



Diversification and Performance in Banking: The Israeli Case

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Abstract

This paper analyzes performance and portfolio choice of banks' investments across business units using methodologies developed mainly for equity investments. The backgrounds to the paper are major recent developments in the financial services industry, mainly consolidation in the banking industry that raised the issue of efficiency gains due to diversification. The paper focuses on banks in Israel as an extended case study, using the fact that Israeli banks have operated as (limited) universal banks for a long time. The results suggest that there are gains to diversification and that risk adjusted performance is mostly consistent with optimal portfolio choice. Most of the previous research in this area has been done in the US. These studies necessarily focused on hypothetical combinations of different business activities because of the legal limits on US banks. Thus, this paper adds to the literature both by examining actual combinations and looking at another country.

Key words: Diversification gains, efficient frontier, optimal portfolio, RAROC—risk adjusted return on capital, VAR—value at risk

1. Introduction

This paper analyzes banks' investments across business units using methodologies developed mainly for equity investments. The backgrounds to this study are the major developments in the last decades in the financial services industry, in particular consolidation in banking. The main question is how these developments will affect the industry in terms of risk-return and value, where possible efficiency gains are due to diversification and other related factors. We study the effects of diversification on the efficient set and optimal portfolios, and examine risk-adjusted performance in banking, which is used as a guide for capital allocation in financial institutions as well as management compensation.

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Consolidation of financial institutions has been the most important development in the financial industry in the last two decades. It is a global phenomenon that accelerated in the 1990s, with most financial mergers and acquisitions involving commercial banks.¹ An important driving force has been regulatory change in the US and Europe (EU). Most notable in the US are the Riegle-Neal Act of 1994 that removed the barrier on domestic geographic expansion of banks and the Gramm-Leach Bliley Act of 1999 (GLBA) that removed the barriers, imposed by the Glass-Steagall Act of 1933, to product expansion and financial conglomeration in US commercial banking and made financial integration straightforward.² In Europe the EU Second Banking Directive, effective 1.1.1993, established a single banking market and the requirement of a single banking license and supervision in the EU. In addition to deregulation consolidation may be also attributed to other factors: improvement in *information technologies*, which made feasible a broader array of financial products to be provided to more clients over wider geographic areas; and *globalization* where financial firms followed the expansion of non-financial firms, with the formation of the EU having a significant impact. It should also be noted that in the last decades the environment in which banks and other financial institutions operate has changed. There has been an increase in the level of (price) risks as well as the exposure (quantity) to market and credit risks. The increase in risks can be attributed at least in part to the developments mentioned above.³ The rise in risk exposure motivated the measurement of performance on a risk-adjusted basis.

One of the main motives for consolidation is the potential for efficiency gains from risk reduction by diversification that is due to low correlations and size of the portfolio.⁴ Diversification can be across financial products (services), and geographic domestic diversification (intrastate), or international. Other possible gains from consolidation and diversification are: managerial economies of scale, increased debt capacity, increased efficiency of resource allocation in internal markets, and exploitation of firm-specific assets in different markets. There are also possible costs of diversification e.g., inefficient allocation of capital among the different segments/activities, and difficulty in designing optimal compensation schemes for managers. Risk-adjusted performance measures, dis-

1 In the period 1990–99 there were about 7,304 mergers (about 4,265 in North America) of financial institutions of which more than 4,400 (3,013 in North America) involved commercial banks, the rest were insurance companies and securities firms. The total value of the merged firms was more than \$1.6 trillion (\$976 billion in North America), of which about \$1.2 trillion (\$711 billion in North America) was in banking, See Group of Ten, BIS (2001).

2 These barriers made U.S. banking the most restricted of all G-10 and EU countries in terms of permitted nonbank activities (securities, insurance, and commerce), See Barth et al. (2000).

3 There are several reasons for the rise in risks faced by banks: a rise in the uncertainty (volatility) of risk factors in the markets in which the banks operate, such as interest rates, exchange rates, and stock-market prices; and an increase in nontraditional activity in off-balance-sheet items such as derivative financial instruments, resulting from deregulation and the globalization of financial markets.

4 Findings generally are that larger, geographically integrated institutions tend to have better efficient frontier, see for example Hughes et al. (1999).

cussed later, address the cost and benefits associated with these issues.⁵ The realization of the potential gains depends on the actual portfolio held by the banks. There is no guarantee that financial firms will hold efficient portfolios given the new efficient frontier, which means that efficiency gains may not be realized. The question about the actual vs. feasible efficient or optimal portfolio is answered empirically in the study.

The focus of the study is product diversification through consolidation in a system with “universal” banking. There is relatively limited evidence on this topic, and most relates to the US where diversification was restricted by regulation. The empirical studies, which are flawed in methodology and the hypothetical data used, find limited diversification gains in terms of reduction of risk and an increase in earnings.

The previous studies have shortcomings in their methodology: separate analysis of risk and/or return and not a combined measure of risk adjusted performance (RAPM) or analysis of efficient portfolios frontier; minimum risk portfolio is considered, where it is not necessarily the optimal portfolio; portfolios are constrained to only two financial activities, banking and one nonbanking activity. More importantly is the data problem: because of regulatory limits (Glass-Steagall, Act of 1933), actual data does not exist for the US for the last 60 years, and studies therefore used simulations of hypothetical mergers data. In Europe where the concept of financial conglomerates and close co-operation between providers of different financial products is not new, the empirical evidence is limited. More on these studies see in the next section.

The main goal of the current study is to overcome the methodology and data deficiencies of previous studies and to provide reliable evidence on diversification gains and performance of banks. In order to accomplish this, first risk-adjusted performance measures (RAPM) are derived, based on the value at risk (VaR) concept as a measure of risk (capital). This study derives measures of risk-adjusted return in banking that are applications of performance measures in finance (Sharpe, Treynor and Jensen). We use two approaches in measuring performance: stand-alone and the portfolio approach which considers the correlations between the different components (business units). Secondly we derive the efficient frontier and optimal portfolios applying the Markowitz model to banking and taking into account the regulatory constraints.

First the risk-adjusted performance of the banks is estimated, using actual Israeli banking financial statements data for the period 1992–2001, and then the efficient frontier and the optimal portfolio are derived, taking into account diversification gains and risk preferences (see Kimball, 1998). The banks in Israel operate as “universal” banks with some regulatory restrictions. They have numerous permitted activities in

5 It should be noted that the observed negative correlation between diversification and a firm’s value might not imply causality. Once characteristics of the firm (profitability, investments) are controlled for, the diversification discount declines and may even become a premium. Thus diversification is a value-enhancing strategy for firms that actually diversify, see Campa and Kedia (2002). In terms of empirical studies, Cubo-Ottone and Murgia (2000) using market valuation of mergers in European banking document positive abnormal returns associated with the announcement of domestic bank-to-bank deals and with product diversification of banks into insurance. In a recent study Ramirez (2002) finds that banks’ security affiliates added 4–7 percent to the market value of commercial banks in the US in 1926 and 1927, and he attributes these to economies of scale and scope.

addition to commercial banking: mortgage banking, overseas banking, investment banking, insurance and commerce.

The main findings of this study are: first, that risk-adjusted performance matters as it yields results that differ from those obtained using the traditional measures such as rate of return on equity (ROE). Secondly, it is quite clear from the estimated efficient frontier and optimal portfolio that there are gains to diversification. Thirdly risk adjusted performance is consistent with optimal portfolio choice. Despite the small sample and the case study nature of the study our results are meaningful and have important implications for other banking systems at least in similar economies.⁶ See Rhodes (1998) who summarizes nine case studies on the efficiency gains of bank mergers.

The rest of the paper is organized as follows: part 2 provides a short literature review. In part 3 the theoretical foundation of risk-adjusted performance is described and then risk-adjusted returns on capital (RAROC) for component activities (business units) of the bank and the entire bank are derived and estimated using Israeli banking data. In part 4 we estimate the efficient frontier and optimal portfolios of Israeli banks using the Markowitz model. Summary of the main results and concluding remarks are presented in part 5.

2. A brief review of the literature

Simulation studies mostly find limited diversification gains in the financial sector: in terms of reduction of risk and earnings increase. Boyd and Graham (1988) in a simulation of mergers of bank holding companies (BHC) with one non-bank financial firm found a small gain in ROE of the merged firm (BHC and insurance and securities firms) where risk declines only in one case (BHC and life insurance). Laderman (2000) found nonbank activities to offer diversification benefits: a decrease in the variance of the return on assets (ROA), and the minimum variance portfolio includes nonbanks. Kwan and Laderman (1999) in a review of the literature on portfolio effects of mergers report on limited benefits of mergers of banks with certain securities activities. Saunders and Walter (1994) in a simulated merger analysis of a large number of mergers among the largest financial intermediaries in the US found that optimal investing in different financial services could reduce risk by as much as one-third compared to a specialized bank. Reichert and Wall (2000) form efficient portfolios of BHC with traditional activities (savings banks, savings and loan associations, personal and business companies) and nontraditional activities (security brokers, commodity brokers/dealers, life insurance underwriters, insurance agents and brokers, investment companies and subdividers and developers). They found some evidence for gain from diversification as measured by a non-increase in the coefficient of variation of ROE. In Europe the concept

6 Israel's reference group includes eight countries that are similar to it in such terms as GDP and the structure of the banking system: Belgium, Denmark, Finland, Greece, Ireland, Portugal and South Africa (see Bank of Israel 2002 Banking Annual Survey).

of financial conglomerates and close cooperation between providers of different financial products is not new. However the empirical evidence that exists outside the US is limited. Cubo-Ottone and Murgia (2000) in a study of mergers and acquisitions in European banking find significant positive abnormal returns associated with product diversification of banks into insurance; they find, however that M&A with securities firms and foreign institutions did not result in a gain. Focarelli et al. (2002), using Italian balance-sheet data on mergers and acquisitions of banks, find an increase in the return on equity after a merger, and a long-run increase in profitability for acquired banks after an acquisition.

3. Risk adjusted performance

The RAROC methodology developed to measure performance adjusted for risk has three possible uses: efficient allocation of capital among the different activities in the banking book as well as in the trading book;⁷ risk-adjusted performance measurement of various banking activities (units), especially in the trading book; management compensation based on risk-adjusted performance, see James (1996), and Uyemura et al. (1996). The Bank of America, for example, has a RAROC system of allocating capital and measuring performance of each business unit and the entire bank, see Zaik et al. (1996).

3.1. Definitions

In the banking literature, three measures of risk-adjusted return have been developed that are related to performance indices in finance:

1. RORAC (Return on Risk-Adjusted Capital): The measure is calculated by dividing the return in excess of the risk-free return (“financing costs”) by the “economic capital” needed to cover losses that are expected during the given period at the stipulated probability, i.e., the value at risk (VaR). In this index, the risk adjustment is made in the denominator and the risk is measured in terms of standard deviation. One may regard this index as an application of the Sharpe ratio that is defined as the excess return over the risk-free return divided by the standard deviation. According to the capital asset pricing model (CAPM) such a measure of risk (total risk) is appropriate for a well-diversified portfolio.
2. RAROC (Risk-Adjusted Return on Capital) the risk adjustment is made in the numerator. The risk-adjusted return is based on the equilibrium model for the pricing of capital assets; for the most part, the CAPM is used. In this index, the return is divided by the required capital or regulation capital. This index may be regarded as an

⁷ Bankers Trust proposed this comprehensive system of risk measurement.

application of the Jensen measure: the excess return over the required return, i.e., the difference between actual return and the required return, defined as the abnormal return α . Notably, the required rate of return—the “hurdle rate”—is not necessarily determined by the CAPM but may be determined by other equilibrium models such as the multi-factor Arbitrage Pricing Theory (APT) model.

3. RARORAC (Risk-Adjusted Return on Risk-Adjusted Capital): in this index, a double risk adjustment is made, in both the numerator and the denominator. The relatively new terminology in the banking literature has not yet become standardized; various definitions of the indices that are not always consistent with the theory of finance appear under one name (see Punjabi, 1998). The next section defines performance indices in banking for component activities and total bank on the basis of the foregoing definitions. We use methodologies developed in finance mostly for equity investments. The measure of risk (capital) in the risk adjusted performance is based on VaR and component VaR for the different banking activities.⁸ The measures of performance are used to estimate the performance of Israeli banks.

3.2. Measures of performance

In this section we derive RAROC indices (hereinafter, we shall use the accepted term RAROC even though we are actually estimating RORAC as well as RAROC indices). These measures are applications of the well known Sharpe, Treynor and Jensen measures of performance in finance.

We now proceed to the risk-adjusted performance of the banks. We used two approaches to estimate the performance : the stand-alone approach where assets are considered in isolation and the portfolio approach, in which correlations between components of banking activity (business units) are taken into account. The theoretical framework for the analysis is provided by the *Internal Systematic Risk* approach, in which systematic risk of a unit is measured in reference to the bank’s portfolio (covariance between the bank’s activity and the bank’ total portfolio of activities) and not to the market portfolio, as is usually done in finance. The difference stems from the fact that, unlike the common assumption of perfect capital markets in which all assets are tradable, in banking a large proportion of a bank’s assets and liabilities are nontradable, especially in the banking book, and the bank’s business (activity) units are of limited marketability. Froot and Stein (1998) developed a two-factor pricing model for banks, where the first factor is the market factor, as in the CAPM, and the second is the bank’s (nontradable) portfolio factor. Accordingly they have defined an internal systematic risk (and price of risk) in terms of the covariance with the bank’s portfolio. In computing the

⁸ VaR is widely used measure of risk, however it is not flawless. The main flaw is that it ignores losses in the tail, unless returns are normally distributed, See Artzner et al. (1999).

VaR of the component activities and the bank as a whole a variance-covariance approach was used.⁹

There are two important differences between the performance measures in finance and their applications in banking (the various RAROC indices) derived in the analysis. First as noted we use an “internal systematic risk” approach, which measures systematic risk relative to the bank’s portfolio and not to the market portfolio. Secondly, the performance measures in finance are expressed in terms of rates of return; RAROC indices in banking on the other hand are expressed in terms of earnings. This is because in banking one examines both the return obtained and the actual positions (investment) in the activities that the bank has chosen to pursue. For this reason, our analysis focuses on earnings parameters and not rates of return.

Three indices were used to measure the banks’ performance in the different activities:

First, pursuant to the Sharpe ratio, a RAROC index was derived for activity i where this activity is considered to “stand alone.” Thus the risk is expressed in terms of standard deviation, i.e., consistent with the definition of VaR. As Shimko (1997) has shown the return on risk adjusted capital (RAROC) can be interpreted as a linear transformation of the Sharpe ratio where capital is measured using VaR.¹⁰ The equation of the RAROC measure is:

$$RAROCs_i = \frac{\Pi_i - \Pi_{fi}}{\sigma_{\Pi_i}}, \quad (1)$$

where:

$$\Pi_i - \Pi_{fi} = \frac{1}{T} \sum_t^T (\Pi_{it} - \Pi_{fit}),$$

and

$$\Pi_{fit} = R_{ft} K_{it},$$

Π_{fi} is average earnings in the risk-free activity attributed to activity i ; K_{it} is the average (beginning-end of year) (equity) investment in activity i in year t ; and Π_i , σ_{Π_i} are the average profits (net operating profit or net profit from ordinary items) and standard deviation of the profit of activity i during the sample period, T respectively. For

9 The *Variance-covariance* approach considers the correlations among returns (earnings) on assets, assuming a normal distribution of returns. VaR is calculated by multiplying the standard deviation by a standard normal value, Z that corresponds to the required significance level (usually 99 percent).

10 Shimko (1997) has shown that RAROC is a simple multiple of the Sharpe ratio:

$$RAROC = \left(\frac{P\&L}{VaR} \right) = SHARPE \sqrt{t} / Z.$$

the bank as a whole $\sigma_{\Pi B}$ is its standard deviation which is consistent with VaR of the bank:¹¹

$$\text{VaR}_B = Z\sigma_{\Pi B}.$$

For the *portfolio approach*, which considers the correlations between the different activities, two other measures are used. The next index is consistent with the Treynor measure where risk is measured in covariance terms, i.e., as component value at risk (CoVaR).¹²

$$\text{RAROC}_i = \frac{\Pi_i - \Pi_{fi}}{B_{\Pi_i}}. \quad (2)$$

The risk index or the CoVaR in the activity is defined as:

$$B_{\Pi_i} = \frac{\sigma_{\Pi_i B}}{\sigma_{\Pi B}} \quad \text{and} \quad \text{CoVaR}_i = ZB_{\Pi_i}, \quad (3)$$

where $\sigma_{\Pi_i B}$, $\sigma_{\Pi B}$ are the covariance between bank earnings and activity i earnings, and the standard deviation of bank earnings respectively. The covariance $\sigma_{\Pi_i B}$ is the systematic risk of activity i , it is the sum of the covariance terms of asset i with all other assets in the portfolio, thus

$$\sigma_{\Pi_i B} = \sum_j \sigma_{\Pi_{ij}} \quad \text{and} \quad \sigma_{\Pi B} = \sqrt{\sum_i \sum_j \sigma_{\Pi_{ij}}}. \quad (4)$$

That is the bank's total risk is defined as the sum of all the variance and covariance of the earnings terms of the component activities, and $\sigma_{\Pi_i B}$ is the systematic risk of activity i , it is the sum of the covariance terms of asset i with all other assets in the portfolio. Where B_{Π_i} is the standardized measure of the systematic risk of activity i . Accordingly the total risk of the bank and its VaR is given by:

$$\sum_i B_{\Pi_i} = \sigma_{\Pi B} \quad \text{and} \quad \sum_i \text{CoVaR}_i = \text{VaR}_B. \quad (5)$$

It should be noted that assets negatively correlated with the portfolio (the bank) have a negative risk measure ("hedge"). The interpretation of the Treynor measure of such assets is not clear and therefore will not be used here.

11 In this approach mean profit is conventionally presumed to be zero, Kupiec (2002), however argues that this assumption may lead to misleading results. Alternatively the VaR can be considered the loss relative to the mean and not to zero to obtain this definition of VaR, see Crouhi et al. (2001) who argue that only this definition of VaR is consistent with capital attribution and RAROC calculations.

12 The risk index of a component activity used in the VaR analysis must meet three conditions (see Garman, 1996, 1997): 1. The sum of risks of the component activities must be equal to the bank's total portfolio risk. 2. An increase (decrease) in an activity will increase (decrease) the bank's total risk by an amount approximately equal to the risk of the activity. 3. A negative risk of a given activity will make the total portfolio less risky (hedging).

Finally, the performance of the banks' activities is measured by means of an abnormal-earnings index based on an "internal" risk measure. This measure of performance of activity i is an application of the Jensen Index in earnings terms:

$$A_i = \Pi_i - (\Pi_{fi} + (\Pi_{Bi} - \Pi_{fi})\beta_{\Pi i}), \quad (6)$$

where:

$$\Pi_{Bi} = \frac{1}{T} \sum_t \frac{\Pi_{Bt}}{K_{Bt}} K_{it} = \frac{1}{T} \sum_t R_{Bt} K_{it},$$

are the attributed earnings of the "benchmark" portfolio (the earnings of activity i assuming a rate of return equal to that of the bank). The risk is defined as the "internal beta" of activity i in earnings terms:

$$\beta_{\Pi i} = \frac{\sigma_{\Pi i B}}{\sigma_{\Pi B}^2}.$$

Index A_i can be considered to be a measure of the *Economic Value Added* (EVA) of the activity; it has many uses in banking, among them in capital budgeting, see Uyemura et al. (1996).

To take account of the difference in size of the banks and activities, the index is standardized by dividing it by the average investment in activity i (K_i):

$$RAROCJ_i = \frac{A_i}{K_i}. \quad (7)$$

To examine performance of a specific activity, we compared performance of the activity in the different banks and in the system as a whole. The indices for the system were calculated on the basis of the aggregate data for all banks, thus, one may relate to the system as to an "additional" bank. We also compared performance in various activities at the bank, including the performance of the entire bank.

3.3. Performance of the Israeli banking system

The measures of performance are estimated for Israel's five largest banking groups and the banking system as a whole, using financial statements data for the period 1991–2001.¹³ The Israeli banking system is highly concentrated as is reflected by the high market share of the five largest banking groups (94% of total assets) and a high Herfindhal–Hirschman index of concentration (0.23). Israel's banking system is one of the more concentrated among developed countries but similar to countries in its reference group (see footnote 6).

13 For an estimate of the VaR of market risks in Israeli banking see Wiener et al. (2001), and Zaken et al. (1997) for an estimate of market risks and the capital requirements in Israeli banking.

As mentioned before the Israeli banking system is “universal,” i.e., the banking groups provide a full range of banking services in addition to commercial banking. In the empirical study total activity of the banking group was divided into nine components: commercial banking; mortgage banking; overseas banking; investment banking and management of funds; credit cards; leasing; insurance; nonfinancial (commerce) companies; and non-major companies.¹⁴ The data of net operating profits (ordinary net income) and investments in the different activities comes mainly from the Note on Investments in Companies on the Equity Basis (principal subsidiaries and affiliated companies) in the annual financial statements of the banks.¹⁵ The investment by the bank in activity i at time t , denoted variable K_{it} , is measured in book value terms. As we know book value may differ from economic value of the investment (i.e., market value), but it has other merits, since the investment is measured uniformly across banks activities and it is consistent with the measurement of the profits from these activities.

The investment in the activity of the bank that heads the group is calculated as the difference between the bank’s equity and the sum of all the investment in each of the other activities. Hence, by definition the sum of the investments in each of the activities, including the activity of the head commercial bank itself, equals the equity of the bank. In this context it is important to note that the measurement is uniform, as banks are required to report to the public in accordance with accepted accounting rules, and in accordance with the banking supervision regulations.

Table 1 presents the average rates of return on equity (ROE), the traditional measure of performance, and average profits in each of the nine banking activities (business units) for the five banking groups and for the total banking system. Bank Leumi was the only bank with investments in all activities. An interesting question is: will the rate of return on equity measure be consistent with risk-adjusted performance? The answer in many cases is no. In table 2 that presents average profits, it is interesting to note that commercial banking contributed about 60 percent of the total profits of the banking system, with a large dispersion in results for the different banking groups: from 12.7 percent at the Discount group to 83.1 percent at First International group. As will be shown later these are reflections of differences in profitability and portfolio composition between the different groups.

In the analysis of performance two questions are of interest: (1) How did a specific activity perform relative to the bank portfolio as a whole (“out-performance” question); (2) How did a specific activity or banking group perform relative to the other activities of the bank or groups? (“ranking” question). In case of a discrepancy between the Treynor and Jensen measures that use systematic risk: the latter measure gives a result that is

14 Non-major companies are defined as investments of less than 1% of the bank’s capital or less than 5% of the bank’s ordinary net income. In most cases the bank does not hold a controlling interest in these companies.

15 All banks present the note in the same format in accordance with accepted accounting principles. Thus the activities of the various monoline subsidiaries are defined and measured in a uniform way. There is one exception, the overseas banking of Bank Hapoalim, which is carried out in part via bank’s branches. This part of the activity is relatively small, and therefore causes no significant bias in the data or the results.

Table 1. Average Return on Equity (ROE) by the nine banking activities of the five major banking groups and the total banking system, 1991–2001

The average rate of return of activity i is $ROE_i = \frac{1}{T} \sum_{t=1}^T \frac{U_{it}}{K_{it}} = \frac{1}{T} \sum_{t=1}^T ROE_{it}$.

T is the length of the sample period in years and ROE_{it} = net operating profit (ordinary items) of activity i in year t divided by average capital (equity investment in activity i) during the year.

Percent, December 2001 prices.

Activities	Leumi	Discount	Hapoalim	Mizrahi	First Intl.	System
Commercial banking	13.8	0.4	15.6	11.2	9.9	10.9
Mortgage banking	10.9	11.2	15.2	12.5	8.5	11.9
Overseas banking	-0.4	6.3	3.6	2.0	5.0	3.4
Investment banking and management	8.2	21.0	5.8	9.4	5.3	7.1
Credit cards	20.8	20.2	36.1	19.6	83.9	15.8
Leasing	-0.2	3.2	15.5	1.1	8.6	6.9
Insurance	12.3	Na	0.0	-44.8	Na	12.0
Non-financial (commerce)	4.8	Na	3.6	Na	Na	5.1
Non-major	-3.6	5.0	9.6	-8.2	-5.2	-0.2
Bank total	7.4	4.3	9.7	9.3	8.6	7.9

easier to interpret.¹⁶ The Sharpe measure, which is based on total risk, may differ from the other two measures with respect to both the out-performance as well as the ranking question. Thus in the interpretation of the results the Sharpe and Jensen measures will be emphasized.

The main findings in tables 3–5 are:

1. First, we report the findings of the performance of the various banking groups, i.e., performance of the entire bank, or total investment, during the sample period.¹⁷ The performance measures (Sharpe and Treynor) show that for the entire sample period 1991–2001, the First International had the best overall performance (3.02), followed by Mizrahi and Hapoalim, while Leumi and Discount performed below the banking-system average of 1.24 (see table 3). Discount has a negative measure meaning that this bank generates an average rate of return smaller than the risk-free rate. It should be noted that the risk-adjusted ranking of the banking groups is quite different from the traditional ranking based on ROE (see table 1): the First International ranks third trailing Hapoalim and Mizrahi. Obviously the performance of

16 These measures, which use systematic risk, will give the same answer to the first question when rates of return are used with the market portfolio. Here however, profits and an “internal” risk approach are used and therefore this result will not hold. In the Treynor measure the benchmark bank portfolio is calculated assuming the investment to equal the total investment of the bank, while in the Jensen measure investment in the specific activity is used.

17 It should be noted that the Sharpe Index (RAROC_S) and the Treynor Index (RAROC_T) are identical when analyzing the entire bank. This is because the risk measures are equal by definition: $B_{\text{IB}} = \sigma_{\text{IB}}$. The Jensen Index (RAROC_J) for the entire bank is equal to zero by definition since we use an internal risk approach.

Table 2. Average profit by the nine banking activities of the five major banking groups and the total banking system, 1991–2001

Millions of Shekels in December 2001 prices; Numbers in parentheses are percent of profits in a given activity out of total profits of the bank.

Profit = net operating profit (ordinary items). The exchange rate of the Shekel at the end of December 2001 was 4.28 Shekels = 1 US\$.

Activities	Leumi	Discount	Hapoalim	Mizrahi	First Intl.	System
Commercial banking	524.1 (76.1)	23.9 (12.7)	543.5 (58.7)	67.7 (34.1)	172.1 (83.1)	1,331.2 (60.3)
Mortgage banking	53.0 (7.7)	30.3 (16.2)	72.8 (7.9)	123.4 (62.1)	29.8 (14.4)	309.4 (14.0)
Overseas banking	44.0 (6.4)	106.2 (56.6)	27.6 (3.0)	2.3 (1.2)	15.5 (7.5)	195.7 (8.9)
Investment banking and management	32.9 (4.8)	4.2 (2.2)	76.3 (8.2)	13.2 (6.6)	3.0 (1.4)	129.6 (5.7)
Credit cards	4.5 (0.7)	7.5 (4.0)	22.3 (2.4)	2.0 (1.0)	-9.9 (-4.7)	26.4 (1.1)
Leasing	1.8 (0.3)	1.2 (0.6)	17.9 (1.9)	0.4 (0.2)	0.8 (0.4)	22.0 (1.0)
Insurance	27.5 (4.0)	0	0	-0.5 (-0.3)	0	26.9 (1.2)
Non-financial (commerce)	30.7 (4.5)	0	119.30 (12.9)	0	0	150.0 (6.8)
Non-major	-29.5 (-4.3)	14.2 (7.6)	46.8 (5.1)	-9.8 (-4.9)	-4.1 (-2.0)	17.6 (0.8)
Bank total	688.9	187.5	926.6	198.8	207.2	2,209.0

the banking group is largely affected by the performance of its main activities (investments). Tables 3–5 show that the most important factor in the auspicious performance of the First International was its relatively good performance in its three major activities (in at least two measures which consider the correlations between the activities): commercial banking, where it had a relatively large investment (69% as compared to 47% of the system, see table 7), mortgage banking and overseas banking. The good performance of Mizrahi was derived mainly from the performance of its large mortgage bank (48% of total investment). At Hapoalim, commercial banking, mortgage banking and non-financial companies performed well. The performance of Leumi, which did well in its commercial banking, was affected clearly by the consistently poor results of its overseas subsidiaries (mainly Bank Leumi of New York in the first half of the sample period). On the other hand, for Discount the commercial banking (relatively small in terms of average investment) performed poorly while overseas banking (relatively large) and mortgage banking performed well.

- Next we analyzed the performance of the different activities of the entire banking system. According to all measures commercial banking and mortgage banking had the best performance among the major banking activities, while non-major business activity had the worst, having a negative Sharpe measure. Among other activities, credit cards, a relatively small activity, performed rather well and overseas banking performed relatively poorly mainly due to the poor performance of Leumi overseas in the first half of the 1990s.

Table 3. RAROCs (“Sharpe” index) by activities of the five major banking groups and the banking system, 1991–2001

$RAROCs_i = \frac{\Pi_i - \Pi_{fi}}{\sigma_{\Pi_i}}$ is the measure of performance of activity i .

$\Pi_i - \Pi_{fi} = \frac{1}{T} \sum_t (\Pi_{it} - \Pi_{fit})$ is the excess profit in activity i over the risk-free profit, defined as:

$$\Pi_{fit} = R_{ft} K_{it}.$$

Activities	Leumi	Discount	Hapoalim	Mizrahi	First Intl.	System
Commercial banking	1.54	-0.24	1.36	0.72	1.85	1.68
Mortgage banking	0.8	1.92	1.35	2.48	1.69	1.69
Overseas banking	-0.14	0.33	-0.12	-0.19	0.13	0.00
Investment banking and management	0.47	0.13	0.03	0.27	0.16	0.18
Credit cards	0.02	0.75	1.28	0.45	-0.43	0.70
Leasing	-0.37	-0.95	0.75	-0.42	-0.21	0.36
Insurance	0.67	Na	Na	-0.68	Na	0.66
Non-financial (commerce)	0.17	Na	0.35	Na	Na	0.34
Non-major	-0.60	-0.06	-0.01	-0.63	0.14	-0.47
Bank total	0.79	-0.05	1.31	1.44	3.02	1.24

3. Last we analyzed the performance of the different banking groups for each activity. The performance was measured as a “stand alone” activity (Sharpe measure) and as component of a portfolio (Treyner and Jensen measures based on the “portfolio (systematic risk)” approach).¹⁸ For illustration we focus on the main findings of the two largest banking groups:

At Bank Leumi, all measures indicate that performance of commercial banking was the best, followed by mortgage banking and investment banking. Overseas banking, in which the bank had a substantial investment, had the worst performance according to all three measures.

At Bank Hapoalim, commercial banking and mortgage banking had the best performance according to all measures. As in other banks, the performance of non-major activities was relatively poor.

Notably, the interbank comparison in regarding a specific activity is limited because the internal correlations on which the systematic risk indices are based may vary from one bank to the next. As explained above, each bank’s risks are measured in internal terms, i.e., the measurement of risk-adjusted performance of activities pertains to each bank separately. Therefore, it is of interest to examine the intra-bank correlations among activities that determine the “internal systematic risk” (“Internal Beta”). As expected, the correlations between earnings of commercial banking and group earnings are high at all banks—approximately 0.8 for the system as a whole—it is relatively low at Leumi (see table 6). In contrast, the correlations

¹⁸ We use an internal systematic risk approach, where systematic risk is measured in reference to each bank’s portfolio. Thus when performing a comparative analysis of activities between banks the Sharpe measure has the advantage of using total risk rather than systematic risk in the analysis of performance.

Table 4. RAROC ("Treyner" Index), by activities of the five major banking groups and the banking system, 1991–2001

$RAROC_i = \frac{\Pi_i - \Pi_{f_i}}{B_{i_i}}$ is the measure of performance of activity i . The risk index or the VaR in the activity is defined in equation (4): $B_{i_i} = \frac{\sigma_{i_i B}}{\sigma_{i_i}} = CoVaR_i$.

Activities	Leumi	Discount	Hapoalim	Mizrahi	First Intl.	System
Commercial banking	2.64	-0.26	1.62	0.83	2.40	2.21
Mortgage banking	0.94	17.68	1.67	4.17	3.09	2.24
Overseas banking	-0.32	-0.50	1.06	16.15	16.45	0.00
Investment banking and management	0.98	-0.31	0.05	2.91	0.34	0.24
Credit cards	-0.05	-1.67	1.63	0.67	6.18	6.05
Leasing	-1.05	-7.16	-1.39	-1.44	0.53	-1.62
Insurance	0.90	Na	Na	1.40	Na	0.69
Non-financial (commerce)	-0.81	Na	5.80	Na	Na	2.35
Non-major	-0.77	0.15	-0.03	-6.83	-0.27	-0.63
Bank total	0.79	-0.05	1.31	1.44	3.02	1.24

of investment banking and overseas banking are relatively low and actually negative for three of the banking groups. The correlation of overseas banking was relatively high for Bank Leumi that was affected by the poor performance of this activity. It was important to find that the correlations among activities at the different banks were not very different, thus one may compare the performance of various activities across banks. It is also important to note the relatively low and sometimes negative correlations found between the different activities, is evidence for the possible gains from diversification across different business activities (see below).

Table 5. RAROCJ ("Jensen" Index), by activities of the five major banking groups and the banking system, 1991–2001

$RAROCJ_i = \frac{A_i}{K_i}$ is the measure of performance of activity i .

$A_i = \Pi_i - [\Pi_{f_i} + (\Pi_{B_i} - \Pi_{f_i})\beta_{i_i}]$ is the excess actual profit over the expected profit.

The risk is defined as the "Internal Beta" of activity i in earnings terms:

$$\beta_{i_i} = \frac{\sigma_{i_i B}}{\sigma_{i_i}} \quad \text{and} \quad \Pi_{B_i} = \frac{1}{T} \sum_t \frac{\Pi_{B_i}}{K_{B_i}} K_{i_t} = \frac{1}{T} \sum_t R_{B_i} K_{i_t}.$$

Activities	Leumi	Discount	Hapoalim	Mizrahi	First Intl.	System
Commercial banking	0.083	-0.040	0.121	0.030	0.004	0.059
Mortgage banking	0.043	0.057	0.084	0.062	0.036	0.056
Overseas banking	-0.026	0.025	-0.13	-0.025	0.008	-0.007
Investment banking and management	0.015	0.014	-0.037	0.025	0.007	-0.004
Credit cards	0.006	0.136	0.195	0.158	2.297	0.061
Leasing	-0.029	-0.023	0.131	-0.031	-0.016	0.023
Insurance	0.098	Na	Na	-0.502	Na	0.094
Non-financial (commerce)	0.008	Na	0.041	Na	Na	0.026
Non-major	-0.070	-0.002	-0.020	-0.117	-0.012	-0.038
Bank total	0	0	0	0	0	0

Table 6. Correlation coefficients of profits from activities with total profit of banking groups and the system, 1991–2001

December 2001 prices.

Activities	Leumi	Discount	Hapoalim	Mizrahi	First Intl.	System
Commercial banking	0.61	0.96	0.88	0.91	0.81	0.8
Mortgage banking	0.89	0.11	0.85	0.62	0.57	0.79
Overseas banking	0.46	-0.69	-0.12	-0.01	0.01	0.29
Investment banking and management	0.00	-0.46	0.8	0.1	0.5	0.8
Credit cards	-0.35	-0.47	0.82	0.7	-0.07	0.12
Leasing	0.37	0.14	-0.57	0.31	-0.42	-0.23
Insurance	0.79	Na	0.62	-0.51	Na	0.6
Non-financial (commerce)	-0.22	Na	0.06	Na	Na	0.15
Non-major	0.82	-0.45	0.55	0.1	0.55	0.81
Bank total	1	1	1	1	1	1

4. Optimal asset allocation and the efficient frontier

4.1. Optimal portfolios

After having estimated and analyzed the performance of Israeli banks on a risk-adjusted basis, we now estimate the optimal structure of their asset portfolios and compare them to the actual portfolios of the banks in 2001 and 1997, see table 7.

In this section, we derive the efficient frontiers of portfolios, the Markowitz portfolios, and the optimal portfolios for each bank separately and for the system as a whole. The framework is mean variance in terms of rates of return. As noted above, the “assets” in a bank’s portfolio are its nine activity units: commercial banking; mortgage banking; overseas banking; investment banking and management of funds; credit cards; leasing; insurance; nonfinancial (commerce) companies; and non-major companies. As before we used annual accounting data for the 1991–2001 period.

After deriving the efficient portfolios, we estimated the optimum portfolio of each bank on the basis of a 3.3 percent average real risk-free rate of return (on a CPI linked government bond) during the period; see Benninga (1989) for the methodology. The optimization was performed in two parts: a long-term analysis and short term one. First, a long-term horizon was used, i.e., unlimited changes in the banks’ positions in the various activities were permitted, subject to the regulatory constraints that pertain to Israeli banks: prohibition of short positions, and nonfinancial investments and insurance (“real” investments) limited to 20 percent of total group’s equity investment.

The results were mostly consistent with our findings concerning banks’ performance in various activities in terms of the direction of change between the existing allocation of investments and the optimal “portfolio.” In other words, our recommendation in most cases is to increase investments in high-performing units. However, the magnitude of the recommended changes is still problematic, i.e., we obtained extreme results for the optimal weights of various activities relative to the existing positions. This calibration

against the current position of 9.5% in “real” investment. (See table 7). Interestingly, commercial banking performed better than mortgage and investment banking over the sample period, but seems to have reached satiation. Our result is consistent with the actual decline of the share of commercial banking in the portfolio of the bank in recent years (from 45.3% in 1997 to 39.4% in 2001).

Bank Hapoalim should make further cutbacks of its commercial banking, even though its investment in this activity is the smallest in the system (28.4% as against a system-wide mean of 36.6%). Consistent with this result, the bank reduced the share of its commercial banking from 44.0% in 1997 to only 28.4% in 2001. On the other hand it should increase its already large investment in investment banking (indeed this rose sharply from 1.4% in 1997 to 29.7% in 2001) as well as its investment overseas. It should be noted that although commercial banking and investment banking had good performance they have different suggested adjustments in the optimal portfolio.

To conclude our results indicate that all banks have over-invested in commercial banking and thus should reduce their investment in this activity, despite the relative good performance of commercial banking in all banking groups. This is indeed what happened in the system in recent years: commercial banking declined from 47.3% in 1997 to 36.6% in 2001. Our results also suggest: an increase in mortgage banking, overseas banking and investment banking for the banking system. As is evident in table 7, our recommendations are validated by the actual changes in the composition of the portfolios of all banking groups.

We also performed an optimization for the short (to medium) term, in which the changes in positions are limited in magnitude. We stipulated a maximum permissible change of 5 percent in the position relative to the existing one. The results are shown in table 9.

The main recommendations here mostly resemble the changes recommended for the longer term.

From both the long and short-term analysis a number of important general results have emerged. First we found that there are gains to product (business line) diversification;

Table 9. Optimal composition of the portfolio, with no short investments, non-financial + insurance < 20% of capital and change in investment limited to 5% relative to existing portfolio, 1991–2001 (Percent).

Activities	Leumi	Discount	Hapoalim	Mizrahi	First Intl.
Commercial banking	34.0	24.8	24.8	31.5	62.8
Mortgage banking	14.4	13.5	15.1	53.1	19.3
Overseas banking	16.3	45.9	13.1	2.8	15.6
Investment banking and management	10.9	0.5	24.7	1.8	0.0
Credit cards	Na	6.2	7.0	6.0	0.0
Leasing	6.2	0.0	0.0	0.0	0.9
Insurance	0.0	Na	Na	0.0	Na
Non-financial (commerce)	9.5	Na	0.0	Na	Na
Non-major	8.7	9.1	15.4	4.7	1.4
Bank total	100.0	100.0	100.0	100.0	100.0

this is quite apparent from the optimal portfolios of the banks that have non-zero investments in all feasible activities. Our results concerning the optimal portfolios of the banking groups are supported by the actual changes in the portfolios over time from 1997 to 2001. That is, the banking groups in general did in fact take advantage of the possible gains from diversification. Second, in most cases the optimal portfolio results are consistent with performance results, good performance is correlated with an increase in the investment in the specific activity in the optimal portfolio. One noticeable exception is commercial banking: this major activity performed well during the sample period, despite the fact the optimal change calls for a reduction of the investment in commercial banking for all banking groups. This may be an indication that the economies in this activity have been exhausted and thus investment has reached saturation. Finally it should be pointed out that our recommendations are subject to some qualifications such as: Some banks may be able to improve the risk—return tradeoff of underperforming units by better management. Also banks may face a downward sloping demand curve for their more profitable services, thus efforts to expand these operations may result in lower returns and/or higher risk.

4.2. *Efficient frontier analysis*

Lastly we delineated the efficient frontier (in terms of mean ROE and standard deviation) of the different banking groups and the banking system (the five banking groups) based on the data for the entire sample period, 1991–2001, and compared them to the actual positions of the banking groups in the period as a whole and in two sub-periods: 1991–1996 and 1997–2001. This provides us with another way of measuring performance by comparing the actual portfolios to the efficient ones across banking groups and also over time. The results are presented in table 10.

In order to compare the actual portfolios to the efficient frontier we have defined efficient portfolios in two ways: maximum mean return portfolio for the given standard deviation of the actual portfolio (denoted EF Mean ROE) and the minimum standard deviation portfolio for the given mean return of the actual portfolio (EF standard deviation). We have calculated also the differences between the actual portfolios and the efficient ones in terms of the means and the standard deviations.¹⁹ (See table 10). As can be seen Leumi improved its performance in the second sub-period (mean return increased from 5.2% to 10% and the standard deviation declined from 3.9% to 1.7%). In the second sub-period the actual portfolio was almost equal to the efficient one. This improvement is reflected by the smaller difference between the actual portfolios and the efficient ones (the difference Actual-EF portfolio approached zero in the second period and so did the Actual-EF standard deviation difference). The position of Discount worsened significantly in the second sup-period (the mean ROE declined from 6.6% to 1.5% and the

19 A positive difference (Actual—EF Mean) and a negative difference (Actual—EF Standard deviation) mean that the actual portfolio outperformed the efficient one.

Table 10. Efficient frontier and actual portfolios of the banking groups and the system for the period 1991–2001 and the sub-periods 1991–1996 and 1997–2001^a

^aThe Efficient Frontier (EF) is for the total sample period 1991–2001. The actual portfolios are for the total period and for two sub periods 1991–1996 and 1997–2001.

^bEF Standard Deviation is the standard Deviation on the efficient frontier for the given actual mean ROE. Similarly EF Mean ROE is the mean ROE on the efficient frontier for the given actual standard deviation.

^cBecause of the shape of the EF of Discount, our calculation of the EF Mean are based on a linear approximation of the EF, and the EF Standard Deviation was not available.

	1991–1996		1997–2001		1991–2001	
	Actual	Efficient Frontier	Actual	Efficient Frontier	Actual	Efficient Frontier
Leumi						
Standard deviation ^b	3.9%	0.7%	1.7%	1.6%	3.9%	1.1%
Mean ROE ^b	5.2%	21.2%	10.0%	10.4%	7.4%	21.1%
Discount^c						
Standard deviation	1.2%	Na	4.8%	Na	4.1%	Na
Mean ROE	6.6%	89.0%	1.5%	105.0%	4.3%	22.0%
Hapoalim						
Standard deviation	2.3%	0.9%	2.7%	1.5%	3.0%	1.2%
Mean ROE	8.0%	17.2%	11.7%	19.9%	9.7%	22.0%
Mizrahi						
Standard deviation	3.2%	0.8%	2.0%	0.9%	2.7%	0.8%
Mean ROE	8.7%	22.0%	10.2%	16.6%	9.4%	19.8%
First International						
Standard deviation	1.0%	1.2%	1.9%	1.0%	1.5%	1.1%
Mean ROE	9.4%	8.1%	8.3%	6.1%	8.9%	6.7%
System						
Standard deviation	2.5%	1.2%	2.1%	0.9%	2.5%	1.0%
Mean ROE	7.0%	25.9%	9.1%	23.7%	7.9%	26.0%

standard deviation increased fourfold from 1.2% to 4.8%). Discount performed poorly in the period as a whole as is reflected by the large differences between the actual and the efficient portfolios. Hapoalim had a position with higher risk (4.1% vs. 1.2%) and higher return (9.7% vs. 8.0%) in the second sub-period compare to the first. This may be explained by the change in risk preferences of the new owners of the bank following the privatization of the bank. Mizrahi improved its performance in the second sub-period due to a new ownership and prudent management. The mean return increased from 8.7% to 10.2% and the standard deviation declined from 3.2% to 2.0%. The improvement is also reflected in the smaller differences between the actual and the efficient portfolios. First International that had by far the best performance in the first sub-period (the highest return and the lowest standard deviation 9.4% and 1.0% respectively) suffered a setback in the second sub-period with both the return declining (to 8.3%) and the risk doubling (to 1.9%); its risk is however still among the lowest in the system. Interestingly due to its superior performance in the first sub-period (1991–96) it was the only bank that was able to outperform (“beat”) the efficient frontier of the entire sample period. One possible explanation for the deterioration is the relatively concentrated portfolio of this

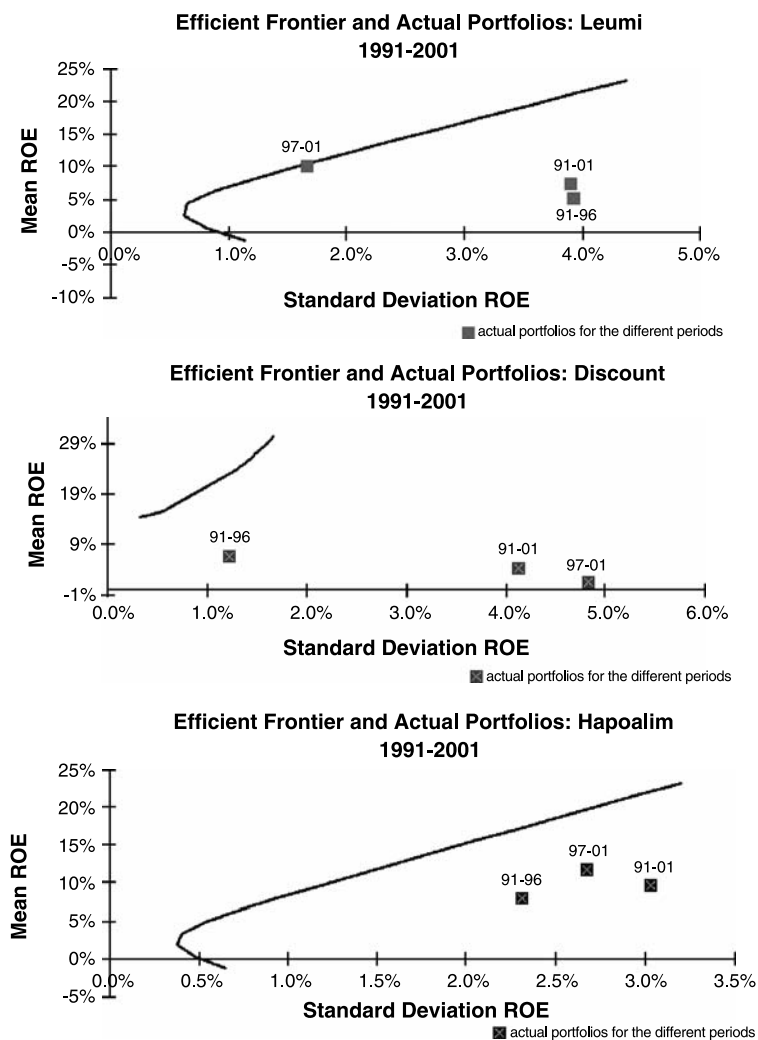


Figure 1. Efficient frontier and actual portfolios of the banking groups and the system, 1991–2001.

group: 67% in commercial banking compared to 37% in the banking system as a whole. Also while the other groups reduced their investment in commercial banking in the period 1997–2001 this group did not, (see table 7). That is the decline in performance can be attributed at least in part to diversifiable non-systematic risk. The system as a whole did better in the second sub-period compared to the first despite the changes in the economic conditions in the second sub-period: economic slowdown and slump in capital markets.

In figure 1 (parts a to f) we present graphically the efficient frontier of each banking group and the system for the entire sample period 1991–2001, and marked the actual

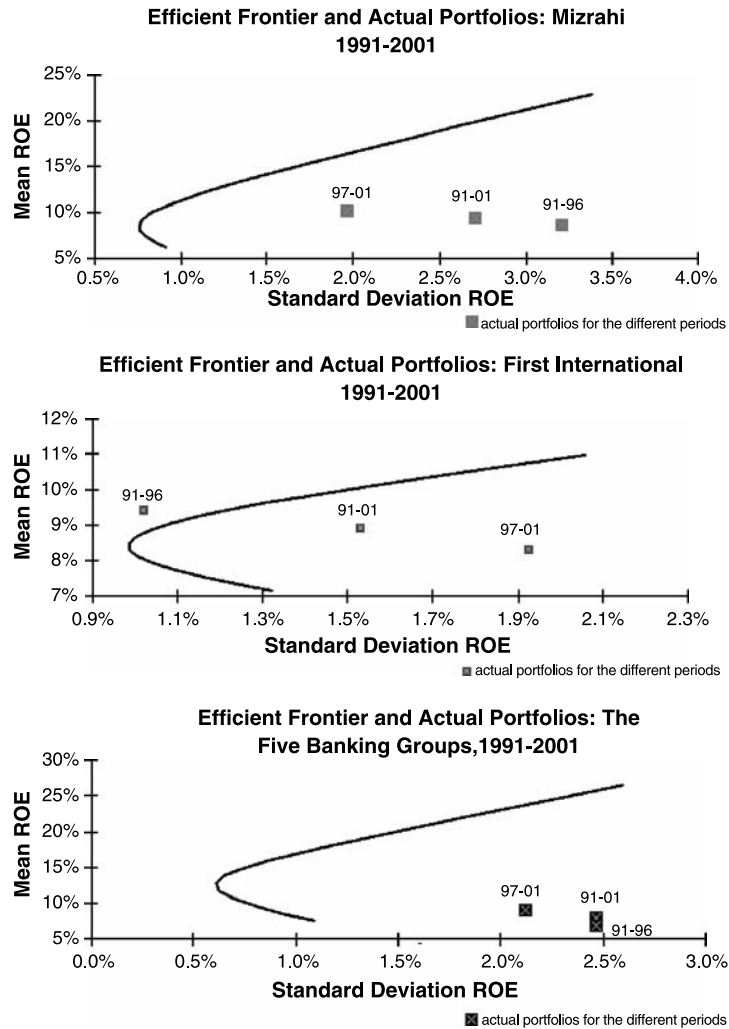


Figure 1. (continued).

portfolios (positions) for the entire period and two sub-periods: 1991–1996 (denoted 91–96) and 1997–2001 (97–01).

5. Summary of the main results and concluding remarks

This paper investigates two current important related topics in banking: the effects of diversification across financial products (business units) in terms of the efficient frontier

and the optimal portfolio of the banking group and the related issue of risk adjusted performance of banks. In view of recent worldwide deregulation and consolidation in banking the effects of diversification became an important issue especially in the US. Empirical evidence, based on actual data, is of importance since the potential theoretical gains from diversification are not certain; it is not assured that efficiency gains will be realized. Thus, it is not guaranteed that financial firms will hold optimal portfolios given the efficient frontier. Our study is based on Israeli banking data, which is a “universal” banking system subject to regulatory restrictions (on “real” activities) where banking groups have engaged in a wide scope of activities in addition to commercial banking: mortgage banking, overseas banking, investment banking, insurance and non-financial activities (commerce). Our findings indicate that gains from diversification do exist, as demonstrated by the well diversified optimal portfolios (see tables 8 and 9). We also found that banks do realize efficiency gains from diversification as is evident from the actual portfolios held by the banking groups and their revisions over time.

As for the issue of risk-adjusted performance, that also becomes more important as the scope of banking activities increases and as risk exposure rises. Our method of performance adjusted for risk is superior to the traditional measures such as ROE and ROA, which do not account for risk. Our evidence suggests that risk adjusted performance measures have an added value since they provide a ranking of performance that differs from the traditional ones. And finally we found a strong positive relation between RAROC and asset allocation i.e. in most cases a high RAROC calls for a higher investment in that activity.

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