and not having enough data for the period under study. Figure 1 depicts the number of stocks in each industry. It is clear from the figure that stock captured in the industries considered in the analysis constitutes 76 percent (29 out of 38 listed companies) of stocks listed on the GSE. Mining had the same number of stocks as Distribution and even one more stock than Food and Beverage, but it dropped out of our sample as a result of illiquidity.

To identify economic states, we consider the Bank of Ghana monetary policy rate. We consider three states of the monetary policy in the 14-year history data available. The monetary policy is purely a macroeconomic factor. The states of the monetary policy were obtained using the distribution of the policy rate between the periods under study.

Based on the distribution of the monetary policy rate, we identify three states. These are periods of the relatively low monetary policy rate (Expansionary state), period of intermediate monetary policy (Transient state) and finally period of high monetary policy rate (Contraction state). It is observed from Figure 2 that the Ghanaian monetary policy rate was between 22.5 and 27.5 during the period between 2000 and early 2004, dropping to a transient state in the later part of 2004. The policy rate does not normally stay long in the transient state as shown in Figure 2, in the later part of 2003 and 2014 (showing a steep slope in both upwards and downwards directions, respectively). Between the later part of 2005 and early 2014, the monetary policy rate hovers between 12.5 and 17.5 percent (expansionary state).

We adopt Hamilton’s (1994) method of extracting transition probabilities from time series. We apply the method across various monetary policy states using Markov’s chain process. Thus, monetary policy rate as a random variable at each point in time $t$, $M_t$, can assume only three states, Expansionary state ($E$), Transient state ($T$) and Contraction state ($C$). Suppose the probability that $M_t$ is in a particular state $(E,T,C)$, it depends on the past only through the most recent value $M_{t-1}$, thus:

$$P\{M_t = E | M_{t-1} = T, M_{t-2} = C\} = P\{M_t = E | M_{t-1} = T\} = p_{ET}. \quad (1)$$

This process is described as a three state Markov’s chain with transition probabilities $\{p_{ij}\}_{i,j} = (E,T,C)$. The transition probability $p_{ij}$ gives the probability that state $i$ will be
followed by state $j$. Note that $\sum_{i,j \in \{E, T, C\}} q_{ij} = 1$. Conveniently, we collect all the transition probabilities from transition matrix given by:

$$
P = \begin{pmatrix}
  p_{EE} & p_{ET} & p_{EC} \\
p_{TE} & p_{TT} & p_{TC} \\
p_{CE} & p_{CT} & p_{CC}
\end{pmatrix}.
$$

An excess return of each industrial portfolio is computed as the difference between the monthly T-bills rate and the returns of the industrial portfolio. We use excess returns in all the analyses. The state indicators are mainly for the purpose of this paper, which is to estimate the potential for risk/return improvement that is offered by a state-based asset allocation.

The study employs the Markowitz portfolio optimization technique to compute the optimum portfolio in the various states of monetary policy rate. This is to determine the optimal risky portfolio that investors can hold by investing in portfolios across the various industry portfolios on the GSE. The return for each stock $i$ for each month $t$ is computed as:

$$
r_{it} = \ln \left( \frac{P_{it}}{P_{it-1}} \right) \times 100\% \tag{2}
$$

where $r_{it}$ is the return of stock $i$ at month $t$, and $P_{it}$ is the price of a stock $i$ at month $t$. This study employs the natural log (ln) since it has unique statistical properties which allow returns to be continuously compounded and summed. Dividend is not included because price is mostly adjusted for divided on the GSE. The industry portfolio returns at each month $t$ is then computed as:

$$
(r_{Pt}) = \frac{1}{N} \sum_{i=1}^{N} (r_{it}) \tag{3}
$$

where $N$ is the number of stocks in a portfolio. Markowitz’s model is therefore formulated using the linear programing models (4) and (5). Model (4) is a minimization problem that aids in computing the minimum variance portfolio. Conversely, Equation (5) is a maximization problem aimed at maximizing the Sharpe ratio in order to generate the
optimum portfolio:

\[
\text{Minimize } \sigma_P^2 = \sum_{i=1}^{4} w_i \sigma_i^2 + 2 \sum_{i=1}^{4} w_i w_j \text{cov}(r_i, r_j),
\]

subject to \( \sum_{i=1}^{4} w_i = 1 \)

\( w \geq 0 \)

\( \sum_{i=1}^{4} w_i E(r_i) \geq E(r_P), \)  

(4)

where \( w_i \) is the proportion of funds invested in each industry, \( r_{it}, r_{ut} \) are the returns on industry portfolios. The objective here is to determine the proportion of funds to invest in the various industries so as to minimize the variance of a person’s portfolio. However, this is subject to some constraints. The first constraint ensures that the total fund is invested in the industries listed on the GSE (Farinelli et al., 2008). This means that the sum of the weights for the various industries should be equal to 1, not less or greater. The second constraint, the non-negativity constraint requires that either nothing or a strictly positive weight is to be assigned to an industry. It also shows the absence of short-selling. Short-selling is not assumed, since in a developing market like the GSE, it is hardly practised due to the illiquid nature of their stock markets (Mensah et al., 2013). The last constraint requires the optimal expected return of the portfolio to be either equal to or greater than the minimum portfolio return. The minimum portfolio return is defined as the expected return from investing equally across the markets.

For the optimum portfolio, we maximize the Sharpe ratio subject to the same constraints as in Equation (4). This is expressed as follows:

\[
\text{Maximize } S_P = \left( \sum_{i=1}^{4} w_i E(r_i) - r_f \right) \sigma_P^{-1},
\]

subject to \( \sum_{i=1}^{4} w_i = 1 \)

\( w_i \geq 0 \)

\( \sum_{i=1}^{4} w_i E(r_i) \geq E(r_P). \)  

(5)

It must be noted that \( \sum_{i=1}^{N} w_i E(r_i) \) is the expected return of the portfolio, \( r_f \) is the average risk-free of the markets under study. \( \sigma_P^{-1} \) denotes the inverse of the portfolio’s risk which is measured as the standard deviation of the portfolio. We apply the above optimization technique to the industry portfolio returns for the overall period under study and the various monetary policy states. This is to assess how in asset allocation, different industries respond to monetary policy states.

4. Results

Panel A of Table I reports the descriptive statistics of the static excess returns of the various industries considered in the paper and the GSE-CI. There is a risk returns trade-off between the industries. The Financial and the Food and Beverage industry portfolios record higher returns than the risk-free rate. The two industries outperform the GSE-CI (market indicator) at
2 and 5 basis points in the period of our study, respectively. The distribution and the manufacturing sector underperform the risk-free rate and market. All the industries record average excess returns, which are significantly different from zero at 5 percent ($p$-values less than 5 percent) in absolute terms. In Panel B, we report the descriptive statistics of the different industries for different state of the monetary policy. In the expansionary state, the Food and Beverage industry consistently outperforms the market. The financial industry registers the second highest average excess return of 0.199 percent. It is only the Food and Beverage industry that performs better than the market in the expansionary state. This is not surprising since the Food and Beverage industry portfolio is less sensitive to a macro-economic environment variable like the monetary policy.

Surprisingly, in the transient state, the market records a negative excess return. The negative excess returns have been contributed by the high negative excess returns recorded by the Distribution and Manufacturing industry portfolios ($-0.798$ and $-1.520$ percent, respectively). The Food and Beverage portfolio continues to perform better than the other industries. The only monetary policy state that the financial stock outperforms both in the market and in the other industries is the contraction state. This is not surprising, because during the contraction period, the high monetary policy rate pushes the interest rates high, and investors would like to invest in industries where returns are realized instantly. Second, in Ghana, the Financial sector forms the greatest part of the services industry and the industry can only thrive in a high interest rate environment. Suffice not to say that the other industries did not perform. Amazingly, the manufacturing sector which recorded negative returns in the Expansionary and the Transient states now record positive excess returns. All the industries, apart from the Distribution, record positive returns in excess of the T-bill rate (risk-free). Overall, it is realized that different industries listed on the GSE perform differently at different monetary policy states.
Thus, the risk premiums on industry portfolios on the GSE are not static throughout the period of our study, but rather depend on the state of the monetary policy. This further encourages the examination of monetary policy state-based industry asset allocation.

We compute pairwise correlations among the four industries and the GSE-CI excess returns. This is to ascertain whether low or negative correlations exist among the industries. Earlier works postulate that in order to benefit from diversification, there should be a low and possibly negative correlation between stock returns of the industries (Gerstner et al., 2008). Table II shows the correlation between the various industries portfolios on the GSE. It is clear from the table that even though the correlations among the industries are significantly different from zero, their magnitudes are not high. The strongest correlation was recorded between the Financial and the Distribution sectors of the listed stocks (0.34 and significantly different from zero at 1 percent). The weakest correlations were between the Manufacturing sector and the Food and Beverage industry (0.097 and significantly not different from zero). Unsurprisingly, the GSE-CI has a strong correlation with the financial industry portfolio. This shows that in the period under our study, the financial sector stocks were the market movers.

In Table III, we report the transition probabilities (P) among the various states defined in this paper. We settled on three states because extending to a higher state can first of all complicate the model in terms of number of parameters. Second we realized that the transition probabilities from the intermediary states were all zero. This indicates that there is no need to create several intermediary states. The results from the table show that there is no possibility of moving from the expansionary state to the contraction state and vice versa, unless through the transient state. Therefore, we conclude that when the monetary policy rate is in the transient state, there is a 5 percent chance that it will fall back to the expansionary state and at a 2 percent change of moving to the contraction state.

4.1 Static and state based asset allocation

We compare the static asset allocation to the state-based asset allocation. By static, we mean applying models (4) and (5) to the entire data without considering the various monetary policy regimes. Table IV shows the optimized portfolio weights for the static asset allocation. The table also shows the risk, average excess returns and the Sharpe Ratio (slope) of the optimum

<table>
<thead>
<tr>
<th></th>
<th>Financial</th>
<th>Distribution</th>
<th>Food and Bev.</th>
<th>Manufacturing</th>
<th>GSE-CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Financial</td>
<td>1.000 (1.0000)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distribution</td>
<td>0.342 (0.0000)</td>
<td>1.000 (1.0000)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Food and Bev.</td>
<td>0.308 (0.0000)</td>
<td>0.268 (0.0003)</td>
<td>1.000 (1.0000)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manufacturing</td>
<td>0.226 (0.0023)</td>
<td>0.205 (0.0059)</td>
<td>0.097 (0.1963)</td>
<td>1.000 (1.0000)</td>
<td></td>
</tr>
<tr>
<td>GSE-CI</td>
<td>0.787 (0.0000)</td>
<td>0.435 (0.0000)</td>
<td>0.423 (0.0000)</td>
<td>0.341 (0.0000)</td>
<td>1.000 (1.0000)</td>
</tr>
</tbody>
</table>

Notes: This table shows the correlations matrix among the four industry classifications on the GSE. The values in parenthesis are \( p \)-values for the null hypothesis test of whether the correlations coefficient is significantly different from the zero. The time-span for the data is January 2000 to December 2014.

<table>
<thead>
<tr>
<th>Transition probabilities</th>
<th>Expan. state</th>
<th>Trans. state</th>
<th>Contra. state</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expansionary state</td>
<td>(12.5–17.5)</td>
<td>0.98</td>
<td>0.02</td>
</tr>
<tr>
<td>Transient state</td>
<td>(&gt; 17.5–22.5)</td>
<td>0.05</td>
<td>0.95</td>
</tr>
<tr>
<td>Contraction state</td>
<td>(&gt; 22.5–27.5)</td>
<td>0.00</td>
<td>0.02</td>
</tr>
</tbody>
</table>

Notes: This table reports the transitions probabilities matrix (P) among the various states defined for the monetary policy. The sample period is January 2000 and December 2014.
Portfolios in the various asset allocation approaches. We report the minimum variance and the optimum portfolio for the static asset allocation taking into consideration the constraints indicated in the optimization problem in Equations (4) and (5). The minimum variance (Min. Var.) portfolio records a −0.29 percent excess return for a risk of 3.69 percent. This portfolio allocates 62.33 percent in the manufacturing sector, 13.95 percent in the financial sector, 16.20 percent in the distribution sector and 7.52 percent in the food and beverage sector. The optimum (tangency) portfolio of the static asset allocation shows an excess return of 0.64 with 54.68 percent of the asset allocated to the financial sector, and 45.32 percent invested in Food and Beverages industry. No investment is made in the Distribution and the Manufacturing industries.

Panels A, B and C of Table V report the state-based asset allocations. In Panel A, we show the asset allocation in the expansionary monetary policy state (low interest rate environment). In this state, the minimum variance portfolio still records negative excess returns with 74.79 percent of funds invested in the manufacturing industry. The optimum portfolio in this state has average excess returns of 0.63 percent, which is less than the market risk premium in that state. The possible asset weighted mixes are 69.37 percent invested in Food and Beverages sector; 30.63 percent invested in Financial sector and zero investment in the Distribution and Manufacturing sectors.

Panel B shows the asset allocation in the transient state. The minimum variance portfolio’s excess return is still negative (−1.01 percent). However, the optimum portfolio which allocates 100 percent (corner solution to the optimization problem) of investment into the financial sector records 0.36 percent excess returns.

This is higher than the market risk premium in the transient state. Surprisingly, it is clear from Panel A that the Food and Beverage industry, which attracts the highest allocation (high portfolio weights) in the expansionary state, has been dropped to zero investment in the transient state. This is a confirmation that the asset allocation of different industries varies in different monetary policy states. The excess returns of the optimum portfolio in the state-based allocations in Panel A and B is lower than that of static based asset allocation.

In Panel C, we show the optimum portfolio in the contraction state (high interest rate state) asset allocation. This is quite encouraging; the results show that various industries on the GSE perform well when interest rates are high. The minimum variance portfolio’s excess returns are positive and higher than that of the static based, expansionary state and transient state asset allocation. The optimum portfolio excess return in this state is the highest (average excess returns of 1.14 percent) among all the monetary policy states. It is also higher than the static asset allocation optimum portfolio’s excess returns. The optimum portfolio’s excess return is mainly contributed by investing 52.42 percent in the Financial sector, 42.28 percent in the Manufacturing sector and 5.30 percent in the Food and Beverages sector.

In sum, we conclude that different industries on the GSE respond to different monetary policy states. It is also established that asset allocation across industries on the GSE is a

<table>
<thead>
<tr>
<th>Equw.</th>
<th>Min. Var.</th>
<th>Optimum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>0.06%</td>
<td>−0.29%</td>
</tr>
<tr>
<td>SD</td>
<td>4.43%</td>
<td>3.69%</td>
</tr>
<tr>
<td>Slope</td>
<td>0.013</td>
<td>−0.079</td>
</tr>
<tr>
<td>Financial</td>
<td>25.00%</td>
<td>13.95%</td>
</tr>
<tr>
<td>Distribution</td>
<td>25.00%</td>
<td>16.20%</td>
</tr>
<tr>
<td>Food and Bev.</td>
<td>25.00%</td>
<td>7.52%</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>25.00%</td>
<td>62.33%</td>
</tr>
</tbody>
</table>

Notes: This table reports the static asset allocation where weights are kept constant over the period of the study. We show the equally weighted portfolio as well. The Markowitz optimization model is used to estimate the possible industrial weight mix that gives the minimum variance portfolio and the optimum portfolio (tangency portfolio). The sample period is January 2000 to December 2014.
<table>
<thead>
<tr>
<th>Panel A: expansionary state asset allocation</th>
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<tbody>
<tr>
<td>Mean</td>
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<tr>
<td>SD</td>
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<tr>
<td>Slope</td>
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<tr>
<td>Financial</td>
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<tr>
<td>Distribution</td>
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<td>Food and Bev.</td>
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<td>Manufacturing</td>
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<tr>
<td>Panel B: transient state asset allocation</td>
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<tr>
<td>Mean</td>
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<td>SD</td>
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<td>Slope</td>
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<td>Financial</td>
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<td>Distribution</td>
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<td>Food and Bev.</td>
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<td>Manufacturing</td>
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<tr>
<td>Panel C: contractionary state asset allocation</td>
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<tr>
<td>Mean</td>
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<td>SD</td>
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<td>Slope</td>
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<td>Food and Bev.</td>
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<td>Manufacturing</td>
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</tbody>
</table>

**Notes:** This table reports the minimum variance portfolio and the optimum portfolio from the state-based asset allocations. It is clear from this table that different assets perform differently in the various state of the monetary policy in Ghana. The sample period is January 2000 to December 2014.
monetary policy state dependent. Therefore, individual investors, portfolio and fund managers should factor in monetary policy states in their asset allocation processes.

5. Summary and implications
This paper investigates and proposes an investment framework on the GSE, which takes into consideration the state of the country’s monetary policy. We investigated this with a sample of monthly data from the GSE over a period of January 2000 and December 2014. We define the monetary policy state by using the distribution of the monetary policy rates over the period under study. We considered three different states of the monetary policy. These are the expansionary states (where policy rates are relatively low), the transient state (policy rate is on the rise or decline to a level where it does not stay for long) and the contraction state a state of relatively high monetary policy rate.

The first results indicate that the risk and returns profile of industry portfolios on the GSE are highly dependent on the prevailing monetary policy state. Detail analysis also reveals that industry asset allocation is sensitive to monetary policy state. The only portfolio that records relatively high excess returns across the various monetary policy states is the Food and Beverage industry. This is not surprising, since the stocks that form the portfolio are mainly consumables, therefore, less sensitive to macroeconomic changes. The benchmark asset allocation which allows portfolio allocation over the entire period records high excess returns relative to the market risk premium.

In sum, we interpret our result as support for the dependence of investors’ asset allocation decisions on monetary policy. In Ghana, an increase in the monetary policy appears to support industries listed on the equity market. The result also gives knowledge about investors’ asset allocation decisions on the GSE, which is a practical balanced source of information for investors’ risk and return choices. For a prudent monetary policy framework, the monetary policy committee should monitor industries listed on the GSE.

The result from our analysis has also an implication for investors, portfolio managers and fund managers to consider the state of the monetary policy in Ghana when making investment decisions.

References


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