RATIO ANALYSIS AND EQUITY VALUATION

Doron Nissim
Graduate School of Business
Columbia University

and

Stephen H. Penman
Haas School of Business
University of California
Berkeley

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Abstract

This paper outlines a financial statement analysis for use in equity valuation. Standard profitability analysis is incorporated, and extended, and is complemented with an analysis of growth. The perspective is one of forecasting payoffs to equities. So financial statement analysis is presented first as a matter of pro forma analysis of the future, with forecasted ratios viewed as building blocks of forecasts of payoffs. The analysis of current financial statements is then seen as a matter of identifying current ratios as predictors of the future ratios that drive equity payoffs. The financial statement analysis is hierarchical, with ratios lower in the ordering identified as finer information about those higher up. To provide historical benchmarks for forecasting, typical values for ratios are documented for the period 1963-1996, along with their cross-sectional variation and correlation. And, again with a view to forecasting, the time series behavior of many of the ratios is also described and their typical "long-run, steady-state" levels are documented.

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Equity analysts adopt various schemes to value shares. Some methods--such as the method of applying multiples of comparable firms to the firm in question--involve no forecasting. Others--so-called asset-based valuation techniques--attempt to correct GAAP balance sheets with estimates of the value of knowledge assets, brand assets, and other tangible and intangible assets. Yet other methods involve forecasting future payoffs to equities. These forecasting approaches usually involve some analysis of financial statements to aid in the forecasting. This paper outlines a financial statement analysis for forecasting and valuation.

Forecasting and valuation is guided by an equity valuation model, like the dividend discount model or the discounted cash flow model, that specifies what is to be forecasted. Because it focuses on accrual-accounting financial statements, the recently-revived residual income valuation model serves as an analytical device to organize thinking about those statements. We explore this thinking in this paper and the ratio analysis it dictates.

The paper comes in two parts. First it <u>identifies</u> ratios that are useful for valuation. Second, it <u>documents</u> typical values of the ratios during the period 1963 to 1996.

<u>Identification</u>. Residual earnings valuation techniques are so called because equity value is determined by forecasting residual income. As a matter of first order, ratio identification amounts to identifying ratios that reflect economic factors that determine -- or drive -- future residual income so that, by forecasting these ratios, the analyst builds a forecast of residual income. So relevant ratios are identified as the building blocks of a forecast, that is, as the attributes to be forecasted in order to build up a forecast of residual income. However, ratios are usually seen as information in current financial statements with which to forecast the future. So current financial statement ratios are deemed relevant for valuation if they predict their own future values. Accordingly the identification of (future) residual income drivers is overlaid here with a distinction between "transitory" features of ratios (that bear only on the present) and "permanent" features (that forecast the future).

At the core is an analysis of profitability and many of the standard profitability ratios are included. Indeed the paper serves to focus traditional ratio analysis on equity valuation. But profitability ratios are complemented with ratios that analyze growth, for both profitability and growth drive residual earnings. Not only are relevant ratios identified, but an algebra -- like the

traditional DuPont analysis (which is incorporated here) -- ties the ratios together in a structured way. This algebra not only explains how ratios "sum up" as building blocks of residual income, but establishes a hierarchy so that many ratios are identified as finer information about others. So the analyst identifies certain ratios as primary and considers other ratios down the hierarchy only if they provide further information. This gives the analysis an element of parsimony. The two primary drivers are profitability and growth and all ratios are structured as providing further analysis of these two.

In residual income valuation, forecasted income must be comprehensive income, otherwise value is omitted. So the ratio analysis is based on a comprehensive income statement. This is timely because FASB Statement No. 130 now requires the reporting of comprehensive income on a more transparent basis and other recent FASB statements, notably statements 115 and 133, have introduced new components of comprehensive income. We analyze comprehensive income but in a way that aids in forecasting and valuation.

Our focus on the residual income valuation model is not to suggest that this model is the only model, or even the best model, to value equities. Penman (1997) shows that dividend and cash-flow approaches give the same valuation as the residual income approach under certain conditions. The residual income model, based as it is on accrual accounting, is of particular help in developing an analysis of accrual-accounting financial statements. But cash flows and dividends are tied to accrual numbers by straightforward accounting relations, so building forecasts of accrual accounting numbers with the aid of analysis builds forecasts of free cash flows and dividends also, as will be seen.

The analysis makes a separation between operating and financing items in the financial statements. This is inspired by the Modigliani and Miller notion that it is the operating activities that generate value, not the (zero net-present-value) financing activities. The separation also arises from an appreciation that financial assets and liabilities are typically close to market value in the balance sheet and thus are already valued, but not so the operating assets and liabilities. The distinction is a feature of the accounting-based valuation model in Feltham and Ohlson (1995) and of "economic profit" versions of the residual income model. Recent FASB statements have required many financial assets to be marked to market. But, correspondingly, unrealized gains and losses are now recognized in comprehensive income and these, like all income line items, have to be considered in a ratio analysis.

Our structured approach to identifying ratios contrasts to the purely empirical approach in Ou and Penman (1989). That paper identified ratios that predicted earnings changes in the data. No thought was given to the identification; indeed there was no justification that earnings changes are the appropriate attribute to forecast for valuation. The approach here also contrasts to that in Lev and Thiagarajan (1993) who defer to "expert judgement" and identify ratios that analysts actually use in practice.

Documentation. Ratio analysis usually compares ratios for individual firms against benchmarks from comparable firms - both in the past and the present - to get a sense of what is "normal" and what is "abnormal". The historical analysis here provides such benchmarks for the equity researcher using residual earnings techniques.

Appreciating what is typical in the history is of assistance in developing prior beliefs for any forecasting but particularly so in a valuation context because there is a tendency for many of the relevant ratios to revert to typical values over time, as will be seen. Further, valuation methods that involve forecasting require continuing value calculations at the end of a forecast period. These calculations require an assessment of a "steady state" for residual income and are often seen as problematical. The documentation here gives a sense of the typical steady state for the drivers of residual income and thus a sense of the typical terminal value calculations required. It shows that steady-state conditions typically occur within "reasonable" forecast horizons and their form is similar to that prescribed by residual income models. This gives a level of comfort to those applying residual income techniques.

The documentation also helps in the classification of financial statement items into "permanent" and transitory". This classification inevitably involves some judgement but the displays here give typical "fade rates" for the components of residual income drivers and thus an indication of which components are typically transitory.

1. The Residual Earnings Valuation Model

There are many ratios that can be calculated from the financial statements and the equity analyst has to identify those that are important. The residual earnings equity valuation model brings focus to the task. The model can be applied to the valuation of any asset but the focus here is on the common equity. The model states the value of common equity at date 0 as

$$V_0^E = CSE_0 + \sum_{t=1}^{\infty} \rho_E^{-t} \; (\overline{CNI}_t - (\rho_E - 1) \; \overline{CSE}_{t-1}) \tag{1}$$

where CSE is the book value of common equity, CNI is comprehensive (net) income available to common, ρ_E is one plus the required return for common equity (the equity cost of capital), and t is a counter of future years beyond the current year, year 0. $CNI_t - (\rho_E - 1) \, CSE_{t-1}$ is residual earnings or residual income and we will refer to it as RE_t. Bars over numbers indicate they are forecasted amounts. The determination of the cost of capital is not at issue here and we work with the presumption that it is an intertemporal constant.

The infinite-horizon forecasting required by this model is considered impractical. So in actual analysis forecasts are made for a finite number of years and a "continuing value", CV_T, is added at the forecast horizon, T:

$$V_0^E = CSE_0 + \sum_{t=1}^{T} \rho_E^{-t} \; \overline{RE}_t \; + \; \frac{CV_T}{\rho_E^T} \tag{1a}$$

As the continuing value is the value at T of residual earnings beyond T it is equal to $\overline{V}_T^E - \overline{CSE}_T$, that is, the forecasted premium at T. Continuing values typically take three forms:

$$CV_T = 0 \qquad\qquad (CV1)$$

$$CV_T = \overline{RE}_{T+1} / (\rho_E - 1) \qquad\qquad (CV2)$$

$$CV_T = \overline{RE}_{T+1} / (\rho_E - g) \qquad\qquad (CV3)$$

where g is one plus the rate of growth in residual earnings. CV1 forecasts a "steady state" of zero residual earnings after T; CV2 forecasts non-zero but constant steady-state residual earnings after T; and CV3 forecasts perpetual growth in residual earnings after T. CV2 is the no-growth case of CV3.

This model is well established in the academic literature [in Preinreich (1938), Kay (1976), Edwards and Bell (1961) and Ohlson (1995), for example]. It has been applied in recent valuation research and financial statement analysis [in Brief and Lawson (1992), Abarbanell and Bernard (1998), Frankel and Lee (1998), Lee, Myers and Swaminathan (1999), Penman and Sougiannis (1998), Sougiannis and Yaekura (1998), and Francis, Olsson and Oswald (1998), for example], and has increasing currency in financial analysis texts and practical equity research.

To apply the model the analyst must develop forecasts of RE. He or she must also decide on which version of the continuing value is appropriate and at what point in the future it is to be

applied. The financial statement analysis in the next section gives a framework for developing RE forecasts, a way of breaking down RE into components to be forecasted, and an orderly way of assembling information to forecast these components. The documentation in Section 3 gives historical values for the components and evidence on steady state RE for calculating continuing values and the critical growth rate, g.

2. Ratio Identification

Residual earnings compares earnings to net assets employed and so is a measure of profitability. Residual earnings can be expressed in ratio form as:

$$RE_t = [ROCE_t - (\rho_E - 1)] \, CSE_{t-1}$$

where $ROCE = CNI_t/CSE_{t-1}$ is the rate of return on common equity. So forecasting residual earnings involves forecasting ROCE and book values to be put in place to earn at the forecasted ROCE. We identify ROCE and CSE as the primary drivers of RE. Distinguishing ROCE and book value as two separate attributes to forecast helps to compartmentalize the task. But this is not to mean that ROCE and book values are independent. The amount of assets a firm will put in place might depend on ROCE and the accounting for book values may affect ROCE. Under conservative accounting, for example, ROCE is below its no-growth rate if investments are growing, and reducing investments generates higher ROCE, as modeled in Zhang (1998).

2.1 The Drivers of ROCE

ROCE is the summary ratio in financial statements and is "driven" by income statement line items that sum to net income in the numerator and balance sheet items that sum to the net assets in the denominator. Residual income valuation requires that forecasted income be comprehensive income, otherwise value is lost. So our income statement analysis is of all the line items that sum to comprehensive income. A coarse division of line items that distinguishes operating from financial activities is a starting point for analysis of ROCE drivers:

CNI = Comprehensive Operating Income (OI) -

Comprehensive Net Financial Expense (NFE)   (2)

CSE = Net Operating Assets (NOA) - Net Financial Obligations (NFO)   (3)

where

NFE = (Financial Expense - Financial Income), after tax

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NOA = Operating Assets (OA) - Operating Liabilities (OL)

NFO = Financial Obligations (FO) - Financial Assets (FA).

Operating liabilities are those generated by operations (like accounts payable, wages payable, pension liabilities and deferred tax liabilities), while financial liabilities are those from raising funds to finance operations. Financial assets (bonds held) are available to finance operations and effectively reduce debt to finance operations (bonds issued).

Balance sheet totals are maintained; that is,

Total Assets = OA + FA,

Total Liabilities & Preferred Stock = OL + FO,

so all balance sheet items are assigned to a category.

Net financial expense (NFE) is the (comprehensive) net expense flowing from net financial obligations and includes interest expense minus interest income, preferred dividends, and realized and unrealized gains and losses on financial assets and obligations; all items drawing tax or tax benefits are multiplied by (1 - marginal tax rate) unless reported on an after-tax basis. All accounting items are identified from the common shareholders' point of view. Thus preferred dividends are a financial expense and preferred stock is a financial obligation. If a firm has net financial assets rather than net financial obligations (financial assets are greater than financial obligations) then it generates net financial income rather than net financial expense.

Operating income (CNI + NFE) is the income flowing from net operating assets and, by the calculations here, is after tax. Details of the calculations used in the data analysis in Section 3 (with COMPUSTAT data) are given in the appendix.

Comparing each income statement component to its corresponding balance sheet component, we get

$$\text{Return on Net Operating Assets (RNOA)}_t = {OI_t}/{NOA_{t-1}}$$

and

$$\text{Net Borrowing Cost (NBC)}_t = {NFE_t}/{NFO_{t-1}}.$$

These ratios summarize the profitability of operating and financing activities. RNOA is similar to Return on Invested Capital (ROIC) but we use RNOA here to emphasize that operating liabilities reduce the net operating assets employed. If the firm is a net creditor rather than a net

debtor (financial assets greater than financial obligations, so NFO is negative), NBC is return on net financial assets.

Given the accounting equation (3) and relation (2),

$$\text{ROCE} = \left[\frac{\text{NOA}}{\text{CSE}} \times \text{RNOA} \right] - \left[\frac{\text{NFO}}{\text{CSE}} \times \text{NBC} \right]$$

that is, ROCE is a weighted average of the return on operating activities and the return on financing activities. It is understood that, unless otherwise indicated, that all measures are for the same period. Income statement amounts are for the period and balance sheet amounts for the beginning of the period. (Balance sheet amounts can also be averages for a period, as is common practice.) Rearranging terms,

$$\text{ROCE} = \text{RNOA} + [\text{FLEV} \times \text{SPREAD}] \tag{4}$$

where

$$\text{FLEV} = \text{NFO} \big/ \text{CSE} \qquad \text{(Financial Leverage)}$$

and

$$\text{SPREAD} = \text{RNOA - NBC.}$$

Thus ROCE is driven by the return on operations with an additional return from the leverage of financial activities. This leverage effect is determined by the amount of leverage and the spread between the return on operations and net borrowing costs. A further decomposition yields

$$\text{ROCE} = [\text{PM} \times \text{ATO}] + [\text{FLEV} \times \text{SPREAD}] \tag{4a}$$

where

$$\text{PM} = \text{OI} / \text{Sales} \qquad \text{(Profit Margin)}$$

and

$$\text{ATO} = \text{Sales} / \text{NOA} \qquad \text{(Asset Turnover)}$$

This decomposition of RNOA into PM and ATO follows the standard DuPont analysis. Following that standard analysis further, PM can be broken down into the gross margin ratio and expense/sales ratios, and ATO into turnover ratios for individual operating assets and liabilities.

There is one modification, however. Operating income includes income generated from sales, after expenses, and thus PM captures the profitability of each dollar of sales. But it also includes items not incurred to generate the reported sales - like equity share of income in a

subsidiary, dividends, and gains and losses on equity investments marked to market. We refer to these items as Other Items and exclude them from a revised profit margin:

Sales PM = OI from Sales / Sales.

So,

$$ROCE = [Sales\ PM \times ATO] + \frac{Other\ Items}{NOA} + [FLEV \times SPREAD].\qquad(5)$$

Both Sales PM and Other Items are after tax. Other Items/NOA has little meaning but "profitability of sales" is identified without noise. Profit margins are typically regarded as crucial and this revised profit margin cannot be affected by acquisitions accounted for under the equity method (for example).

A further modification is required when there are minority interests in subsidiaries. With minority interests (MI) on the consolidated balance sheet, equation (3) is restated to

CSE = NOA - NFO - MI.

And return on total common equity is calculated as

$ROTCE_t = (CNI_t + MI\ share\ of\ income_t)/(CSE_{t-1} + MI_{t-1})$.

The components in (5), with FLEV redefined as NFO/(CSE+MI), aggregate to ROTCE rather than ROCE and

$$ROCE = ROTCE \times MSR\qquad(6)$$

where

$$Minority\ Sharing\ Ratio\ (MSR)\ =\ \frac{CNI / (CNI\ +\ MI\ share\ of\ income)}{CSE / (CSE\ +\ MI\ on\ balance\ sheet)}.$$

An additional driver of RNOA involves operating liabilities. Clearly the netting out of operating liabilities in the calculation of NOA increases RNOA through a denominator effect, and appropriately so: to the extent that a firm has "non-interest" credit from payables (for example) it levers up its RNOA. This leverage is a driver of profitability and can be measured. Suppliers who advance the payables presumably charge implicitly for the credit in terms of higher prices. Denote io as the implicit interest charge on operating liabilities other than undiscounted deferred taxes, and calculate

$$ROA\ =\ \frac{(OI\ +\ io)}{OA}$$

as the Return on Operating Assets that would be made without leverage from operating liabilities. Then

$$\text{RNOA} = \left[\text{ROA} \times \frac{\text{OA}}{\text{NOA}}\right] - \left[\frac{\text{io}}{\text{OL}} \times \frac{\text{OL}}{\text{NOA}}\right] = \text{ROA} + \text{OLLEV} \times \left[\text{ROA} - \frac{\text{io}}{\text{OL}}\right] \qquad (7)$$

where

$$\text{OLLEV} = \frac{\text{OL}}{\text{NOA}}$$

is operating liability leverage, and

$$\text{OLSPREAD} = \text{ROA} - \frac{\text{io}}{\text{OL}}$$

is operating liability spread. This is of the same form as the financial leverage formula in (4): RNOA is levered up by operating liability leverage and the leverage effect is determined by the operating liability leverage and the spread between ROA and the implicit borrowing cost. The implicit borrowing cost can be estimated with the short-term borrowing rate.[1]

This analysis yields seven drivers of ROCE:

- Sales Profit Margin (PM)
- Asset Turnover (ATO)
- Other Items / NOA
- Financial Leverage (FLEV)
- Net Borrowing Cost (NBC) which, when compared to RNOA, gives SPREAD
- Operating Liability Leverage (OLLEV)
- Minority Interest Sharing (MSR)

Forecasting ROCE involves forecasting these drivers and aggregating them according to (5) (with ROTCE substituted for ROCE), (6) and (7).

2.2 The Drivers of Book Value

To forecast residual income one must forecast CSE as well as ROCE. CSE can be decomposed into

$$\text{CSE} = \text{Sales} \times \frac{\text{NOA}}{\text{Sales}} \times \frac{\text{CSE}}{\text{NOA}}$$

and thus, when there are no minority interests,

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[1] Deferred taxes are not discounted (and the government does not implicitly charge interest). And the net interest cost of pension liabilities is explicit in the footnotes. So

io = (short-term borrowing rate x OL other than deferred taxes and pensions) + net interest on pension liabilities

$$CSE = Sales \times \frac{1}{ATO} \times \frac{1}{1 + FLEV} .$$
(8)

Sales drive the net operating assets and $\frac{1}{ATO}$ is the amount of NOA that has to be put in place

to generate a dollar of sales. The NOA can be financed by equity or borrowing and $\frac{1}{1 + FLEV}$

captures this financing decision. Accordingly, future CSE is forecasted by predicting three
drivers:

- Sales

- Asset Turnover (ATO)

- Financial Leverage (FLEV).[2]

With the forecast of the drivers in (5), (6), (7) and (8), the forecasting of residual earnings
is complete. The nesting of ratios within (5), (6), (7) and (8) - so they "aggregate" - is by careful
definition and accounting relations (2) and (3), and involve no economic assumptions. The
relationships hold under all economic conditions and for all accounting principles provided
earnings are comprehensive earnings.

2.3 Reducing the Analysis

Just as residual earnings can be calculated for common equity (net assets) so it can be
calculated for any component of net assets. For the two (operating and financing) components
identified above,

Residual Operating Income $(ReOI)_t = OI_t - (\rho_w - 1) NOA_{t-1}$

and

Residual Net Financial Expense $(ReNFE)_t = NFE_t - (\rho_D - 1) NFO_{t-1}.$

ρ_w is the required return for the operations (we use "w" to donate it as the weighted-average cost
of capital, as is standard) and $_D$ the required return on the net financial obligations (the cost of
capital for debt). The value of the net operating asset component of equity is

$$V_0^{NOA} = NOA_0 + \sum_{t=1}^{\infty} \rho_w^{-t} \overline{ReOI}_t .$$

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[2] When there are minority interests, an additional driver is the ratio of minority interests to common equity.

This is often referred to as the value of the firm or enterprise value. The value of the net financial obligations is

$$V_0^{NFO} = NFO_0 + \sum_{t=1}^{\infty} \rho_D^{-t} \overline{ReNFE}_t .$$

By the accounting equation (applied to values rather than book values),

$$V_0^E = V_0^{NOA} - V_0^{NFO}$$

and so V_0^E as stated in (1) is equivalent to[3]

$$V_0^E = NOA_0 - NFO_0 + \sum_{t=1}^{\infty} {}_W^{-t} \overline{ReOI}_t - \sum_{t=1}^{\infty} {}_D^{-t} \overline{ReNFE}_t .$$

For any asset or obligation measured at market value, forecasted residual income must be equal to zero (it is forecasted to earn at the cost of capital). If NFO is measured on the balance sheet at market value such that $NFO = V_0^{NF0}$, then the present value of forecasted $ReNFE_t$ is zero (and if the present value of ReNFE is zero, then $NFO = V_0^{NOA}$). If so, then for finite forecast horizons,

$$V_0^E = CSE_0 + \sum_{t=1}^{T} \rho_W^{-t} \overline{ReOI}_t + \frac{CV_T^{NOA}}{\rho_W^T} \tag{9}$$

with three forms for the continuing value:

$$CV_T^{NOA} = 0 \tag{CV01}$$

$$CV_T^{NOA} = \overline{ReOI}_{T+1} \Big/ \left(\rho_W - 1 \right) \tag{CV02}$$

$$CV_T^{NOA} = \overline{ReOI}_{T+1} \Big/ \left({}_W - g \right) \tag{CV03}$$

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[3] For V_0^{NOA} and V_0^{NFO} to be added as separate values and be equivalent to (1), it is required that

$$_E = {}_W + \frac{V_0^{NFO}}{V_0^E} \times [{}_W - {}_D]$$

(which is the same form as (4)). That is, the cost of capital for operations is

$$_W = \left[\frac{V_0^E}{V_0^{NOA}} \times {}_E \right] x \left[\frac{V_0^{NFO}}{V_0^{NOA}} \times {}_D \right]$$

as in standard finance that evokes Modigliani and Miller financing irrelevance. The distinction between different costs of capital for different net assets is somewhat cosmetic for the purposes of this paper as the ratio analysis and the documentation that follows do not concern the cost of capital. The observation that different income streams have different risks (and thus different costs of capital) is standard in finance texts and we adhere to this orthodoxy largely so as to not offend the eye.

where g is now one plus the forecasted growth rate in ReOI beyond T.

Residual operating income, like residual income, can be expressed in terms of a ratio measure of profitability:

$$ReOI_t = [RNOA_t - (\rho_w - 1)]NOA_{t-1}$$

so ReOI is forecasted by predicting RNOA and the net operating assets to be put in place to earn at the forecasted RNOA. (Again, RNOA and NOA may not be independent.) Accordingly, with a valuation based on forecasting ReOI, the number of drivers to be predicted are reduced. The drivers of RNOA are

- Sales Profit Margin (PM)
- Asset Turnover (ATO)
- Other Items
- Operating Liability Leverage (OLLEV)

and, as NOA = Sales/ATO, the drivers of NOA are

- Sales
- Asset Turnover (ATO)

This reduction in the forecasting task is a clear efficiency. Financial leverage considerations drop out, including leverage effects on the cost of capital. One need only forecast the operating profitability and the NOA and forget forecasting borrowing and dividend policy. But the approach is only appropriate if financial assets and financial obligations are measured at their fair value (an efficient market price). This is the case for many financial assets under FASB Statement No. 115. Other financial assets and liabilities are often close to market value (as a workable approximation), or their fair values are disclosed in footnotes under FASB Statement No. 107.

RNOA and NOA have a common driver (ATO). ReOI can be forecasted in one step that utilizes both RNOA and NOA drivers:

$$ReOI = Sales \times \left[PM - \frac{\rho_w - 1}{ATO} \right] \qquad (10)$$

The ratio, $\dfrac{\rho_w - 1}{ATO}$ compares the ATO to the required return on operations and is a measure of the efficiency of the NOA in generating sales relative to the required return on NOA.

2.4 Drivers of Growth in Residual Earnings

The continuing value calculation requires a growth rate, g, for residual income, as in CV2 and CV3, and CV02 and CV03. As residual income is driven by the accounting rate of return and book value, it is clear that its growth is driven by increases in the rate of return and/or increases in book value. There are simplified calculations to capture this. (We deal with residual operating income (and thus CV02 and CV03), with the calculation for full residual income (and thus CV2 and CV3) implicit.) One plus the growth rate is

$$\text{Growth Rate in ReOI}_t \ = \ \text{ReOI}_t/\text{ReOI}_{t-1} \ = \ \frac{\left[\text{RNOA}_t - \rho_w - 1\right]\text{NOA}_{t-1}}{\left[\text{RNOA}_{t-1} - \rho_w - 1\right]\text{NOA}_{t-2}}.$$

So growth in ReOI (which can be greater or less than 1) is driven by changes in RNOA, NOA, and the cost of capital. We deal with cases where the forecasted cost of capital is constant.

Constant RNOA. Pro forma analysis often comes to the conclusion that, in "the long-run," profitability will converge to a permanent level. If this is such that, at a point, T, in the future, one forecasts that subsequent RNOA will equal the cost of capital, then the continuing value calculation is CV01. But if one forecasts that RNOA will be different from the cost of capital but constant, then

$$\text{Growth Rate in ReOI}_t = \frac{\text{NOA}_{t-1}}{\text{NOA}_{t-2}}$$

for all t>T. Growth is driven solely by increases in NOA.

A permanent level of non-zero ReOI (RNOA ≠ cost of capital) may reflect permanent abnormal real profitability (in the sense that the firm can invest always in non-zero net present value projects). But it can also be induced by the accounting: "conservative accounting," for example, that always keeps book values low (by expensing R&D, for example) will yield permanent positive ReOI even with zero NPV projects. This is modeled in Feltham and Ohlson (1995). Beaver and Ryan (1998) provide some empirical evidence.

Constant RNOA, constant PM and constant ATO. As RNOA is driven by profit margin and turnover, a constant RNOA can be driven by a changing PM with a canceling effect of changing ATO, and by both constant PM and constant ATO. In the latter case growth in ReOI is driven solely by growth in sales. From (10) growth in ReOI can also be expressed as

$$\text{Growth Rate in ReOI}_t = \frac{\text{Sales}_t \times \left[\text{PM}_t - \frac{w-1}{\text{ATO}_t} \right]}{\text{Sales}_{t-1} \times \left[\text{PM}_{t-1} - \frac{w-1}{\text{ATO}_{t-1}} \right]}$$

so, for constant PM and ATO (and cost of capital),

$$\text{Growth Rate in ReOI}_t = \frac{\text{Sales}_t}{\text{Sales}_{t-1}}.$$

A constant PM and ATO means constant RNOA and growth in ReOI determined only by growth in NOA. But a constant ATO means NOA grows at the same rate as sales. One need only forecast sales growth to get the growth rate.

Varying RNOA and Constant NOA. In this case growth in ReOI is driven by changes in RNOA. One would expect it to apply in the case of declining RNOA, not increasing RNOA. RNOA and growth in NOA are presumably not independent. So, for example, increasing RNOA might generate more investment in NOA, declining RNOA less investment in NOA.

2.5 The Drivers of Free Cash Flow and Dividends

Comprehensive income is defined such that for a period, t,

$\text{CSE}_t = \text{CSE}_{t-1} + \text{CNI}_t - d_t$

where d_t is net dividends (dividends + share repurchases – share issues). So, recognizing the division of the income statement into operating and financing components in (2) and the accounting equation in (3),

$\text{NOA}_t - \text{NFO}_t = \text{NOA}_{t-1} - \text{NFO}_{t-1} + \text{OI}_t - \text{NFE}_t - d_t.$

Free cash flow$_t \equiv C_t - I_t$ where C_t is cash flow from operations and I_t is cash flow in investing activities. In accrual accounting, free cash flow has no effect on common stockholders' equity, but affects NOA and NFO in the balance sheet. So

$\text{NOA}_t - \text{NFO}_t = \text{NOA}_{t-1} + \text{OI}_t - (C_t - I_t) - \text{NFO}_{t-1} - \text{NFE}_t + (C_t - I_t) - d_t$

and accordingly the change in the balance sheet components of common equity, NOA and NFO, are

$\Delta\text{NOA}_t = \text{OI}_t - (C_t - I_t)$

$\Delta\text{NFO}_t = d_t + \text{NFE}_t - (C_t - I_t)$

where Δ indicates change (growth). Rearranging these difference equations,

$$C_t - I_t = OI_t - \Delta NOA_t = NOA_{t-1}\left[RNOA_t - \left(\frac{NOA_t}{NOA_{t-1}} - 1\right)\right] \tag{11}$$

and

$$d_t = C_t - I_t - NFE_t + \Delta NFO_t. \tag{12}$$

See Feltham and Ohlson (1995).

We have developed the ratio analysis with residual income valuation in mind. But it is clear from (11) that the same drivers that drive ReOI--RNOA and NOA growth--also drive free cash flow, so the ratio analysis applies to discounted cash flow analysis also. Forecasting free cash flows requires no additional information once RNOA and growth in NOA are forecasted as (11) is just an accounting relation. And indeed one cannot imagine forecasting free cash flow without first forecasting profitability and the investment in NOA that drive free cash flow.[4]

If dividend discounting techniques are used to value equity, (12) shows that dividends are also forecasted from forecasts of free cash flow drivers along with a forecast of financing activities: dividends are the residual of free cash flow after servicing net debt.

2.6 Forecasting and the Analysis of Current Financial Statements

The drivers identified generate both current and future rates of return and book values. The future drivers are the building blocks of forecasted residual earnings. Drivers are identified in current financial statements to forecast future drivers. Accordingly, the analysis of current financial statements should be guided by the "predictive ability" criterion: any enhancement that improves forecasts is an innovation.

This perspective calls for an analysis that distinguishes aspects of the drivers that will likely drive the future ("persistent" features) and those that relate only to the present ("transitory" features). And some features may persist for a short period (transitory but not pure transitory) while some may be enduring ("permanent" features). This distinction is particularly important for the analysis of comprehensive income (which is required for residual income valuation) as

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[4] Free cash flow treats growth in NOA (ΔNOA) as a negative driver (it is subtracted in (11)) whereas residual income treats investment as a positive driver. This identification is the main difference between residual income and discounted cash flow techniques.

comprehensive income below "net income" under FASB Statement No. 130 typically includes a number of transitory items.

We will refer to items judged persistent as "core items" and those judged transitory as "unusual items". So

OI = Core OI + Unusual Operating Income (UOI)

and

NFE = Core NFE + Unusual Financial Expense (UFE).

Tax is allocated to these components unless they are reported net of tax. With this division,

$$\text{RNOA} = \text{Core RNOA} + \frac{\text{UOI}}{\text{NOA}} = \frac{\text{Core OI}}{\text{NOA}} + \frac{\text{UOI}}{\text{NOA}}$$

$$= \frac{\text{Core OI from Sales}}{\text{NOA}} + \frac{\text{Core other Items}}{\text{NOA}} + \frac{\text{UOI}}{\text{NOA}}.$$

Similarly,

$$\text{NBC} = \text{Core NBC} + \frac{\text{UFE}}{\text{NFO}} = \frac{\text{Core NFE}}{\text{NFO}} + \frac{\text{UFE}}{\text{NFO}}.$$

UFE are transitory components from realized and unrealized gains and losses on financial items and Core NBC is the borrowing cost (cost of debt capital) minus interest yield on financial assets that are unaffected by these current realizations.

The distinction between core and unusual items and sales and non-sales items can be used to further decompose ROCE. Calculate

$$\text{Core Sales PM} = \frac{\text{Core OI from Sales}}{\text{Sales}}$$

and substitute in (5):

$$\text{ROCE} = [\text{Core Sales PM} \times \text{ATO}] + \frac{\text{Core Other Items}}{\text{NOA}} + \frac{\text{UOI}}{\text{NOA}}$$

$$+ \left[\text{FLEV} \times (\text{Core RNOA} - \text{Core NBC} + \frac{\text{UOI}}{\text{NOA}} - \frac{\text{UFE}}{\text{NFO}}) \right]. \qquad (13)$$

Core RNOA - Core NBC is the Core SPREAD. But, if one is forecasting ReOI and valuing according to (9), only the RNOA decomposition is relevant. Indeed, the dismissal of financial items from the valuation in (9) can be justified on the grounds that any deviation of current NBC

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from the cost of capital for debt (like gains and losses on financial items) is pure transitory and does not affect the forecast of future residual income (or expense) from financing activities.[5]

Expression (13) does not incorporate all the drivers that have been identified. This can be done as follows:

$$\text{ROCE} = \text{MSR} \times \Big[(\text{Core Sales PM x ATO`}) + \frac{\text{Core Other Items}}{\text{OA}} + \frac{\text{UOI}}{\text{OA}}$$

$$+ (\text{OLLEV} \times \text{OLSPREAD}) + (\text{FLEV} \times \text{SPREAD}) \Big].$$

where ATO` $\equiv$ Sales/OA, FLEV $\equiv$ NFO/(CSE + MI) and the SPREAD is decomposed as in (13). This includes the Minority Sharing Ratio (MSR) and the operating liability leverage drivers. But it revises the asset turnover to ATO` which excludes operating liabilities.

Focusing on ReOI and the operating activities, an item is classified as unusual if it is not expected to repeat in the future - like a one-time charge or profits from discontinued operations. But recurring items for which the expected future amount is zero are also so classified. This is typical of items that reflect fluctuations in market prices - like currency gains and losses and non-service components of pension expense that result from the quasi mark-to-market of pension liabilities. If market prices "follow a random walk" current gains and losses due to changes in prices do not predict future gains and losses.

2.7 Commentary

The ratio analysis laid out is a scheme for using ratios in an efficient and orderly manner in valuation analysis. It has a normative flavor to it but it is not offered as the definitive analysis. It does not suggest that a ratio not identified as an element of the decomposition here - the current ratio, for example - is not useful in forecasting future residual earnings. But it does avoid the pure empirical approach (in Ou and Penman (1989) for example) of trawling through the data, without structure, and choosing ratios on the basis of whether they worked as predictors in the past.

The analysis very definitely utilizes the structure of accounting that, through accounting relations, ties components together as joint drivers of residual income. It eschews modeling of the economics. One might model how residual income behaves in different economic circumstances (under competition, monopoly, regulation, for example) but residual income is an

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[5] Again, if minority interests exist, equation (13) is a decomposition of ROTCE, not ROCE.

accounting calculation. Residual income methods "work," whatever the economic circumstances, if the accounting enables one of the three continuing value calculations (Penman (1997)). It is an empirical issue (which we investigate in the documentation section) whether a particular set of accounting rules - US GAAP for example – yield these continuing values for actual firms. Modigliani and Miller (economic) concepts are referred to but the analysis leaves the user with a choice as to whether to embrace those concepts.[6]

Economic factors, of course, determine value. We speak here of financial statement drivers, but these drivers are driven by the economics of the firm. The analysis here identifies the accounting drivers of residual earnings that attach to economic factors. Indeed, analysis of financial statements directs how to analyze business activity and to translate economic factors into terms (accounting drivers) that forecast residual earnings and lead to a valuation.

The analysis involves some judgement as to "what makes sense". But this is inevitably part of the "art" of design in bringing academics' models to practice (Colander (1992)). As such it stands as a point of departure for those with better judgement.

Many of the ratios are familiar and the basic structure follows the familiar DuPont scheme. But there are innovations:

- Ratio analysis is integrated with valuation analysis, giving substance to "fundamental analysis."

- The analysis is of comprehensive income. Components of "other comprehensive income" and dirty-surplus income in the balance sheet (and items in the Statement of Recognized Gains and Losses and Reconciliation of Shareholder Funds Statements in the UK) are included in ratios. Residual earnings valuation techniques require the forecasting of comprehensive income, otherwise value is lost.

- The analysis takes a forecasting perspective. Ratio analysis is seen as an analysis of current financial statements but also as an analysis of future residual earnings. Forecasted ratios are the building blocks of forecasted residual earnings. Current ratios forecast future ratios.

- The analysis of current financial statements is guided by the principle of predictive ability. So transitory and core aspects of ratios are identified (in principle).

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[6] The analysis omits effects on shareholder value of taxes on dividends and the value effects of the tax-deductibility of interest on debt. These are controversial issues but, if accepted, are a matter of the comprehensive income calculation (that is, including these effects in expenses and deferred taxes). Similarly GAAP omits the calculation of

- The decomposition leads to parsimony in analysis. Ratios further down the hierarchy are utilized only if they provide more information than those higher up. Ratios that involve financing activities are ignored if financial items are at their fair value on the balance sheet. RNOA and growth forecasts can be simplified if components are constant, so the analyst can focus on the key drivers that will affect the forecast.

- Profitability analysis is at the core of the analysis, but this is complemented with an analysis of growth.

- There is an extended analysis of drivers of profitability beyond the standard analysis.

- Minority interest share in accounting value is accommodated.

- There is a clear distinction between operating and financing items. This is done by applying "clean-surplus" accounting, not just between the income statement and balance sheet totals, but between operating and financing totals on the income statement and balance sheet: NOA are identified in the balance sheet to match to operating income, and NFO are separated to match to net financial expense, to yield "clean" measures of operating profitability and borrowing costs.

- Financial leverage is redefined from the traditional Debt/Equity ratio.

- An operating liability leverage driver is identified.

The last three points are important to the discovery of operating profitability. Some calculations of operating profitability mix operating and financing items (a violation of clean-surplus). A common calculation is return on total assets:

$$\text{ROTA} = \frac{\text{NI} + \text{Interest Expense} \times (1 - t) + \text{MI share of income}}{\text{Total Assets}} \tag{14}$$

where t is the tax rate. This often ignores items in comprehensive income (by starting with net income) but also includes interest income in the numerator and financial assets in the denominator. Further, certain income items (like accrued expenses) are in the numerator, but the corresponding operating liabilities (like accounts payable and accrued liabilities) are not subtracted from the denominator. The identification of operating liabilities (as distinct from financing), leads to the notion of operating liability leverage and the analysis gives an explicit expression (7) for it.

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the cost to shareholders of employee stock options but this is also a matter of recognising an expense in comprehensive income. It does not affect the decomposition.

The reduced analysis of Section 2.3 aims at focusing on the aspects of the business that generate value, the operations. Clearly there is a question of definition (of operating and financing activities) but we have in mind that operations are carried out to "make money," as distinct from the zero-net-present-value activities (zero-residual-earnings activities) involved in financing these activities. So, buying and selling bonds at market price to raise cash for an industrial firm is a financing activity, but buying and selling bonds for a bond trader is an operating activity. Knowing the business is important to the identification. The identification can only be made if operating and financing activities are separable. So, if a firm holds debt in a foreign currency to hedge against exchange rate losses from operations, the separation cannot be made. And, if disclosure is insufficient to make the distinction, the separation cannot be made. The principle of clean surplus accounting requires that operating and financing income, separately identified in the income statement, must be matched with operating and financing net assets separately identified in the balance sheet. Otherwise measures of operating profitability and net borrowing cost that involve the matching are "dirty."

If operating and financing items cannot be identified, the reduced analysis is not feasible and the analyst works with forecasting residual earnings, as in Section 1, rather than residual operating earnings. This requires an analysis of the financing activities, as in Sections 2.1 and 2.2. And, it involves adjustments to the cost of equity capital for continually changing forecasted leverage.

3. Documentation

There are two parts to the documentation, a cross-sectional analysis and a time series analysis. The cross-sectional analysis gives typical numbers for the ratios in the data. This is of particular help for ratios like RNOA, OLLEV, FLEV and the core ratios which may be unfamiliar or which are defined differently from standard texts. The time series analysis documents how ratios typically evolve over time. With the view of using current drivers as predictors of future residual earnings drivers, the time series analysis documents the transition from current drivers to future drivers.

The documentation is for firms using U.S. GAAP. It covers NYSE and AMEX firms listed on the combined COMPUSTAT (Industry and Research) files for the 34 years from 1963 to 1996. These are relatively well-established firms. Non-surviving firms are included. The

appendix explains how ratios are calculated from COMPUSTAT items. Some calculations are hampered by insufficient disclosure in the financial statements, to distinguish operating and financing items and core and unusual items for example. But our analysis is also somewhat restricted by lack of data on COMPUSTAT and these difficulties are discussed in the appendix.

Many ratios can have extreme values, usually due to very small denominators. So in most cases median ratios are presented as representative numbers. Where means and standard deviations are reported, they exclude the upper and lower one percent of the distribution. Ratios with negative denominators are also excluded.[7] Balance sheet numbers are averages of beginning and ending amounts. All income numbers are after tax, with the appropriate tax allocation at all points. For residual earnings and residual operating earnings, we set the cost of capital at the current one year treasury rate plus 6%, the conjectured equity risk premium. We do not attempt to distinguish levered and unlevered costs of capital. This reflects our uncertainty about the appropriate risk premium more than anything else; in any case our focus is on the accounting numbers, not the cost of capital.

Before providing the documentation we should indicate that we began the empirical analysis by attempting to estimate multivariate models to forecast residual operating income, RNOA, and growth in NOA from the pooled cross-section and time-series data. With parsimony in mind, these models were estimated by including ratios in the hierarchical order of the decomposition so that ratios were only introduced if they had explanatory power beyond higher level ratios under which they nest. The analysis produced large t-statistics and reasonable R-square values in estimation, but the models performed poorly in prediction out of sample. This was the experience in Ou and Penman (1995) also. We became convinced that coefficients in these models are not stable across firms and time, lending credence to the conjecture that financial statement analysis is contextual. Accordingly the documentation here is more descriptive, designed to identify empirical regularities and provide general benchmarks as a point of departure for the contextual analysis of individual firms. As it happens, we will show that the relationship between current and future drivers is non-linear, so pooled, linear models are not likely to work well. (None of this is to imply that robust, parametric, predictive models cannot

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[7] Except for the calculation of NBC and Core NBC since firms can have negative net financial obligations (that is, net financial asset positions).

be estimated; but that estimation calls for careful econometrics and a careful partitioning of the data.)

3.1 Cross-sectional Analysis

Typical Ratios

Table 1 summarizes the mean, median and other aspects of the distribution of ratios pooled over all firms and all years, 1963-1996. The first panel gives the main drivers of the ROCE component of residual earnings. The second panel gives ratios that help isolate core profitability and measures that drive the growth of residual earnings.

The minority sharing ratio (MSR) is close to one for a large section of firms so ROCE is typically a good approximation for ROTCE. Median ROCE (12.2%) is, interestingly, close to, or perhaps a little higher than what is normally assumed as the equity cost of capital: Ibbotson and Sinquefield (1983) calculate the historical average return to equity at about 12.5% at a point about half way through our sample period, although this is often claimed to be too high because it reflects an expost successful stock market (See Brown, Goetzmann and Ross (1995)).

RNOA is higher at the mean and median than the traditional ROTA, and has considerably higher variation. The distribution of the difference between the two demonstrates that the "clean" distinction between operating and financing items and the adjustment for operating liabilities can have a significant effect: for over 50% of firm-years the absolute difference is greater than 3%. The median RNOA of 10.3% compares with a median ROTA of 7.0% and is closer to what we typically think of as an average business return. The numbers for ROTA (or "return on assets") reported in texts and in the business press often seem too low and we suggest that this is due to poor measurement. Median operating liability leverage (OLLEV) and median operating liability spread (OLSPREAD) are positive (0.34 and 3.6% respectively), so typically operating liability leverage is used favorably, contributing to the difference between RNOA and ROTA.

The distinction between operating and financing assets and liabilities changes the financial leverage measure, FLEV, from the traditional Debt/Equity ratio measured as (Total Liabilities + Preferred Stock) / Common Equity. Median FLEV is 0.40, compared to 1.17 for the Debt/Equity ratio. This is because FLEV recognizes only indebtedness from financing activities and also recognizes that debt held (as assets) effectively defeases debt owed. So for about 20%

of firms financial leverage is negative; these firms are net holders of financial assets rather than net issuers.

Net borrowing costs (NBC) in the table are after tax. Adjusting the median 6.1% for tax rates (see appendix), the before-tax rate is typical of corporate borrowing rates. The variation in borrowing cost is probably due to variation in borrowing rates but also to recognition of (transitory) realized and unrealized gains and losses on financial items. The SPREAD over the net borrowing cost is positive at the median but negative for about 30% of firm-year observations. Median ROCE (12.2%) is higher than median RNOA (10.3%), indicating that typically the on-average positive leverage combines with positive spread to lever ROCE favorably.

The standard DuPont profit margin (PM) and asset turnover (ATO) which drive RNOA are given in the last two columns of Panel A of Table 1. The first eight ratios in Panel B (from Sales PM to Core SPREAD) are additional ratios that extend the standard analysis of ROCE in (4a) to that in (13). The Sales PM shifts the PM slightly lower—from 5.5% to 5.4% at the median, more so in the positive tail—because of the exclusion of Other Items from the numerator of Sales PM. Other Items/NOA is typically small; only about 20% of firms report equity earnings in subsidiaries. But the identification of unusual operating items has a larger effect, particularly away from the median. Comparison of Core Sales PM with Sales PM and of Core RNOA with RNOA reflects the effect of these unusual items. This effect is understated here since COMPUSTAT does not give enough financial statement detail to identify all unusual items. Further unusual items, such as strikes and unusual orders, can be discovered from footnotes and the management discussion and analysis. A more thorough analysis of unusual items will refine the Core RNOA further.

The Core NBC and Core SPREAD in the table are presented with qualifications. Realized gains and losses on debt are not identified by COMPUSTAT. Unrealized gains on long-term financial assets and unrealized gains and losses on short-term financial assets have been recognized only since FASB Statement No. 115 became effective in 1994.[8] Prior to 1994 (when only unrealized losses on long-term financial assets were recognized), our measured UFE was zero for almost all firms. Thus the table presents Core NBC, UFE/NFO and Core Spread for 1994-1996 only. Indeed our identification of unusual financial items is a response to Statement

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[8] Some firms adopted the Statement in 1993.

No. 115 and the distribution here gives an indication of how accommodation of this statement affects the numbers.

The remaining columns of Panel B give growth rates and free cash flow. Continuing value calculations require growth rates for either residual earnings (RE) or residual operating income (ReOI). Panel B gives the distribution of annual growth rates during 1963-1996. If ROCE is constant, growth in residual earnings is driven by growth in CSE and if RNOA is constant, growth in ReOI is driven by growth in NOA. So growth rates in CSE and NOA are also given. Median growth in CSE is 9.0% and median growth in NOA is 8.8%. These are, however, annual growth rates and the continuing value calculation requires long-run expected growth rates. So the relevant question is how growth rates "settle down" in the long-run, and we return to this issue later. Profitability and growth in NOA yielded a median free cash flow of 2.5% of NOA and, for about 40% of firm-years, free cash flow was negative.

Decomposition of the primary drivers is only of use if it provides more information. Table 2 gives a matrix of Spearman correlations for the ratios summarized in Table 1. We leave it for the reader's inspection.

<u>Typical Ratios Over Time</u>

The ratios in Table 1 are typical of the period. But they give no indication of the variation and trends over time that is helpful for prediction. Figures 1a-1f trace median values over the 34-year period. With forecasting in mind, one might look at these figures as a basis for projecting to the future (beyond 1996). "Permanent" trends might be extrapolated. More recent numbers might be given more weight but might also be interpreted against any historical tendency to revert to central or typical values.

Figure 1a plots median ROCE against the one-year treasury yield (the "risk-free rate") and our estimate of the cost of equity capital (the treasury yield plus 6%). We noted in Table 1 that the grand median ROCE of 12.2% looked like the equity return and Figure 1a indicates this is consistently so; median ROCE is greater than the risk-free rate in all years except 1982 and tracks the cost of capital (somewhat surprisingly).[9] But ROCE is less than the assumed cost of

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[9] The product-moment (Pearson) correlation between median ROCE and the treasury yield is 0.29. The correlation between the lagged median ROCE and the treasury yield is 0.67. The one-year treasury yield is measured at the beginning of the year. Thus ROCE is more strongly related to the yield at the end of the year than to the yield at the beginning of the year.

equity (implying negative residual earnings) in a majority of the years, suggesting that the cost of capital estimate is too high. If anything, one expects ROCE to be greater than the cost of capital because conservative accounting that keeps book values low and ROCE high is said to be practiced. Interestingly, Claus and Thomas (1997), O'Hanlon (1998) and Gebhardt, Lee and Swaminathan (1999) impute lower equity risk premiums than the 6% from forecasted residual earnings in the U.S. and actual residual earnings in the UK. In any case, there is a central tendency in the "economy-wide" ROCE in Figure 1a which should be noted for forecasting: it moves around its grand median and to some extent, tracks the cost of capital. Results are similar with the five-year treasury yield as the risk-free rate.

Figure 1b plots median ROCE and its two drivers, RNOA and NBC. The (after-tax) NBC can be compared with the (pre-tax) treasury yield in Figure 1a. Periods where interest rates move away from NBC are those where financial obligations are less likely to be at market value. ROCE is consistently higher than RNOA indicating a consistently favorable financial leverage effect. Median RNOA is consistently a positive spread above net borrowing cost. Figure 1c plots median FLEV that, with the SPREAD, produces the leverage effect, and contrasts it to the Debt/Equity ratio. Figure 1c also plots the OLLEV that levers the RNOA. FLEV and OLLEV are, year-to-year, quite stable. OLLEV has a slight positive trend; the recognition of employment benefit liabilities in the late 1980's and 1990's presumably contribute. The median Debt/Equity ratio increased more than FLEV over the years, induced by an increase in operating liabilities. The Debt/Equity ratio differs from FLEV also in the treatment of financial assets. Cash from operations can be used to buy the firm's own debt (which affects the Debt/Equity ratio) but can also be used to buy financial assets, others' debt (which does not affect the Debt /Equity ratio). In both cases the firm is buying debt, engaging on a financing transaction that reduces its net debt but does not affect the operations. The FLEV measure, based on a separation of financing and operating activities, capture both cases; the Debt/Equity ratio does not.

Figure 1d plots median ROTA and RNOA and figure 1e plots core and unusual components of RNOA. ROTA consistently understates RNOA but the two do move together. Core RNOA is consistently lower than RNOA, except in the early 1990's when the many restructurings produced large negative unusual charges. Note that in the 1990's the refined Core RNOA gives a very smoothed trend to the probability.

Figure 1f plots median Core RNOA again but also plots its drivers, Core Sales PM, Other Items/NOA and ATO. In the early part of the sample period, changes in economy-wide Core RNOA seem to have been driven more by changes in ATO than changes in Core Sales PM. But during the last 10 years Core Sales PM has driven the Core RNOA, with median ATO reasonably constant.

Interaction between Ratios

The extended decomposition in (13) gives the drivers of ROCE and show how they "aggregate." But there may be interactions: a certain level of one driver may imply a certain level for another. Here we examine the data for these interactions. They are depicted in figures 2a-2d. The figures plot joint values of median ratios for 238 four-digit SIC industry groups over 1963-1996. Plots were also made for just the more recent 1987-96 period with similar results.[10] These plots should be read in conjunction with the correlations in Table 2.

FLEV and SPREAD. Financial leverage levers ROCE relative to RNOA, as in (4), and the amount of leverage depends on both FLEV and SPREAD. As the effect of leverage (favorable or unfavorable) depends on the sign of the SPREAD, FLEV may be set by management after contemplating the SPREAD the firm will generate. One might expect a positive relationship between FLEV and SPREAD: a firm borrows more (to lever up ROCE) only if it can maintain high SPREAD which is less likely to turn unfavorable. But some argue that financing is irrelevant. Positive leverage generates higher anticipated ROCE (and thus higher residual earnings), but increases the risk of lower profitability. So higher anticipated residual earnings are exactly offset in present value form by an increase in the cost of equity capital. Accordingly management may choose leverage for reasons other than increasing profitability of the equity.

Figure 2a plots FLEV on SPREAD. The leverage effect is given by FLEV*SPREAD and we can think of fitting iso-leverage effect curves through the plots. The relationship is, surprisingly, negative. The Spearman rank correlation between FLEV and SPREAD is –0.36, and between FLEV and RNOA is –0.42. Perhaps a high median RNOA or SPREAD is the reward to business risk and firms with high business risk choose to have lower financing risk. Perhaps profitable firms generate a lot of cash which they use to reduce leverage.

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[10] In constructing these figures, a few extreme observations were deleted.

OLLEV and OLSPREAD. Operating liability leverage levers RNOA relative to ROA, as in (7), and the amount of leverage depends on both OLLEV and OLSPREAD. In a similar way to Figure 2a, Figure 2b plots the interaction between OLLEV and OLSPREAD. The rank correlation between the two is 0.13, and the rank correlation between OLLEV and RNOA is 0.27, indicating operating liability leverage works favorably, on average.

PM and ATO. The DuPont decomposition recognizes that RNOA = PM * ATO and it is commonly recognized that firms can generate the same RNOA with different combinations of margins and turnovers. Figure 2c replicates the figure in Selling and Stickney (1989) that is often displayed in texts, but the profit margin is the refined Core Sales PM and ATO here is based on NOA which incorporates operating liabilities. Iso-RNOA lines fitted through these plots are convex and downward sloping. The rank correlation between Core Sales PM and ATO is –0.42.

RNOA and Growth in NOA. RNOA and Growth in NOA combine to grow residual operating income. One might expect firms that generate higher RNOA to grow their net operating assets. But growth in NOA reduces RNOA if the accounting is conservative. Figure 2d shows that median RNOA and Growth in NOA are positively related in the sample period. The rank correlation between the two is 0.27.

The full set of correlations in Table 2 are at the firm level, not the industry level. Inspection will reveal some further relationships. For example, Core NBC is only slightly negatively correlated with RNOA (-0.07) but is positively correlated with FLEV (0.25); FLEV and OLLEV are negatively correlated (-0.26); and OLLEV is negatively correlated with Core Sales PM (without the recognition of imputed interest expense), but positively correlated with ATO, and overall OLLEV is positively correlated with RNOA.

3.2 Time-Series Analysis

This section documents the typical evolution of ratios over time. Ratios were identified in Section 2 as drivers of future residual earnings. With a view to forecasting, the analyst is not

primarily concerned with current drivers, but with how current drivers will transition to the future. Will they persist or will they decay? If ratios decay, what will be their future level?

Of particular interest is the question of whether drivers tend to converge to typical values overtime. As with all valuation methods, a residual earnings valuation can be made from forecasts for truncated forecast horizons if attributes "settle down" to permanent levels within the horizon.[11] If they do, continuing values can be calculated. Practical analysis typically makes assumptions about continuing values, as does academic research using analysts forecasts (which are typically made only for two to five years).[12] Do residual earnings and their drivers typically "settle down" in the way assumed? And, if so, what is the typical form of the continuing value calculation?

We examine these issues by reference to the displays in Figure 3, 4, 5 and 6, along with simple rank correlation measures. The displays are based on ranking a given measure in a base year, year 0, forming 10 portfolios from the rankings, and then tracking median values for each portfolio for the following five years. The ranking is done six times, in 1965, 1970, 1975, 1980, 1985, and 1990. For each of these years portfolio medians are calculated for the ranking year and for the following five years. At end of the five years the ranking is done again for the next five years, and so on until 1990. The figures give the mean of portfolio medians over the six sets of calculations. The patterns depicted are quite robust over the six time periods, however. The displays are offered with one caveat. Firms in the base year that do not survive are not in the calculations in years after they drop out. Thus the expost averages may be biased estimates of exante amounts for going concerns.

The displays are to be read in conjunction with Table 3. That table gives the Spearman rank correlations between ratios and their t-lagged values (t = 1, 2, …, 5), calculated using all firm-year observations (1963-1996). It also gives the ratio of the variance of the portfolio measures in the relevant year with that in the base year, as an indication (at the portfolio level) of the speed of conversion toward a common amount. The correlations are analogous to R^2 in a linear regression and the variance ratios are analogous to a standardized slope coefficient.

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[11] Ohlson and Zhang (1998) and Penman (1997) model finite-horizon residual earnings valuation

[12] See, for example, Frankel and Lee (1997) and Lee, Myers and Swaminathan (1998). Penman and Sougiannis (1998), Francis, Olsson and Oswald (1998), and Sougiannis and Yaekura (1998) make continuing value assumptions when comparing residual earnings to other valuation techniques.

Residual Earnings (RE), Residual Operating Income (ReOI) and FLEV. Figures 3a and 3b give the average behavior of median RE and ReOI over five years from the base year. Both are per dollar of average book value (CSE and NOA respectively) in the base year. Both are calculated with a cost of capital equal to the risk-free rate plus 6% in the base year but the patterns are similar when the cost of capital for subsequent years is the risk-free rate implied for that year in the term structure, plus 6%.

The following observations are made for both RE and ReOI. First, current residual earnings forecast future residual earnings, not only in the immediate future but five years ahead. High residual earnings firms (in the cross section) tend to have high residual earnings later and low residual earnings firms tend to have low residual earnings later. Indeed, the rank correlations in Table 3 between RE in year 0 and RE in years 1, 2, 3, 4 and 5, for individual firms are 0.57, 0.36, 0.25, 0.20, and 0.18, respectively. The corresponding rank correlations for ReOI are 0.64, 0.43, 0.31, 0.26, and 0.24. Second, both the figures and the decaying rank correlations indicate residual earnings tend to converge to central values, with the more extreme becoming more typical over time. But third, permanent levels are not zero for a number of portfolios. It appears that continuing values of the type CV2 and CV02 are typical, not CV1 or CV01. A nonzero permanent level of residual earnings can be explained by persistent nonzero net present value investing or by conservative or liberal accounting. Third, long run positive or negative growth in residual earnings is not typical; the typical continuing value calculation is of the type CV2 and CV02, not CV3 and CV03.

One other aspect of Figures 3a and 3b warrants mention. The majority of firms have negative RE or ReOI by the fifth year. Re and ReOI are determined in part by the cost of capital. With conservative accounting practiced on average, one expects long-run RE and ReOI to be, on average, positive and ROCE and RNOA to be greater than the cost of capital. If this is the case, the displays indicate that the typically assumed equity risk premium of 6% is too high. As mentioned earlier, risk premiums estimated using the residual earnings model are less than 6%.

Financial leverage drives the difference between RE and ReOI so Figure 3c shows how FLEV changes overtime. FLEV is fairly constant for all portfolios except that with the highest FLEV. A temporarily high FLEV can produce temporarily high RE (through the leverage effect on ROCE) even when RNOA is "normal". But mean reversion in FLEV forecasts that unusually high RE, so induced, will become more typical. Valuation by forecasting ReOI avoids these

considerations and also avoids forecasting changes in discount rates due to forecasted changes in leverage.

ROCE, RNOA, Growth in CSE and Growth in NOA. Residual earnings measures are driven by rates of return and growth in book value. Figures 4a and 4b trace portfolio medians of ROCE and RNOA and Figures 4c and 4d trace portfolio medians of annual growth rates in CSE and NOA. The mean reversion in ROCE in figure 4a is well documented (in Freemen, Ohlson and Penman (1982), Penman (1991) and Fama and French (1998)). A similar central tendency is evident for RNOA. So the mean reversion in RE and ReOI is driven in part by that in the two rates of return. However, Figures 4c and 4d indicate that growth in book value also decays toward economy-wide levels, driving RE and ReOI toward central values.[13]

Core Sales PM, Other Items, Unusual Operating Items and ATO. Figures 5a, b, c and d plot the drivers of RNOA, with Other Core Items and Unusual Operating Items deflated by NOA.[14] The division of profitability into Core Sales PM, Other and Unusual Items distinguishes components with different persistence. Differences in Core Sales PM perpetuate. And, with the exception of the highest ATO group, asset turnovers remain fairly constant.

As indicated in Section 2.4, forecasting that profit margins and ATO will be constants simplifies the forecast of growth: the growth rate in ReOI for a continuing value calculation is then determined solely by forecasting growth in sales.

Changes in Sales, Core Sales PM and ATO. The Figure 5 graphs are for portfolios formed from the cross section. Figure 2c indicates systematic differences in profit margins and turnovers across industries, so the differences in the long-run profit margins and ATOs in Figure 5 are probably due to permanent differences in technology and cost structure across industries. So Figures 6a, b and c picture the evolution of changes in sales, Core Sales PM and ATO.

The patterns indicate that unusual changes are transitory. Figure 6b also indicates that Core Sales PM can contain further transitory income (after isolating unusual items) and this is

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[13] Survivorship bias is a particular concern in interpreting Figures 4c and 4d, however. CSE and NOA increase through acquisitions and such growth is incorporated in the numbers here. But the negative growth of firms acquired is not.

[14] Figure 5b includes only non-zero Other Core Items.

detected by looking at changes.[15] Similarly changes in ATO are mean reverting, and rapidly so.[16]

Table 3 and the supporting displays incorporate all firms that survive to each forward year. If the survival rate differs over the portfolios or the reason for non-survival differs, these expost representations may be biased depictions of exante patterns. Correcting for any effect of attrition is problematical. One might include expost liquidating earnings for firms that drop out but exante forecasts are usually made for going concerns (without anticipation of the effects of termination).

Panel A of Table 4 gives the average survival rates for the 10 residual earnings portfolios in Figure 3a. The numbers in the table are averages over the six replications (1965-1970, ..., 1990-1995) of the percentage of firms in each of the 10 portfolios in the base year that survived in each of the subsequent 5 years. Survivorship rates are similar across all portfolios except the bottom two (with the lowest RE). Patterns for all groups are conditional upon survival, but for these two groups the forecaster must be particularly concerned with forecasting survivorship as well as forecasting drivers. Panel B of Table 4 gives the percentage of terminations due to merger or exchange, as indicated by CRSP. The main reasons for non-surviving are mergers, exchange of stock, liquidation and delisting, with mergers and exchanges presumably resulting in higher payoffs than liquidation or delisting.

4. Conclusion

This paper has laid out a structured financial statement analysis that facilitates forecasting and valuation. The analysis involves an analysis of profitability and an analysis of growth. The analysis of profitability extends the traditional analysis, the analysis of growth complements it: profitability and growth drive equity values. The analysis is guided by the residual earnings valuation model but is appropriate for forecasting free cash flows and dividends if other valuation approaches are adopted.

Section 2.7 summarizes the major features of the scheme. The overall perspective is one of forecasting (and, from forecasts, valuation) so financial statement analysis is depicted, as a

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[15] The pattern for the largest negative change in Core Sales PM in year 0 is particularly interesting. This portfolio has the largest (positive) changes in subsequent years. Is this "big bath" accounting that shifts income to the future?

matter of first order, as an analysis of the future. Ratios are identified as drivers of future residual earnings, free cash flow and dividends. Ratios in current financial statements are then viewed as information to forecast the future drivers.

The paper documents typical values for ratios and typical patterns for ratios over time. The broad general descriptions are benchmarks that establish priors for forecasting. They are input to a more contextual analysis (of industries and firms) and a more sophisticated econometric forecasting analysis. The overall feature of the accounting data is central tendency-- convergence of drivers to a common level in the cross section--which bodes well for calculating continuing values with standard valuation techniques.

The analysis does not deal with uncertainty in forecasting. This is incorporated in valuation models through the discount rate (or discounts from expected values) and one conjectures that financial statement analysis is also relevant for determining the discount rate.

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[16] The persistence of ATO changes for one period here is partly due to using average NOA in the calculation of ATO.

This appendix describes how the variables are measured. Since perfect identification of operating and financing items requires data that are not available on Compustat, some of the variables are measured with error. When applicable, we discuss measurement issues below the variable's definition.

Financial Assets (FA) = cash and short term investments (Compustat #1) plus investments and advances-other (Compustat #32).

Companies hold cash on a regular basis also because they cannot perfectly synchronize cash receipts and disbursements. Thus, a portion of "cash and short-term investments" is an operating asset. But we cannot separate the operating portion of cash from the total of cash and short-term investments, and we cannot separate interest income on operating cash from total interest income. So we classify all cash as a financial asset.

There are generally two types of investment securities: debt and equity. Investments in debt securities are financial assets, but investments in equity securities are usually investments in the operations of affiliated companies, and thus are operating assets. Compustat reports long-term investments in debt securities together with long-term investments in equity securities (other than those accounted for using the equity method). Since we found that most investments are in debt securities, we classify these investments (#32, "investments and advances – other") as financial assets.

Another measurement issue is that "investments and advances – other" (#32) includes long-term receivables that are related to operating activities. However, receivables are usually carried close to their value even when they relate to operating activities (e.g., long-term lease receivables). More importantly, interest income on all receivables is included in interest income, which is classified as financial income (see below).

Operating Assets (OA) = Total Assets (TA, Compustat #6) minus Financial Assets (FA).

Financial Obligations (FO) = debt in current liabilities (#34) plus long term debt (#9) plus preferred stock (#130) minus preferred treasury stock (#227) and plus preferred dividends in arrears (#242).

Net Financial Obligations (NFO) = Financial Obligations (FO) minus Financial Assets (FA).

Common Equity (CSE) = common equity (#60) plus preferred treasury stock (#227) minus preferred dividends in arrears (#242).

Net Operating Assets (NOA) = Net Financial Obligations (NFO) plus Common Equity (CSE) and plus Minority Interest (MI, #38)

Operating Liabilities (OL) = Operating Assets (OA) minus Net Operating Assets (NOA).

Core Net Financial Expense (Core NFE) = after tax interest expense (#15 * (1- marginal tax rate)) plus preferred dividends (#19) and minus after tax interest income (#62 * (1- marginal tax rate)).

Unusual Financial Expense (UFE) = lag marketable securities adjustment (lag #238) minus marketable securities adjustment (#238).

Due to data problems we cannot include gain/loss on early extinguishment of debt, a component of UFE, in our measure of UFE. This item is classified as an extraordinary item and Compustat provides only the total of extraordinary items with no information on their nature. So we include all extraordinary items in operating income. In any case, our classification excludes extraordinary items from core income.

Another data issue with the measurement of UFE is that cumulative translation adjustment, a dirty surplus equity account, reflects unrealized currency translation gains and losses not only on operating items, but also on financial assets and liabilities. COMPUSTAT (and often the financial reports) do not provide enough details to separate the two. Since NOA are usually larger than NFO, we include this income item in operating income (see below).

Net Financial Expense (NFE) = Core Net Financial Expense (Core NFE) plus Unusual Financial Expense (UFE).

Clean Surplus Adjustments to net income (CSA) = marketable securities adjustment (#238) minus lag marketable securities adjustment (lag #238) plus cumulative translation adjustment (#230) and minus lag cumulative translation adjustment (lag #230).

CSA should include all items that change common equity and bypass the income statement (dirty surplus items) other than net dividends. Compustat provide information on the cumulative balance of two dirty surplus items: translation gains and losses (#230) and unrealized gains and losses on financial items (#238). Thus, CSA may be estimated as the change in these items during the year. These two items, while the more common and material dirty surplus items, are not the only ones.

An alternative approach to calculating CSA is by analyzing the change in retained earnings. That is, CSA equals the change in retained earnings minus net income and plus net dividends. There are several problems with this approach, however. The main problem is that stock dividends, share retirements and share repurchases (when accounted for using the par value method) reduce retained earnings but are not CSA.[17]

Comprehensive Net Income (CNI) = net income (#172) minus preferred dividends (#19) and plus Clean Surplus Adjustment to net Income (CSA).

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[17] The effect of stock dividends on retained earnings is included in item #231 (Retained Earnings - Other Adjustments). This item also includes the effect of notes receivable (presumably for share issues). Both items are not income items, and thus the change in #231 should be the deducted from the change in retained earnings. The problem is that this item is available only starting 1982.

Comprehensive Operating Income (OI) = Comprehensive Net Financial Expense (NFE) plus Comprehensive Net Income (CNI) and plus Minority Interest in Income (MII, #49).

Some parts of dirty surplus income (e.g., currency translation gains and losses) are associated with minority interests, but COMPUSTAT (and often financial reports) do not provide the detail necessary to adjust minority interest income for dirty surplus items. So minority interest income, and therefore operating income, are misstated. However, since minority interest is usually very small, the effect of this misstatement is likely to be immaterial for most companies.

Unusual Operating Income (UOI) = after tax nonoperating income (expense) excluding interest and equity in earnings ((#190 - #55) $\times$ (1- marginal tax rate)) plus after tax special items (#17 $\times$ (1- marginal tax rate)) plus extraordinary items & discontinued operations (#48) plus cumulative translation adjustment (#230) and minus lag cumulative translation adjustment (lag #230).

Other Operating Income Items (Other Items) = Equity in earnings (#55).

Operating Income from Sales (OI from Sales) = Operating Income (OI) minus Other Operating Income Items (Other Items).

Core Operating Income from Sales (Core OI from Sales) = Operating Income from Sales (OI from Sales) minus Unusual Operating Income (UOI).

Marginal Tax Rate = the statutory federal tax rate plus 2% average state tax rate. The federal tax rate was 22% in 1963, 28% in 1964, 26% in 1965-1978, 46% in 1979-1987, 34% in 1988-1992 and 35% in 1993-1996.

Interest on Operating Obligations (io) = the one year risk-free rate at the beginning of the year multiplied by the difference between operating liabilities (OL) and "Deferred Taxes and Investment Tax Credit" (#35).

A more precise calculation would not impute implicit interest on the accrued pension cost but instead add the net interest cost on the net pension obligation (i.e., interest cost minus actual return on plan assets). However, Compustat gives details about the pension interest cost and the actual return on plan assets only starting 1991, and it does not provide the net accrued pension cost. This liability is probably included in item #75 (liabilities - other).

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Table 1
Summary of Ratios, 1963-1996

Panel A: Drivers of ROCE

	ROCE	MSR	ROTCE	RNOA	ROTA	RNOA – ROTA	OLLEV	OLSPREAD	FLEV	DEBT/ EQUITY	NBC	SPREAD	PM	ATO
Obs.	58897	58891	58920	59398	59854	59398	59400	59849	58922	58899	59850	59392	59777	59400
Mean	10.2%	1.00	10.3%	11.1%	6.8%	4.2%	0.43	3.4%	0.60	1.53	6.1%	4.8%	6.4%	2.36
Std	15.9%	0.02	15.7%	12.5%	6.3%	6.8%	0.34	8.2%	0.85	1.35	9.8%	20.8%	8.3%	1.82
Percentiles:														
95%	30.5%	1.03	30.4%	33.3%	16.8%	17.6%	1.13	17.2%	2.30	4.28	19.8%	41.7%	22.0%	6.35
90%	24.2%	1.01	24.2%	24.2%	13.7%	10.9%	0.79	12.1%	1.72	2.96	12.9%	25.9%	16.5%	4.51
75%	17.5%	1.00	17.5%	15.8%	10.0%	5.7%	0.51	7.0%	0.92	1.97	8.4%	9.6%	9.6%	2.89
50%	12.2%	1.00	12.2%	10.3%	7.0%	2.9%	0.34	3.6%	0.40	1.17	6.1%	3.3%	5.5%	1.97
25%	6.4%	1.00	6.4%	6.4%	4.6%	1.3%	0.24	0.3%	0.05	0.68	3.9%	-1.3%	2.9%	1.22
10%	-4.5%	1.00	-4.4%	-0.2%	0.1%	-0.5%	0.16	-5.2%	-0.23	0.39	-0.9%	-11.6%	-0.1%	0.57
5%	-20.7%	0.99	-20.4%	-9.5%	-5.7%	-3.7%	0.12	-11.7%	-0.40	0.27	-7.2%	-25.7%	-5.9%	0.39

Panel B: Core Income Ratios and Growth Drivers

	Sales PM	Core Sales PM	Other Items/NOA	UOI/ NOA	Core RNOA	Core NBC	UFE/ NFO	Core SPREAD	Growth in RE	Growth in ReOI	Growth in CSE	Growth in NOA	FCF/ NOA
Obs.	59777	59777	59400	59400	59398	6217	6217	6149	54992	55377	54994	55379	59398
Mean	6.2%	5.8%	0.2%	0.6%	10.5%	5.4%	0.0%	4.8%	-38.9%	-46.3%	11.1%	12.3%	0.7%
Std	8.2%	6.7%	0.6%	4.1%	10.4%	9.3%	0.1%	20.4%	394.7%	363.3%	19.0%	21.4%	22.5%
Percentiles:													
95%	21.5%	18.8%	1.6%	7.1%	29.5%	16.7%	0.1%	42.4%	410.7%	346.9%	49.4%	57.0%	35.8%
90%	16.2%	14.5%	0.7%	3.9%	22.1%	11.1%	0.0%	24.5%	201.9%	163.9%	32.4%	38.4%	23.3%
75%	9.3%	8.5%	0.0%	1.5%	14.7%	7.4%	0.0%	10.3%	78.0%	64.5%	17.1%	20.0%	11.3%
50%	5.4%	5.0%	0.0%	0.4%	9.5%	5.5%	0.0%	3.7%	4.0%	0.8%	9.0%	8.8%	2.5%
25%	2.8%	2.7%	0.0%	0.0%	5.9%	3.6%	0.0%	-1.4%	-91.4%	-85.9%	2.8%	0.7%	-7.8%
10%	-0.2%	0.3%	0.0%	-2.3%	0.9%	-0.2%	0.0%	-12.5%	-324.2%	-300.2%	-6.8%	-8.7%	-25.3%
5%	-6.1%	-3.8%	0.0%	-6.2%	-6.0%	-5.0%	-0.3%	-29.7%	-695.4%	-641.3%	-17.8%	-17.2%	-43.4%

Calculations are made from data pooled over firms and over years (1963-1996). Ratios with nonpositive denominators are excluded (except of NBC and Core NBC). Mean and standard deviation calculations exclude the upper and lower 1% of observations. Core NBC, UFE/NFO and Core Spread are based on data for 1994-1996 only. The growth ratios require two years of lagged data and thus have fewer observations. Growth in CSE and NOA are annual change divided by the prior year's value, in percent. Growth in RE and ReOI are annual change divided by the absolute value of prior year's value, in percent. Growth in RE (ReOI) is calculated only when CSE (NOA) is positive.

Table 2
Spearman Correlation Matrix of Ratios

	ROCE	MSR	ROTCE	RNOA	ROTA	RNOA-ROTA	OLLEV	OLSPREAD	FLEV	DEBT/EQUITY	NBC	SPREAD	PM	ATO
ROCE	1.00	0.01	1.00	0.90	0.90	0.80	0.18	0.86	-0.15	-0.07	-0.07	0.73	0.60	0.24
MSR	0.01	1.00	-0.01	-0.03	-0.03	-0.03	0.01	-0.03	0.06	0.07	0.02	-0.03	-0.01	-0.03
ROTCE	1.00	-0.01	1.00	0.90	0.90	0.80	0.18	0.86	-0.15	-0.07	-0.07	0.73	0.60	0.24
RNOA	0.90	-0.03	0.90	1.00	0.93	0.94	0.27	0.92	-0.42	-0.28	-0.07	0.76	0.55	0.37
ROTA	0.90	-0.03	0.90	0.93	1.00	0.77	0.04	0.90	-0.32	-0.33	-0.05	0.73	0.62	0.24
RNOA-ROTA	0.80	-0.03	0.80	0.94	0.77	1.00	0.46	0.84	-0.45	-0.21	-0.05	0.70	0.43	0.46
OLLEV	0.18	0.01	0.18	0.27	0.04	0.46	1.00	0.13	-0.26	0.16	0.03	0.15	-0.24	0.61
OLSPREAD	0.86	-0.03	0.86	0.92	0.90	0.84	0.13	1.00	-0.36	-0.27	-0.12	0.74	0.66	0.21
FLEV	-0.15	0.06	-0.15	-0.42	-0.32	-0.45	-0.26	-0.36	1.00	0.81	0.25	-0.36	0.00	-0.39
DEBT/EQUITY	-0.07	0.07	-0.07	-0.28	-0.33	-0.21	0.16	-0.27	0.81	1.00	0.20	-0.27	-0.06	-0.14
NBC	-0.07	0.02	-0.07	-0.07	-0.05	-0.05	0.03	-0.12	0.25	0.20	1.00	-0.56	-0.13	0.04
SPREAD	0.73	-0.03	0.73	0.76	0.73	0.70	0.15	0.74	-0.36	-0.27	-0.56	1.00	0.50	0.24
PM	0.60	-0.01	0.60	0.55	0.62	0.43	-0.24	0.66	0.00	-0.06	-0.13	0.50	1.00	-0.43
ATO	0.24	-0.03	0.24	0.37	0.24	0.46	0.61	0.21	-0.39	-0.14	0.04	0.24	-0.43	1.00
Sales PM	0.60	-0.01	0.60	0.55	0.62	0.43	-0.24	0.66	0.00	-0.06	-0.13	0.50	0.99	-0.42
Core Sal. PM	0.54	-0.02	0.54	0.48	0.57	0.35	-0.23	0.59	0.01	-0.06	-0.14	0.44	0.90	-0.42
Other / NOA	0.07	0.02	0.07	0.07	0.07	0.07	0.04	0.06	0.01	0.03	0.04	0.03	0.09	-0.03
UOI/NOA	0.30	0.00	0.30	0.35	0.28	0.37	0.02	0.33	-0.11	-0.05	-0.03	0.27	0.33	0.01
Core RNOA	0.82	-0.04	0.82	0.91	0.86	0.84	0.28	0.84	-0.41	-0.28	-0.07	0.69	0.46	0.40
Core NBC	-0.07	0.02	-0.07	-0.07	-0.05	-0.05	0.03	-0.12	0.25	0.21	0.99	-0.55	-0.13	0.04
UFE/NFO	0.00	-0.01	0.00	0.00	0.00	0.00	-0.01	0.01	0.00	0.00	0.08	-0.05	0.01	0.00
Core SPREAD	0.64	-0.03	0.64	0.68	0.65	0.61	0.16	0.66	-0.36	-0.28	-0.58	0.93	0.42	0.24
Growth in RE	0.48	0.01	0.48	0.42	0.41	0.39	0.07	0.47	-0.04	0.00	-0.03	0.35	0.30	0.09
Growth in ReOI	0.45	-0.01	0.45	0.46	0.42	0.44	0.12	0.50	-0.13	-0.06	-0.02	0.35	0.28	0.14
Growth in CSE	0.58	-0.01	0.58	0.55	0.57	0.48	0.01	0.52	-0.14	-0.11	-0.03	0.44	0.38	0.13
Growth in NOA	0.29	-0.02	0.29	0.27	0.31	0.22	-0.09	0.25	-0.04	-0.08	0.00	0.22	0.21	0.03
FCF/NOA	0.13	0	0.13	0.19	0.15	0.21	0.15	0.17	-0.13	-0.06	-0.04	0.15	0.09	0.11

Table 2 (continued)

	Sales PM	Core Sales PM	Other / NOA	UOI / NOA	Core RNOA	Core NBC	UFE / NFO	Core SPREAD	Growth in RE	Growth in ReOI	Growth in CSE	Growth in NOA	FCF/ NOA
ROCE	0.60	0.54	0.07	0.30	0.82	-0.07	0.00	0.64	0.48	0.45	0.58	0.29	0.13
MSR	-0.01	-0.02	0.02	0.00	-0.04	0.02	-0.01	-0.03	0.01	-0.01	-0.01	-0.02	0
ROTCE	0.60	0.54	0.07	0.30	0.82	-0.07	0.00	0.64	0.48	0.45	0.58	0.29	0.13
RNOA	0.55	0.48	0.07	0.35	0.91	-0.07	0.00	0.68	0.42	0.46	0.55	0.27	0.19
ROTA	0.62	0.57	0.07	0.28	0.86	-0.05	0.00	0.65	0.41	0.42	0.57	0.31	0.15
RNOA-ROTA	0.43	0.35	0.07	0.37	0.84	-0.05	0.00	0.61	0.39	0.44	0.48	0.22	0.21
OLLEV	-0.24	-0.23	0.04	0.02	0.28	0.03	-0.01	0.16	0.07	0.12	0.01	-0.09	0.15
OLSPREAD	0.66	0.59	0.06	0.33	0.84	-0.12	0.01	0.66	0.47	0.50	0.52	0.25	0.17
FLEV	0.00	0.01	0.01	-0.11	-0.41	0.25	0.00	-0.36	-0.04	-0.13	-0.14	-0.04	-0.13
DEBT/EQUITY	-0.06	-0.06	0.03	-0.05	-0.28	0.21	0.00	-0.28	0.00	-0.06	-0.11	-0.08	-0.06
NBC	-0.13	-0.14	0.04	-0.03	-0.07	0.99	0.08	-0.58	-0.03	-0.02	-0.03	0.00	-0.04
SPREAD	0.50	0.44	0.03	0.27	0.69	-0.55	-0.05	0.93	0.35	0.35	0.44	0.22	0.15
PM	0.99	0.90	0.09	0.33	0.46	-0.13	0.01	0.42	0.30	0.28	0.38	0.21	0.09
ATO	-0.42	-0.42	-0.03	0.01	0.40	0.04	0.00	0.24	0.09	0.14	0.13	0.03	0.11
Sales PM	1.00	0.91	0.02	0.33	0.46	-0.13	0.01	0.42	0.30	0.28	0.38	0.21	0.09
Core Sales PM	0.91	1.00	0.01	0.07	0.54	-0.14	0.01	0.48	0.22	0.20	0.35	0.20	0.08
Other / NOA	0.02	0.01	1.00	0.03	0.08	0.04	0.00	0.03	0.03	0.03	0.03	0.01	0.02
UOI/NOA	0.33	0.07	0.03	1.00	0.07	-0.03	0.01	0.05	0.24	0.24	0.19	0.10	0.05
Core RNOA	0.46	0.54	0.08	0.07	1.00	-0.07	0.00	0.75	0.34	0.37	0.52	0.26	0.18
Core NBC	-0.13	-0.14	0.04	-0.03	-0.07	1.00	0.00	-0.58	-0.03	-0.02	-0.03	0.00	-0.04
UFE/NFO	0.01	0.01	0.00	0.01	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
Core SPREAD	0.42	0.48	0.03	0.05	0.75	-0.58	0.00	1.00	0.26	0.27	0.40	0.21	0.14
Growth in RE	0.30	0.22	0.03	0.24	0.34	-0.03	0.00	0.26	1.00	0.86	0.14	-0.06	0.16
Growth in ReOI	0.28	0.20	0.03	0.24	0.37	-0.02	0.00	0.27	0.86	1.00	0.13	-0.13	0.12
Growth in CSE	0.38	0.35	0.03	0.19	0.52	-0.03	0.00	0.40	0.14	0.13	1.00	0.56	-0.20
Growth in NOA	0.21	0.20	0.01	0.10	0.26	0.00	0.00	0.21	-0.06	-0.13	0.56	1.00	-0.60
FCF/NOA	0.09	0.08	0.02	0.05	0.18	-0.04	0.00	0.14	0.16	0.12	-0.20	-0.60	1.00

All correlations are at the firm level using the pooled data for 1963-1996.

Table 3
Summary Measures for the Evolution of Ratios

Year t Relative to Base Year		1	2	3	4	5
RE	$corr_t$	0.565	0.359	0.246	0.196	0.179
	var_t/var_0	0.409	0.226	0.139	0.114	0.106
ReOI	$corr_t$	0.636	0.432	0.314	0.260	0.242
	var_t/var_0	0.655	0.479	0.434	0.444	0.342
FLEV	$corr_t$	0.939	0.849	0.783	0.736	0.701
	var_t/var_0	0.906	0.763	0.653	0.584	0.531
ROCE	$corr_t$	0.623	0.424	0.306	0.247	0.227
	var_t/var_0	0.330	0.153	0.072	0.053	0.048
RNOA	$corr_t$	0.668	0.483	0.372	0.315	0.296
	var_t/var_0	0.515	0.288	0.183	0.146	0.102
Growth in CSE	$corr_t$	0.663	0.313	0.191	0.129	0.105
	var_t/var_0	0.503	0.090	0.043	0.025	0.013
Growth in NOA	$corr_t$	0.583	0.162	0.066	0.044	0.047
	var_t/var_0	0.381	0.038	0.019	0.007	0.005
Core Sales PM	$corr_t$	0.836	0.732	0.672	0.637	0.616
	var_t/var_0	0.790	0.683	0.616	0.552	0.538
Other Core Items/NOA	$corr_t$	0.736	0.582	0.480	0.417	0.371
	var_t/var_0	0.590	0.390	0.283	0.188	0.137
Unusual Items/NOA	$corr_t$	0.404	0.304	0.244	0.221	0.197
	var_t/var_0	0.149	0.075	0.035	0.032	0.028
ATO	$corr_t$	0.946	0.892	0.855	0.827	0.805
	var_t/var_0	0.914	0.853	0.770	0.682	0.641
Growth in Sales	$corr_t$	0.309	0.111	0.098	0.098	0.108
	var_t/var_0	0.083	0.015	0.008	0.007	0.013
ΔCore Sales PM	$corr_t$	-0.043	-0.082	-0.052	-0.039	-0.010
	var_t/var_0	0.031	0.008	0.007	0.004	0.001
ΔATO	$corr_t$	0.161	-0.105	-0.086	-0.038	-0.005
	var_t/var_0	0.022	0.017	0.008	0.010	0.005

$Corr_t$ is the Spearman rank correlation between each ratio and its t-lagged value calculated using all firm-year observations (1963-1996). The variance ratio is based on the portfolio analysis. This analysis is done by forming ten portfolios from a ranking on a ratio in a base year, and calculating the median ratio for each portfolio in the base year and each of the subsequent five years. (The base years are 1965, 1970, 1975, 1980, 1985 and 1990.) Next, means of portfolios' medians over the six replications are calculated (Figures 3a-6c plot these means). var_t is the variance of the mean of portfolios' medians in year t. Thus, var_t/var_0 measures the speed of mean reversion.

Table 4
Percentage Survivorship Rates for Residual Earnings Portfolios

Year t Relative to Base Year:	1	2	3	4	5
Panel A: Percentage survivorship rates					
Portfolio:					
10 (high RE)	97.63	95.56	93.93	90.96	88.58
9	97.28	95.51	92.98	90.24	88.14
8	97.48	95.61	94.00	91.51	89.67
7	97.83	95.07	92.03	89.57	86.89
6	97.97	95.40	92.99	90.41	87.57
5	97.57	95.57	93.40	90.69	88.69
4	98.00	95.30	92.90	89.36	87.33
3	97.74	95.16	92.01	89.10	86.16
2	96.38	93.64	89.95	85.34	80.69
1 (low RE)	95.38	90.99	86.59	82.55	78.69
Panel B: Percentage of terminations due to merger or exchange					
Portfolio:					
10 (high RE)	77.27	81.40	81.97	83.91	84.40
9	100.00	97.78	95.83	94.06	94.17
8	96.15	97.73	98.33	96.43	94.23
7	100.00	97.83	96.20	95.24	94.82
6	85.00	82.61	87.50	87.13	87.02
5	88.46	88.00	88.41	91.67	92.31
4	95.46	92.16	94.81	90.44	90.58
3	87.50	94.00	92.86	88.70	87.41
2	93.10	96.00	96.39	89.60	90.12
1 (low RE)	72.50	74.68	76.07	75.00	75.26

Panel A reports average (over the six replications: 1965-1970, ..., 1990-1995) of the percentage of firms in each of the 10 residual earnings (RE) portfolios that survived in the respective year after the base year.

The main four reasons for non-surviving are mergers, exchange of stock, liquidation and delisting. Panel B gives the percentage of non-surviving firms that terminated due to a merger or exchange.

Figure 1a: Median ROCE, One-year Treasury Rate and the Assumed Cost of Equity Capital
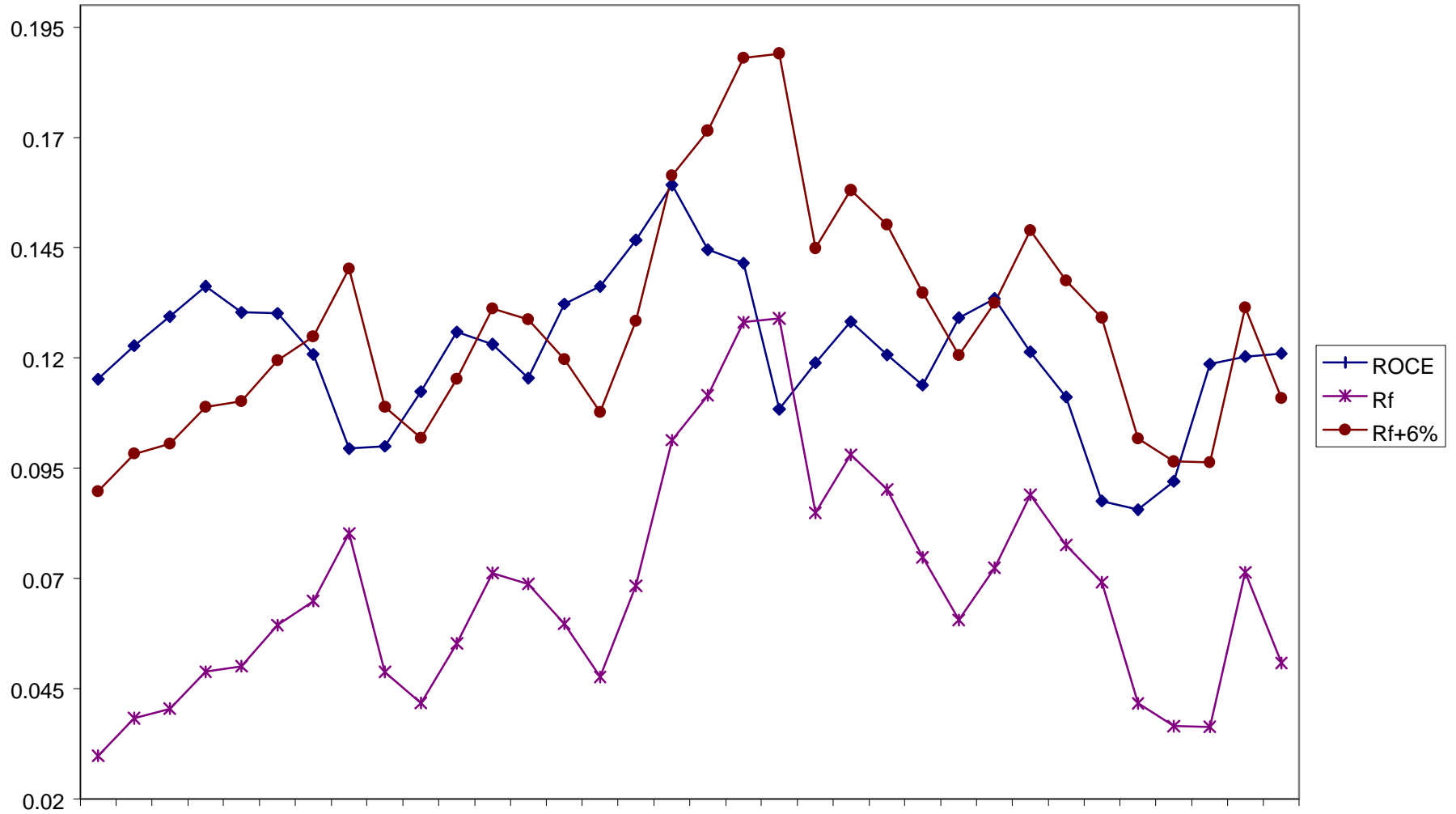
Figure 1b: Median ROCE, RNOA and NBC Over Time
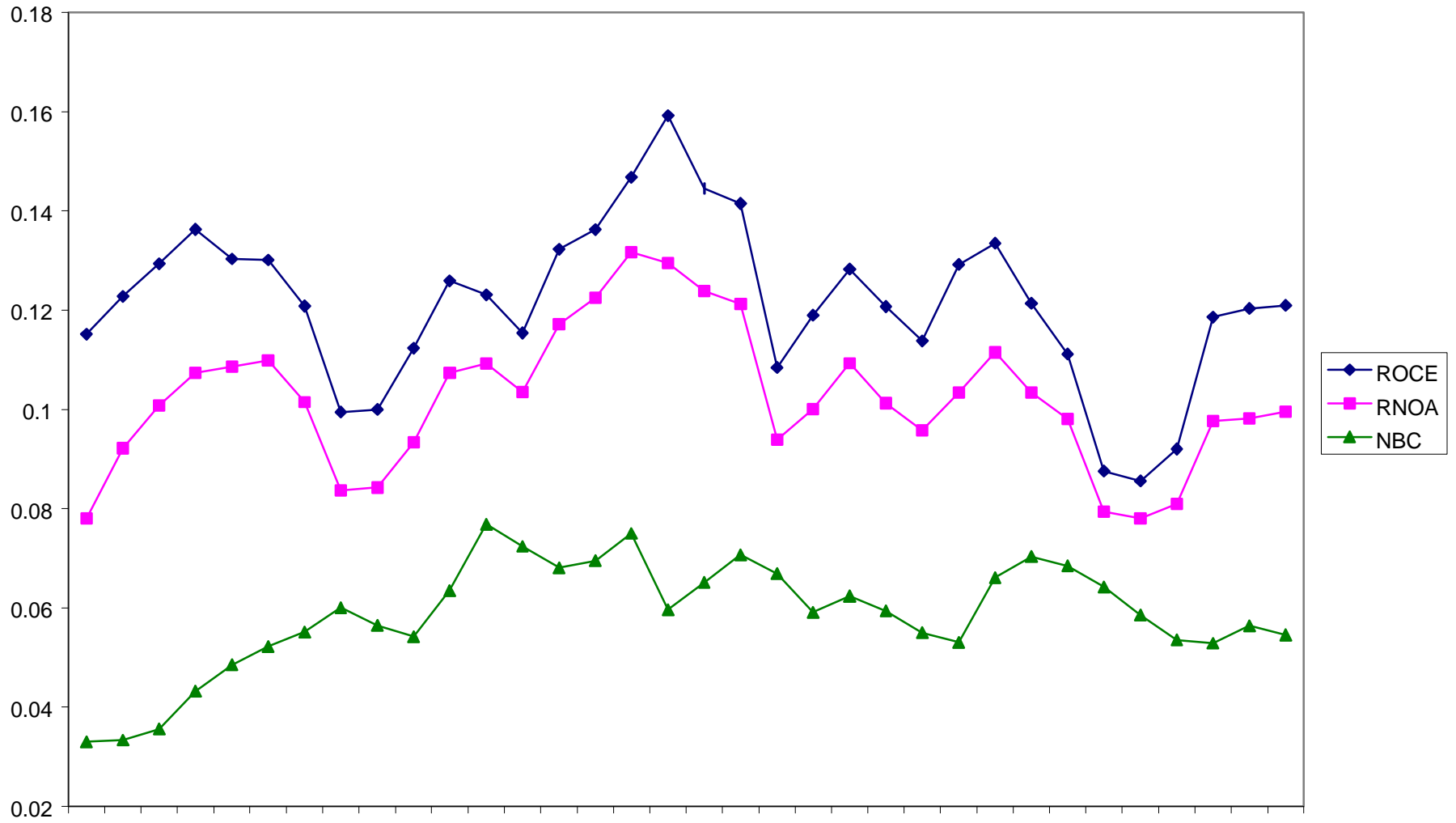
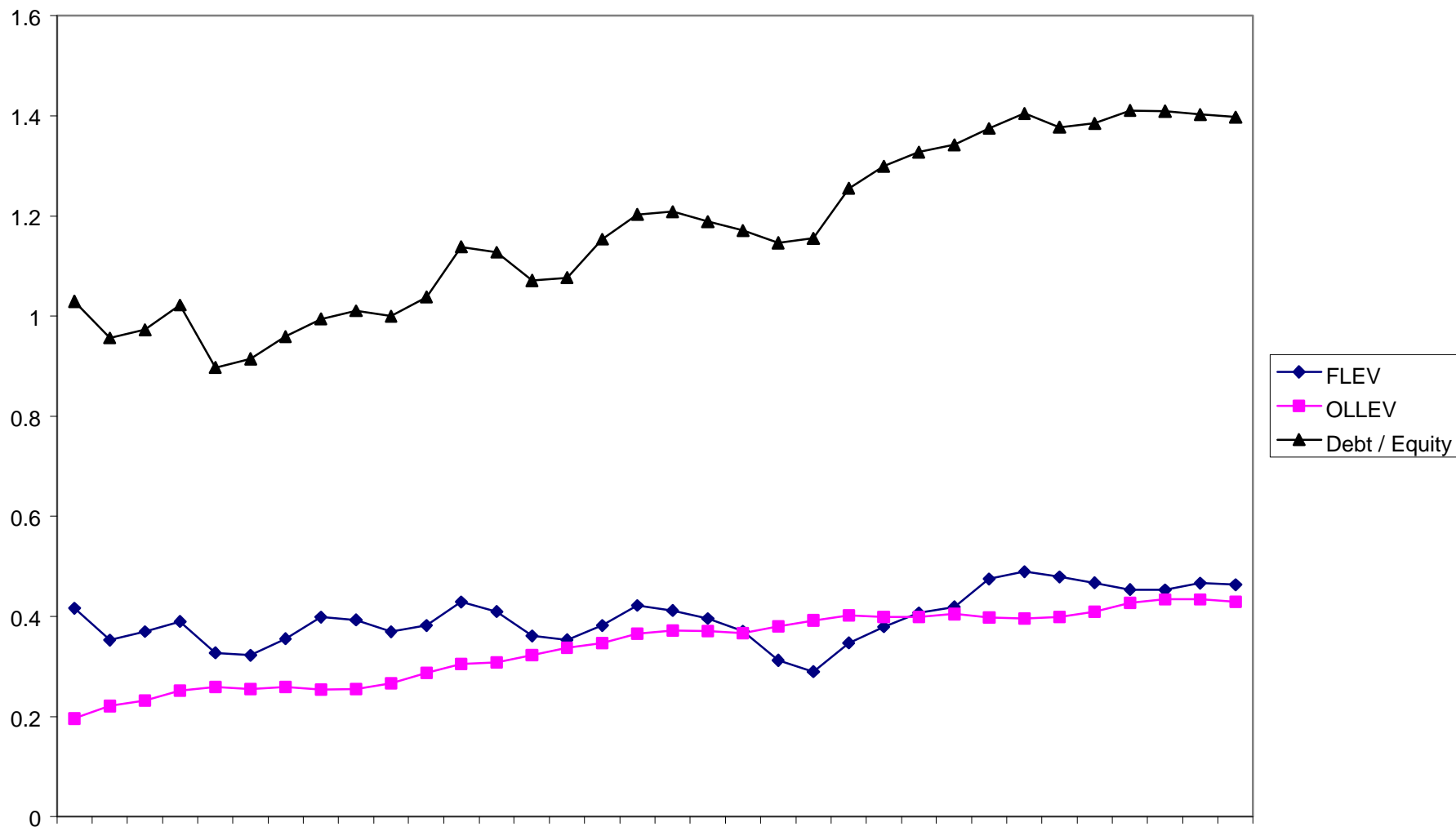**Figure 1c: Median FLEV, OLLEV and Debt/Equity Over Time**
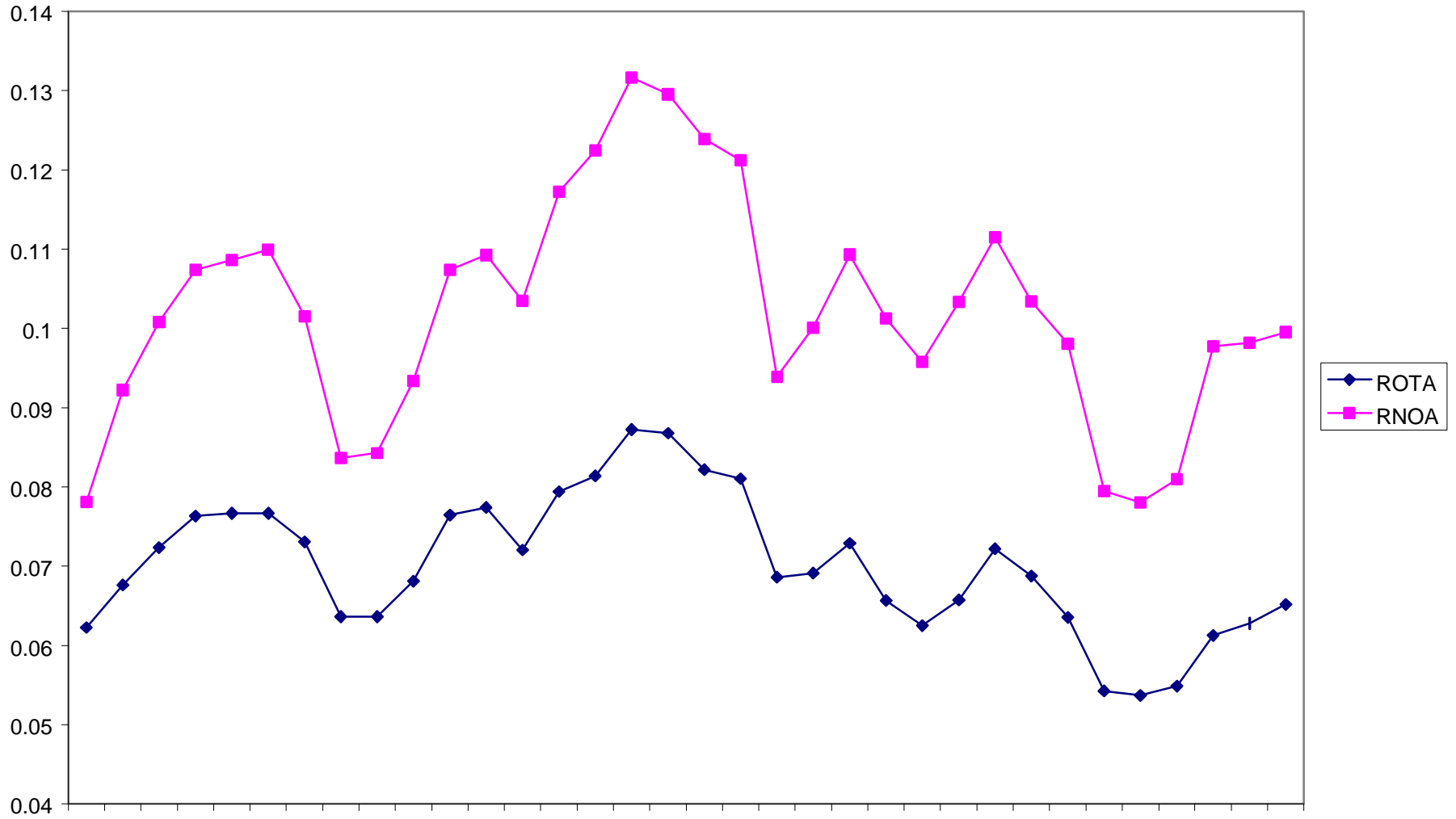
Figure1d: Median ROTA and RNOA Over Time
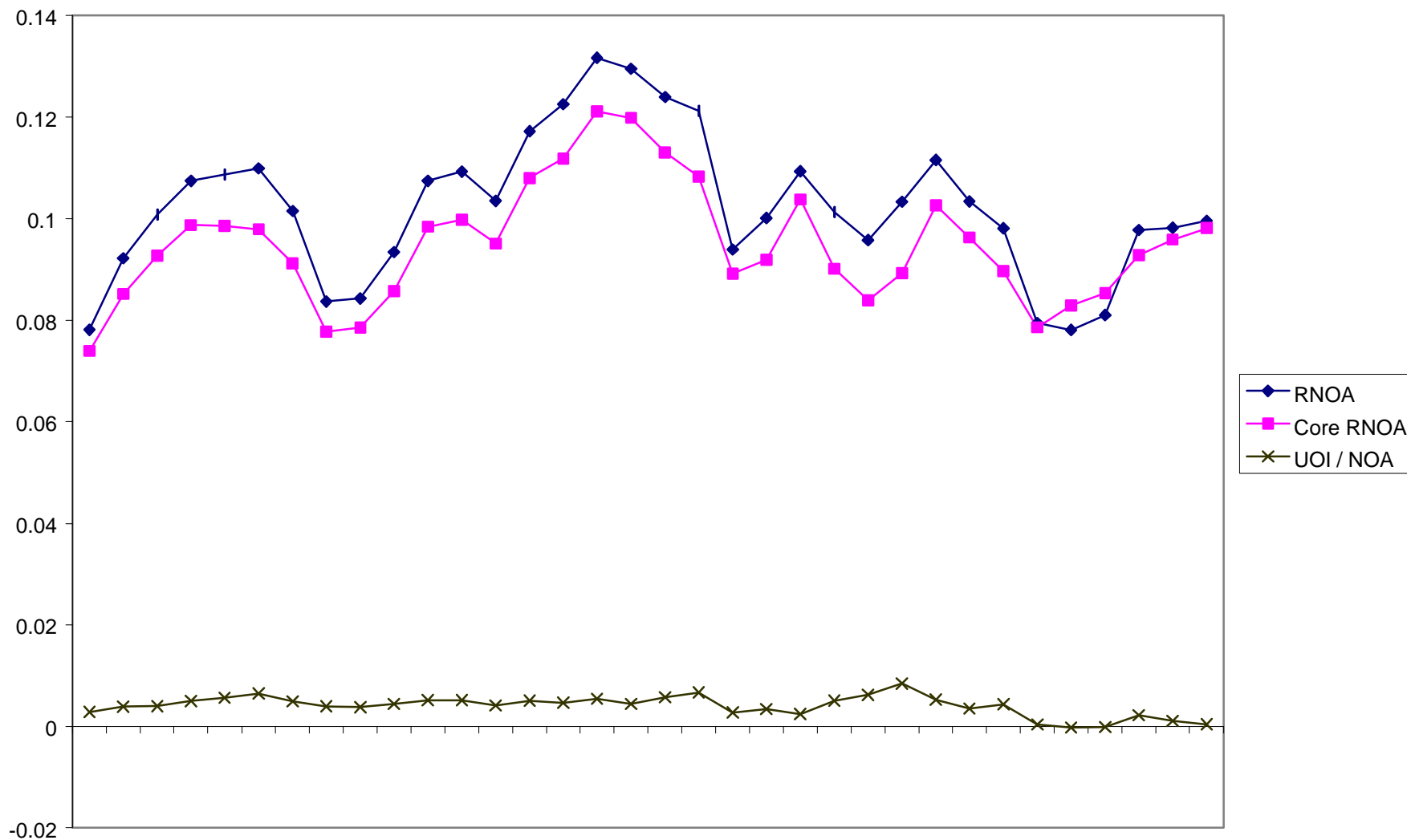
Figure 1e: Median RNOA and Its Components Over Time
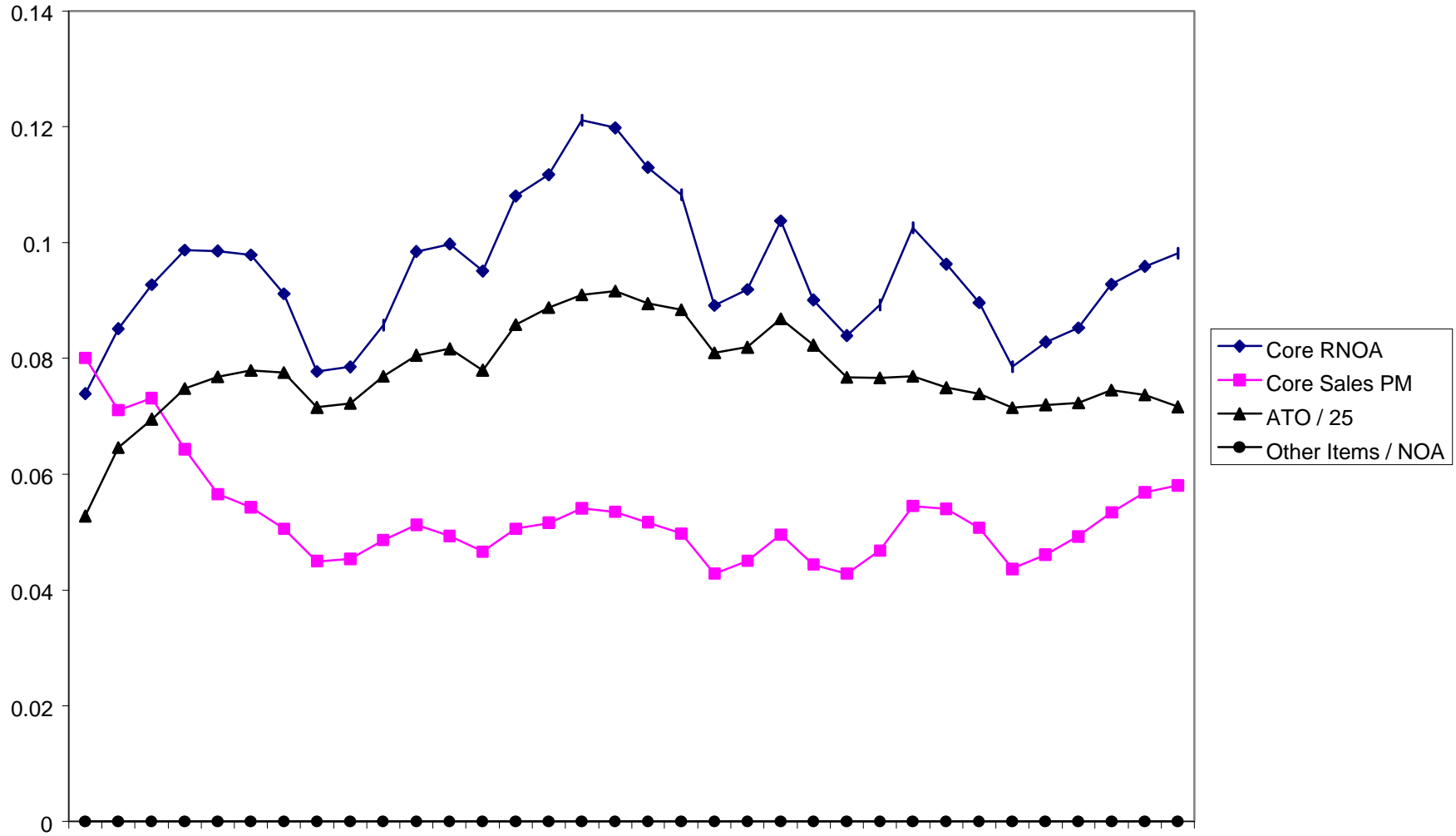
Figure 1f: Median Core RNOA and Its Components Over Time

Legend:
- Core RNOA
- Core Sales PM
- ATO / 25
- Other Items / NOA

Figure 2a: Median FLEV on Median SPREAD

Figure 2b: Median OLLEV on Median OLSPREAD
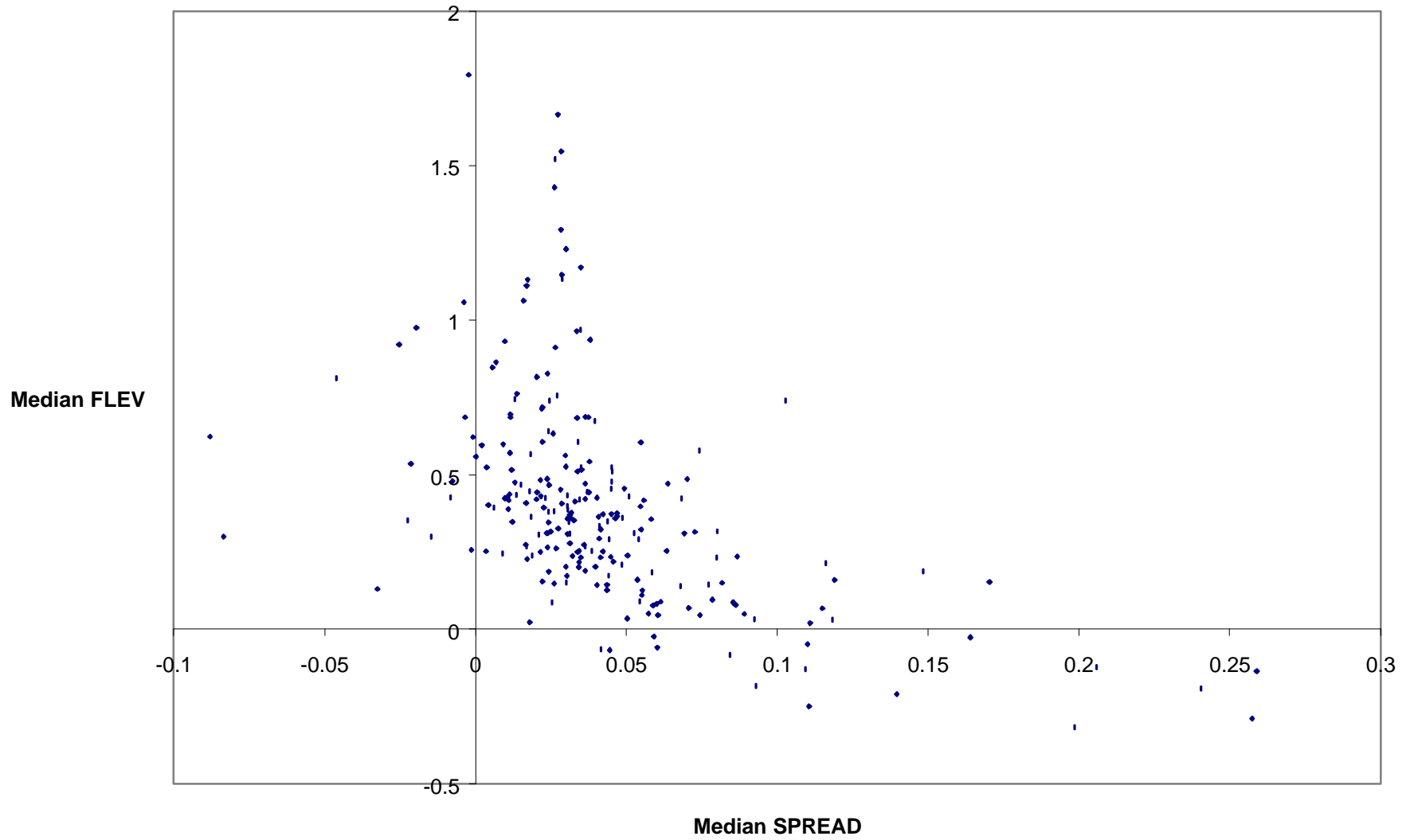
Figure 2c: Median Core Sales PM on Median ATO
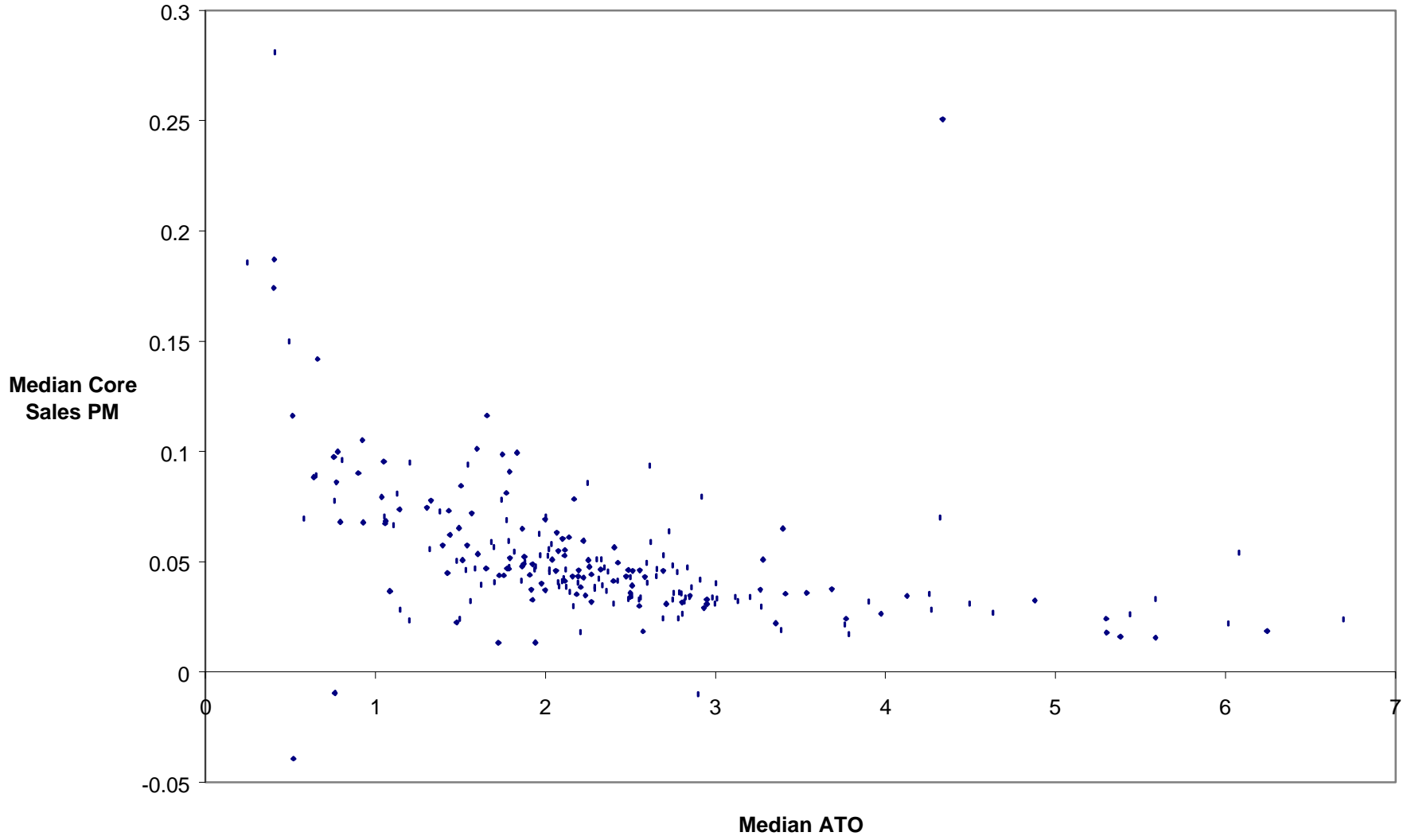
Figure 2d: Median RNOA on Median Growth in NOA
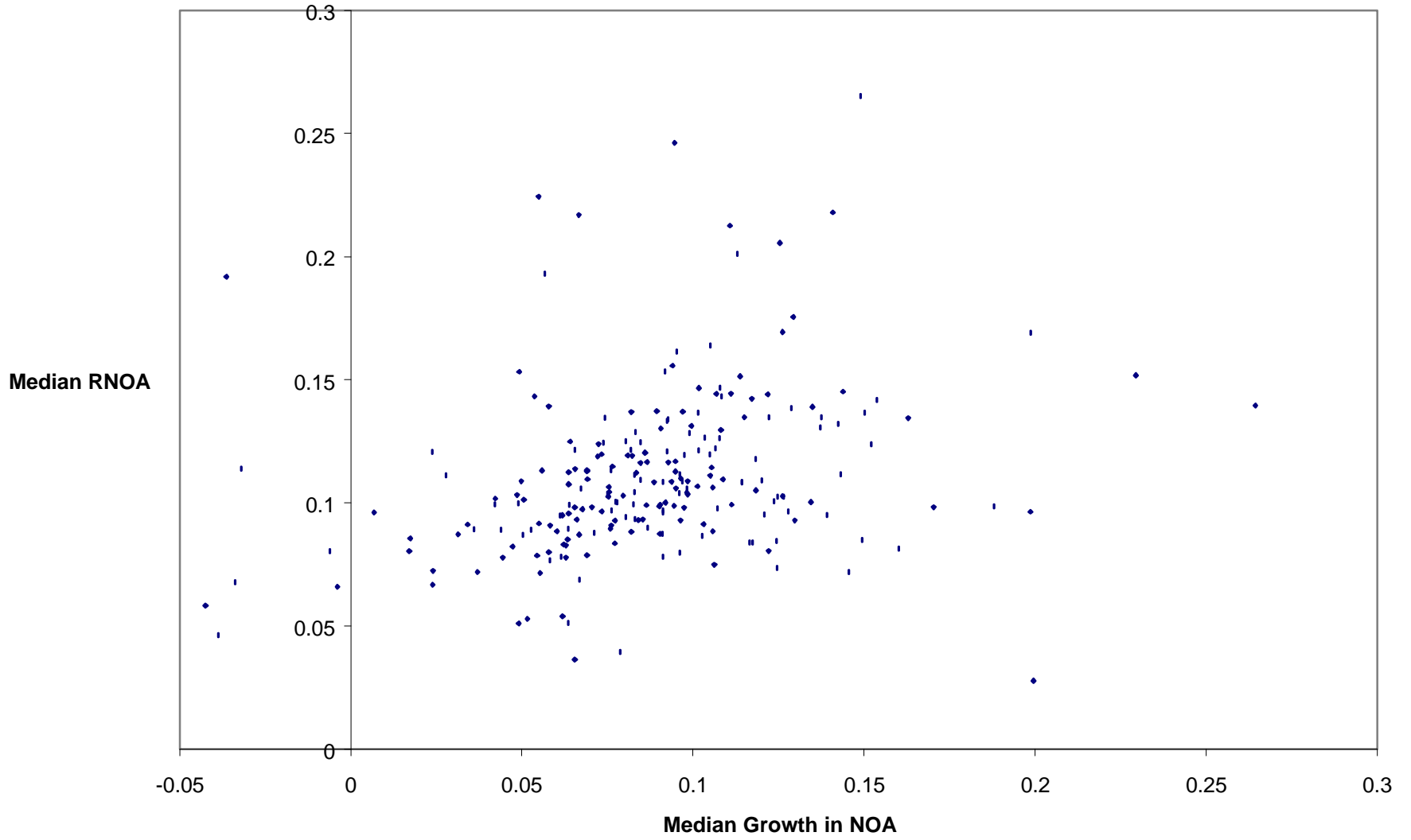
Figure 3a: Evolution of RE Over Time

RE Deflated by CSE in Year 0

Year Relative To Portfolio Formation Year
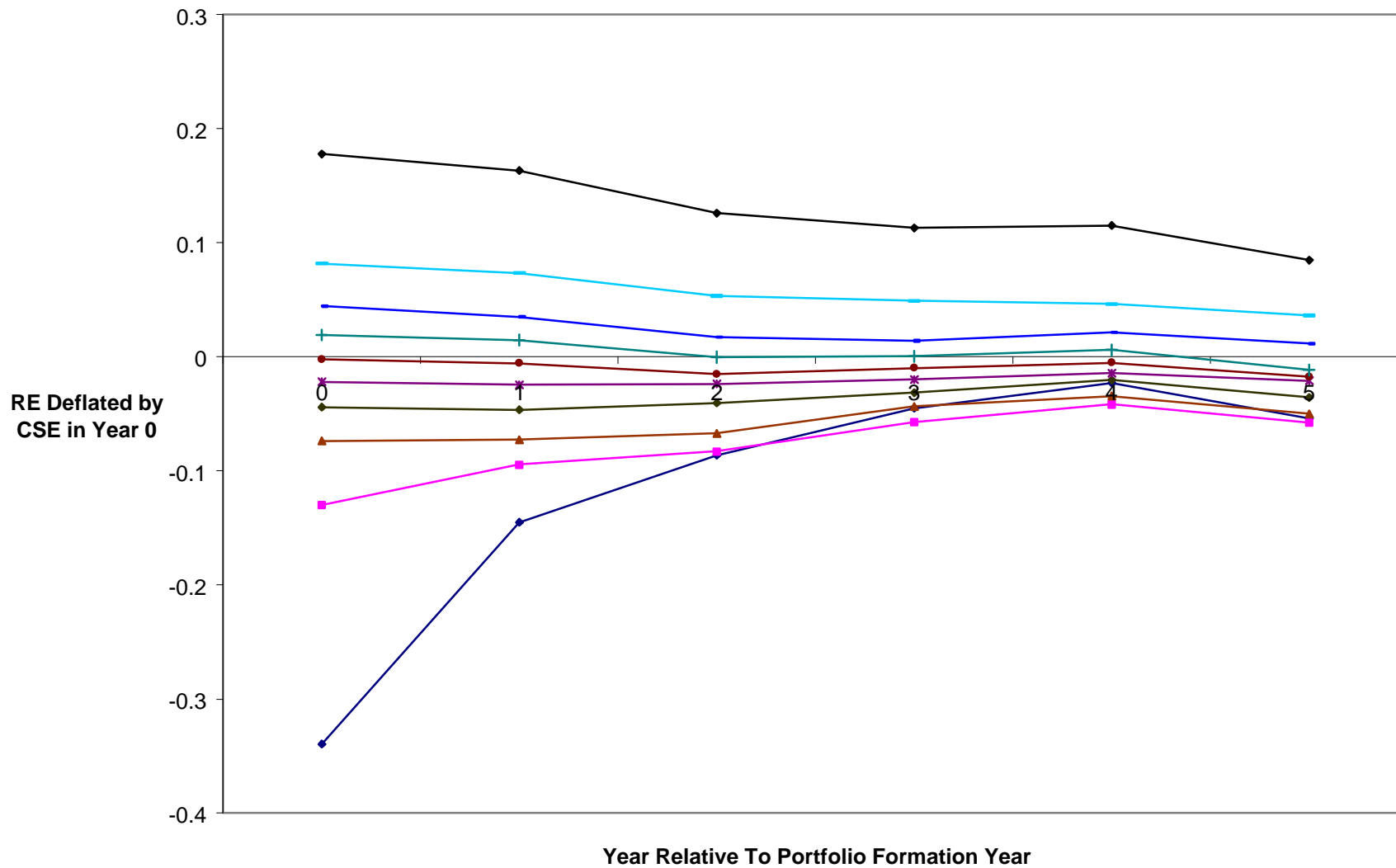
Figure 3b: Evolution of ReOI Over Time

ReOI Deflated by
NOA in Year 0

Year Relative To Portfolio Formation Year
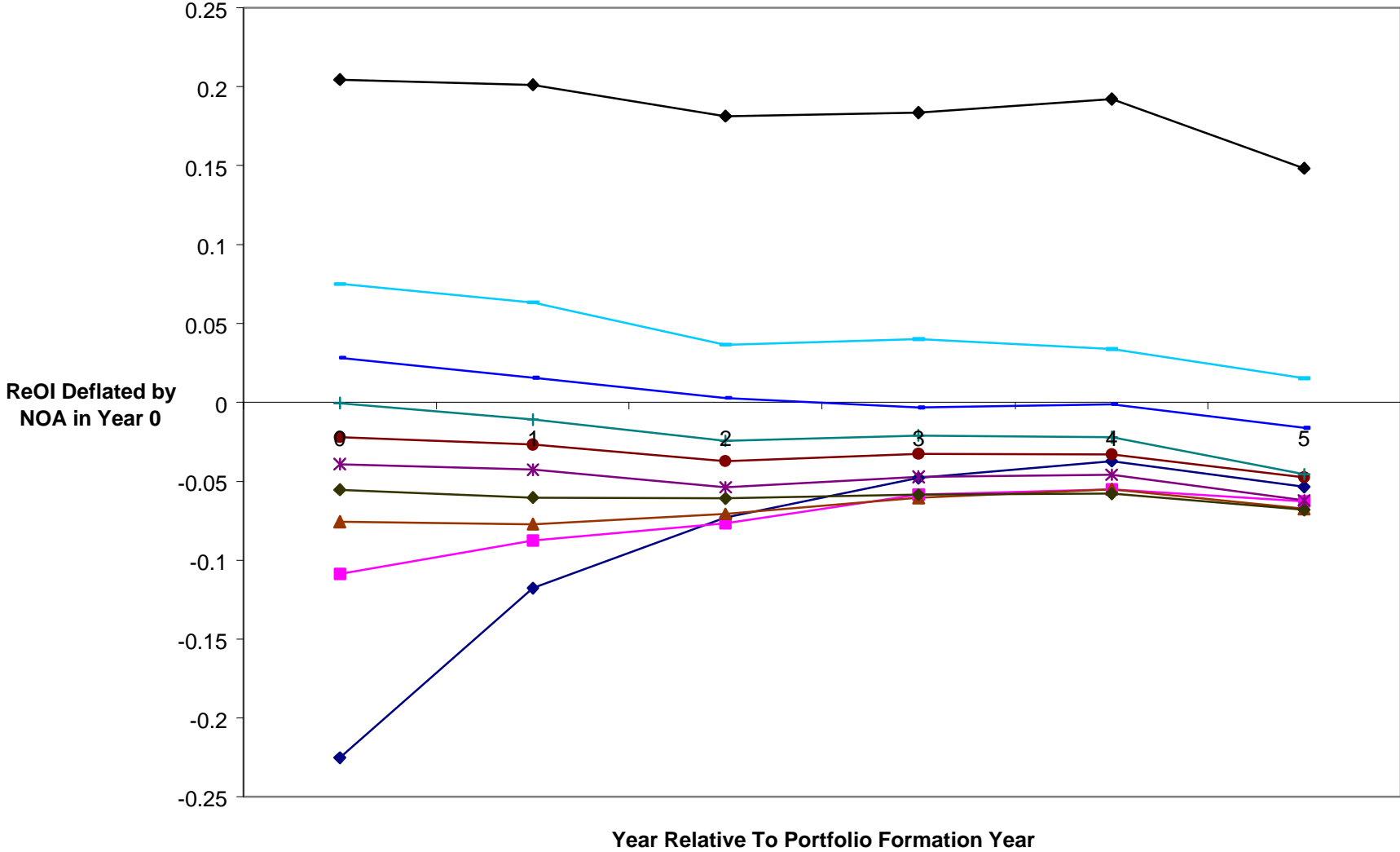
Figure 3c: Evolution of FLEV Over Time

FLEV

Year Relative To Portfolio Formation Year
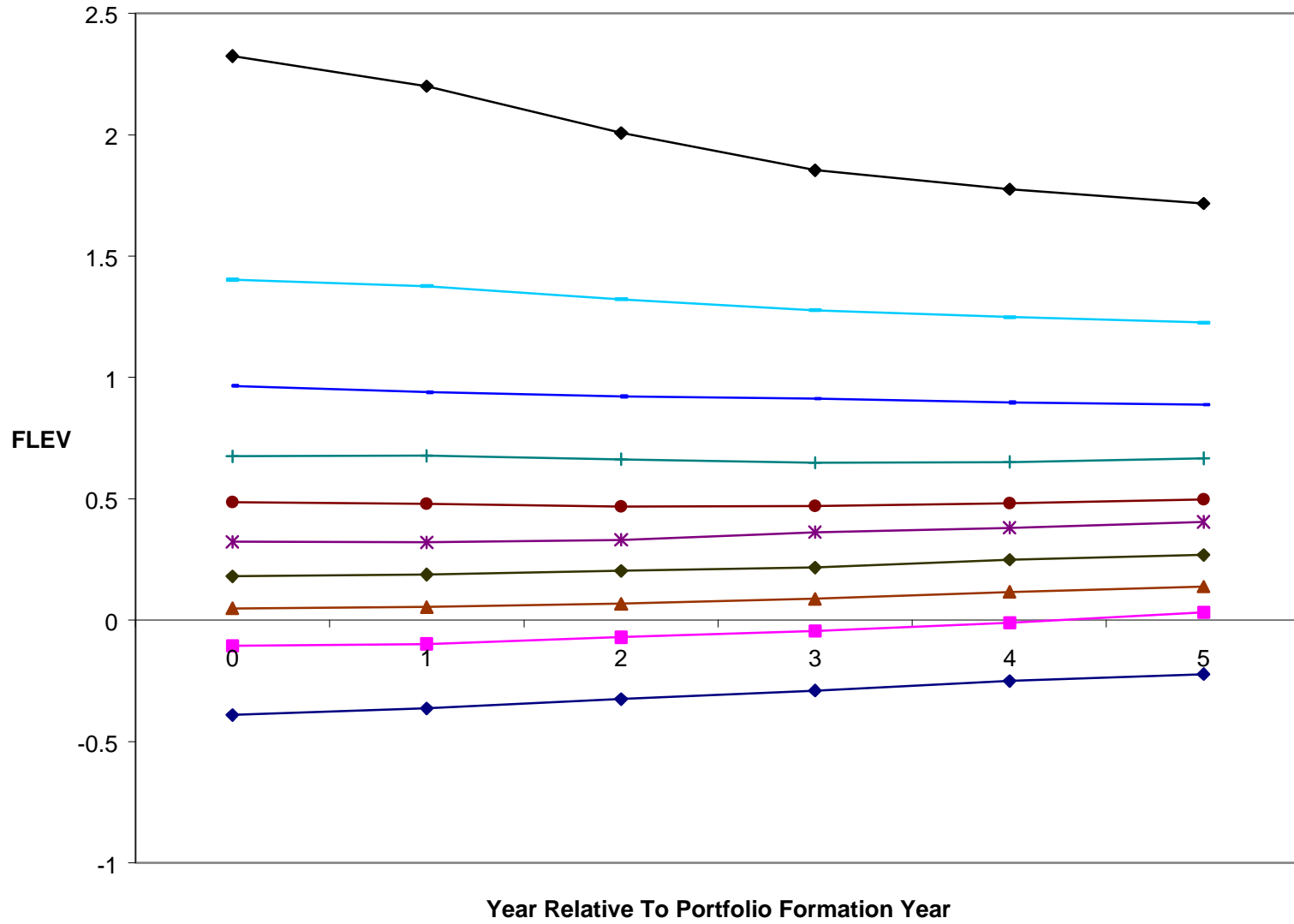
Figure 4a: Evolution of ROCE Over Time
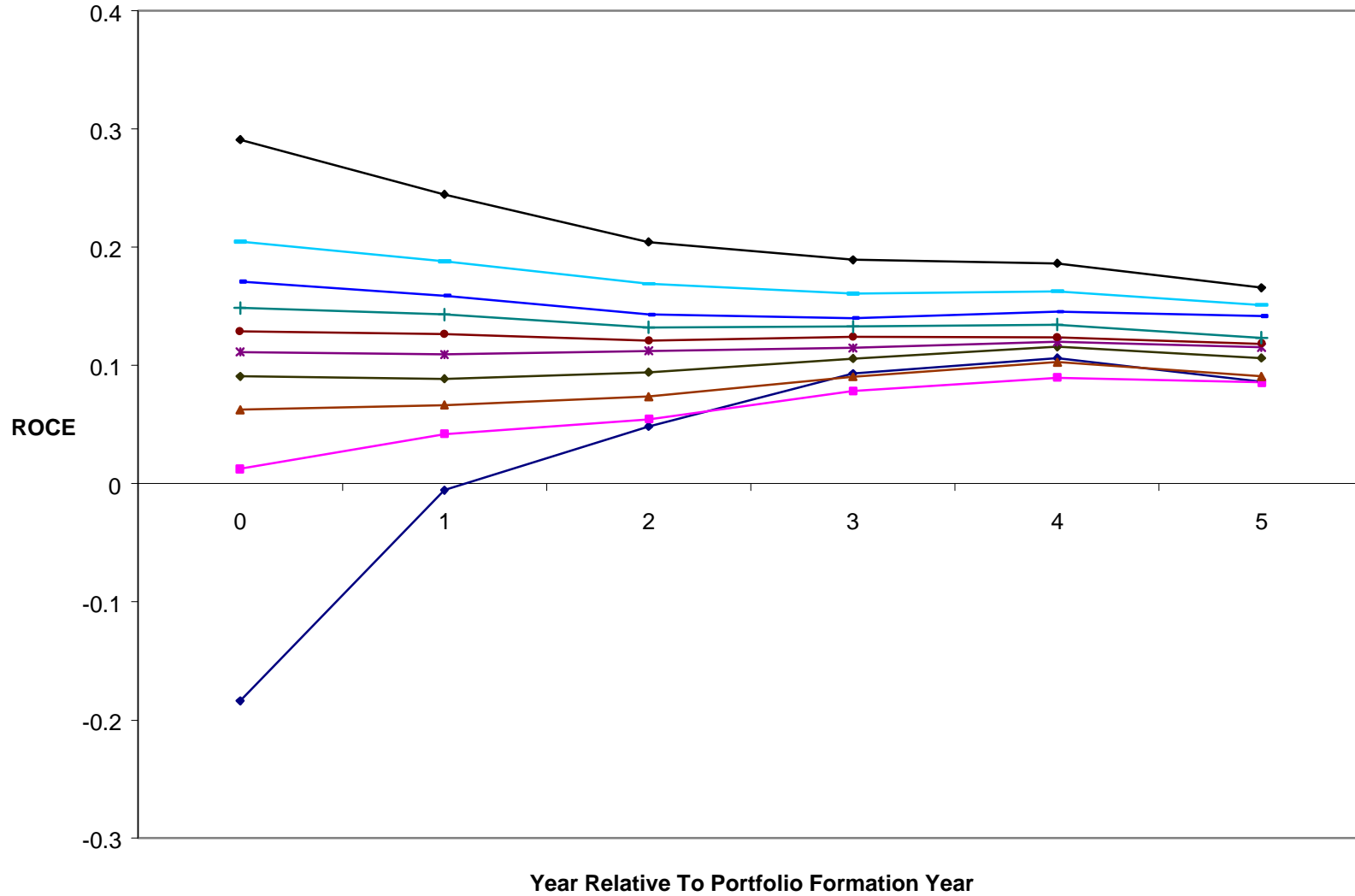
Figure 4b: Evolution of RNOA Over Time

RNOA

Year Relative To Portfolio Formation Year
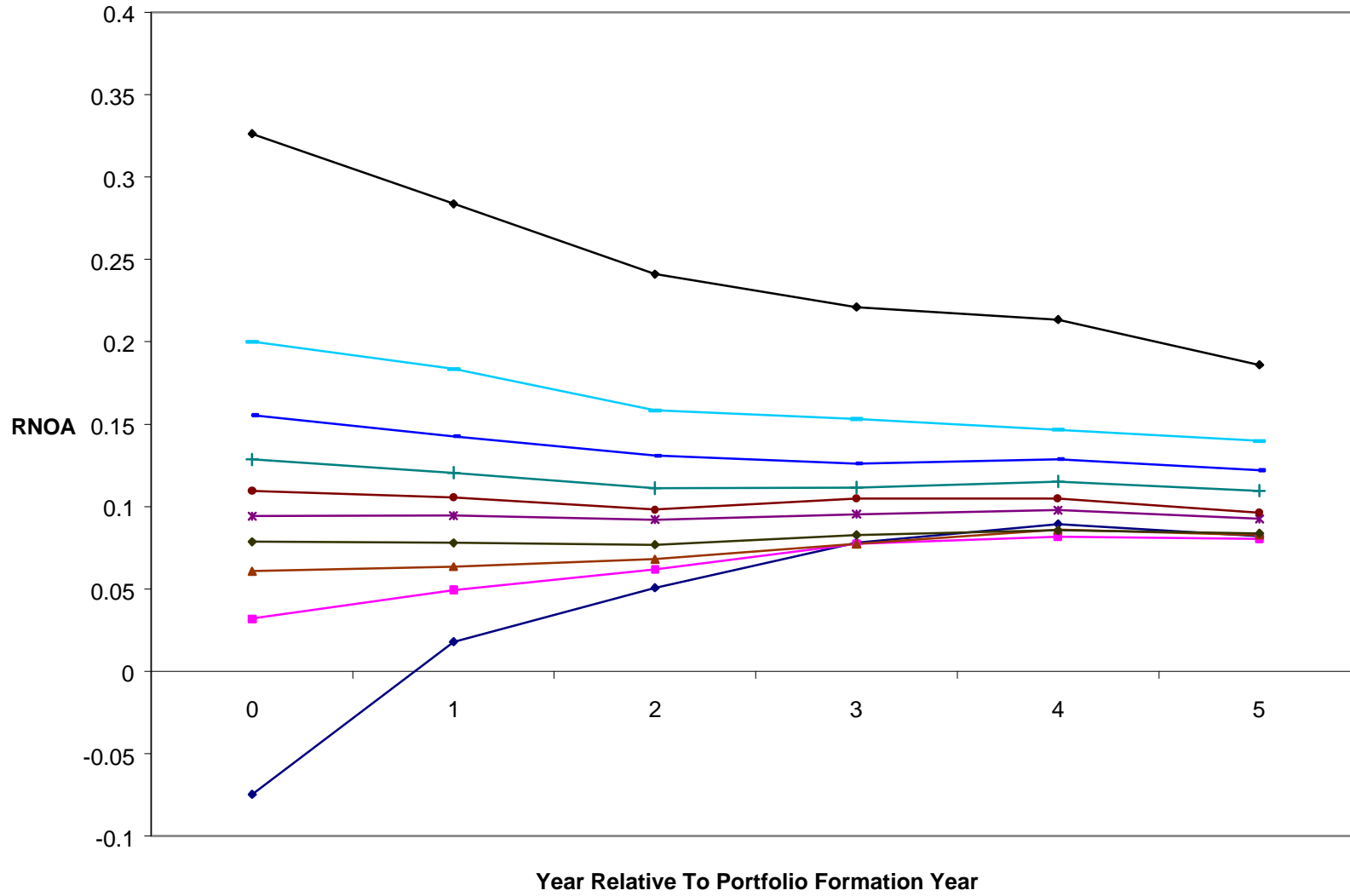
Figure 4c: Evolution of Growth in CSE Over Time

Figure 4d: Evolution of Growth in NOA Over Time

Growth in NOA

Year Relative To Portfolio Formation Year
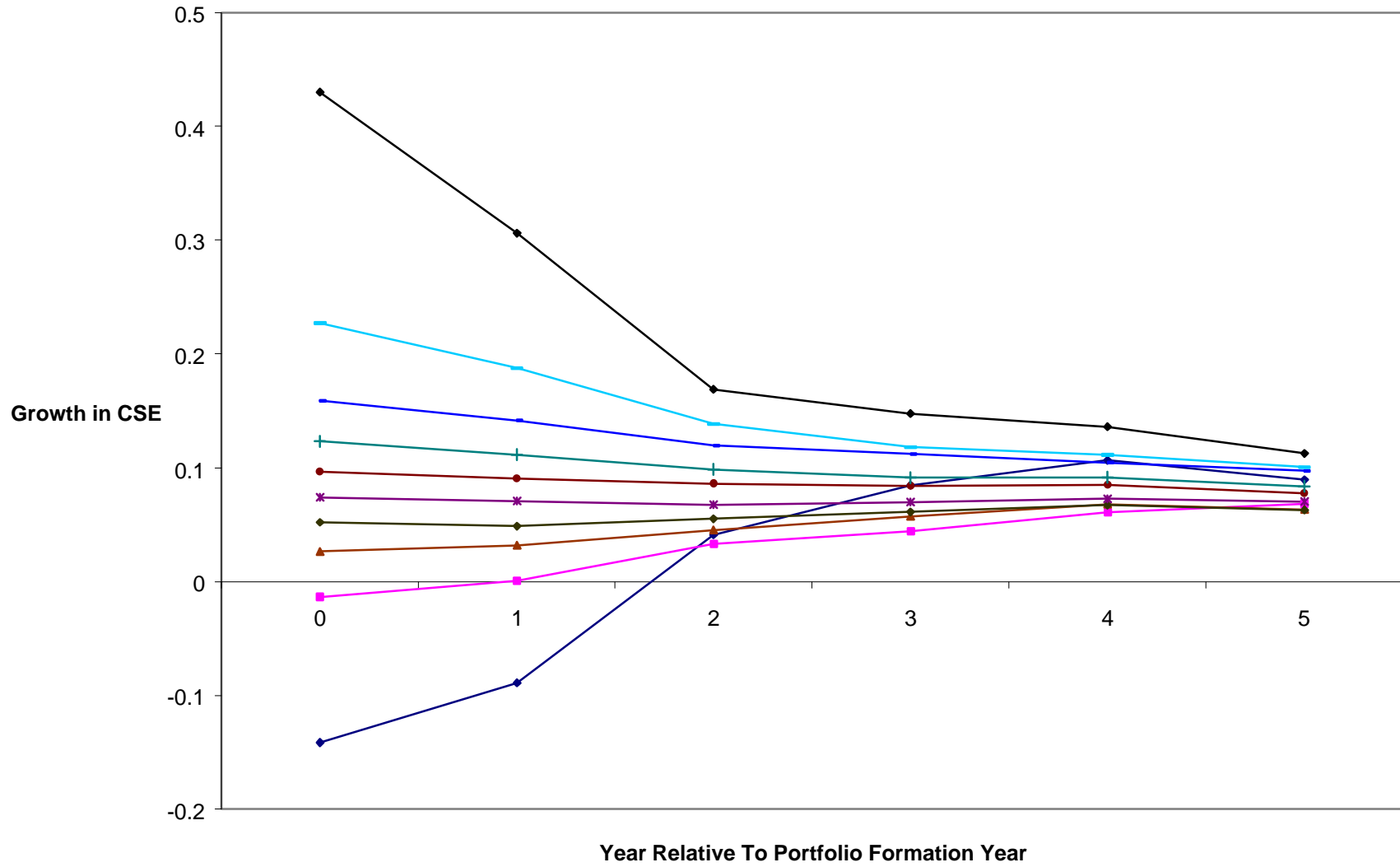
Figure 5a: Evolution of Core Sales PM Over Time

Core Sales PM

Year Relative To Portfolio Formation Year
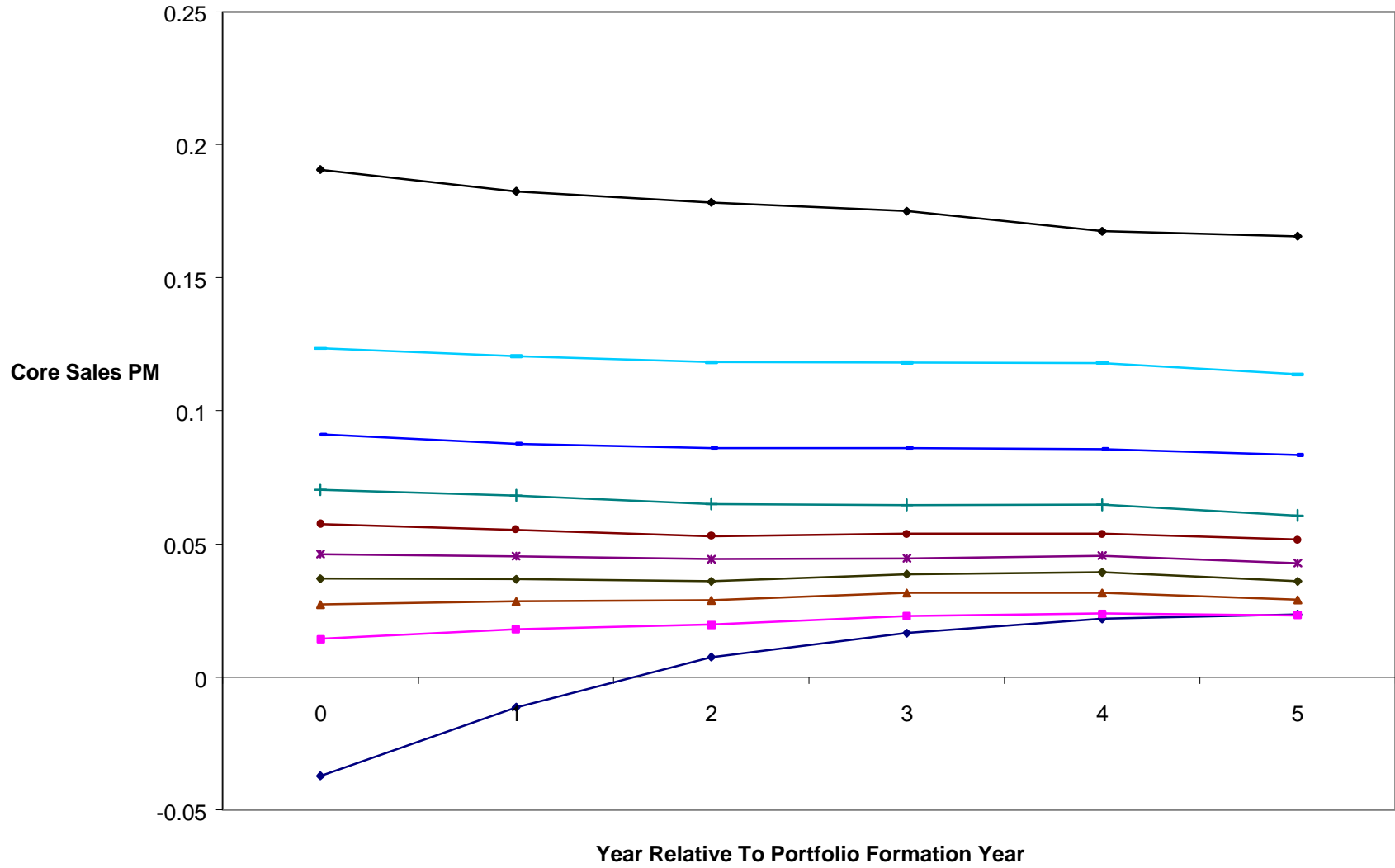
Figure 5b: Evolution of Other Core Items/NOA Over Time

Other Core Items/ NOA

Year Relative To Portfolio Formation Year

Figure 5c: Evolution of UOI/NOA Over Time
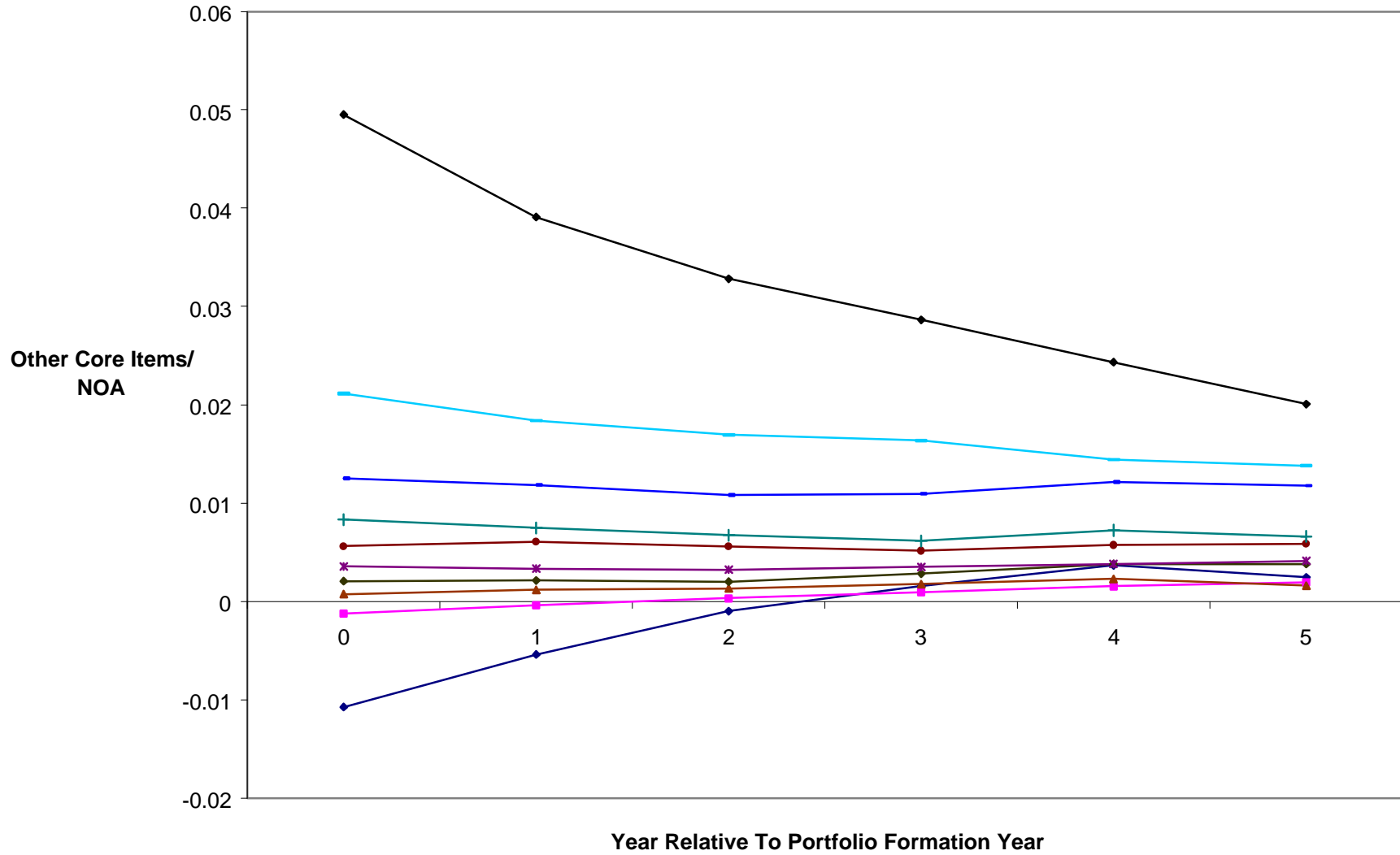
UOI/NOA

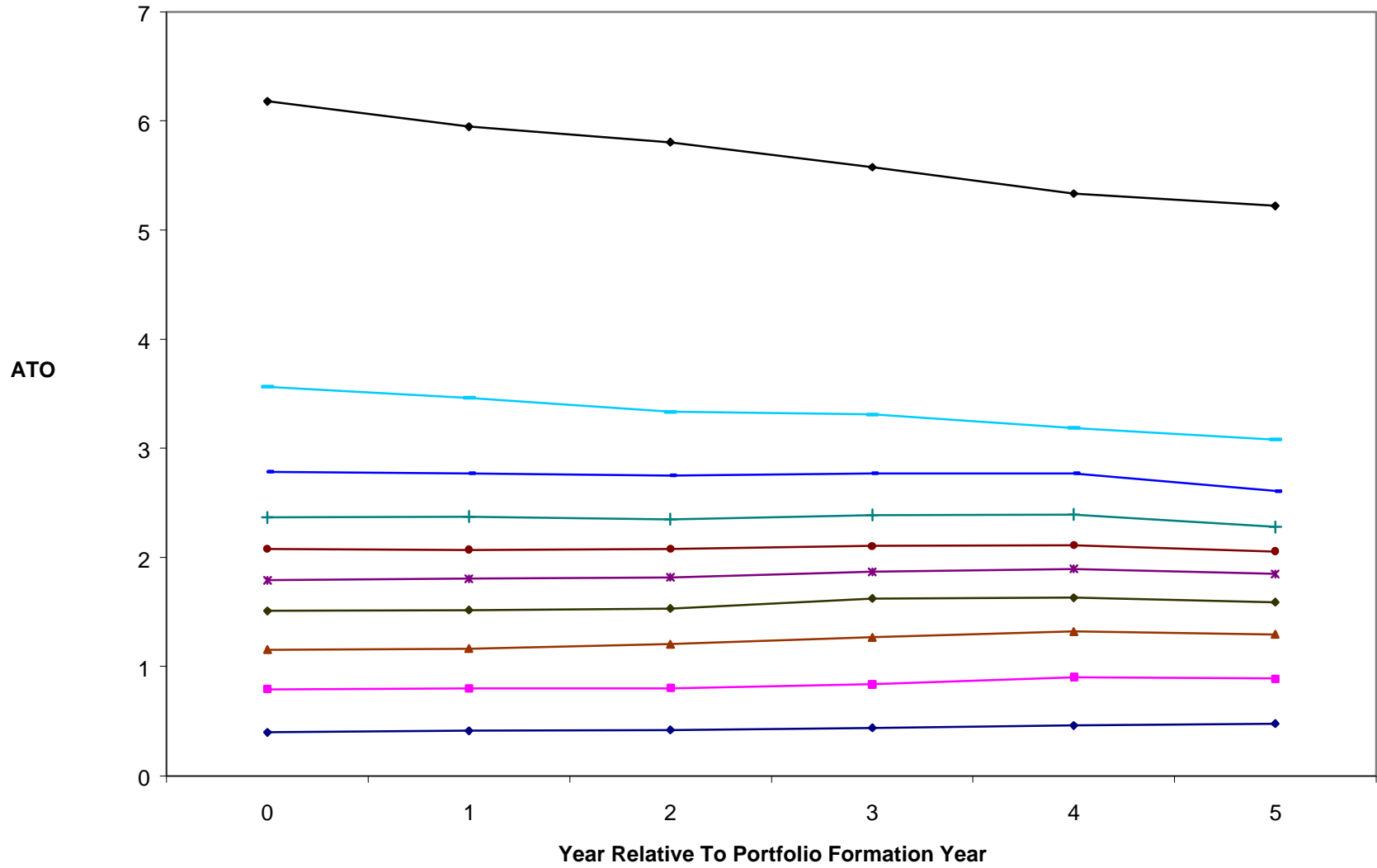Year Relative To Portfolio Formation Year

Figure 5d: Evolution of ATO Over Time

Figure 6a: Evolution of Sales Growth Rate Over Time

Figure 6b: Evolution of Change in Core Sales Profit Margin Over Time

Change in
Core Sales PM

Year Relative To Portfolio Formation Year

Figure 6c: Evolution of Change in ATO Over Time

Change in ATO

Year Relative To Portfolio Formation Year