Lecture 8: Exercises

19.11 ROI and residual profit (Adopted by Horngren, C.T., Bhimani, A., Datar, S.M. and Foster, G. (2012). Management and cost accounting. Prentice Hall, 5th eds.)

Récré-Gaules SARL produces and distributes a wide variety of recreational products. One of its divisions, the Idefix Division, manufactures and sells 'menhirs', which are very popular with cross-country skiers. The demand for these menhirs is relatively insensitive to price changes. The Idefix Division is considered to be an investment centre and in recent years has averaged a return on investment of 20%. The following data are available for the Idefix Division and its product:

Total annual fixed costs	€1000 000
Variable costs per menhir	€300
Average number of menhirs sold each year	10000
Average operating assets invested in the division	€1600000

Required:

1. What is the minimum selling price per unit that the Idefix Division could charge in order for Marie-Aimée Obelix, the division manager, to get a favourable performance rating? Management considers an ROI below 20% to be unfavourable.
2. Assume that Récré-Gaules judges the performance of its investment centre managers on the basis of residual income rather than ROI, as was assumed in requirement 1. The company's required rate of return is considered to be 15%. What is the minimum selling price per unit that the Idefix Division should charge for Obelix to receive a favourable performance rating?

Suggested solution:

$$\text{ROI} = \frac{\text{Income}}{\text{Investment}} = \frac{\text{Revenues}}{\text{Investment}} \times \frac{\text{Income}}{\text{Revenues}}$$

Operating profit = ROI × Investment

[No. of menhirs sold (Selling price – Var. cost per unit)] – Fixed costs = ROI × Investment

Let X = minimum selling price per unit to achieve a 20% ROI.

1 10,000 (X – €300) – €1,000,000 = 20% (€1,600,000)

$\qquad\qquad\qquad$ 10,000X = €320,000 + €3,000,000 + €1,000,000

$\qquad\qquad\qquad\qquad\quad$ = €4,320,000

$\qquad\qquad\qquad\qquad$ X = €432

2 10,000 (X – €300) – €1,000,000 = 15% (€1,600,000)

$\qquad\qquad\qquad$ 10,000X = €240,000 + €3,000,000 + €1,000,000

$\qquad\qquad\qquad\qquad\quad$ = €4,240,000

$\qquad\qquad\qquad\qquad$ X = €424

19.12 Pricing and return on investment (Adopted by Horngren, C.T., Bhimani, A., Datar, S.M. and Foster, G. (2012). Management and cost accounting. Prentice Hall, 5th eds.)

Salvador SA assembles motorcycles and uses long-run (defined as 3-5 years) average demand to set the budgeted production level and costs for pricing. Prices are then adjusted only for large changes in assembly wage rates or direct materials prices. You are given the following data:

Direct materials, assembly wages and other variable costs	€1 320 per unit
Fixed costs	€300 000 000 per year
Target return on investment	20%
Normal utilisation of capacity (average output)	1 000 000 units
Investment (total assets)	€900 000 000

Required:

1. What operating profit percentage on revenues is needed to attain the target return on investment of 20%? What is the selling price per unit?
2. Using the selling price per unit calculated in requirement 1, what rate of return on investment will be earned if Salvador assembles and sells 1500 000 units? 500 000 units?
3. The company has a management bonus plan based on yearly division performance. Assume that Salvador assembled and sold 1000 000 units, 1500 000 units and 500 000 units in three successive years. Each of three people served as divisional manager for one year before being killed in a car accident. As the principal heir of the third manager, comment on the bonus plan.

Suggested solution:

1   ROI $=$ $\dfrac{\text{Operating profit}}{\text{Investment}}$

   $20\% = \dfrac{\text{Operating profit}}{€900,000,000}$

Operating profit $=$ €180,000,000

Target revenues:

Fixed overhead	€300,000,000
Variable costs, 1,000,000 × €1,320	1,320,000,000
Desired operating income	180,000,000
Revenues	€1,800,000,000

Operating profit as a percentage of revenues is $\dfrac{€180,000,000}{€1,800,000,000}$ or 10%.

The selling price per unit is €1,800,000,000 ÷ 1,000,000 units = €1,800.

	ROI at various sales volumes over 3 years		
Units sold	1,000,000*	1,500,000*	500,000*
Revenues, €1,800 per unit	€1,800**	€2,700**	€900**
Variable costs, €1,320 per unit	1,320	1,980	660
Fixed costs	300	300	300
Total costs	1,620	2,280	960
Operating profit	€ 180	€420	€(60)
Return on investment	20%	46.67%	–6.67%

*Row not directly used in calculations.

**All revenues, costs and operating profit are in millions of euros.

A summary analysis of these three cases follows:

Volume	$\dfrac{\text{OperatingProfit}}{\text{Revenues}}$	$\times$	$\dfrac{\text{Revenues}}{\text{Total Assets}}$	Return on investment
1,000,000	10.00%	×	2	20.00%
1,500,000	15.55%	×	3	46.65%
500,000	–6.67%	×	1	–6.67%

3 One year may often be too short a time span in the use of an operating income measure for gauging performance or for paying bonuses. For instance, motorcycle sales may be heavily influenced by general economic conditions that are not controllable by the division managers whose bonuses are significantly affected thereby. Also, some short-run savings in manufacturing costs may have long-run damaging effects. Examples include repairs, maintenance, quality control and exerting severe pressures on employees for productivity.

Thus, the heir to the third manager may have much justification for being unhappy with any bonus plan that is tied solely to a one-year operating income measure.

19.13 Residual income, economic value added® (Adopted by Horngren, C.T., Bhimani, A., Datar, S.M. and Foster, G. (2012). Management and cost accounting. Prentice Hall, 5th eds.)

Intervilles SA operates two divisions, a Lorry Rental Division that rents to individuals and a Transportation Division that transports goods from one city to another. Results reported for the last year are as follows:

	Lorry Rental Division	Transportation Division
Total assets	€650 000	€950 000
Current liabilities	120 000	200 000
Operating profit before tax	75 000	160 000

Required:

1. Calculate the residual income for each division using operating profit before tax and investment equal to total assets minus current liabilities. The required rate of return on investments is 12%.

2. The company has two sources of funds: long-term debt with a market value of €900 000 at an interest rate of 10% and equity capital with a market value of €600 000 at a

cost of equity of 15%. Intervilles' income tax rate is 40%. Intervilles applies the same weighted-average cost of capital to both divisions, since each division faces similar risks. Calculate the economic value added (EVA®) for each division.

3. Using your answers to requirements 1 and 2, what would you conclude about the performance of each division? Explain briefly.

Suggested solution:

1.

	Lorry Rental Division	Transportation Division
Total assets	€650 000	€950 000
Less: current liabilities	120 000	200 000
Investment	€530 000	€750 000
Required return (12% x investment)	63 600	90 000
Operating profit before tax	75 000	160 000
Residual income (profit - return)	€11 400	€70 000

2.
After-tax cost of debt financing = (1 - 0.4) x 10% = 6%
After-tax cost of equity financing = 15%
Weighted average cost of capital = 9.6%

Required return for EVA®:

	Lorry Rental Division	Transportation Division
Investment	€530 000	€750 000
9.6% x investment	50 880	72 000
Operating profit before tax = 0.6 x operating profit before tax	45 000	96 000
EVA® (profit after tax - required return)	(€5 880)	€24 000

3
Both the residual profit and the EVA® calculations indicate that the Transportation Division is performing better than the Lorry Rental Division. The Transportation Division has a higher residual profit (€70000 versus €11400) and a higher EVA® (€24 000 versus negative €5880). The negative EVA® for the Lorry Rental Division indicates that on an after-tax basis the division is destroying value - the after-tax economic return from the Lorry Rental Division's assets is less than the required return. If EVA® continues to be negative, Intervilles may have to consider shutting down the Lorry Rental Division.

19.15 Return on investment; comparisons of three companies. [CMA, adapted] [(Adopted by Horngren, C.T., Bhimani, A., Datar, S.M. and Foster, G. (2012). Management and cost accounting. Prentice Hall, 5th eds.)

Return on investment is often expressed as follows:

$$\frac{Income}{Investment} = \frac{Revenues}{Investment} \times \frac{Income}{Revenues}$$

Required

1. What advantages are there in the breakdown of the computation into two separate components?
2. Fill in the following blanks:

	Companies in same industry		
	A	B	C
Revenue	€1 000 000	€500 000	?
Profit	€100 000	€50 000	?
Investment	€500 000	?	€5 000 000
Profit as % of revenue	?	?	0.5%
Investment turnover	?	?	2
Return on investment	?	1%	?

After filling in the blanks, comment on the relative performance of these companies as thoroughly as the data permit.

Suggested solution:

1.
The separate components highlight several features of return on investment not revealed by a single calculation:
The importance of investment turnover as a key to profit is stressed.
The importance of revenues is explicitly recognised.
The important components are expressed as ratios or percentages instead of euro figures. This form of expression often enhances comparability of different divisions, businesses and time periods.
The breakdown stresses the possibility of trading-off investment turnover for income as a percentage of revenues so as to increase the average ROI at a given level of output.

2.
(Filled-in blanks are in bold face.)

	Companies in same industry		
	A	**B**	**C**
Revenue	€1 000 000	€500 000	**€ 10 000 000**
Profit	€100 000	€50 000	**€ 50 000**
Investment	€500 000	**€ 5 000 000**	€5 000 000
Profit as % of revenue	**10%**	**10%**	0.5%
Investment turnover	**2.0**	**0.1**	2.0
Return on investment	**20%**	1%	**1%**

Income and investment alone shed little light on comparative performances because of disparities in size between Company A and the other two companies. Thus, it is impossible to say whether B's low return on investment in comparison with A's is attributable to its larger investment or to its lower profit. Furthermore the fact that Companies B and C have identical profit and investment may suggest that the same conditions underlie the low ROI, but this conclusion is erroneous. B has higher margins but a lower investment turnover. C has very small margins (1/20 of B's) but turns over investment 20 times faster.

The following analysis of the situation could be made:

Introducing revenues to measure level of operations helps to disclose specific areas for more intensive investigation. Company B does as well as Company A in terms of profit margin, for both companies earn 10% on revenues. But Company B has a much lower turnover of investment than does Company A. Whereas a euro of investment in Company A supports 2 euros in revenues each period, a euro investment in Company B supports only 10 cents in revenues each period. This suggests that the analyst should look carefully at Company B's investment. Is the company keeping a level of stocks larger than necessary for its revenue level? Are debts being collected promptly? Or did Company A acquire its fixed assets at a price level that was much lower than that at which Company B purchased its plant?

On the other hand, C's investment turnover is as high as A's, but C's profit as a percentage of revenue is much lower. Why? Are its operations inefficient, are its material costs too high, or does its location entail high transportation costs?

Analysis of ROI raises questions such as the foregoing. When answers are obtained, basic reasons for differences between rates of return may be discovered. For example, in Company B's case, it is apparent that the emphasis will have to be on increasing turnover by reducing investment or increasing revenues. Clearly, B cannot appreciably increase its ROI simply by increasing its profit as a percentage of revenue. In contrast, Company C's management should concentrate on increasing the percentage of profit on revenue.

19.16 Financial and non-financial performance measures, goal congruence. [CMA, adapted] [(Adopted by Horngren, C.T., Bhimani, A., Datar, S.M. and Foster, G. (2012). Management and cost accounting. Prentice Hall, 5th eds.)

Thor-Equip AS specialises in the manufacture of medical equipment, a field that has become increasingly competitive. Approximately two years ago, Knut Solbaer, president of Thor-Equip, decided to revise the bonus plan (based, at the time, entirely on operating profit) to encourage divisional managers to focus on areas that were important to customers and that added value without increasing cost. In addition to a profitability incentive, the revised plan also includes incentives for reduced rework costs, reduced sales returns and on-time deliveries. Bonuses are calculated and awarded semi-annually on the following basis. A base bonus is calculated at 2% of operating profit. The bonus amount is then adjusted by the following amounts:

a (**i**) Reduced by excess of rework costs over 2% of operating profit.

(ii) No adjustment if rework costs are less than or equal to 2% of operating profit.

b Increased by €5000 if over 98% of deliveries are on time, by €2000 if 96-98% of deliveries are on time and by €0 if on-time deliveries are below 96%.

c **(i)** Increased by €3000 if sales returns are less than or equal to 1.5% of sales.

(ii) Decreased by 50% of excess of sales returns over 1.5% of sales.

Note: If the calculation of the bonus results in a negative amount for a particular period, the manager simply receives no bonus and the negative amount is not carried forward to the next period.

Results for Thor-Equip's Kari and Sih Divisions for the year 2004, the first year under the new bonus plan, follow. In the previous year, 2003, under the old bonus plan, the Karl Division manager earned a bonus of €27 060 and the Siri Division manager a bonus of €22 440.

	Kari Division		Siri Division	
	1 January 2004 to 30 June 2004	1 July 2004 to 31 December 2004	1 January 2004 to 30 June 2004	1 July 2004 to 31 December 2004
Sales	€4 200000	€4 400 000	€2 850 000	€2 900 000
Operating profit	€462 000	€440 000	€342 000	€406 000
On-time delivery	95.4%	97.3%	98.2%	94.6%
Rework costs	€11500	€11000	€6000	€8000
Sales returns	€84 000	€70 000	€44 750	€42 500

Required:

1. Why did Knut need to introduce these new performance measures? That is, why does he need to use these performance measures over and above the operating profit numbers for the period?

2. Calculate the bonus earned by each manager for each six-month period and for the year 2004.

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Suggested solution:

1 Operating income is a good summary measure of short-term financial performance. By itself, however, it does not indicate whether operating income in the short run was earned by taking actions that would lead to long-run competitive advantage. For example, Thor-Equip's divisions might be able to increase short-run operating income by producing more product while ignoring quality or rework. Knut, however, would like to see division managers increase operating income without sacrificing quality. The new performance measures take a balanced scorecard approach by evaluating and rewarding managers on the basis of direct measures (such as rework costs, on-time delivery performance and sales returns). These motivate managers to take actions that Knut believes will increase operating income now and in the future. The non-operating income measures serve as surrogate measures of future profitability.

2 The semi-annual installments and total bonus for the Kari Division are calculated as follows:

Kari Division Bonus Calculation
for the year ended 31 December 2004

1 January 2011 to 30 June 2011		
Profitability	(0.02) (€462,000)	€9,240
Rework	(0.02 × €462,000) – €11,500	(2,260)
On-time delivery	No bonus – under 96%	0
Sales returns	[(0.015 v €4,200,000) – €84,000] × 50%	(10,500)
Semi-annual installment		(3,520)
Semi-annual bonus awarded		€0
1 July 2011 to 31 December 2011		
Profitability	(0.02) (€440,000)	€8,800
Rework	(0.02 × €440,000) – €11,000	(2,200)
On-time delivery	96–98%	2,000
Sales returns	[(0.015 v €4,400,000) – €70,000] × 50%	(2,000)
Semi-annual installment		6,600
Semi-annual bonus awarded		€ 6,600
Total bonus awarded for the year		€ 6,600

8

The semi-annual installments and total bonus for the Siri Division are calculated as follows:

Siri Division Bonus Calculation
for year ended 31 December 2004

1 January 2011 to 30 June 2011

Profitability	(0.02) (€342,000)	€ 6,840
Rework	(0.02 × €342,000) – €6,000	0
On-time delivery	Over 98%	5,000
Sales returns	[(0.015 × €2,850,000) – €44,750] × 50%	(1,000)
Semi-annual bonus installment		€10,840
Semi-annual bonus awarded		€10,840

1 July 2011 to 31 December 2011

Profitability	(0.02) (€406,000)	€ 8,120
Rework	(0.02 × €406,000) – €8,000	0
On-time delivery	No bonus – under 96%	0
Sales returns	[(0.015 × €2,900,000) – €42,500] which is greater than zero, yielding a bonus of	3,000
Semi-annual bonus installment		€11,120
Semi-annual bonus awarded		€11,120
Total bonus awarded for the year		€21,960

19.18 Relevant costs, performance evaluation, goal congruence (Adopted by Horngren, C.T., Bhimani, A., Datar, S.M. and Foster, G. (2012). Management and cost accounting. Prentice Hall, 5th eds.)

Mikkeli Oy has three operating divisions. The managers of these divisions are evaluated on their divisional operating profit, a figure that includes an allocation of corporate overhead *proportional to the revenues of each division*. The operating profit statement (in thousands) for the first quarter of 2005 is as follows:

	Tampere Division	Oulu Division	Kotka Division	Total
Revenues	€2000	€1200	€1600	€4800
Cost of goods sold	1050	540	640	2230
Gross profit	950	660	960	2570
Division overhead	250	125	160	535
Corporate overhead	400	240	320	960
Divisional operating profit	€300	€295	€480	€1075

The manager of the Tampere Division is unhappy that his profitability is about the same as the Oulu Division's and is much less than the Kotka Division's, even though his revenues are much higher than either of these other two divisions'. The manager knows that he is carrying one line of products with very low profitability. He was going to replace this line of business as soon as more profitable product opportunities became available, but he has kept it because the line is marginally profitable and uses facilities that would otherwise be idle. That manager now realises, however, that the sales from this product line are attracting a fair amount of corporate

9

overhead because of the allocation procedure and maybe the line is already unprofitable for him. This low-margin line of products had the following characteristics for the most recent quarter (in thousands):

Revenues	€800
Cost of goods sold	600
Avoidable division overhead	100

Required:

1. Prepare the operating profit statement for Mikkeli Oy for the second quarter of 2005. Assume that revenues and operating results are identical to the first quarter except that the manager of the Tampere Division has dropped the low-margin product line from his product group.
2. Is Mikkeli Oy better off from this action?
3. Is the Tampere Division manager better off from this action?
4. Suggest changes for Mikkeli's system of division reporting and evaluation that will motivate division managers to make decisions that are in the best interest of Mikkeli Oy as a whole. Discuss any potential disadvantages of your proposal.

Suggested solution:

This exercise illustrates the dysfunctional behaviour that could be motivated by arbitrary allocations of corporate overhead to profit-conscious divisional managers.

1 Without the €800,000 in sales from the low-margin product line in the Tampere Division, the second quarter operating statements (in thousands) will be:

	Tampere	Oulu	Kotka	Total
Net sales	€1,200	€1,200	€1,600	€4,000
Cost of sales	450	540	640	1,630
Divisional overhead	150	125	160	435
Divisional contribution	600	535	800	1,935
Corporate overhead	288	288	384	960
Operating income	€ 312	€ 247	€ 416	€ 975

2 The company is worse off as a result of dropping the low-profitability line of products because it has lost €100,000 in contribution margin from the dropped product line with no reduction in corporate overhead. Total operating income decreases from €1,075,000 in the first quarter to €975,000 in the second quarter.

3 The Tampere Division manager's performance evaluation measure (divisional operating income) is higher (€312,000 in the second quarter compared with €300,000 in the first quarter) as a result of dropping the low-profitability product line. The Tampere Division manager is able to show a €12,000 higher operating income because the €100,000 in lost contribution margin from the dropped product line is more than offset by the €112,000 reduction in corporate overhead that is charged to the Tampere Division. Tampere Division sales are now only 30% of corporate sales rather than the previous 41.7% of sales (so 30% of total corporate overhead costs of €960,000 equalling €288,000 are allocated to the Tampere Division in the second quarter, whereas 41.7% of €960,000 equalling €400,000 were allocated to the Tampere Division in the first quarter).

4 The easiest solution is to not allocate fixed corporate overhead to divisions. Then the problem of dysfunctional behaviour will not arise. But central management may want the division managers to 'see' the cost of corporate operations so that they will understand that

the corporation as a whole is not profitable unless the combined divisions' contribution margins exceed corporate overhead. In this case, an allocation basis should be chosen that is not manipulable or under the control of division managers. It must also have the property that the action taken by one division does not affect the corporate overhead allocations that get made to the other divisions (as occurred in the second quarter for the company).

In general, a lump-sum allocation based on, say, budgeted net income or budgeted assets, rather than an allocation that varies proportionately with an actual measure of activity (such as sales or actual net income) will minimise dysfunctional behaviour. The allocation should be such that managers treat it as a fixed, unavoidable charge, rather than a charge that will vary with the decisions they take. Of course, a potential disadvantage of this proposal is that managers may try to underbudget the amounts that serve as the cost-allocation bases, so that their divisions get less of the corporate overhead charges.

19.19 Evaluating managers, ROI, value-chain analysis of cost structure (Adopted by Horngren, C.T., Bhimani, A., Datar, S.M. and Foster, G. (2012). Management and cost accounting. Prentice Hall, 5th eds.) [40-50 minutes]

User Friendly Computer is one of the largest personal computer companies in the world. The board of directors was recently (March 2005) informed that User Friendly's president, Felix Lechat, was resigning to 'pursue other interests'. An executive search firm recommends that the board consider appointing Peter Diamond (current CEO of Computer Power) or Rachida Kamel (current CEO of Plum Computer). You collect the following financial information on Computer Power and Plum Computer for 2003 and 2004 (in millions):

	Computer Power		Plum Computer	
	2003	**2004**	**2003**	**2004**
Total assets	€360.0	€340.0	€160.0	€240.0
Revenues	€400.0	€320.0	€200.0	€350.0
Costs				
R&D	36.0	16.8	18.0	43.5
Design	15.0	8.4	3.6	11.6
Production	102.0	112.0	82.8	98.6
Marketing	75.0	92.4	36.0	66.7
Distribution	27.0	22.4	18.0	23.2
Customer service	45.0	28.0	21.6	46.4
Total costs	300.0	280.0	180.0	290.0
Operating profit	€100.0	€40.0	€20.0	€60.0

In early 2005, a computer magazine gave Plum Computer's main product five stars (its highest rating on a five-point scale). Computer Power's main product was given three stars, down from five stars a year ago because of customer-service problems. The computer magazine also ran an article on new-product introductions in the personal computer industry. Plum Computer received high marks for new products in 2004. Computer Power's performance was called 'mediocre'. One 'unnamed insider' of Computer Power commented: 'Our new-product cupboard is empty.'

Required:

1.   Use the DuPont method to analyse the ROI of Computer Power and Plum Computer in 2003 and 2004. Comment on the results.
2.   Calculate the percentage of costs in each of the six business-function cost categories for Computer Power and Plum Computer in 2003 and 2004. Comment on the results.
3.   Rank Diamond and Kamel as potential candidates for CEO of User Friendly Computer.

Suggested solution:

1.

Computer Power

2003	1.111	0.250	0.278
2004	0.941	0.125	0.118

Plum Computer

2003	1.250	0.100	0.125
2004	1.458	0.171	0.250

Computer Power's ROI has declined sizably from 2003 to 2004, largely because of a decline in operating profit to revenues. Plum Computer's ROI has doubled from 2003 to 2004, in large part due to an increase in operating profit to revenues.

2.

	Computer Power		Plum Computer	
Business function	2003	2004	2003	2004
R&D	12.0%	6.0%	10.0%	15.0%
Design	5.0	3.0	2.0	4.0
Production	34.0	40.0	46.0	34.0
Marketing	25.0	33.0	20.0	23.0
Distribution	9.0	8.0	10.0	8.0
Customer service	15.0	10.0	12.0	16.0
Total costs	100.0%	100.0%	100.0%	100.0%

Business functions with increases/decreases in the percentage of total costs from 2003 to 2004 are:

	Computer Power	Plum Computer
Increases	Production	R&D
	Marketing	Design
		Marketing
		Customer service
Decreases	R&D	Production
	Design	Distribution
	Distribution	
	Customer service	

Computer Power has decreased expenditures in several key business functions that are critical to its long-term survival, notably research and development and design. These costs are (using

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the Chapter 8 appendix terminology) discretionary and can be reduced in the short run without any short-run effect on customers, but such action is likely to create serious problems in the long run.

3.

Based on the information provided, Kamel is the better candidate for president of User Friendly Computer. Both Computer Power and Plum Computer are in the same industry. Kamel has headed Plum Computer at a time when it has considerably outperformed Computer Power:

The ROI of Plum Computer has increased from 2003 to 2004 while that of Computer Power has decreased.

The computer magazine has increased the ranking of Plum Computer's main product, while it has decreased the ranking of Computer Power's main product.

Plum Computer has received high marks for new products (the lifeblood of a computer company), while Computer Power new-product introductions have been described as 'mediocre'.