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Portfolio diversification in a highly inflationary emerging market

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Abstract

This study applies modern portfolio theory to the individual asset allocation decision of an investor in an emerging market. The study utilizes data from January 1991 to January 1999. Turkey's experience with high inflation, depreciation in its currency, and a relatively fast growing economy provide a unique financial environment to examine personal portfolio asset allocation. Seven investments are considered for inclusion in the portfolio, including the Turkish, German and American stock markets, gold, and 12-month bank deposits denominated in Turkish liras, German marks, and U.S. dollars. The findings indicate that the lira-denominated bank deposit is the dominant investment vehicle. © 2001 Elsevier Science Inc. All rights reserved.

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1. Introduction

This study examines the application of modern portfolio theory to the personal asset allocation decision of an investor in the Turkish financial markets. Turkey has experienced high inflation, budgetary deficits, depreciation in its currency, and a relatively fast growing economy. This creates a high level of uncertainty for the individual investor. In this environment we examine investment decisions considering seven different alternatives for inclusion in the personal portfolio of a Turkish investor. These alternatives include investing in the Turkish stock market, in the German stock market, in the American stock market, in gold, and 12-month bank deposits denominated in Turkish liras, German marks, and United States dollars.

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Modern portfolio theory argues that investors can reduce risk by investing in a portfolio of assets. Using financial instruments in developed financial markets with stable economic conditions, it has been well established that there is a risk reduction benefit through portfolio diversification with little or no negative impact on return. The portfolio diversification argument is also investigated internationally by taking into account imperfect correlation between financial markets of countries involved. However, due to the high inflationary setting and other distortions in the Turkish financial system, the findings of this study do not show the Turkish investor as enjoying any significant diversification benefit from investing internationally.

It is interesting to ask how an individual investor in an unstable emerging market environment would use modern portfolio theory to benefit from diversification given the locally available investment instruments. Unstable economic conditions increase the uncertainty associated with various investment alternatives. A chronic inflationary condition in an economy would clearly make investment decisions challenging. Would such an investor arrive at a portfolio similar to Western portfolios, or would it be substantially different? Turkey is a logical choice for this kind of study.

Turkey is a Western-looking but developing nation on the edge of modern Europe. Turkey has been plagued with high inflation and significant currency devaluations, but is politically democratic and remains one of the relatively more stable countries in the region. Finally, Turkish investors do have the ability to invest outside the country, facing no capital flight restrictions from the government.

This study contributes to the literature by providing a better understanding of the individual financial decision making process in a highly inflationary emerging market where the economic environment distorts the selection of investment alternatives. In doing so the study relies on the risk diversification argument of modern portfolio theory to develop efficient portfolios.

2. Review of the literature

The benefits of portfolio diversification are well documented in developed financial markets. Markowitz (1952) provided the basic modern portfolio theory framework for analyzing the risk and return relationship in a portfolio of assets and developed the mean-variance portfolio optimization model. By selecting different investment vehicles that are less than perfectly positively correlated, investors can maintain an overall rate of return while the lowering the level of risk. Markowitz's concept of modern portfolio theory was initially applied to the investment vehicles available in the United States.

In the last few decades the diversification argument has been carried further to include international opportunities. Grubel (1968), Levy and Sarnat (1970), and others, showed that including foreign stocks in a portfolio improved portfolio diversification. Solnik (1974) argued the "primary motivation in holding a portfolio of stocks is to reduce risk", and he demonstrated that international diversification can lower the systematic risk in a portfolio. Eun and Resnick (1988) examined the need to control for exchange rate volatility when engaging in international investing. Black and Litterman (1991) contended that the efficient

frontier of portfolios exhibited less risk for each level of return when international investments were included. Their conclusion was that international investing did reduce the level of risk beyond investing solely in a domestic portfolio. Clarke and Tullis (1999) indicated that a long-run allocation of 20–30% in foreign equity for an investor in the United States, appeared appropriate based on market history. Michaud et al. (1996) focused on both return and risk and concluded, ''international diversification increases return per unit of risk . . .''.

Relevant to this study is also the issue of whether an equity market in a developing country can provide investors with a hedge against inflation. It is generally conceded (see Jaffe and Mandelker, 1976; Fama and Schwert, 1977; Fama, 1981; Reilly, 1997) that in the U.S., the equity market often does not provide such a hedge. However, there is some evidence (Murphy and Sahu, 2001) to the contrary. Studies have extended this question to developed foreign markets (Branch, 1974; Cohn and Lessard, 1981), with much the same result.

If it is questionable as to whether the major equity markets hedge against inflation in developed countries, it is even less likely that inflation will be hedged in the equity markets of developing countries. Eaker et al. (2000) found that inflation had a significant impact on emerging market returns and advocated holding a diversified portfolio to ameliorate the effect. While answering the question of how inflation impacts emerging market returns is not part of this study, it may be noted that the Istanbul Stock Exchange (ISE) index failed as a hedge against inflation in Turkey during the period of this study by producing a negative real rate of return.

3. Overview of the Turkish economy and equity market

3.1. Macroeconomic conditions

The Turkish economy has been undergoing major structural changes in the last few decades. Stabilization programs aimed at solving economic problems followed a series of economic crises. These problems have included the high level of inflation, budget deficits, and the uncertainty caused by the frequent early governmental elections. The main economic indicators during the study period are reported in Table 1. The most notable item is the annual inflation rate during the study period, ranging from 32.1 to 149.6%. In this period the Turkish economy also experienced a sizeable increase in the level of domestic and external debt relative to gross national product (GNP). For example, the external debt increased from about $50 billion in 1990 to $111.2 billion by 1999. The ratio of net domestic borrowing over GNP has increased from 5% in 1990 to 14.5% in 1999. Similarly, the ratio of domestic debt to GNP almost doubled in the last 10 years. The high level of domestic and international borrowing has been the result of relatively high budget deficits. Moreover the increase in internal borrowing has kept interest rates relatively high during the period. The size of the economy, on the other hand, has grown by almost 30% in real terms. The GNP growth rate has remained relatively high during the period with the exception of 1994 and 1999, when the country experienced major economic crises. Similarly, per capita income

Table 1
Economic indicators

Variable	1991	1992	1993	1994	1995	1996	1997	1998	1999
GNP (billion $)	150	158	178.7	132	170	184	194	204	185
GNP growth (%)	0.4	4.3	7.6	−6.1	8.1	7.5	8.0	3.8	−6.4
Inflation (%)	59.2	61.4	60.3	149.6	64.9	81.9	90.6	51.4	66.5
Per capita income ($)	2,655	2,744	3,056	2,161	2,788	3,000	3,105	3,213	2,878
Domestic debt/GNP (%)	15.4	17.6	17.9	20.6	17.3	21	21.4	21.9	29.3
Net borrowing/GNP (%)	5.1	90.2	8.1	11.4	7.2	11.6	10.5	10.2	14.5
External debt (billion $)	50.5	55.6	67.3	64.4	73.3	84.1	91.5	106	111.2
Interest rate (T-bills) (%)	68	74	70	105	85	132	108	116	104
TL/$ (year end)	554.9	8351.6	14047.8	37440.3	56729.8	104705.7	199530.6	306908.9	527105.2
TL/DM (year end)	3231.4	5280.1	8224.1	23788.4	39365.9	67482.4	112328.1	186652.1	272528.9
Istanbul Stock Exchange									
Firms	134	145	160	176	205	228	258	277	285
Market capitalization (billion $)	15.5	9.9	37.8	21.8	20.8	30.8	61.4	33.4	112.2
Traded value (million $)	8,502	8,567	21,771	23,203	52,357	37,737	58,104	70,396	84,034

Source: Undersecretary of Foreign Trade, The Banks Association of Turkey, and The Central Bank of Turkey.

increased approximately 25% during the study period. With respect to exchange rates, the Turkish lira has continued to depreciate rapidly against major currencies as a result of high inflation.

In summary, over the past few decades Turkey initiated economic policies consistent with rapid development in technology and globalization, resulting in many important transitions for its economic development. At the same time it continued to have major problems with inflation rates, budget deficits, and uncertainty in financial markets in general. This presents an interesting economic environment for investment decisions by individual investors.

3.2. Turkish financial markets

Turkey has nearly a 150-year history of capital markets. The first securities market in the Ottoman Empire was established in 1866 following the Crimean War under the name of the ''Dersaadet Securities Exchange''. This exchange created an opportunity for European investors who were seeking higher returns in Ottoman markets. The exchange was closed as a result of the outbreak of World War I and the resulting disintegration of the Ottoman Empire. After establishment of the Republic of Turkey in 1923, a new law was enacted in 1929 to recognize the exchange under the name of the ''Istanbul Securities and Foreign Exchange Bourse''. This market developed quickly and became very active in meeting the funding requirements of new enterprises in Turkey. However, the effects of the Great Depression and the impending World War II interrupted this success.

In the 1980s the economic liberalization and the application of free market principles re-emerged. Both changes in the legislative and institutional framework helped to establish a sound capital market. Following the establishment of the Capital Market Board in 1982, the ISE came into existence in its present form. The ISE is the only stock exchange in Turkey, and it began operations in 1986.

The ISE has grown considerably since its establishment. The number of companies traded on the exchange climbed from 80 at the end of 1986 to 315 at the end of 2000. There are four different equity markets within the ISE structure—the National Market, the Regional Market, the New Companies Market, and the Watch-List Companies Market. The majority of the firms (93.4%) are traded at the National Market. The total market capitalization of the firms traded has increased from $938 million at the end of 1986 to $112.2 billion at the end of 1999. The number of firms traded has almost increased by four-fold over these 14 years, and the total value of transactions has sharply increased from only $13 million in 1986 to over $84 billion in 1999.

The second type of market within the ISE is the debt market, known as the Bonds (government) and Bills Market. This is a semi-automated market for both outright purchases and sales and repo and reverse-repo transactions. The last type of market within the ISE system—the ISE International Market—began operation in July 1996. The objectives of this market are to encourage the flow of international capital to the ISE and to provide a transparent and secure trading environment for securities issued in international markets.

There were 81 banks operating in Turkish banking system by the end of 1999. Total assets of these banks were around $133.5 billion. The share of total assets held by state owned commercial banks was 35% while the share of assets held by privately owned commercial

banks was 49%. Other banks (under the deposit insurance fund, development and investment banks, and foreign banks) hold the remaining 16% of assets. The open foreign exchange position of the system was $13.2 billion.

The government financed these deficits via domestic borrowing, with the banks being major purchasers of government securities. These purchases are mainly funded through high interest paying deposits and international borrowings. This, along with the high level of chronic inflation, kept interest rates at fairly high levels.

4. Personal asset management in Turkey

Due to the nature of the Turkish economy, Turkish savers and investors manage their assets differently than the typical investor in the economically developed West. Different risk and return relationships exist in Turkey due to distortions in the system. The potential investment vehicles for the individual investor include the stock market, gold, and deposit accounts denominated in Turkish liras, U.S. dollars and German marks of varying maturities. Since the corporate bond market is not very well developed, it is not a realistic investment option for small investors.

Though the ISE rate of return was near 65% during the period of this study, the ISE was a poor vehicle for investing due to high inflation and the extreme volatility of that market. This is particularly true since other investment alternatives had comparable return and significantly less risk.

As is common in many places in the developing world, gold is a popular mechanism for inclusion in a personal portfolio. Gold is perceived as a good hedge against both inflation and severe devaluations. Active gold markets exist in Istanbul and many other cities in Turkey where individuals purchase gold to hold as an investment asset.

Furthermore, in order to protect themselves against high inflation and occasional dramatic currency devaluations, many savers and investors in Turkey have resorted to holding some portion of their assets in non-lira denominated investment vehicles. The holding of U.S. dollars and German marks (and bank accounts denominated in these currencies) is a common practice for many Turkish citizens. Both the U.S. and German currencies are highly stable and easily convertible currencies from major economies. These currencies are seen as effective means to hedge against the volatility of the lira, and the high inflation in the economy. Furthermore, German marks are also popular because there are many Turkish citizens employed as guest workers in Germany, where the Turkish population now exceeds 2.5 million persons.

5. Data and methodology

This study considers the risk and return opportunities for a hypothetical Turkish investor considering the ideal mix of assets within the constraints of the Turkish economy. The study utilizes the commonly held assets for such an investor to construct efficient frontiers of portfolios.

The investment vehicles considered as possible investments are the ISE index, the United States S&P 500 index, the Frankfurt DAX index from the German market, gold, and 12-month time deposits denominated in Turkish liras (TL), United States dollars ($) and German marks (DM). Due to the nature of the Turkish economy, savings deposits with maturities beyond a 1-year period are not realistic for small investors.

This study utilizes 96 months of monthly market data from January 1991 to December 1998. Data for a hold out sample is based on an additional 12 months of data from January 1999 to December 1999. Monthly observations for returns on gold, changes in the consumer price index, interest rates on 12-month TL, $ and DM time deposits, and the TL/$ and TL/DM exchange rates were obtained from the Central Bank of Turkey. The ISE provided the data on the domestic stock market index. Data on the S&P 500 and the Frankfurt DAX were obtained from *The Wall Street Journal*. Foreign exchange rates were used to convert the return of foreign currency-based investment vehicles to Turkish lira-based returns. Monthly mean returns and standard deviations were calculated from the monthly return data for each of the assets, using data that have been adjusted for exchange rates where necessary. A risk-return comparison was made between the various investment vehicles. Correlation coefficients were also measured to estimate the relationship between the investment vehicles. The lira-adjusted values were used to ascertain the efficient frontier.

Commonly accepted approaches were then used to construct the recommended portfolio for the Turkey-based investor. First a minimum variance portfolio (MVP) was derived using the Markowitz model familiar in modern portfolio theory. An efficient frontier of portfolios was derived. An equally weighted portfolio (EQW), comprised of all seven possible assets, was developed. Finally, using 12 months of data from January 1999 to December 1999, we compared the MVP and EQW portfolios.

6. Findings

The mean return and standard deviation of returns for each of the various individual investment alternatives are shown in Table 2a. Clearly, the lira-denominated time deposit and the two foreign equity indexes offered the highest rates of return during the time of this study. The 12-month lira-denominated account stochastically dominates the other investment alternatives, with the highest return, smallest standard deviation, and the best Sharpe ratio. This point is further examined after the presentation of the efficient frontier. Given that the average annual rate of inflation across the period of study was 77.41%, six of the financial assets in this study had nominal rates of return less than the rate of inflation. Only the 12-month lira-denominated account had a positive real return. From a risk perspective the ISE index exhibited more than twice the volatility of the second most volatile asset (the DAX). Data for the same seven assets during the period of January 1999 to December 1999 are reported in Table 2b.

Table 3 provides information on the correlation between returns in each of the investment vehicles that are available to a Turkish investor. Many correlation coefficients are very low (or negative), indicating a low (or inverse) relationship between the investment alternatives.

Table 2
Lira-based rates of return, standard deviations, and Sharpe ratios[a]

Investment vehicle	Mean annual return (%)	Standard deviation of returns	Sharpe ratio
(a) 1990–1998			
S&P 500	73.43	22.89	0.41
DAX	71.96	27.40	0.29
ISE	64.68	56.81	0.01
Gold	53.48	16.77	−0.63
TL 12-month	83.23	4.37	4.41
$ 12-month	64.83	20.12	0.04
DM 12-month	65.36	19.90	0.07
(b) 1999			
S&P 500	69.41	14.97	0.36
DAX	66.08	26.70	0.08
ISE	218.80	90.40	1.71
Gold	53.87	22.07	−0.46
TL 12-month	85.49	3.87	5.56
$ 12-month	67.91	4.58	0.86
DM 12-month	50.85	3.46	−3.79

[a] All values stated as percentages.

The highest correlation tends to be between the DM and $ time deposits. Interestingly, the highest correlation between the ISE and any alternative investment is 0.1654, indicating the ISE might fit into a broader portfolio of investments. However, such intuition is not to be rewarded.

Given the data described above for the seven investment vehicles, a MVP and an accompanying efficient frontier were developed. This information is reported in Table 4. Efficient frontier portfolios were determined by following the commonly accepted procedures of modern portfolio theory for the development of a minimum variance portfolio. The minimization of the variance of the portfolio to ascertain the frontier was accomplished, subject to certain constraints. The constraints were that a given efficient portfolio must earn a specified rate of return (with several rates of return used to develop the frontier), and the weighting of the investment vehicles in each portfolio must sum to one with no vehicle being allowed to have negative weighting.

Table 3
Correlation coefficients for lira-adjusted returns, 1990–1998

	S&P 500	DAX	ISE	Gold	TL 12-month	$ 12-month	DM 12-month
S&P 500	1.0000						
DAX	0.5852	1.0000					
ISE	0.1654	0.1475	1.0000				
Gold	−0.0948	0.0101	−0.0583	1.0000			
TL 12-month	0.1022	0.1150	0.1031	0.1697	1.0000		
$ 12-month	−0.0437	0.1315	−0.0777	0.6701	0.2130	1.0000	
DM 12-month	−0.0619	−0.0126	−0.0279	0.6222	0.2504	0.8889	1.0000

Table 4
Frontier portfolios, 1990–1998[a]

Portfolios			S&P 500	DAX	ISE	Gold	TL 12-month	$ 12-month	DM 12-month
Annual return (%)	Annual standard deviation	Sharpe ratio							
84.0[b]	–	–	0.0	0.0	0.0	0.0	0.0	0.0	0.0
83.0	4.34	4.38	0.0	0.0	0.0	0.77	99.23	0.0	0.0
82.51[c]	4.33	4.28	0.0	0.0	0.0	2.42	97.58	0.0	0.0
80.0	4.54	3.53	0.0	0.0	0.47	10.56	88.97	0.0	0.0
75.0	5.93	1.86	0.0	0.0	1.69	26.61	71.70	0.0	0.0

[a] All values stated as percentages.
[b] No feasible solution.
[c] Minimum variance portfolio.

The MVP had a return of 82.51%, a standard deviation of 4.33%, and a Sharpe ratio of 4.28. The lira account makes up about 98% of this portfolio. The only other asset in this portfolio is gold with a weight of <3%. Above that point on the efficient frontier another portfolio with an 83% return was ascertained, but it had an even heavier weighting of the 12-month deposit. There was not a feasible solution for a return of 84%, making the efficient frontier quite small. The entire efficient frontier runs only from a return of 82.51% (the MVP) to an upper return of 83.23% (the portfolio which is composed of only the lira account). At the few higher returns available, the weighting of the lira account only increases.

Returns below that of the MVP are on the inefficient portion of the frontier. This inefficient frontier would graphically slope down to the right from the MVP. Table 4 portfolios with returns of 80 and 75% are on this downward sloping, inefficient frontier. As the required return on the portfolio is forced lower, the weighting of the lira account declines, but still remains the overwhelming majority of the portfolio. With the exception of gold, no other assets play a significant role in any portfolio.

Table 5 describes the characteristics of the potential portfolio when the investor chooses to equally weight (EQW) the seven potential investment vehicles. This portfolio has a return of 68.14%, a standard deviation of returns of 15.82%, and a Sharpe ratio of 0.26. In comparison to the MVP, the EQW portfolio is clearly inefficient. The return and variance of the EQW portfolio cause it to be inferior to every portfolio reported in Table 4. Graphically, the EQW would plot below and to the right of all portfolios shown in Table 4 that were developed by minimizing the variance of the portfolio

Table 5
Equally-weighted portfolio, 1990–1998[a]

Portfolios			S&P 500	DAX	ISE	Gold	TL 12-month	$ 12-month	DM 12-month
Annual return (%)	Annual standard deviation	Sharpe ratio							
68.14	15.82	0.26	14.29	14.29	14.29	14.29	14.29	14.29	14.29

[a] All values stated as percentages.

Table 6
MVP portfolio, 1999[a]

Portfolios			S&P 500	DAX	ISE	Gold	TL 12-month	$ 12-month	DM 12-month
Annual return (%)	Annual standard deviation	Sharpe ratio							
84.73	3.73	5.56	0.0	0.0	0.0	2.43	97.57	0.0	0.0

[a] All values stated as percentages.

Table 7
EQW portfolio, 1999[a]

Portfolios			S&P 500	DAX	ISE	Gold	TL 12-month	$ 12-month	DM 12-month
Annual return (%)	Annual standard deviation	Sharpe Ratio							
87.49	13.97	1.68	14.29	14.29	14.29	14.29	14.29	14.29	14.29

[a] All values stated as percentages.

To test the predictive power of the portfolios developed using the MVP and EQW approaches, a hold out sample was utilized. An additional year of monthly data was used to see which approach to building a portfolio would have been more successful for the for the typical investor in Turkey. Results are reported in Tables 6 and 7. In Table 6 the data shows that the MVP approach would have produced a return of 84.73%, a standard deviation of 3.73%, and a Sharpe ratio of 5.56. Table 7 indicates that the EQW methodology would have produced a return of 87.49, a standard deviation of 13.97, and a Sharpe ratio of 1.68. The EQW methodology produced an inferior portfolio during the 1991–1998 period, and the EQW approach again produced a 1-year portfolio for 1999 that was inferior to the MVP on a risk-adjusted basis.

A statistical analysis was conducted comparing the results from the hold out sample. The *T*-test results indicate that at the 10% level there was no statistically significant difference between the returns on these two portfolios. That is not surprising since we were not trying to maximize return. However, the *F*-test results for equality of variances in the hold out sample indicate that at the 1% level there was a statistically significant difference between the variances.

7. Summary and conclusions

This study applies the modern portfolio theory to the personal asset allocation decision of an investor in the Turkish financial markets. Turkey has been experiencing high inflation, budgetary deficits, depreciation in its currency, and a relatively fast growing economy. The existence of relatively high uncertainty in this economy would reduce the investment horizon of an individual investor considerably.

Results of our analysis indicate the virtual absence of gold and the total absence of any of the three equity markets, or foreign currency denominated accounts in any efficient portfolio. The analysis indicates that across this time period, the only asset that should have been given a significant wealth allocation was the Turkish lira-denominated time deposit. This has fascinating implications for the personal finances of Turkish savers and investors. The first observation must be that the commonly practiced inflation and devaluation hedging strategy of holding gold or foreign currency-denominated accounts (or simply holding foreign currency) does not seem to be the correct strategy. While there have been an occasion where abrupt and severe devaluations have hurt investors holding the lira-denominated account, the data across the entire period tells us that in the long-run the lira-denominated accounts have been the superior financial assets. The second observation must be that the highly speculative domestic stock market is not an acceptable investment alternative in a modern portfolio theory framework. The domestic equity market does not belong in a minimum variance portfolio due to its extreme volatility. The third (and most surprising) observation of this analysis is that the two foreign markets should also be excluded. This is not because they are unattractive investment vehicles, but because the 12-month lira account too completely dominates all other alternatives.

It is legitimate to wonder if the government is preventing capital flight with the high rates that are set on the 12-month lira accounts, even though there is no government acknowledgement of such a policy. The high returns and low volatility—relative to the other available financial assets—make these lira accounts quite attractive investments that must clearly dominate any portfolio. Because of this apparent distortion in the system the Turkish lira-denominated 12-month account becomes the only financial asset that should receive a major wealth allocation from a Turkish investor.

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