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Optimization of residential property management

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Abstract

Purpose – The paper aims to provide an analysis of the principle-agent relationship between owner (principal) and manager (agent) of investment properties by: developing an optimization model for the net profit scenario that any third party manager of properties in multiple locations faces; and describing the principal's (or owner's) problem and likewise developing an income optimization model. The model allows illustrating the misalignment of incentives and compensation arrangements common to the business of managing small investment properties.

Design/methodology/approach – The paper provides an in depth review of literature on the agency problem, both in general as well as in real estate research and compares the qualitative findings with analytical results provided by the model. The latter is developed by applying a transaction cost framework to the context of income structures in investment properties and their management.

Findings – The optimization model shows that profit maximization for the manger (agent) depends on an optimum number of properties to be managed. It is further shown that the compensation methods customary in small real estate management contracts are inappropriate for the manager to control and cover the transaction costs, which result from the fact that more than one location is managed. The result is a kind of impossibility theorem, stating that management of small investment properties based on customary compensation structures is unprofitable as the number of properties and their distance rises.

Practical implications – The analysis shows that industry practice for the compensation of management of small investment properties does not address the inherent principle-agent problem. Consequently, additional compensation and incentive mechanisms as well as control structures need to be employed by the owner. The paper, therefore, provides a starting point to review and improve industry practice.

Originality/value – The paper expands the existing literature of the agency problem in real estate by providing an optimization model for management of investment properties. The model and findings are of interest to academics for its analytical treatment of agency relationships; as well as to practitioners, as the analysis reveals inefficiencies in industry practice.

Keywords Marketing agencies, Modelling, Property marketing, Real estate

Paper type Research paper

1. Introduction

A central issue in real property investment is management. In particular, questions that need to be answered include:

- Who shall do the management?
- Who bears the management costs?
- How one accounts for those costs?
- What is the most efficient management structure?

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The owner can always decide to also perform the property management – however, costs affecting the investment return are still incurred and complicate the return calculation. When the owner retains an outside manager, other well known conflicts enter the business arrangements.

The framework that captures these conflicts is known as the "agency problem" (or "principal-agent problem"). The problem arises when an agent provides a service to the principal, which includes holding the principal's capital as well as some level of the authority for decision making with regards to this capital. Although the agent and the principal are each interested in utility maximization, their individual objectives differ, often resulting in sub-optimal capital management, and hence return, for the principal.

The agency problem was first reported in literature in the late 1960s and early 1970s of the twentieth century. The early literature (Wilson, 1968; Berhold, 1971; Ross, 1973; Heckerman, 1975) recognizes the problem and deals mostly with its normative character, hence developing models to overcome the issue with an appropriate structure of the contractual agreement between principal and agent. Building upon these works, Jensen and Meckling (1976) expand into the positive aspects of the agency theory by investigating it in the context of property rights. They develop not only a comprehensive treatment of agency costs, but further extend this concept into the theory of the firm itself, resulting in the theory of a firm's capital structure and the so-called zero-agency cost, a special case of the firm owned by a single owner-manager.

According to Jensen and Meckling (1976) agency cost is defined as:

- the cost of monitoring expenditures by the principal;
- the cost of bonding expenditures by the agent; and
- the residual loss.

Additionally, they show that agency cost is affected by costs of replacing management and the amount of outside competition for management, a conclusion, which was confirmed by Fama (1980).

Later studies built upon the seminal work by Jensen and Meckling, refining in particular the requirement to reduce the agency costs by optimizing the capital structure as well as by appropriate incentive structures for agents. Some of the resulting works include: Haugen and Senbet (1979) who study the phenomenon of informational asymmetry of the agency problem in the context of moral hazard. In particular, they present an approach to reduce agency costs by an appropriate financing package offered to the manager. Barnea *et al.*, (1981), further expanded these ideas into the contractual arrangements between the different parties of an agency problem, which result in complexities in the capital structure, such as conversion and call privileges on corporate debt. The authors conclude that an optimal capital structure is reached when agency costs are balanced with benefits from yields of different financial tools and tax exposure.

However, researchers disagree on the interpretation of the use of specific financial tools to reduce agency costs. One example is the argument regarding the use of stock options to resolve the agency problem (Haugen and Senbet, 1981; Farmer *et al.*, 1986).

Holmström (1979), Baron and Holmström (1980) and Baron (1982) present further important work on the implementation of incentive contracts to overcome agency problems and moral hazard. Starks (1987) suggests that symmetric incentive contracts, which include positive incentives as well as penalties, are more effective than

reward-only systems. Thakor and Ramakrishnan (1982) on the other hand focus on the reduction of agency costs by effective agent monitoring.

Jassim *et al.*, (1988) moves the study of the agency problem further into the field of specifically financial management, focusing again on managerial compensation as a tool to overcome the problem. Van Ackere (1993) further provides an overview of the application of principal agent problems to the areas of accounting, industrial organization, finance and marketing and summarizes major criticism of the model. A general review and discussion of the agency-problem research is provided by Eisenhardt (1989).

Recent literature focuses on the strategic aspects of the principal agent problem. Makadok (2003) finds that agency and governance problems need to be investigated in conjunction with resource issues, such as the manager's expectation of the future value of a resource. Other research attempts to find mathematical models to quantify the aspects of a principal-agent relationship (Demski and Dye, 1999). Sharma (1997) discusses the agency model in the context of principal-professional exchanges, which differ from the classical owner-manager scenario as the agency relationship here is routed in asymmetric knowledge.

To summarize, among many variations proposed to minimize agency costs, the literature suggests that the contractual agreements between principal and agent should be designed to provide incentives to the agent. Such contracts tend to lead to the optimization of utility for both the agent and the principal.

Until now only limited work was reported with regards to the principle agent problem in relationship to the size of the firm and its ability to control agency costs.

Fama and Jensen (1983) investigate the effects of separation of ownership and control in large corporations as well as other organizations, such as professional partnerships or nonprofit companies. They suggest that in all of these organizations, large or small, the separation of decision (initiation and implementation) as well as risk bearing functions (ratification and monitoring) is applied to address the agency problem. There is no difference between the sizes of the firms, as long as a decision control system is implemented in a comparable way. The common approach for such a control system is a board of directors.

Ang *et al.*, (2000) provide an in depth study of agency costs of small corporations, based on a recently released database[1]. Absolute and relative agency costs are determined by comparing no-agency-cost firms (found among non-publicly traded firms) with similarly sized firms that incur agency costs. As predicted by Jensen and Meckling, Ang *et al.* find that agency costs increase with a reduction in managerial ownership and with increasing numbers of non-managerial shareholders, therefore, implicitly providing a model to lower these costs by implementing an appropriate management structure.

Recently, Fosberg and Rosenberg (2003) expand on the work of Ang *et al.* and studied the applicability the concepts to large corporations. They conclude that, besides greater share ownership by top management and major shareholders, dual leadership structures are also effective measures to control agency costs. This is in line with earlier studies by Rozeff (1982) and Kim and Sorensen (1986), who report that greater concentrations of corporate ownership can reduce agency costs. Lease *et al.*, (1983) find that agency costs are lower when ownership is concentrated in outside owners.

To conclude, there is general agreement in the literature of general managerial science and financial management that agency costs increase with a dispersion of ownership and decrease with the level of competition for management functions. Dual leadership concepts and financial incentive packages are generally thought to be approaches to lower agency costs. Although it is recognized that agency costs also vary with the size of the firm, differences in approaches for small or large organizations on how to overcome principal-agent problems are either not evident or are yet to be explored.

The real estate management literature recognizes several areas to which the agency problem applies. The earliest work, Solt and Miller (1985), covers the agency relationship between investors and managers of Real Estate Investment Trusts. The authors find that the fees as paid by investors are positively related to the financial performance of their investment, hence indicating that the fee structure is at least effective in aligning managerial action to the interests of investors.

Zorn and Larsen (1986) investigate agency relationships in brokerage contracts, reporting that incentive structures in such contracts should rather be based on percentage fees than on flat fees. Munneke and Yavas (2001) elaborate on the details of compensation structures as a means to improve results in real estate brokerage. In fact, various further papers discuss and prove the existence of the agency problem in the seller-broker relationship and the importance of appropriate incentive structures (Geltner *et al.*, 1991; Arnold, 1992; Zietz and Newsome, 2001; Rutherford *et al.*, 2005).

Fletcher and Diskin (1994) explore agency relationships in appraisals made for institutional asset managers and conclude incentives and compensation schemes are again the key to addressing the problem. Colwell and Munneke (1998) discuss the use of percentage leases to overcome agency problems between landlord and tenant in regional malls. The choice of two asset management forms, namely owner manager or third party managed, is investigated by Sirmans *et al.*, (1999), and it is concluded that owner management results in higher rents and that profit considerations affect the choice of management form.

Leasing of commercial real estate is investigated by Benjamin and de la Torre (1998). They find that among conflicting incentives affecting lessee and lessor, lessors need to be able to exploit economies of scale, to control free-rider problems and to better evaluate the residual value. Sirmans and Sirmans (1991) report that information asymmetries between landlord and tenants can be overcome by signals provided by the landlord, such as employing professional management companies that hold professional designations, resulting in higher visibility of the expected management quality for the tenant. Legal coverage of principal-agent issues in real estate is discussed in a case study by Holland and Harper (1991). Agency problems arising from outsourcing of corporate real estate functions are investigated by Gibler and Black (2004). The authors conclude that an optimal balance of staffing/outsourcing could possibly be achieved by keeping all strategic functions in house.

Lastly, LaCour-Little and Chun (1999) and Alexander *et al.*, (2002) study the agency relationships between mortgage lenders and investors.

The variety of topics covered by the current literature in real estate research suggests that the principal-agent problem is well recognized. The effort to find solutions, i.e. to lower agency costs, focuses again on the incentive structures of contractual agreements between the various agents and principals.

As in the general management literature, there seems to be little research on possible effects of different sizes of real estate organizations. In the residential real estate market, ownership ranges from small and private, to large and public. Professional property management companies are employed across the spectrum. One would expect that institutional owners benefit from experienced ownership and greater available resources as they deal with management incentives. Less is known about small property owners. Rosenberg and Corgel (1990) determine that there are several provisions in management contracts, which influence the agency problem. Some of these are: term of the contract, agency authority, owner indemnification and agent compensation methods. The authors then performed an empirical study of agency costs implicit in standard property management contracts. The findings are that agency costs for property management contracts are significant, and that they are higher for institutional owners than for non-institutional owners, due to fact that ownership is more dispersed, as was predicted in the general management literature (Jensen and Meckling, 1976; Rozeff, 1982; Lease *et al.*, 1983; Kim and Sorensen, 1986). Contrary to earlier findings, however (Jensen and Meckling, 1976; Fama, 1980), competition for property management appears to have no impact on agency costs. In particular, their analysis shows that agency costs are the highest for institutional owners related to the property management company (absence of competition) and lowest for similarly related private owners, who have superior ownership control and knowledge. Rosenberg and Corgel (1990) also conclude that existing property management contracts need to be adjusted to improve the alignment of manager's and owner's interests and that net operating income (NOI) is the appropriate base to determine property management income. Jaffe (1976) confirms that the set-up of the agent's compensation is central to align different objectives.

Despite the conclusions by Rosenberg and Corgel (1990), by industry convention, management compensation for small properties continues to be based on rental collections and not on NOI.

With the background of this apparent contradiction between literature and industry practice for small properties, this paper examines the effect of agency on residential real-estate investment and expands the available literature by presenting a theoretical model which:

- describes the principal's (or owner's) problem, with a precise definition of the principal's (or owner's) objectives;
- develops an optimization problem that any manager of properties in multiple locations faces; and
- illustrates the misalignment of incentives and compensation arrangements common to the business of managing small investment properties.

The conclusion is a kind of impossibility theorem, which affects privately-owned properties as the number of locations rise. The model reveals a threshold of number of locations above which owners and property managers cannot optimize their net income simultaneously. Under the given conventions of the industry, managing small investment properties for a fee is apparently unprofitable. In other words, although the agency problem is well recognized, at the small property level an inability to control agency costs seems to prevail when the owner hires a manager.

2. Model for optimization of property management

Any model treating the agency problem requires a function to express income for both the agent (the property manager) as well as the principal (the owner). The following develops the required equations.

2.1 Model for property manager – net profit[2]

As for any other firm, the target of a property management service is to maximize net profits by increasing revenue and lowering costs. In this model, it is assumed that revenue is based on management fees, incurred as rates per managed unit. Furthermore, two types of costs are incurred:

(1) in-house costs, consisting primarily of accounting services, which are assumed to be fixed; as well as

(2) variable transactions costs, which are incurred by dispatching employees to visit and inspect managed properties.

The number of properties managed, the size of the properties as well as the distance between them determine these variable transaction costs.

The resulting net profit function, NP, is given in equation (1.a):

$$\mathrm{NP} = gu - \mathrm{ac} - \mathrm{tc} \tag{1.a}$$

with: NP – net profits; g – rate per unit at which fee income is realized; u – number of units managed; ac – accounting costs; tc – transaction (transportation) costs, a function[3].

Transaction costs are modeled as an increasing function of location count and distance:

$$\mathrm{tc} = \frac{hu\mathrm{e}^{d\mathrm{loc}}}{2} \tag{2}$$

with: tc – transaction costs; h – a rate at which transaction costs are incurred; d – a remoteness factor to indicate the average distance of each property from the office; loc – number of locations; e – the base of the natural log

Combination of equations (1.a) and (2) results in Equation (1b), depicting the dependence of net profit, NP, on all employed variables:

$$\mathrm{np} = gu - \mathrm{ac} - \frac{\mathrm{e}^{d\mathrm{loc}}hu}{2} \tag{1.b}$$

2.2 Model for property owner – net operating income

Management fees are – in particular for small properties – calculated as a percentage of effective gross income (EGI) from tenants, thus as a percentage of rent. EGI is defined as the actual receipts after vacancy and credit loss and hence, the net income of the owner is affected by vacancy rates. In the first step to develop the model, two types of costs are considered:

(1) fixed costs, such as taxes and insurance as well as;

(2) variable costs, which are occupancy driven, such as maintenance.

The existing connection between vacancy rates and higher rents is for now ignored and costs incurred due to vacancy are included in the variable costs.

The owner's NOI, is provided in equation (3.a):

$$\text{noi} = r - \text{fc} - \text{vc} \tag{3.a}$$

with: NOI – net operating income; r – rent collected; fc – fixed costs (not related to occupancy such as taxes and insurance); vc – variable costs (occupancy-driven costs such as maintenance which for now will include vacancy).

Variable costs are modeled as an increasing function of rent and include management fees (equation (4)):

$$\text{vc} = 100\left(1 - e^{-0.025r}\right) + \text{mgt}r \tag{4}$$

with: vc – variable costs; e – base of the natural log; mgt – management fee, a percentage of rent[4].

Combining equations (4) and (3.a) results in equation (3.b) as expression for NOI:

$$\text{noi} = r - \text{mgt}r - \text{fc} - 100\left(1 - e^{-0.025r}\right) \tag{3.b}$$

2.3 Impact of vacancy rate

As already mentioned, the level of vacancy affects the rent that can be charged, as the collected rent, cr, is a percentage of scheduled market rent, sr, and hence driven by demand (equation (5.a)):

$$\text{cr} = \text{sr}(1 - \text{vf}) \tag{5.a}$$

The vacancy factor, vf, explains the difference between scheduled rent and collected rent. Rearrangement of equation (5.a) for vf leads to equation (5.b):

$$\text{vf} = 1 - \frac{\text{cr}}{\text{sr}} \tag{5.b}$$

with: vf – vacancy factor, $0 < \text{vf} < 1$; cr – collected rent; sr – scheduled rent.

It is convenient for expository purposes to introduce the vacancy factor through a function for collected rent dependent on scheduled rent. Thus, collected rent is scheduled rent scaled by the vacancy factor. In dollars, collected rent, cr, is what remains after schedule rent, sr, has been reduced by vacancy. Equation (5.b) can also be expressed as:

$$\text{cr} = \text{sr} - \text{vf}(\text{sr}) \tag{5.c}$$

or:

$$\text{cr} = \text{sr} + 1 - \alpha^{\beta \text{sr}} \tag{5.d}$$

The term $1 - \alpha^{\beta \text{sr}}$ is the dollar amount of vacancy suffered. This term must be negative to make cr < sr. Therefore, ($\alpha^{\beta \text{sr}}$ must be > 1. In equilibrium, a normal vacancy rate represents no more than the usual market frictions arising from tenant turnover. In healthy rental markets the vacancy rate should be around 5 percent due to these frictions. Clearly, the choice of α and β is important to achieve this result, but the size of sr is also involved. In our present model, the interplay between these variables results in either an unrealistic rent or vacancy factor.

In order to consider the vacancy effect adequately in the model, collected rent, cr, is to be used instead of r in both the expressions for the property manager's net profit as well as the owner's NOI.

In the initial model of the manager's dilemma, management fees were expressed as a rate incurred by the number of units managed, $g \cdot u$. This is now substituted with $\mathrm{mgt} \cdot \mathrm{cr}$, identically to the expression used in the calculation of net operating profit of the owner.

Together with equation (5.d), the final expression for net profit, NP, and net operating profit, NOI, are given in equations (1.c) and (3.c), respectively.

Net profit of property manager, considering vacancy effect:

$$\mathrm{np} = \mathrm{mgt} \cdot \mathrm{cr} - \mathrm{ac} - \mathrm{tc} = \mathrm{mgt}(\mathrm{sr} + 1 - \alpha^{\beta \mathrm{sr}}) - \mathrm{ac} - \frac{\mathrm{e}^{d\mathrm{loc}} hu}{2} \tag{1.c}$$

NOI of owner, considering vacancy effect:

$$\mathrm{noi} = 1 - 100(1 - \mathrm{e}^{-0.025(1+\mathrm{sr}-\alpha^{\beta \mathrm{sr}})}) - \mathrm{fc} + \mathrm{sr} - \alpha^{\beta \mathrm{sr}} - \mathrm{mgt}(1 + \mathrm{sr} - \alpha^{\beta \mathrm{sr}}) \tag{3.c}$$

3. Results

The equations developed above are used to investigate the theoretical impact of the various variables on net profit and net operating profit, respectively, as well as the interaction of both as they measure the income of property manager and owner. The agency problem can be addressed successfully if both parties are able to maximize their income.

The commercial software Mathematica[5] is used to perform modeling calculations. As is customary when studying models with many variables, some variables are held constant in order to reduce the number of variables studied at once. Table I provides the data sets used in this paper.

Before the question of agency is addressed, each income function is first analyzed in isolation.

3.1 The property manager's net profit

As explained above, net profit, NP, is dependent on transaction costs, which increase with the number of locations and the distance between them (equations (2) and (1.b)). Using equation (1.b) and the datasets *d*1 and *d*2, which only differ in the distance factor *d*, plots for net profit in dependence on the number of locations, are obtained as shown in Figure 1.

	*d*1	*d*2	*d*3	*d*4	*d*5	*d*6	*d*7
ac	10	10	10	10	10		10
fc						50	
g	500	500	500	500			
h	0.05	0.05	0.05	0.05	0.05		0.05
u	50	50		50	50		50
d	0.6	0.5	0.5	0.5	0.5		0.5
loc					3		15
α				1.25	1.25	1.25	1.25
β				0.05	0.05	0.05	0.05
mgt					0.1	0.1	0.1

Table I.
Seven data sets, *d*1-*d*7, used for modeling

The graph shows that net profits decrease with the number of locations, as transaction costs rise. At a critical number of locations, property management becomes unprofitable. The respective threshold of non-profitability is dependent on the distance between the locations and of course, it is of interest to determine the respective number. However, before finding this optimal number of locations, one might argue that what really matters is the average building size, as the number of units to be managed in one location should affect transaction costs and hence, net profit. Intuitively, managing one large property might be the optimum – but the market rarely provides buildings set up according to profit maximization theories.

Figure 2 shows how the manager's net profit varies with the number of locations and units. The graph is obtained by using the dataset *d*3 with fixed values for accounting costs, the management fee per unit as well as distance and transaction rates.

As expected, net profit increases with the number of units per location and, as shown earlier, decreases with the number of locations.

The building size can be expressed as:

$$\text{size} = \frac{u}{\text{loc}} \tag{6}$$

Rearranging to express units in terms of size of the building and substituting u in equation (1.b) leads to equation (1.d):

$$\text{np} = g \cdot \text{loc} \cdot \text{size} - \text{ac} - \frac{e^{d\text{loc}} h \cdot \text{loc} \cdot \text{size}}{2} \tag{1.d}$$

To determine the optimal number of locations, the derivative of NP with respect to loc is determined (equation (1e)):

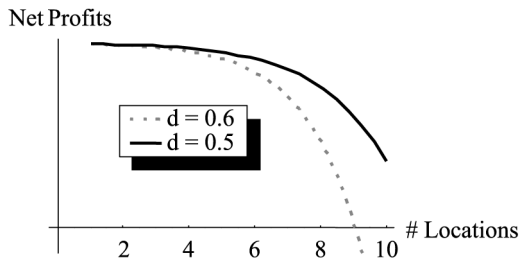

Figure 1.
Net profits at two distance factors dependent only on number of locations

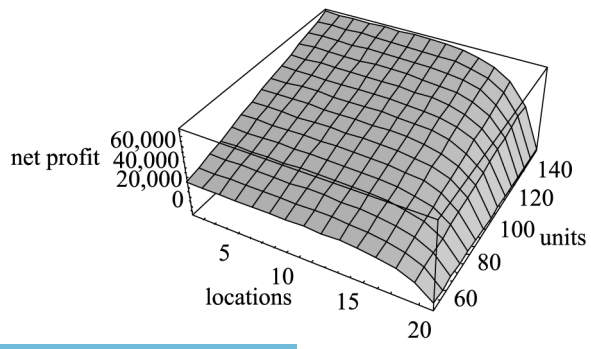

Figure 2.
Manager's net profit in dependence on the number of locations and on units per location

$$\frac{\delta \mathrm{np}}{\delta \mathrm{loc}} = \mathrm{size}[g - 0.5 \cdot h \cdot \mathrm{e}^{d\mathrm{loc}}(d\mathrm{loc} + 1)] \tag{1.e}$$

The respective graph is shown in Figure 3, using again the dataset *d*3.

Although it seems that the net profit depends on building size, solving for $d\mathrm{NP}/d\mathrm{loc} = 0$ (determination of maximum) eliminates size and (compare with equation (1.e)). For the dataset *d*3, the optimal location number of 15 is obtained.

Hence, the surprising conclusion is reached that under the given conditions; building size does not matter for the optimum. Although larger buildings produce more profit, it is the number of locations that determines the maximum net profit (of course holding the other variables, such as the fee and accounting costs, constant).

Returning to the impact of distance on net profit, Figure 4 shows the optimal number of locations depending on distance. With increasing distance, the number of optimal locations decreases. This suggests the intuitively satisfying result that dense urbanization offers more management efficiency than rural or sparsely urbanized areas.

To summarize, the model shows that – given fixed values of accounting costs and management fee – the property manager can optimize net profit by finding the optimal number of locations, depending on the distance between the different properties.

3.2 The owner's net operating income

For the property owner, it is of interest to analyze the impact of the variable costs on NOI, and in particular, the effect of increasing rent which results in increasing

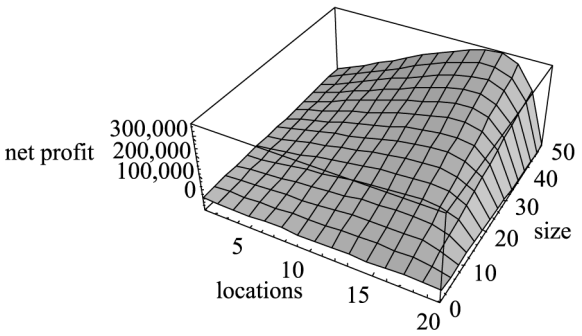

Figure 3.
Net profit in dependence on number of location and on size

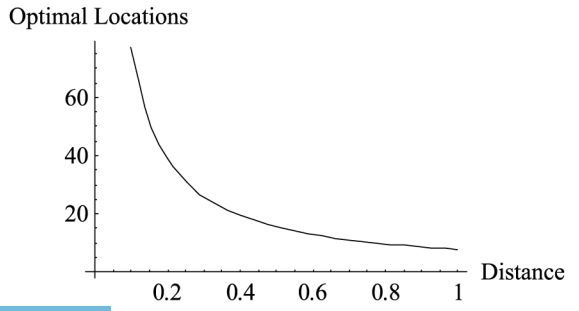

Figure 4.
Optimal number of locations dependent only on distance between locations

management fees and hence, rising costs. Based on equation (4) and using a 10 percent management fee as an example, the graphs in Figure 5 shows that with increasing rent, variable costs first exhibit a steep increase, which then quickly flattens.

Indeed, the derivative of NOI with respect to rent becomes a constant with increasing rent (hence, variable costs do not increase significantly above a certain threshold), as is shown in equation (7), derived from equation (3.b) and using again the 10 percent management fee as an example (the second term in the equation is negligible with increasing r):

$$\frac{\delta \text{noi}}{\delta r} = 0.9 - 2.5\text{e}^{-0.025r} \tag{7}$$

The effect of constant variable costs after a certain threshold on NOI as given in equation (3.b) is shown in Figure 6.

This result suggests that rent can be increased and NOI will continue to rise indefinitely. While perhaps mathematically possible, market economics will of course intervene. At some level of rent, there will be no further demand, hence no more tenants and NOI drops to zero. In general, fewer tenants are available as rent rises.

This graph ignores the effect of vacancy rate on NOI, as explained in Section 2.3. Thus, the result, which is mathematically correct, but economically not feasible, is not unexpected and strengthens the need to consider the vacancy rate in the overall model.

However, it is still important to recognize that a significant increase in variable costs is only observed over a small, initial increase in rent. Hence, the owner can optimize NOI (maximize income) by adjusting rent, at least within the framework of the given market environment.

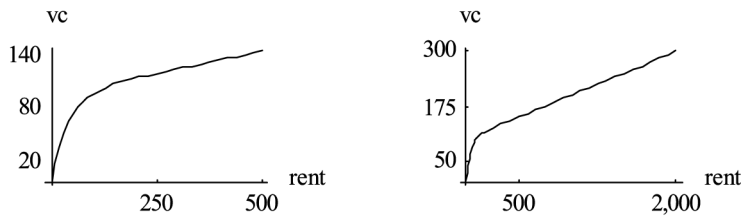

Figure 5.
Variable costs in dependence on rent, on two different scales

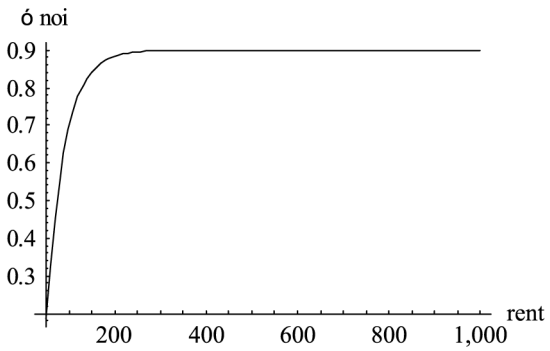

Figure 6.
Change in NOI dependent only on rent

3.3 Is optimization of income achievable for both property manager and owner?
After discussing how the property manager and the property owner can maximize their income independent of each other, the next step is the analysis of if and how both can achieve this goal simultaneously – a given requirement to address the agency problem. Thus, far, the model provides the insight that the owner maximizes income through rent, whereas the property manager considers number of locations and distance. Rent was not considered in Section 4.1 when discussing the property manager's situation, as revenue was modeled as a fee incurred per managed unit. However, as was already discussed in Section 3.3, rent, or better, collected rent, is a more appropriate measure for the manager's income then just a fee incurred per unit. Therefore, equations (1.c) and (3.c), which express the manager's net profit, NP, and the owner's NOI, in dependence on scheduled rent is used to reconcile both parties income maximization problem.

Both parties will benefit from the highest possible rent collectable in a given market. This optimum rent can be determined in three ways:

(1) determine maximum scheduled rent based on the definition of scheduled rent (equation (5.d));

(2) determine scheduled rent at maximum net profit, NP, for property manager (equation (1.c)); and

(3) determine scheduled rent at maximum net operating profit, NOI, for owner (equation (3.c)).

Setting the partial derivative of equation (5.d) with respect to scheduled rent to zero and using the dataset *d*4, the optimum scheduled rent is calculated as $402.94, and accordingly, the collected rent for this data set is $313.31.

Similarly, the partial derivative of equation (1.c) with respect to scheduled rent is set to zero. Solving for scheduled rent, using dataset *d*5 (which is identical to *d*4, except that it includes a value for mgt and loc) results again in the optimal scheduled rent of $402.94. It is pointed out though, that it is necessary to constrain locations to three and accounting costs to ten to keep NP positive in the rent range of our example. This fact is to be discussed in more detail.

Finally, the partial derivative of equation (3.c) with respect to scheduled rent is also set to zero. Using data set *d*6, the optimal NOI is again achieved at the same schedule rent of $402.94.

Plotting equations (5.d), (1.c) and (3.c) on the same graph in Figure 7 combines the perspectives and shows collected rent, the manager's net profit and the owners NOI. All three graphs are optimized for the scheduled rent of $402.94.

At first it seems that all is well and the agency problem is addressed, as both manager and owner can optimize their income at the same level of rent. As was pointed out earlier, the graph for the property manager's net profit was obtained by constraining the number of locations to three. In Section 4.1, however, it was shown that the optimal number of locations to maximize NP is 15 (for the given sets of data). Dataset *d*7 differs from the one used to generate Figure 7 (*d*5) only in the number of locations – it is now set to 15. The resulting net profit line is shown in Figure 8.

Although the optimal net profit is again obtained for a schedule rent of $402.94, the actual net profit is negative for all levels of scheduled rent. In particular, it can be shown that for this model, management is unprofitable at any number of

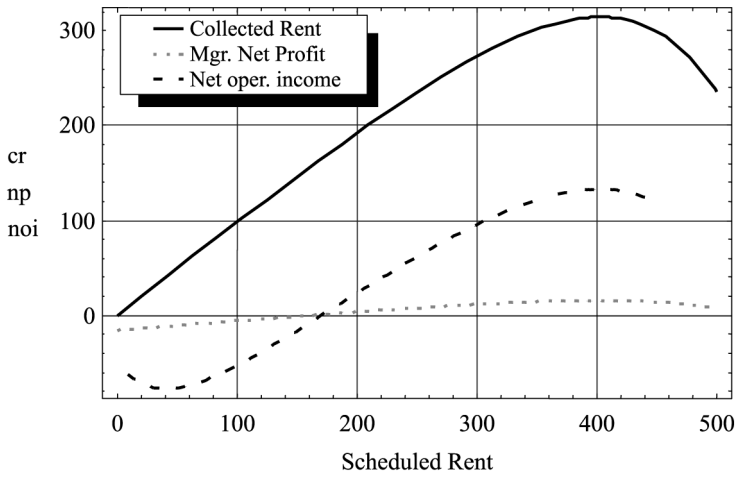

Figure 7.
Scheduled rent, manager's net profit (location = 3) and owner's NOI in dependence on scheduled rent

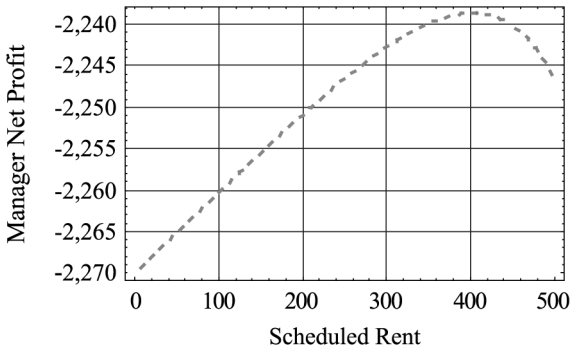

Figure 8.
Manager's net profit, NP, in dependence on rent, with location = 15

locations above five. The contractual and incentive framework currently used by industry in which the manager is paid a percentage of collected rent, makes property management of more than a few locations unprofitable due to the effect of increasing transaction costs.

4. Conclusions

The literature on principal-agent problems in real estate, based on empirical work, establishes that agency costs are higher for institutional owners in comparison to small, private owners, due to dispersion of ownership (Rosenberg and Corgel, 1990). It is also well accepted that compensation of property management should be based on net operating profit, and not collected rent (Rosenberg and Corgel, 1990). However, industry practice for the management of small real estate investments is still based on collected rent.

This paper develops a model to describe both the manager's as well as the owner's functions of net profit and NOI, respectively. The model is applied to study the effect of the apparent contradictions in management compensation structures on the ability to optimize management and to address the principal agent problem.

For the owner, it can be shown that optimization of income is achieved by maximizing rent as a basis of net income. This result is not surprising and the extent of net income maximization is limited by the constraint in rent a given market situation imposes, as there is a threshold of maximum rent after which there will be no further demand. This effect is taken into account by expressing NOI as dependent on actual, collected rent, which in turn is a function of schedule rent and the vacancy rate.

For the property manager, collected rent is the source of income. However, due to the cost structure (transaction costs) inherent in the function of property management, the number of locations and distance play a major role. As is expected, increasing distance leads to decreases in net profit. It can be shown that the actual size of each location (the number of units per location) does not drive the optimization of net profit. However, net profit is optimized at an optimal number of locations, which is dependent on the distance, the level of fixed cost and on the compensation level.

Whereas manager and owner are able to optimize their income in separation (a fictional situation, of course), it is very hard if not impossible to optimize for both parties within a reasonable range of rent. Also within a region of optimal rent, the number of locations, which can still be managed profitably, is very limited. In fact, under the given method of compensation, it is impossible to manage a large number of locations. Whereas of course the owner would incur higher income from an increased number of locations, the manager has no incentive to manage those, as transaction costs cannot be controlled. In fact, it can be shown that the customary compensation of the manager as percentage of collected rent creates perverse incentives, despite the fiduciary duty of the manager to maximize the owner's net income. The manager's fee income (and the need to cover transaction costs) is maximized by collecting the most rent from tenants. However, tenants paying the highest rent often subject the property to more intense use and often vacate after a short tenancy. While the manager shares in vacancy losses because agency fee is based on collected income, increased expenses are borne solely by the owner. The net income of both manager and owner are affected by vacancy rates. But the owner's interest in maximizing net income considers expenses; the manager's interest in maximizing fee income does not.

Hence, the presented model supports the conclusions found in literature, namely that property manager's compensation should not be based on a percentage of collected rent. However, the model is also able to determine the root cause of this conclusion by showing that the number of locations is the actual determining factor in rendering property management non-profitable at certain sizes of the investment.

While the literature reports general approaches to overcome agency problems in any type of firm, independent on the size of what is to be managed, it seems that it is worthwhile to investigate different business situations in more detail to come to a more thorough understand on how to overcome agency conflicts. It is not easy to see why the small real estate investment sector has not yet moved to different compensation structures for property managers. It seems that the industry should address the unsolved agency problem as well as non-profitability with additional incentive and monitoring structures.

5. Summary

This paper examines in depth the problem of optimization of small property management in face of the principal-agent problem that arises from the separation of ownership and management.

A detailed model is developed, which describes the optimization of income for both the owner as well as the property manager, dependent on the different costs incurred on both sides. A common driver of income is rent, and it is shown that de facto collected rent, as a function of scheduled rent and vacancy rate, needs to be employed to model the impact of the market mechanism appropriately. The model also determines the level of collected rent that results in the maximization of the income functions of the parties, owner and manager.

However, the number of locations and distance between them influences the optimization of income for the property manager, and an optimum of locations can be determined for a given set of other fixed costs[6]. The model then reveals that the compensation methods customary in small real estate management contracts (management fees as a percentage of collected rent) are inappropriate for the manager to control and cover the transaction costs, which result from the fact that more than one location is managed. The result is in fact a kind of impossibility theorem. In particular, the management of small investment properties is unprofitable as the number of properties and their distance rises. Even though the income function is optimized at a certain level of collected rent, in synchronization with the optimization of the owner's income, the manager's net income is negative.

Hence, the applied compensation structures fail to overcome the agency problem and even more, render the business of small property management unprofitable. Consequently, additional compensation and incentive mechanisms as well as control structures need to be employed.

Notes

1. National Survey of Small Business Finances, by the Federal Reserve Board.
2. The model is based on US real estate markets and all financial transactions occur on a monthly base.
3. The numbering of equations follows the concept that modifications of one expression, e.g. the expression for net profit, through substitution of terms, receive running numbers of (1.a), (1.b), (1.c), etc.
4. The reader may question why the management fee is expressed differently for the manager and the owner. Initially, the manager's income is expressed in a fee per unit, in order to discuss the effect of numbers of units and location size. For the actual comparison of manager's and owner's income and their joint optimization, both are expressed as a percentage of rent. The reconciliation of the different approaches is explained in Section 2.3.
5. Mathematica, Version 4.2, Wolfram Research, 2002, Champain, IL.
6. Owing to the uniqueness of real estate, the argument of economies of scale is not applicable. To provide examples: even in identical rental properties (in terms of building, apartment size, etc.), each unit exhibits individual problems, such as different maintenance issues, different problems with rent collection from different occupants and so on, hence preventing the manager from reaching economies of scale when increasing the number of managed properties.

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