



Adopting residual income-based compensation plans: Do you get what you pay for?

James S. Wallace*

Graduate School of Management, University of California, Irvine, CA 92697-3125, USA

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Abstract

Managers, consultants, and the financial press assert that compensation plans based on residual income change managers' behavior. This assertion is empirically tested by selecting a sample of firms that began using a residual income performance measure in their compensation plans and comparing their performance to a control sample of firms that continue to use traditional accounting earnings-based incentives. The results generally support the adage 'you get what you measure and reward'. The results also support many hypothesized managerial actions associated with residual income-based performance measure incentives. © 1997 Elsevier Science B.V. All rights reserved.

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1. Introduction

This paper investigates whether managers of firms adopting compensation contracts with residual income-based performance measures take actions consistent with the incentives from these measures. In this paper I study the actions of a sample of forty firms that have adopted compensation plans based on residual income, defined as earnings before interest less a capital charge on total

* Corresponding author. Tel.: (949) 824-6112; fax: (949) 824-8469; e-mail: jswallac@uci.edu

capital (debt and equity). I compare these actions to a matched-pairs control sample of firms where incentive compensation continues to be based on traditional accounting earnings (e.g., earnings per share (EPS), operating profits). The results of the empirical tests support the adage ‘you get what you measure and reward’, with significant increases noted in residual income for the firms adopting residual income-based compensation (treatment firms) relative to the control firms. Relative to the control firms, the treatment firms (i) decreased their new investment and increased their dispositions of assets, (ii) increased their payouts to shareholders through share repurchases, and (iii) more intensively utilized their assets. These actions are consistent with the strong rate of return discipline associated with the explicit capital charge in residual income-based measures. These actions are also consistent with managers reducing agency conflicts of free cash flow. Finally, weak evidence suggests that market participants respond favorably to adoption of residual income-based compensation plans, as evidenced by increased stock returns.

Ideally, the performance measures selected for management compensation contracts are those measures that best motivate management to maximize the value of the firm. A very small, but growing number of firms are selecting residual income-based measures.¹ A maintained hypotheses in this study is that something within the environments of these firms now make residual income more suitable than the traditional earning-based measures they replace. The purpose of this paper is not to predict which firms are likely to adopt residual income-based measures, nor is the purpose to test whether these measures are somehow superior to those measures they replace. Instead, the purpose of this paper is to study whether managers make decisions consistent with the incentives of the new residual income-based measures. While these actions are generally considered consistent with mitigating agency costs and therefore increasing shareholder value, these same actions can also be associated with sub-optimal decisions (e.g., reducing investment in positive NPV projects in order to avoid the now explicit capital charge).

The remainder of the paper is organized as follows. Section 2 discusses the agency problem that exists between owners and managers, the potential consequences of using traditional earnings-based performance measures in compensation plans, and the potential effects of adopting residual income in an attempt to mitigate these agency costs. Specific hypotheses are also developed in Section 2. Research design and sample selection criteria are presented in Section 3. Section 4 provides results from empirical testing of the hypotheses. Finally, Section 5 provides some concluding remarks.

¹ Forms of residual income appear under various names such as abnormal earnings in Ohlson (1995) or Economic Value Added (EVA[®]) popularized by the consulting firm Stern Stewart. One of the earliest to mention the residual income concept was Alfred Marshall when he defined economic profit as total net gains less the interest on invested capital at the current rate (Marshall, 1890).

2. Theory and hypotheses development

2.1. *The agency problem between shareholders and managers*

A maintained assumption throughout this study is that the fundamental objective of a publicly-traded firm is to maximize shareholder wealth. I further assume that managers seek to maximize their individual utility and that their utility is an increasing function of total compensation. Compensation plans provide one method to mitigate agency conflicts by providing incentives for managers to make decisions that are in the best interest of the shareholders.

2.2. *Investing decisions*

The cost of debt financing is charged against earnings in the form of interest expense on existing debt, however there is no corresponding charge against earnings for equity financing. Any project that is expected to earn greater than the embedded cost of debt increases the absolute level of earnings but reduces shareholder wealth unless it also earns greater than the firm's opportunity cost of all (debt and equity) capital. Earnings-based incentive plans can therefore lead to over-investment. In contrast, because of the charge on all capital, a residual income performance measure provides incentive to avoid such over-investing.² This leads to the following hypothesis related to investing decisions.

H1: *Ceteris paribus*, asset dispositions will increase and new investment will decrease for firms following adoption of a residual income-based compensation plan, relative to firms where the manager is evaluated and compensated based on traditional earnings measures.

I test the investment decision hypothesis (H1) in two steps. First I examine asset dispositions deflated by beginning of year total assets (H1A).³ Second, I examine new investment (H1B), defined as acquisitions and capital expenditures, all deflated by beginning of year total assets. In order to generate positive residual income, projects must have returns in excess of the firm's opportunity

² One further cause of potential over-investment results from the firm's cash flow identity and the linkage between the firm's investment and dividend policies (Smith and Watts, 1992). Dividend covenants that contain restrictions on maximum payouts effectively impose a minimum investment policy. As the dividend constraint becomes binding and the firm has exhausted its positive NPV investments, managers may be forced to over-invest in negative NPV projects.

³ A reason why an outside firm may be willing to pay a price that is high enough to entice the selling firm to sell an asset is the asset was not originally in the most efficient user's hands. This is consistent with the free cash flow agency argument where the selling firm accumulated sub-optimal assets in an effort to increase the size of the firm.

cost of capital, not merely the associated cost of debt capital. This should lead managers to become more selective in their retention of existing projects and in their choice of new projects following the adoption of a residual income performance measure. Therefore I expect to observe relatively more dispositions and less new investment for treatment firms in the post-adoption period than in the pre-adoption period, relative to control firms.

There is a potential factor biasing against hypothesis H1B. A manager might turn down a positive NPV project where the expected payoffs occur in the later stages of the project. Because some projects have expected accounting losses in the early stages, a manager evaluated on short-term results may choose to pass up such a project even though the project is expected to have a positive NPV over its entire life, hence a project that should increase shareholder wealth. While this time-horizon agency conflict is not directly addressed through residual income-based compensation plans, it can be considered in the course of implementing the compensation plan.⁴ If the time-horizon problem is reduced, assuming no capital rationing, managers will select more positive NPV projects, even if the projects have expected losses in the early years.⁵ This increased investment will serve to bias against H1B. Therefore, *ex ante*, H1A provides the more powerful test.

2.3. *Financing decisions*

Shareholder wealth maximization can also be jeopardized if managers fail to pay out free cash flow, the excess of the firm's cash flow that can be invested in positive NPV projects.⁶ Under a residual income incentive plan, managers are penalized if they accumulate capital that is not able to earn at least the firm's

⁴ See Stern et al. (1995) (p. 43) for a description on how compensation plans can include 'bonus banks' to help mitigate time-horizon problems. Also see Appendix A for an example of the Crane Co's incentive compensation utilizing such a 'bonus bank'

⁵ This is consistent with Larcker (1983) who finds an association between the adoption of long-term performance plans and an increase in long-term capital investment.

⁶ Managers face several incentives to retain free cash flow in order to increase their own personal utility (Jensen, 1993). One reason for retaining free cash flow is to insulate the firm from capital markets. Capital markets serve a monitoring role by subjecting any additional capital needs of the firm to impartial scrutiny. This monitoring function is not present if the firm is able to avoid capital markets by financing new projects from existing cash reserves that have been accumulated rather than paid out to shareholders. A second, and perhaps more compelling reason for managers to resist paying out free cash flow is the desire to increase the size of the firm. Murphy (1985) documents a positive correlation between total management compensation and firm size. A manager's compensation is also generally increased through promotions (Baker et al., 1988), which are more likely in a growing firm. A final reason given for manager's reluctance to pay out free cash flow is the power and prestige, along with the physical perquisites, that accompany managing a larger firm. Even when downsizing is the correct managerial action to take, managers may retain free cash flow and prevent shareholders from redirecting capital to a more productive use.

opportunity cost of capital. One way to reduce the total charge for capital is to reduce capital through share repurchases and dividends payouts. This leads to hypothesis H2.

H2: *Ceteris paribus*, overall share repurchases and dividend payouts will increase for firms following adoption of a residual income-based compensation plan, relative to firms where the manager is evaluated and compensated based on traditional earnings measures.

Share repurchases and dividend payments represent two alternatives available for managers to pay out free cash flow and thus increase shareholder wealth by reducing free cash flow agency costs. Both share repurchases and dividends are predicted to increase for the treatment firms relative to their match-pairs in the post-adoption period compared to the pre-adoption period. However, since considerable evidence exists that dividends are 'sticky' (i.e., firms are reluctant to increase dividend payouts unless they are confident that free cash flow will be available in future periods to sustain the payout ratio (Miller and Rock, 1985), share repurchases are likely to be the preferred option for paying out free cash flow. This is especially true for excess cash derived from non-recurring items such as asset dispositions.

Similar to the investing hypotheses H1, I decompose the financing hypothesis H2 into its two component parts, repurchases per share and dividends per share, to form hypotheses H2A and H2B, respectively. *Ex ante*, H2A provides the more powerful test.

2.4. *Operating decisions*

In addition to paying out free cash flows, residual income is also increased by using existing assets more intensively. I examine asset turnover, defined as sales divided by total assets, which measures intensity of asset use. This leads to hypotheses H3.

H3: *Ceteris paribus*, total asset turnover will increase for firms following adoption of a residual income-based compensation plan, relative to firms where the manager is evaluated and compensated based on traditional earnings measures.

While total asset turnover considers all assets taken together, and should be the most powerful test, I also examine three individual intensity measures. (1) inventory turnover defined as cost of goods sold divided by average inventory,⁷

⁷ Inventory is calculated as Compustat™ data item D3, inventory, plus data item D240, LIFO reserve. Cost of goods sold is adjusted by the annual change in the LIFO reserve. Data item D240 is included in order to place all firms on a common FIFO basis.

(2) accounts receivable turnover defined as sales divided by average accounts receivable, and (3) accounts payable turnover defined as cost of goods sold divided by average accounts payable. As is the case with hypothesis H3, one would expect improvement in capital utilization following the adoption of a residual income performance measure resulting from the additional focus on the denominator in each these ratios. This leads to hypotheses H3A, H3B and H3C predicting an increase in inventory turnover and accounts receivable turnover, and a decrease in accounts payable turnover for firms following adoption of a residual income-based compensation plan, relative to firms where the manager is evaluated and compensated based on traditional earnings measures.

2.5. *Residual income*

If residual income is the new key performance measure for treatment firms, residual income should be the measure managers will work toward. Therefore, I test to see that residual income increases for the treatment firms relative to their control firm counterparts. This leads to hypothesis H4.

H4: *Ceteris paribus*, residual income will increase for firms following adoption of a residual income-based compensation plan, relative to firms where the manager is evaluated and compensated based on traditional earnings measures.

2.6. *Shareholder wealth*

Each of the above hypotheses is directed at management actions predicted to be valued by shareholders. Presumably, adopting residual income-based compensation plans enhance management incentives to make value-enhancing decisions. Given the stock market is forward looking and anticipates changes in future management actions, these expectations should be impounded in the period surrounding the adoption of a residual income-based compensation plan. This reasoning leads to hypothesis H5.

H5: *Ceteris paribus*, shareholder wealth will increase for firms following adoption of a residual income-based compensation plan, relative to firms where the manager is evaluated and compensated based on traditional earnings measures.

3. Methodology

3.1. *Research design*

The empirical tests in this study rely on an interrupted time-series design. The object of the analysis is to infer whether adoption of a residual income-based

compensation plan (the treatment) has the predicted effect on managerial actions. If adoption has an effect, I should observe differences in the observations before and after the treatment, i.e., an ‘interruption’ in the time series.

Two major validity threats to the analysis of an interrupted time series are the possibility that (1) some event other than the treatment (a history threat), or (2) natural changes in a firm through time (a maturation threat) cause the change in the time series (Cook and Campbell, 1979). The use of a properly selected control group decreases these threats since both treatment and control firms are subject to potential omitted variables and primarily differ based on the partitioning variable.

3.2. *Sample selection*

The sample is composed of a group of forty firms that have adopted compensation plans that feature a residual income performance measure. These treatment firms were identified through a computer search of the LexisTM, ABI/InformTM and The Wall Street JournalTM Ondisc databases over the ten year period ending fiscal year 1994, and from a Stern Stewart and Company marketing brochure containing a list of firms that have used EVA[®] to some extent.

Several firms identified in the press as using a residual income measure in their management decision making have not (as of 1994) included residual income measures in their incentive compensation plans. Since the purpose of this paper is to study if management actions change following the adoption of residual income-based compensation, I limit my treatment firms to only those forty firms that I can identify as having incentive compensation plans explicitly based on residual income. I am able to identify an additional thirty-six firms that claim to use residual income for some internal decision making, however have not yet explicitly included this performance measure in their incentive compensation as of 1994. A discussion of tests using these additional 36 firms appears in Section 4.6.2. I confirm the existence of a residual income-based compensation plan by reading the firms’ proxy statements. I also identify the year of first adoption from the proxy statement. Appendix A provides an excerpt from one of these proxy statements.

In order to lessen validity threats, I select a match-pair control group of firms that use earnings-based measures in their compensation plans. The control group is matched to the treatment firms based on four-digit SIC and firm size. The firms are first matched on four-digit SIC. Next, the firm closest in size is chosen based on total assets in the year prior to the treatment firm’s adoption of an incentive plan with a residual income-based performance measure. In a few cases I fail to find a suitable control firm using this criteria due to reasons such as an insufficient number of years of data or very large size differences. In three instances I match on three-digit SIC, in one instance I match on two-digit SIC,

and in one instance I match on one-digit SIC. In each of these cases, the industry match seems subjectively reasonable.

Barber and Lyon (1996) study methodology used to match treatment firms with control firms. The authors find that while matching based on industry and size works well in certain circumstances, matching based on pre-event performance proved a superior methodology. While I did not explicitly match on pre-event performance, based on return on assets the treatment and control firms appear to be similar in financial performance in the year prior to the treatment firms' adoption of residual income performance (p -value = 0.66). Therefore the matched sample used in this study is roughly the same as that recommended in Barber and Lyon (1996).

Although an effort was made to match firms as closely as possible, treatment firms are different by definition in that they have self-selected to adopt residual income-based compensation plans.⁸ The factors that lead treatment firms to choose residual income may not be present in control firms, e.g. control firms may have found other means of mitigating potential agency costs. Two measures, management stock ownership and firm leverage are used as control variables in later empirical tests. Table 1 contains a list of each treatment firm, along with its matched-pair control. Also included in this table is the year the treatment firm first included residual-income in its incentive compensation and each firm's SIC number.

Included in the sample observations are five years prior to the plan adoption (pre-adoption period), the year of the adoption, and up to three years following the adoption (post-adoption period). All but five of the sample firm pairs had the necessary data for these periods.⁹ The majority of the treatment firms adopted their residual income-based compensation plans in 1993 and 1994, the last two years of the test period, with eighteen (45%) in 1994 and twelve (30%) in 1993.

⁸ The following performance measures for control (treatment) firms are reported for the post-adoption (pre-adoption) period:

	Control	Treatment
Generic terminology (e.g., firm performance, financial results)	9	20
Multiple financial measures (e.g., earnings, sales, ROA)	18	7
Earnings (e.g., operating profits, earnings growth, EPS)	12	11
Return (e.g., ROA, ROE, ROI)	<u>1</u>	<u>2</u>
Total	<u>40</u>	<u>40</u>

⁹ Three firms have four years of data, one firm three years of data, and one firm only two years of data in their respective pre-adoption periods.

Table 1
Descriptive statistics of sample firms

Year of adoption ^a	SIC #	Treatment firm	SIC #	Control firm
1993	4213	American Freightways Corp.	4213	Arnold Industries
1994	8734	Applied Bioscience Intl.,Inc.	8071	Alliance Imaging
1993	3590	Applied Power, Inc.	3590	Moog
1993	4813	AT and T Corp.	4813	GTE
1994	3823	Autoclave Engineers, Inc.	3823	Gelman Sciences
1992	3411	Ball Corp.	3411	Crown Cork and Seal Co. Inc.
1994	3826	Beckman Instruments, Inc.	3826	Perkin-Elmer
1991	3510	Briggs and Stratton Corp.	3510	Stewart and Stevenson Services Inc.
1990	4931	Cilcorp, Inc.	4931	Citizens Utilities
1993	3541	Cincinnati Milacron, Inc.	3541	Kennametal Inc.
1993	3672	Comptronix Corp.	3672	Park Electrochemical
1990	3490	Crane Co.	3490	Whittaker
1988	4011	CSX Corp.	4011	Santa Fe Pacific
1987	3564	Donaldson Company, Inc.	3564	Ampco-Pittsburgh Corp
1993	3690	Duracell International, Inc.	3690	Varian Associates Inc.
1994	7320	Equifax, Inc.	7320	First Financial Management
1992	3050	Furon Company	3050	Wynns International Inc.
1986	2400	Georgia Pacific Corp.	2400	Weyerhaeuser
1994	8051	Grancare, Inc.	8051	Genesis Health Ventures Inc.
1993	3550	Harnischfeger Industries, Inc.	3559	Applied Material
1993	3714	Hayes Wheels International, Inc.	3714	Eagle-Picher
1994	2835	Incstar Corp.	2835	Advanced Magnetics
1994	2835	Intl. Murex Technologies Corp.	2835	Molecular Biosystems
1994	6211	Jefferies Group, Inc.	6211	Legg Mason Inc
1994	2590	Kinetic Concepts, Inc.	2590	Shelby Williams
1994	3021	L A Gear, Inc.	3021	Vans Inc
1994	3531	Manitowoc Co., Inc.	3531	Astec Industries Inc.
1994	4400	Maritrans, Inc.	4400	Ogelby Norton
1994	3360	Mathews International Corp.	3360	Sudbury Inc
1994	6211	Merrill Lynch and Co., Inc.	6211	Salomon Inc
1994	3089	Premark International, Inc.	3089	Illinois Tool Works Inc.
1991	2040	Quaker Oats Co.	2040	Ralston Purina
1993	2834	R. P. Scherer Corp.	2834	Forest Laboratories Inc.
1994	5912	Revco D. S., Inc.	5912	Longs Drugs
1993	2621	Scott Paper Co.	2621	Kimberly Clark Corp.
1994	3724	Teledyne, Inc.	3724	Sequa Corp
1994	6199	TransAmerica Corp.	6199	Loews Corp
1992	3523	Varity Corp.	3524	Toro
1993	5000	W.W. Grainger, Inc.	5070	Waxman Ind
1993	2820	Wellman, Inc.	2821	Rexene

^aYear of adoption represents the year in which the treatment firm first included a residual income measurement in its incentive compensation plan.

Only three firms reported adoption prior to 1990. The mean (median) number of years in the post-adoption period for the sample firm pairs is 2.33 (2.0) years with a standard deviation of 1.98 years. Twenty four two-digit SIC industries are represented among the forty treatment firms. The largest representations are from electronic and other electric equipment (seven firms) and chemical and allied products (four firms).

Table 2 provides descriptive statistics comparing the treatment firms to the matched-pairs control firms. Although some matched-pairs differ in size, overall the treatment and control firms show no significant size difference in the year prior to adoption, based on total assets (p -value = 0.53) in a two tailed t -test reported in Panel A of Table 2. As previously mentioned, the treatment and control firms also appear to be similar in financial performance in the year prior to adoption (p -value = 0.66). Positive accounting theory posits that firms also make operating, investing, and financing decisions based on how close the firms may be to their debt covenants, commonly operationalized as leverage. The treatment and control firms are similar, on average, in leverage (p -value = 0.53).

Panel B of Table 2 compares the treatment and control firms in the pre-adoption period for selected variables that will form the empirical tests described in section four of this paper. None of the differences in variables reported in Panel B are significant at conventional levels using either a parametric t -test or a nonparametric Wilcoxon test. Interestingly, residual income is actually higher for the control firms than for the treatment firms in the pre-adoption period, although not at significant levels.

3.3. *Additional controls*

Two variables are included as controls in the empirical tests that follow. The control variables are the change in top management and board stock ownership, and the change in leverage. The first additional control variable, the change in management and board stock ownership between the pre-and post-adoption period, is included to control incentive effects of stock ownership (e.g., a stronger alignment of manager and shareholder interests). Leverage is postulated to proxy for effects of the firm's debt structure on management decisions (Watts and Zimmerman, 1986). Increased leverage also provides increased monitoring of management and decreases the opportunities for management to waste free cash flow (Jensen, 1989). Therefore, the second control variable is included to control for the potential effects of leverage.

3.4. *Empirical models*

The purpose of this study is to examine whether the adoption of a residual income performance measure for incentive compensation influences manager's actions consistent with the interests of shareholders. The tests examine

Table 2
Descriptive statistics comparing treatment and control firms

Variable	Sample	Mean (\$ mil, \$ per share, or ratio)	Median (\$ mil, \$ per share, or ratio)	Std. dev. (\$ mil, \$ per share, or ratio)	<i>t</i> -stat for difference of means	Wilcoxon <i>p</i> -value for difference of medians
<i>Panel A: Matching criteria in year prior to adoption^a (n = 40 pairs)</i>						
Total assets	Treatment	7441.24	692.88	25828.15	0.53	0.29
	Control	8021.36	422.45	30266.22		
Return on assets	Treatment	0.03	0.04	0.05	0.66	0.81
	Control	0.02	0.04	0.08		
Leverage	Treatment	0.26	0.25	0.16	0.53	0.97
	Control	0.28	0.25	0.23		
<i>Panel B: Descriptive data in the pre-adoption period^b (n = 40 pairs)</i>						
New investment	Treatment	213.80	45.48	668.17	0.58	0.43
	Control	220.00	28.13	643.99		
Dispositions	Treatment	9.40	1.52	22.17	0.34	0.64
	Control	15.37	1.43	55.65		
Repurchases per share	Treatment	0.46	0.10	0.85	0.15	0.12
	Control	0.83	0.13	1.56		
Dividends per share	Treatment	0.61	0.41	0.62	0.60	0.89
	Control	0.73	0.32	1.42		
Asset turnover	Treatment	1.17	1.23	0.48	0.42	0.23
	Control	1.10	1.11	0.63		
Residual income	Treatment	10.60	-10.69	471.09	0.72	0.38
	Control	17.56	-5.94	372.25		

Notes: I calculated one summary statistic, the mean, for each firm in the pre-adoption period. The mean and median values shown in Panel B represent summary statistics of the distribution of firm summary statistics.

^aYear of adoption represents the year in which the treatment firm first included a residual income measurement in its incentive compensation plan.

^bThe pre-adoption period consists of the five year period prior to the year of adoption.

hypothesized changes in management actions between the pre- and post-adoption periods. The hypotheses are tested with the following OLS regression that includes an indicator variable (type) for treatment or control firms and two additional control variables.¹⁰

$$\Delta \text{Dependent variable}_i = \alpha + \beta_1 \text{Type}_i + \beta_2 \Delta \text{Owner}_i + \beta_3 \Delta \text{Leverage}_i + \varepsilon,$$

where

- $\Delta \text{Dependent variable}_i$ = the change in the variable of interest (e.g., share repurchases, residual income) for firm *i* between periods;
- Type_i = an indicator variable for firm *i* set equal to 1 for treatment firms and 0 for control firms;
- ΔOwner_i = the change between periods in stock ownership of the top management and board of directors group identified on firm *i*'s proxy statement;
- $\Delta \text{Leverage}_i$ = the change in leverage (debt divided by total assets) for firm *i* between periods.

4. Empirical results

4.1. Evidence on investing decisions

The first set of hypotheses, H1A and H1B examine managers' investing decisions following the adoption of residual income-based compensation.

¹⁰I also employ an approximate randomization test (Noreen, 1989). I generate probabilities $P(\text{Ran})$, of the null hypothesis that there is no association between the dependent variable being examined and the right hand side variables. This is accomplished by repeatedly running the regression after shuffling the vector of dependent variables and recording the β coefficients. This creates a pseudo distribution to which the original β coefficients are compared. Because the observed values of the test statistics (i.e., the β coefficients) are compared to an empirical distribution generated under the null, this test does not require any assumptions about the population from which the sample is drawn (e.g., normality), nor does the test even require the data to be a random-Tsample. This is especially appealing in studies using archival data such as this that rely on a self-selected sample of firms. Examples of accounting research that use approximate randomization testing include Bowen et al. (1989) and Blacconiere and Bowen (1993). The results appearing in Tables 3–6 are qualitatively unchanged under the approximate randomization procedure. Additionally, the OLS regressions are run with the level of stock ownership and the level of leverage instead of changes in these control variables, and both levels and changes in these control variables, with the results appearing in Tables 3–6 qualitatively unchanged.

Table 3
Tests of H1 – Investing decisions

Dependent variable ^a	Firm pairs	Independent variables ^b				
		Intercept	Type	$\Delta Owner$	$\Delta Leverage$	adjR ²
Dispositions ^c	40					
Predicted sign		+ / –	+	+	+	
Coefficient		– 0.00	0.01	– 0.00	0.06	0.09
<i>t</i> -stat.		– 0.22	2.21	– 0.43	2.58	
<i>p</i> -value		0.82	0.02	0.34	0.01	
New investment	40					
Predicted sign		+ / –	–	–	–	
Coefficient		0.02	– 0.05	0.00	– 0.14	0.01
<i>t</i> -stat.		0.86	– 1.37	1.32	– 1.02	
<i>p</i> -value		0.39	0.09	0.10	0.16	

Results are reported for the following regression

$$Dependent\ variable_i = \alpha + \beta_1 Type_i + \beta_2 \Delta Owner_i + \beta_3 \Delta Leverage_i.$$

^aDispositions = sale PPE (D107)/beginning total assets (D6_{*t*-1}).

New investment = (acquisitions (D129) + capital expenditures (D128))/beginning total assets (D6_{*t*-1}).

^bType is a dummy variable indicating the type of firm (1 for treatment where treatment firms are those that have adopted a residual income-based compensation plan).

$\Delta Owner$ represents the change in stock ownership, as reported on the firm's proxy statement for top management and the board of directors as a group, from the pre-adoption period to the post-adoption period. Pre-adoption period is the five-year period prior to the year of adoption. Post-adoption is the year of adoption through up to three years following adoption (when available). $\Delta Leverage$ represents the change in debt to total assets from the pre-adoption period to the post-adoption period.

^cEx ante, the more powerful test.

Results for the investment hypotheses are reported in Table 3. Both asset dispositions and new investments are significant in the hypothesized direction with *p*-values on β_1 of 0.02 and 0.09, respectively. Holding changes in ownership and leverage constant, this represents an increase in dispositions of 1% of total assets, on average, and a decrease in new investments of 5% of total assets, for the treatment firms relative to the control firms following residual income adoption. As expected, the ex ante more powerful test, asset dispositions, yields the stronger result.

In isolation, it is difficult to interpret whether the observed reduction in net investment is a value-increasing action. Although this observation is consistent with hypothesis H1A and H1B, it is possible that managers are reducing positive

NPV projects, not projects earning below their cost of capital. Critics of EVA[®] claim that the measure provides incentives to under-invest in positive NPV projects. Proponents and users of EVA[®] claim that this is not the case, and in fact claim EVA[®] encourages investments that increase shareholder wealth.¹¹

4.2. Evidence on financing decisions

Table 4 provides results of the tests of H2A and H2B, that managers increase share repurchases and dividends following the adoption of residual income-based compensation. Both repurchases per share and dividends per share increase in the post-adoption period relative to the pre-adoption period for firms adopting residual income. Relative to the matched-pair control firms, treatment firms on average increased repurchases per share by \$1.11 and dividends per share by \$0.17. Only repurchases per share, the ex ante more powerful test, is significant with a p -value zero on β_1 . These results are consistent with firms, when faced with transitory free cash flow, choosing to pay out the free cash flow to shareholders in such a that does not signal a permanent change in dividend payout.¹²

4.3. Evidence on operating decisions

Another method for managers to increase shareholder wealth is to increase the return earned with the existing capital stock through more intensive operations. Hypotheses H3 examine this incentive. Table 5 reports the ex ante more powerful test, total asset turnover, significant at the 0.05 level. This represents an increase of 0.09 times, on average, for the treatment firms relative to the control firms following residual income adoption. Of the remaining three turnover ratios (i.e., inventory turnover, accounts receivable turnover, and accounts

¹¹ Perhaps, one of the most vocal critics is the consulting firm Boston Consulting Group. See, for example, Eric Olsen in the October 1996 Boston Consulting Group publication, Perspectives. For a rebuttal, see Shiely (1997), COO of Briggs and Stratton, an EVA[®] firm. Mr. Shiely's response was published in the February 1997 Stern Stewart publication, EVANGELIST[™].

¹² As is the case with residual income, earnings per share also provides incentives for managers to repurchase shares. To the extent that EPS is used by control firms or is the pre-adoption period measure of the treatment firms, the resulting new incentive changes are weakened. Two treatment firms identified earnings per share as their sole performance measure prior to adoption residual income and three control firms identify earnings per share as their primary performance measure.

Table 4
Tests of H2 – Financing decisions

Dependent variable ^a	Firm pairs	Independent variables ^b				adj R ²
		Intercept	Type	$\Delta Owner$	$\Delta Leverage$	
Repurchases per share ^c	40					
Predicted sign		+ / –	+	+	+	
Coefficient		– 0.49	1.11	– 0.01	0.18	0.08
<i>t</i> -stat.		– 1.90	3.08	– 0.39	0.13	
<i>p</i> -value		0.06	0.00	0.35	0.45	
Dividends per share	40					
Predicted sign		+ / –	+	+	+	
Coefficient		– 0.22	0.17	– 0.03	1.33	– 0.00
<i>t</i> -stat.		– 1.15	0.64	– 1.08	1.23	
<i>p</i> -value		0.25	0.26	0.14	0.11	

Results are reported for the following regression:

$$\Delta Dependent variable_i = \alpha + \beta_1 Type_i + \beta_2 \Delta Owner_i + \beta_3 \Delta Leverage_i.$$

^aRepurchase per share = share repurchases (D115)/outstanding shares (D25). Dividends per share = (D26).

^bSee Table 3 for descriptions of independent variables.

^c Ex ante, the more powerful test.

payable turnover) only accounts receivable turnover (increase of 0.55 times) is significant at conventional levels (*p*-value = 0.08).¹³

4.4. Evidence on residual income

Table 6 reports evidence consistent with managers working to increase firm residual income following the adoption of residual income-based compensation. The coefficient on β_1 is significant with a *p*-value of 0.02. Following residual income adoption, the treatment firms relative to the control firms increased

¹³ Not all three of these remaining turnover ratios are applicable to each treatment firm (i.e., service firms may not have inventory, accounts payable and receivable are not comparable between financial services firms and other firms). Because all tests are not applicable to all firms, five firms are deleted from the accounts receivable turnover test, seven firms are deleted from the accounts payable turnover test, and ten firms are deleted from the inventory turnover test.

residual income an annual average of nearly \$200 million. This result is consistent with the adage ‘you get what you measure and reward’.¹⁴

4.5. *Evidence on shareholder wealth increases*

Finally, I test whether adoptions of residual income-based compensation plans are reflected in increased shareholder wealth. Tests of changes in shareholder wealth are problematic. It is difficult to determine exactly when the market first learns of a firm’s change in its incentive compensation plan and therefore when this information is impounded in the firm’s share price. Because of this uncertainty I am unable to use a traditional ‘short-window’ event study methodology.

A second problem regarding shareholder wealth tests concerns the interpretation of any results. Any change in shareholder wealth can reasonably be attributed to a multitude of causes. In the present case, a change in behavior associated with the adoption of residual income-based compensation is one possible cause of increases in shareholder wealth. Another plausible explanation is the adoption of the residual income measure signals further policy changes such as divestitures or capital structure. The adoption can also signal management’s private information regarding future firm performance. The reader should consider these alternative explanations for any changes in shareholder wealth associated with the adoption of residual income-based compensation.

To test the equity markets’ reaction to the adoption of residual income-based compensation, I first calculate monthly returns for each treatment firm for a 24-month period consisting of the twelve months prior to the year of adoption and the twelve months of the adoption year. A 24-month window surrounding the beginning of the adoption year (month one of the test period) is selected because of the uncertainty as to when the market first learns of the firm’s

¹⁴ The empirical tests of H1–H4 are based on the premise that a change in a compensation plan performance measure resulted in a change in incentives which leads to a change in managerial actions. Since residual income is the new performance measure included in the incentive compensation plans, it follows that one would expect to see an increase in this measure after adoption by the treatment firms relative to the matched-pair control firms. An alternative explanation is that the treatment firms’ management choose the residual income measure as a result of changes already experienced by the firm which management determine will be better measured by residual income than by the previously used performance measures. In other words, an alternative view is that the residual income performance measure is not causing the observed management actions, but that residual income is merely management’s self selected measure that best fits expected performance. Unfortunately, because management’s intentions are not observable, one can never absolutely untangle alternative explanations for the observed outcomes.

Table 5
Tests of H3 – Operating decisions

Dependent variable ^a	Independent variables ^b					
	Firm pairs	Intercept	Type	$\Delta Owner$	$\Delta Leverage$	adj R^2
Asset turnover ^c	40					
Predicted sign		+ / -	+	+	+	
Coefficient		-0.04	0.09	-0.01	-0.37	0.11
<i>t</i> -stat.		-0.99	1.67	-2.68	-1.65	
<i>p</i> -value		-0.33	0.05	0.01	0.05	
Inventory turnover	30					
Predicted sign		+ / -	+	+	+	
Coefficient		-1.53	1.62	-0.03	-9.82	-0.03
<i>t</i> -stat.		-0.82	0.65	-0.14	-1.04	
<i>p</i> -value		0.42	0.26	0.44	0.15	
A/R turnover	35					
Predicted sign		+ / -	+	+	+	
Coefficient		-0.21	0.55	-0.00	0.52	-0.01
<i>t</i> -stat.		-0.73	1.44	-0.13	0.35	
<i>p</i> -value		0.47	0.08	0.40	0.36	
A/P turnover	33					
Predicted sign		+ / -	-	-	-	
Coefficient		0.43	-0.24	-0.04	-0.71	-0.04
<i>t</i> -stat.		0.76	-0.31	-0.69	-0.24	
<i>p</i> -value		0.45	0.38	0.25	0.40	

Results are reported for the following regression:

$$\Delta \text{Dependent variable}_i = \alpha + \beta_1 \text{Type}_i + \beta_2 \Delta \text{Owner}_i + \beta_3 \Delta \text{Leverage}_i.$$

^aAsset turnover = sales (D12)/average total assets ((D6_{*t*} + D6_{*t-1*})/2).

Inventory turnover = cost of goods sold (D41 + D240_{*t*} - D240_{*t-1*})/avg. inventory ((D3_{*t*} + D240_{*t*} + D3_{*t-1*} + D240_{*t-1*})/2).

A/R turnover = sales (D12)/average accounts receivable ((D2_{*t*} + D2_{*t-1*})/2).

A/P turnover = cost of goods sold (D41)/average accounts payable ((D70_{*t*} + D70_{*t-1*})/2).

^bSee Table 3 for descriptions of independent variables.

^cEx ante, the more powerful test.

adoption. Four matched-pairs are not included in this test because of missing data. Next I compute market-adjusted abnormal monthly returns by subtracting the CRSPTM value-weighted return from each corresponding firm *i* monthly return. Each of the individual firm's monthly abnormal returns is averaged to yield a monthly average cross-sectional abnormal return (AAR). Finally, the

Table 6
Tests of H4 – Residual income

Independent variables ^b						
Dependent variable ^a	Firm pairs	Intercept	Type	$\Delta Owner$	$\Delta Leverage$	adj R^2
Residual income	40					
Predicted sign		+ / –	+	+	+	
Coefficient		– 54.89	198.80	– 4.91	320.88	0.02
<i>t</i> -stat.		– 0.77	2.02	– 0.57	0.81	
<i>p</i> -value		0.44	0.02	0.28	0.21	

Results are reported for the following regression:

$$\Delta \text{Dependent variable}_i = \alpha + \beta_1 \text{Type}_i + \beta_2 \Delta \text{Owner}_i + \beta_3 \Delta \text{Leverage}_i.$$

^aResidual income = net income (D18) + after-tax interest (D15 × 0.65) – capital charge (D37 × weighted average cost of capital (assumed to be 12%)).

^bSee Table 3 for descriptions of independent variables.

average monthly abnormal returns are accumulated to produce a cumulative average abnormal return (CAAR) measure. Fig. 1 displays the AARs and Fig. 2 displays the corresponding CAARs.¹⁵

Although not statistically significant, as seen in Fig. 2, the treatment firms, on average, outperformed the market over the twenty-four month period by over 4% (*p*-value of 0.31 using an approximate randomization test). On an individual firm basis for the 24 month period, twenty-two firms reported positive CAARs and fourteen firms reported negative CAARs (significant at 0.09 using a non-parametric sign test). Although it is not possible to determine exactly when the market learned of the individual firm's decision to adopt residual income-based compensation plans, for many of the firms the first public information is probably the firm's proxy statement. These statements are usually released between three and four months after the firm's fiscal year end. Fig. 1 reports two

¹⁵ An alternative shareholder-wealth hypothesis test is conducted in Bushman et al. (1995). The authors study whether the form of compensation contracts is associated with firm performance, which they measure using Tobin's *Q* (a measure relating the market value of the firm to the current value of the firm's assets). The authors find firms employing what they refer to as balanced incentives (e.g., residual income measures) outperform firms using only growth measures (e.g., earnings per share) or rate of return measures (e.g., return on assets).

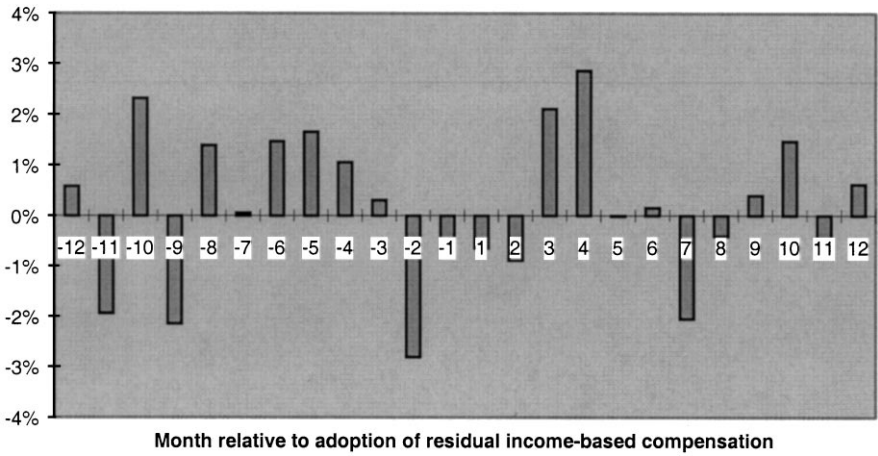


Fig. 1. Monthly average abnormal returns (AAR) of treatment firms surrounding the adoption of residual income-based compensation

$$AAR_t = \sum_{i=1}^{36} R_{it} - R_{mt}$$

where R_{it} = the return on individual treatment firm i 's stock for month t , R_{mt} = the market return for month t , t = month relative to adoption of residual income performance measure month 1 = first month of the year of adoption

of the largest positive abnormal returns occur around this time (p -value of 0.036 using an approximate randomization test).¹⁶

In summary, the treatment firms show a significant decline in net investment following residual income adoption relative to the control firms. Because the actual composition of the investment set facing the firm is not observable, there is no direct means to determine if this decline resulted from positive or negative NPV projects. The investing hypotheses tests show an increase in payout to

¹⁶ I also calculate an AAR measure defined as the average monthly treatment firm return minus the monthly return of the matched-pair control firm. With this alternative AAR definition, the CAAR graph was very similar and at the end of the period the CAAR is slightly over 2% (p -value = 0.44 using approximate randomization test). The largest positive average abnormal returns again appear around month four. In order to prevent undue influence resulting from a few unusual monthly returns, any monthly return observation with an absolute value greater than 50% was winsorized to 50%. Three total observations from two treatment firms and four total observations from two control firms were winsorized. Without winsorization the resulting CAAR is approximately 0.5% higher. I performed two additional tests, a sign test and a difference of proportions test, comparing the signs of the differences between the matched-pairs firms. Each of these were significant (p -values of 0.004 and 0.05). A Wilcoxon signed rank sum test for matched pairs proved insignificant, however (p -value = 0.15).

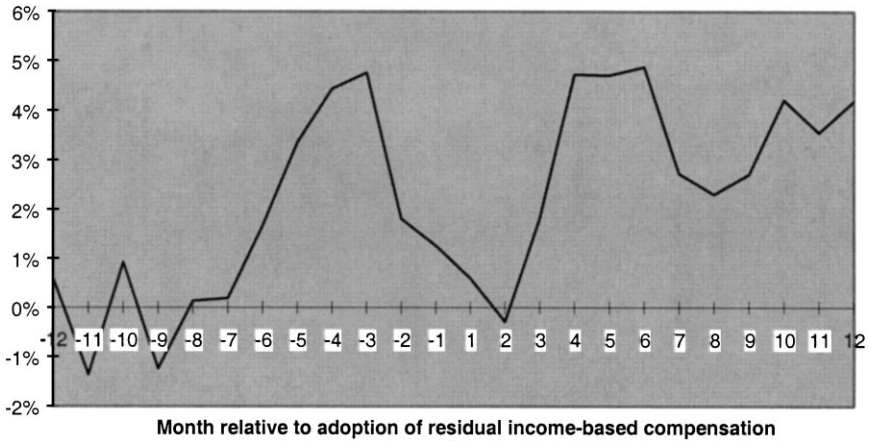


Fig. 2. Monthly cumulative average abnormal returns (CAAR) of treatment firms surrounding the adoption of residual income-based compensation

$$CAAR_t = \sum_{i=1}^{24} \sum_{i=1}^{36} R_{it} - R_{mt}$$

where R_{it} = the return on individual treatment firm i 's stock for month t , R_{mt} = the market return for month t , t = month relative to adoption of residual income performance measure month 1 = first month of the year of adoption

shareholders of treatment firms following adoption of residual income, relative to the control firms. This is consistent with managers overcoming a temptation to 'build empires'. It does not, however, let us differentiate whether positive or negative NPV projects contributed to the above noted decrease in net investments. The third set of tests, operating hypotheses, show an increase in total asset turnover by treatment firms following adoption of residual income, relative to the control firms. This is also consistent with managers investing more selectively and disposing of under-performing assets. Finally, the treatment firms, relative to their match control firms, show a significant increase in residual income following the adoption of residual income as a performance measure.

4.6. Sensitivity analyses

4.6.1. Test of alternative explanations for share repurchases

Finance theorists offer an alternative explanation for why firms repurchase their stock. Share repurchases have been used as a measure to prevent hostile takeovers. I searched the LexisTM (database for any mention of a hostile takeover attempt on any of the treatment firms during the two years leading up to their

adoption of residual income, along with the entire post-adoption period. Several of the treatment firms were identified as possible suitors in hostile takeovers, however only two firms, Teledyne, Inc. and Revco D.S., Inc., were identified as a target.¹⁷ Neither firm repurchased any shares in the entire pre-adoption period, and only Revco repurchased shares in the post-adoption period. The repurchase did not occur until three years after adoption, therefore the two events appear unrelated. It therefore does not seem likely that the treatment firms were using share repurchases a takeover defense.

4.6.2. *Test using alternate samples*

All of the above tests are conducted using a treatment group of 40 firms that I identify as having changed to the use of a residual income measure in their incentive compensation. I also identify a group of 36 firms that use a residual income measure to some extent in their decision making, however, as of 1994, have not, included the measure in their incentive compensation.¹⁸ I repeat each of the tests appearing in Tables 3–6 using identical methodology. The results are generally weaker for these firms, with only significant results observed for the asset disposition test. The observed results for the financing, operating, and residual income tests are all insignificant. These results support the contention that residual income-based performance measures only work if they are used in compensation plans.

Not all firms in the treatment sample use identical measures of residual income. EVA[®], a variation of residual income that includes modifications to GAAP earnings in addition to a capital charge, is mentioned in twenty-three of the firm's proxy statements as the firm's performance measure. It is possible that modifications to GAAP earnings, and not the capital charge, is responsible for the results previously discussed. In order to test this alternative hypothesis I partitioned treatment firms into two groups, EVA[®] firms and a non-EVA[®] firms.¹⁹ I rerun the regressions appearing in Tables 3–6 with the addition of a dummy variable indicating whether the firm is an EVA[®] firm or a non-EVA[®] firm. In no case is the coefficient on the dummy variable significant at the 0.10 level.

¹⁷ Teledyne, Inc. was mentioned as a possible takeover target of WHX, Inc., the parent company of Wheeling Pittsburgh Steel. Revco D.S., Inc., was mentioned as a possible target of Rite Aid Inc. and of Jack Eckerd Corp. Two other treatment firms, International Murex Technologies Corp. and Cincinnati Milacron, Inc., reported initiating other anti-takeover provisions.

¹⁸ Several of the firms indicate they have subsequently included the residual income measure in their management compensation.

¹⁹ In order to partition the two samples I assume any firm that explicitly refers to their performance measure in their proxy statement as EVA[®] to be an EVA[®] firm. All other firms are labeled non-EVA[®] firms.

4.6.3. *Downsizing as an alternate hypothesis*

The primary findings of this study are consistent with these firms mitigating the agency problems between management and shareholders by adopting residual income compensation measures. However, an alternative explanation exists. These findings are also consistent with a firm downsizing. In order to investigate this alternative explanation of the reported results, I test whether treatment firms ‘downsized’ following the adoption of residual income. I use two proxies for downsizing, changes in the number of employees and changes in total assets. These results are inconsistent with the downsizing hypothesis, with treatments firms showing increases in size relative to their controls using either measure of downsizing. I also include the change in employees as an additional control variable in the regressions used to test hypotheses H1–H4 with qualitatively similar results to those reported in Tables 3–6.

4.7. *Limitations*

Generally, residual income performance measures are incorporated gradually into the culture of the firm. Typically they are used for internal decision making several years before being explicitly included in managers’ incentive compensation. Although not explicitly included in compensation plans, it is possible that managers are implicitly rewarded on residual income, thus affecting the actions studied in this paper (Bowen et al., 1981). This works against finding results in an interrupted time-series design since the ‘interruption’ is improperly specified and would reduce the power of the reported tests.

Firms that adopt new performance measures in their compensation plans may be changing other aspects of their environment. This is alleged to be the case with firms adopting EVA[®]. In particular, firms that use the consulting firm Stern Stewart and Co. to help them implement an “EVA[®] financial management system” often increase the intensity of their incentives along with increased education leading to employees having a greater awareness of the opportunity cost of capital and value creation. It is therefore possible that the observed effects attributed to the residual income measure are at least partially the result of environmental changes. The sensitivity test where a subsample of EVA[®] firms are separately tested and not found to be noticeably different to the other treatment firms provides some assurance against this alternative explanation of the results, however the reader should still consider this possibility.

In addition to changing performance measures, firms adopting residual income may also be changing the structure of their compensation. When constructing empirical tests using control firms, I assume that the percentage of compensation that is long-term versus short-term remains constant over time, or if it changes, the change occurs equally in both treatment and control firms. Nearly every firm in this study has long-term incentive compensation for its managers. The primary sources are stock options and restricted stock. The

stated purpose of the long-term incentives is to align the interests of managers with that of shareholders. To the extent these long-term incentives encourage managers to develop growth opportunities, they will bias against both the investing and financing hypotheses.

Finally, the sample of firms studied in this paper does not constitute a random sample. The treatment firms have voluntarily chosen to adopt residual income-based compensation and likely are firms where the board or senior management has determined that certain problems exist, such as over-investment. It is also possible that only successful treatment firms are identified, firms that appear in the financial press, promote their compensation plans in proxy statements, or are identified by consulting firms. However, to the extent that firms actually disclose performance measures used in their incentive compensation plans, all firms reporting to the SEC should have been identified. Because the results reported in this paper are not from a random sample, the reader should be careful when generalizing the incentive effects of residual income performance measures. Simply because residual income-based measures may be associated with certain management actions in the treatment firms does not imply that these same effects will occur in all firms. Other firms may not be subject to the same degree of agency problems and therefore may not find the adoption of residual-income performance measures cost beneficial.

5. Summary

In this study, I discuss how the inherent conflict of interest between the shareholders of a firm and the managers who run the firm can lead to dysfunctional managerial actions such as sub-optimal investment decisions and the reluctance of managers to pay out free cash flow. Residual income has been adopted by a small but rapidly increasing number of firms as a means to help align the interests of managers with those of the shareholders. I test hypotheses of predicted management actions resulting from the change of performance measures used in incentive compensation plans from traditional earnings-based to residual income-based. I also test for performance changes following residual income adoption and for the stock market reaction to the adoption decision.

Although one cannot conclude from this research that a residual income-based performance measure will 'cause' managers to make decisions that are valued by shareholders, an association is found between performance measures and hypothesized management actions. Relative to the control firms, firms that adopted a residual income performance measure (1) increased their dispositions of assets and decreased their new investment, (2) increased their payouts to shareholders through share repurchases, and (3) used their assets more intensively. These actions are consistent with the strong rate of return discipline associated with the explicit capital charge in residual income-based measures.

These actions are also consistent with managers overcoming a free cash flow agency conflict. Finally, weak evidence suggests that capital market participants respond favorably to adoption of residual income-based compensation plans.

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Appendix A. Crane Co. Proxy Statement disclosures of residual income-based compensation

The Company's annual incentive compensation program utilizes the principles of Economic Value Added (EVA) with a three-year rolling horizon. EVA is defined as the difference between the return on total capital invested in the business and the cost of capital, multiplied by the total capital employed ('EVA Calculation'). Compared to such common performance measures as return on capital, return on equity, growth in earnings per share and growth in cash flow, EVA has the highest statistical correlation with the creation of value for shareholders. The program does not involve the establishment or meeting of any goals. Rather, the increase or decrease in EVA for a business unit during the year, both absolutely and compared to the prior year, is the sole basis for any incentive compensation award, thereby motivating managers to focus on continuous value improvement.

Awards are uncapped to provide maximum incentive to create value. While particular EVA formulas are tailored to the size and unique characteristics of the business unit or units for which a specific executive is responsible, the key elements of the EVA formula applicable to any individual are the Cost of Capital (generally the cost of capital to the Company), the Return on Capital, the Amount of Capital employed in the business unit, the Net Operating Profits of the unit after tax, and the prior year's EVA. Awards are calculated on the basis of year-end results, and award formulas utilize both a percentage of the

change in EVA of a business unit from the prior year, whether positive or negative, and a percentage of the positive EVA, if any, in the current year. The EVA award is usually calculated for an entire business unit and the executive receives a percentage of the unit's award. For executive officers responsible for more than one business unit, the formula is based on a percentage of the aggregate EVA, positive or negative, of the units reporting to the executive.

After the EVA award, whether positive or negative, for a particular year has been determined, it is credited to the executive's 'bank account'. If the executive's account is a positive number, $33\frac{1}{3}$ of the account balance is paid to the executive in cash annually. The remainder of the account balance represents the individual's 'equity' in the account for future years. If EVA awards are negative, an account balance can be negative. In such case, the officer will receive no incentive compensation payments until the aggregate of subsequent EVA awards results in a positive account balance. Each year, the Company adds interest to a positive balance or charges interest on a negative balance at an appropriate money market rate. The account is subject to forfeiture in the event an executive officer leaves the Company by reasons of termination or resignation. The bank account concept with the vulnerable three-year payout gives the annual incentive compensation program a longer-term perspective and provides participants with ownership incentives as the account balances build or decline. Although the program is formula driven, the Committee retains discretion to review and adjust its impact on business units and individuals for reasonableness and to preserve its incentivizing objectives.

Crane Co. Proxy Statement 14 March 1995

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