Contents

Financial Forum

Demand for reinsurance: Evidence from Australian insurers

Luiz Augusto Ferreira Carneiro, Michael Sherris

Enterprise Management

Process principle—The way to company’s competitiveness

Gustav Tomek, Věra Vávrová

Property development firms IPOs in Brazil: Was there overpricing or not?

Claudio Tavares de Alencar, João da Rocha Lima Júnior

ESDS: An E-business SOA service replica distribution scheme

SHUAI Qing-hong

Economics Theory & Practice

The spill over effects of monetary policies and the welfare effects of the currency appreciation in an open economy—A simple discussion

Lixin Sun, Jim Ford, David Dickinson

Avatar-based learning in Second Life

Samia L. Jones
Demand for reinsurance: Evidence from Australian insurers*

Luiz Augusto Ferreira Carneiro¹, Michael Sherris²

(¹. Department of Accounting and Actuarial Science, University of São Paulo, São Paulo 05508-900, Brasil;
². Australian School of Business, Sydney 29052, Australia)

Abstract: Reinsurance is widely recognised as important in insurer risk and capital management. This paper examines the factors that determine insurer demand for reinsurance using Australian data. The Australian situation is interesting because of the tax imputation system and the prudential regulations that were in force during the period of the study. As far as the authors are aware, this is the first paper to empirically analyse the demand for reinsurance in Australia. A panel-data set (1996-2001) is used, which provides 543 observations. The authors provide a careful approach to econometric diagnostic testing and the choice of the most appropriate panel-data model and the authors show how failure to do so may generate misleading results. Based on a robust estimation procedure, the authors find strong evidence of a positive relation between variables related to company size and the demand for reinsurance in Australia. The impact of leverage, taxes, and return on investments are not statistically significant.

Key words: insurer risk management; reinsurance demand; panel-data estimation

1. Introduction

Corporate risk management theory that has been developed in recent years, has identified the circumstances under which risk management strategies add value to a firm. These circumstances generally arise from market imperfections including frictional costs such as taxes, agency costs, financial distress and bankruptcy costs. Insurer risk management adds value from the use of capital and reinsurance strategies that reduce frictional costs including insolvency costs to policyholders and shareholders.

Mayers and Smith (1990) were the first to empirically test the theoretical hypotheses underlying the demand for reinsurance. While much attention has been paid to collecting data and defining good proxies, limited attention has been paid to ensuring robust estimation. For example, the first empirical studies neither mention the type of estimator used nor do they give the results of econometric diagnostics. Also, the most recent empirical studies have been using panel-data models instead of cross-sectional models. However, diagnostics are particularly important for panel-data models, because the many assumptions required for their error structure. The authors cover this in more detail in section 5. Also, the appendix gives a summary of important issues on panel data models.

This paper provides important contributions to empirical methodology as well as to insurer risk management. It is the first article, as far as we are aware, to empirically test the demand for reinsurance using Australian data. The number of insurers in Australia is not as large as in countries used in previous studies, but a larger data set

* Support from Australian Research Council Discovery Grant DP0345036 and from CAPES, Brazil is gratefully acknowledged.
Luiz Augusto Ferreira Carneiro, Ph.D., assistant professor, Department of Accounting and Actuarial Science, University of São Paulo; research fields: insurance, pension funds and private health care.
Michael Sherris, professor of actuarial studies, Australian School of Business; research field: risk management.
Demand for reinsurance: Evidence from Australian insurers

(543 observations) and robust inference were made possible with the use of panel-data methods. This article emphasises the importance of econometric diagnostics, especially in panel-data sets. Many data sets of this type will reasonably be expected to have panel heteroskedasticity, correlation across panels and serial (auto) correlation. Based on the authors’ diagnostics, the authors show that failure to choose the correct panel-data model may generate misleading results.

The authors find significant evidence that reinsurance demand in Australia is mainly motivated by variables related to company size. The results imply that larger insurers, insurers members of a group of companies, reinsurers and captive insurers reinsure more. Another important result is that leverage is not significant related to reinsurance purchases. The same is true for taxes and investment return. In the Australian case, some of these results are less surprising, given the tax imputation system the non-progressive corporate tax rate.

The structure of this paper is as follows. The next section provides an overview of the theory of corporate risk management and how this impacts insurer risk and capital management including the demand for reinsurance. It also develops the hypotheses and proxy variables used in our empirical study. Section 3 discusses empirical results obtained in previous studies. Section 4 describes the Australian data set used. Section 5 gives the estimated results using Australian data in an Ordinary Least Squares (OLS) model with Panel-Corrected Standard Errors (PCSEs). It also compares them with those obtained with OLS, random-effects and fixed-effects estimators. Finally, section 6 concludes.

2. Reinsurance and the theory of insurer risk management

2.1 Conditions for risk management and reinsurance to be irrelevant

For perfect, frictionless and complete market assumptions (re-)insurance decisions have been shown to be irrelevant to the shareholders of the firm that cedes the risk. However, the theoretical assumptions under which reinsurance is irrelevant, do not hold in practice and real world (re-)insurance decisions add value to a firm under more realistic market assumptions. By relaxing the theoretical assumptions reinsurance becomes important in the risk and capital management of the firm. The classic paper of Modigliani and Miller (1958, 1963) showed that under conditions of perfect capital markets, the financial decisions of a firm are irrelevant in the sense that they do not change the total value of the firm. This follows from the fact that shareholders can reverse engineer the financing decisions of the firm on their own account at fair market prices.

Fama (1978) extended the Modigliani-Miller theorem and showed that propositions about the irrelevance of the financing decisions of firms can be built either on the assumption that investors and firms have equal access to the capital market or on the assumption that no company issues securities for which there are not perfect substitutes from other firms (no firm produces any security monopolistically). With either approach, it was shown that if the capital market is perfect, then a firm’s financing decisions have no effect on its market value and its financing decisions are of no consequence to its security holders.

The argument of Modigliani and Miller implies that if a firm changes its financing structure through the use of any financial instruments, then investors who hold claims issued by the firm can change their holdings of risky assets to offset the change in the firm’s financing policy, leaving the distribution of their future wealth unaffected.

1 The model’s assumptions are: Perfect capital markets (no transaction costs, no bankruptcy costs, no taxes, no managerial agency costs); Individuals have equal access to the capital market; Homogeneous expectations and information is costless to both investors and firms and investment strategies of firms are given.
This applies to the use of any risk management strategy including derivatives and insurance contracts.

The Capital Asset Pricing Model (CAPM) developed by Sharpe (1964), Lintner (1965) and Mossin (1966) has influenced the modern understanding of corporate risk management. The CAPM includes two mutually exclusive types of risk: unsystematic risk, or specific risk to the corporations and systematic risk, or risk common to all economic agents. Cummins (1976) and Main (1982, 1983) developed the implications of the CAPM for the corporate demand for insurance. It was shown that, under the CAPM’s ideal assumptions, investors optimally hold a fully diversified portfolio and by doing this they costlessly self-insure against any unsystematic (pure) risks faced by the firms in which they invest. Thus, the firms’ market value would not increase if firms contracted insurance for their unsystematic risks. Additionally, in this setting, firms are not better-off either if they buy insurance against systematic risks.

On the supply side, insurers writing policies to cover a firms’ systematic risk would end up holding a portfolio whose return is exactly correlated with the market return. Thus, if insurers used CAPM in their pricing, then the premium they would charge would account not only for the actuarial odds but also for holding this systematic (undiversifiable) risk. Therefore, a firm insuring its systematic risk would not increase its market value, because the premium paid is loaded with a compensation for the insurer to hold the ceded systematic risk. Thus, under the CAPM assumptions, the value of risk is the same for the insurance company and for the risk managing firm, so that the firm will not contract insurance because any economic gains would be offset by the premium. Thus, the CAPM provides an ideal setting under which corporations will have no motivation to insure against specific risks, and insurance premiums charged for any available insurance against systematic risks will be high enough to deter corporate purchases.

Doherty and Tinic (1981) also use the CAPM to show the conditions under which reinsurance does not increase the value of the insurer’s common stock, which is assumed to be traded in an efficient financial market. Their setting differs from the previous setting used by Cummins (1976) and Main (1982, 1983) because it has three types of market players: the reinsurers, the insurers and the insureds. The direct insurance market is assumed to be perfectly competitive. It is assumed that the insureds are neutral to risk, so that the price they are willing to pay for insurance does not depend on the insurer’s probability of ruin. In efficient financial markets, the value of the insurer’s common stock reflects the values of assets and contingent liabilities. The insurer may contract reinsurance to reduce the systematic (and total) risk of its common stock. However, the value of the insurer’s common stock will remain unchanged because efficient financial markets imply that reinsurance transactions, as well as direct transactions, are consummated at market clearing prices, which include an additional charge for the reinsurer to bear systematic risk. In fact, this explanation is the same as the one given by Cummins and Main, but adapted to the reinsurance market. The key point made by Doherty and Tinic is that if insurance demand is not sensitive to the insurer’s ruin probability, then exchanging assets and liabilities at market clearing prices do not offer any gains to the shareholders of the ceding and the reinsurance companies.

2.2 When do risk management and reinsurance really matter?

Doherty and Tinic (1981) state that if one relaxes the assumption that insurance demand is perfectly inelastic with respect to the insurer’s ruin probability, then the value of the insurance company can be increased through the use of reinsurance at market prices. In fact, assuming that prospective insurance buyers are risk averse and
incompletely diversified the premium they would be willing to pay for policies from an insurer with higher ruin probability would be lower to account for the risk of default on the policies. Thus, reinsurance at market prices allows the ceding insurer to charge higher premiums and increase the expected return to its shareholders above the equilibrium required rate.

Blazenko (1986) relaxes the assumption of a perfectly competitive direct insurance market. He allows the possibility that insurable risks are not completely diversifiable in the immediate transaction with an insurer. Such a possibility happens when the insurance market is imperfectly competitive and reinsurance can create value by providing additional capacity to the market in facilitating the spread of risk. Froot, Scharfstein and Stein (1993) provide a framework for corporate risk management incorporating frictional costs and considering both investment and financing decisions. They discuss the impact on risk management strategies of capital market imperfections and the differing costs of internal versus external financing. In line with developments in corporate financial theory, frictional costs and other market imperfections are important factors that create a demand for reinsurance.

Mayers and Smith (1982) state that if the firm’s financing policy is important it is so because of: (1) taxes, (2) contracting costs (including agency costs), or (3) the impact of the financing policy on the firm’s investment decisions. They examine these costs and their impact on corporate insurance purchases. Analogously, the same theoretical setting was used in the literature to explain hedging demand in large widely-held corporations, whose owners hold diversified portfolios of securities. Because hedging is defined in broad terms, which may include insurance and reinsurance, the results from the hedging literature are also applicable to the reinsurance case. One example is given by Smith and Stulz (1985), who show that a value-maximizing firm will hedge because of taxes, costs of financial distress and managerial risk aversion. A more detailed description of the effects of frictional costs on the demand for reinsurance is considered in the next section.

2.2.1 Taxes

Mayers and Smith (1982) identify provisions in the American tax code that can lead to a change in the firm’s effective marginal tax bracket so that the purchase of insurance is favored.

Firstly, there are carry-back and carry-forward provisions so that the uninsured loss neither can be fully deducted from taxable income nor has to be carried forward for some years. With this, the expected tax liability of a self-insured firm can be higher than that of a firm with insurance.

Secondly, the progressivity in the corporate profits tax reduces the expected tax shield of the self-insured company. This happens because the uninsured loss can move pre-tax profits to a lower marginal tax bracket and thus reduce the tax shield that would be obtained with any additional losses.

Smith and Stulz (1985) also provide a tax rationale for hedging. They state that if effective marginal tax rates of corporations are an increasing function of the corporation’s pre-tax value, then the after-tax value of the firm is a concave function of its pre-tax value. Thus, as a consequence of Jensen’s inequality, if hedging reduces the variability of pre-tax firm values, then the expected corporate tax liability will be reduced and the expected post-tax value of the firm will be increased, even in the case of incomplete hedging. However, this is only true as long as the cost of hedging is not larger than the reduction of the corporate tax liability.

Thirdly, in the case of property insurance, the present value of the tax reduction from increasing depreciation (since the depreciation basis will be greater with the replaced asset in the case of loss) can exceed the taxes from immediately realizing the gain from indemnity and then the firm’s tax liability is reduced. Thus, the rationale is that firms with large expected casualty losses relative to their taxable income have an incentive to insure.
In the Australian taxation system, the imputation system reduces the impact of taxation as a factor in risk management strategies at the corporate level. Individual domestic shareholders receive a credit for corporate taxation to be offset against their personal taxation.

2.2.2 Agency costs of debt

Reinsurance purchases can become economically feasible when agency costs are present. Jensen and Meckling (1976) and Myers (1977) both show that the firm faces two types of contracting costs associated with principal-agent problems: (1) agency costs of equity and (2) agency costs of debt.

Jensen and Meckling (1976) define an agency relationship as a contract under which one or more persons (the principal(s)) engage another person (the agent) to perform a service on their behalf which involves delegating decision making authority to the agent. It is assumed that the principal and the agent both maximize their own utility functions, so that they will almost always incur some cost in order to ensure that the agent will make optimal decisions in the sense of maximizing the principal’s welfare.

Agency costs are either the costs of inducing the agent to behave as if he were maximizing the principal’s welfare or the costs incurred by the firm when the principal-agent problem is not fully avoided. The relationship between the stockholder and the manager of a corporation fits the definition of the principal/agent relationship. The same is true for the relationship between bondholders and managers acting on the shareholder’s behalf.

2.2.3 The underinvestment problem

Myers (1977) develops a model to explain that agency costs of risky debt are a reason why rational firms limit borrowing, even when there is a tax advantage to corporate borrowing and capital markets are strictly perfect, efficient and complete. He shows that leveraged firms can forgo taking a positive present value project because shareholders’ value can be reduced if gains from the project accrue primarily to the debt holders. Thus, this underinvestment problem is an agency cost resulting from risky debt.

Mayers and Smith (1987) provide a first discussion of the role played by insurance in bonding the corporate investment decision. In their model, the firm is assumed to be financed with risky debt and the only source of uncertainty is the possibility of casualty loss. Underinvestment occurs in the sense that, in certain states of nature, shareholders of the levered firm choose to forego a positive net present value investment that, in the absence of risky debt, would be undertaken. Shareholders may decide to underinvest because the benefits of investment in some states of nature would accrue primarily to bondholders. Therefore, a potential conflict of interests exists between shareholders and bondholders. However, the firm can mitigate this conflict by including a covenant in the bond contract requiring insurance coverage. In fact, in their model insurance premiums are actuarially fair and contracting insurance is optimal whenever there is any amount of risky debt. Schnabel and Roumi (1989) extend the model to account for the effects of a premium loading. They show that there must be a minimal level of risky debt above which it is optimal to insure and below which it is not.

In MacMinn (1987), the existence of previously issued risky debt was shown to motivate an underinvestment problem. The analysis showed that, if the previously issued bonds had been issued with an insurance covenant, then the underinvestment problem could be eliminated and the stock and bond values could be increased relative to the case with no covenant. Although the analysis shows that stock value increases, it does not show if stockholders benefit from all the gains from solving the underinvestment problem.

Garven and MacMinn (1993) show that an insurance covenant can be designed that allows current shareholders to capture the gain in value and that the gain in value equals the agency costs of the underinvestment problem. It is shown that the insurance covenant not only increases current shareholder value but also eliminates
the agency costs of underinvestment. In the presence of premium loadings, the corporation demands insurance if the agency cost of the underinvestment problem exceeds the premium loading. In fact, for a sufficiently small agency cost, there is no demand for insurance. Therefore, the insurance covenant implied in their model allows shareholders to increase their value by the difference between the agency cost and the premium loading whenever it is positive.

2.2.4 The asset substitution problem

The arbitrage argument of Modigliani and Miller (1958, 1963) assumes that investment decisions will be independent of the capital structure. The optimal amount of debt should balance the tax deductions provided by interest payments against the external costs of potential default.

Jensen and Meckling (1976) challenge this argument and argue that there are some incentive effects associated with investment decisions in highly leveraged firms. They state that under some circumstances the owner-manager has an incentive to increase investment risk after debt is issued so that wealth is transferred from bondholder to equity holders, including him.

For example, it can be that the owner-manager is not indifferent between a low risk investment and a high risk investment. In fact, the riskier investment will be preferable if the owner has the opportunity to first issue debt, then decide which of the investments to take, and then sell all or part of his remaining equity claim on the market. Therefore, he can transfer wealth from the bondholders to the equity holders by promising to take the low risk investment, selling bonds and then taking the high risk investment.

The literature refers to this effect as the asset substitution problem. However, assuming rational expectations, the potential bondholders will accurately perceive the motivation of the equity owning manager and his opportunity to take the riskier project. Therefore, potential bondholders will discount the price that they will be willing to pay for new debt issued to account for the asset substitution problem. This discount on the bond price is an agency cost engendered by the issuance of debt and it is entirely borne by the owner-manager of the firm.

Leland (1998) develops a model which measures agency costs from asset substitution and the benefits of hedging to the value of the firm. However, he also finds that hedging benefits are not necessarily related to environments with greater agency costs. He argues that equity holders may voluntarily agree to hedge after debt is issued, even though it benefits debt holders: the tax advantage of greater leverage allowed by risk reduction more than offsets the value transfer to bondholders.

Morellec and Smith (2004) use an intertemporal version of the basic model used by Leland (1998) to examine the firm’s ability to commit to a specific hedging policy. They show that cash flow volatility is costly for shareholders since it induces distortions in investment policy. Therefore, shareholders have incentives to maintain the firm’s hedging policy once debt has been issued.

2.2.5 Expected bankruptcy costs

Until the mid 1980s, there was a great deal of controversy about the relevance of bankruptcy costs (or costs of financial distress) to the capital structure and to the value of the firm. In fact, if bankruptcy costs are relatively significant, then it may be argued that, at some point, the expected values of these costs outweighs the tax benefit derived from increasing leverage and the firm will have reached its optimum capital structure. Furthermore, one aspect of these costs that affects the firm’s value and its cost of capital is the fact that payments must be made to the third parties other than bondholders and owners. In fact, all expenses from the liquidation process are deducted from the net asset value of the bankrupted firm.

Warner (1977) is the first to show some evidence on bankruptcy costs in large firms. His empirical work is
based on bankruptcy costs for 11 bankrupt railroads. It is emphasized that not all of these costs are measurable. In fact the literature refers to two types of bankruptcy costs: (1) direct costs, which include lawyer’s and accountant’s fees, other professional fees, and the value of the managerial time spent in administering the bankruptcy; (2) indirect costs, which include lost sales, lost profits, lost investment opportunities and possibly the inability of the firm to obtain credit or to issue securities except under special terms.

Warner (1977) shows that, the ratio of direct bankruptcy costs to the market value of the firm appears to fall as the value of the firm increases. Also, he finds that the direct cost of bankruptcy is on average about only one percent of the market value of the firm prior to bankruptcy. However, his work is based on a very specific sample of firms, and also he is also unable to present a good measure for indirect bankruptcy costs.

Altman (1984) develops a methodology to estimate expected bankruptcy costs, including both direct and indirect costs. He uses a sample of 19 industrial firms and a second sample of seven large bankrupt companies. He finds that bankruptcy costs in many cases exceed 20% of the value of the firm measured just prior to bankruptcy and even in some cases measured several years prior. His results also show that bankruptcy costs ranged from 11% to 17% of firm value up to three years prior to bankruptcy.

Altman (1984) calls attention to the important fact that indirect bankruptcy costs are not limited to firms which actually fail. In fact, firms which have higher probabilities of bankruptcy, whether they fail or not, can still incur these costs. Thus, whenever bankruptcy costs are present, protecting the firm through insurance and/or derivatives can help to reduce these costs and increase the value of the firm. Of course, the net benefit of this protection will depend on the cost of insurance and hedging.

Following this reasoning, Smith and Stulz (1985) show that transaction costs of bankruptcy can induce widely held corporations to implement risk management strategies. Their model shows that the value of the levered firm equals the value of the unlevered firm minus the present value of bankruptcy plus the present value of the tax shield from interest payments. They also find that hedging decreases the present value of bankruptcy costs and increases the present value of the tax shield of debt.

Regarding empirical implications, it is argued that even small bankruptcy costs can be sufficient to induce large firms to hedge, if the reduction in expected bankruptcy costs exceeds the costs of hedging. In fact, Warner (1977) finds that bankruptcy costs are less than proportional to firm size, so that the reductions in expected bankruptcy costs is greater for small firms, which are then more likely to hedge. Also, Nance, et al (1993) argue that smaller US firms are more likely to have taxable income in the progressive region of the tax schedule, again implying that they are more likely to hedge. However, on the other side, Block and Gallagher (1986) and Booth, Smith and Stolz (1984) argue that hedging programs exhibit informational scale economies and those larger firms are more likely to hedge. Also, in the case of derivative markets, there are significant scale economies in the structure of transaction costs, implying that large firms are more likely to hedge with these instruments. Thus, it is argued that the relation between hedge and firm size is theoretically undetermined.

2.3 Hypotheses and proxy variables
The theory on corporate demand for hedging and (re)insurance enables us to derive some hypotheses and the respective proxy variables used in our empirical work. These hypotheses and proxy variables are outlined bellow. Lastly, Table 2 shows the expected results for each of the proxy variables with respect to their relation with the extent of reinsurance activity. A more detailed explanation of the data set is given in section 4 of this paper.

2.3.1 Financial distress costs
If reinsurance can reduce the variability of future financial results then it can also reduce expected costs of
financial distress. As explained before, these costs can be classified as both direct and indirect bankruptcy costs. Therefore, the following hypothesis is derived:

Hypothesis 1 (H1): The higher the expected costs of financial distress, the higher the corporate demand for reinsurance.

Proxy for H1: The ratio of total liabilities to total assets (before reinsurance) (LEV).

One important aspect of the reinsurance data used is that provisions for outstanding claims, which are part of insurers’ liabilities used to calculate “leverage”, are gross of reinsurance recoveries revenue. In this case, leverage is a measure of the risk insurers faced before they contracted reinsurance: ex ante risk. Therefore, leverage here is predetermined with respect to reinsurance purchases.

2.3.2 Scale economies

Insurer’s size is a proxy for many factors that impact the corporate demand for reinsurance. Yet, there is much about the relation between these factors and insurer’s size. Some examples are available in the literature on corporate demand for hedging and demand for reinsurance. For example, it is argued that even small bankruptcy costs can be sufficient to induce large firms to hedge, if the reduction in expected bankruptcy costs exceeds the costs of hedging. However, Warner (1977) finds that bankruptcy costs are less than proportional to firm size, so that the reductions in expected bankruptcy costs are greater for small firms, which, for this reason, should be more likely to hedge. In the case of reinsurance, Mayers and Smith (1990) argue that bankruptcy should have a higher impact on smaller firms, and that small firms are less likely to have the “specialized internal talent” available in larger firms. However, they also argue that the impact of size through taxes and investment-incentive motives is not defined.

Nance, et al (1993) argue that smaller US firms are more likely to have taxable income in the progressive region if the tax schedule, again implying that they are more likely to hedge. Cummins, et al (2001) also argue that larger insurers may be more diversified and therefore would demand less additional risk management instruments. However, on the other side, Block and Gallagher (1986) and Booth, Smith and Stulz (1984) argue that hedging programs exhibit information scale economies and that larger firms are more likely to hedge. Thus, despite the fact that most empirical results show a significant positive relation between (re)-insurance/hedging and company size, it is argued that the relation between (re)-insurance/hedging and company size is theoretically undetermined. Therefore, we have the following hypothesis:

Hypothesis 2 (H2): Company size has an effect on hedging demand, although the sign of the effect is ambiguous a priori.

Proxies for H2: (1) natural logarithm of insurer’s total book asset value (LnSIZE); (2) dummy variable for insurer’s members of a group of companies (D_group); (3) dummy variable for reinsurers (D_reinsurer) and (4) dummy variable for captive insurers (D_captive).

2.3.3 Taxes

The Australian company income tax structure is not progressive and an imputation system also reduces the importance of taxation as a factor in risk and capital management for Australian insurers. Theory and evidence from the US insurance market show that there is an incentive to contract reinsurance in the presence of a more convex tax schedule, which is not the case in Australia, where corporate income tax is fixed at 30%.

Hypothesis 3 (H3): The higher the convexity of the corporate effective tax function, the higher the demand for reinsurance.

Proxy for H3: the ratio of corporate taxes to premium (TAX).
If insurers have tax incentives to contract reinsurance, then more reinsurance should be related with a lower percentage of taxes per premium.

2.3.4 Insurer’s investment policy

Risk management at the firm level is only economically feasible if the increase in firm value is greater than the hedging costs, and if shareholders cannot benefit from a similar increase in value by managing risk on their own account at a lower cost. Therefore, if insurers reinsurance, it is expected that reinsurance is being used to increase firm value through reduction in taxes, costs of financial distress and agency costs.

Insurers also seek to create value to their shareholders through a wide range of investments. Table 1 shows that in the case of Australian general insurers, investment revenue is crucial. Table 1 shows that underwriting results from general insurers in Australia were negative for all years from 1998 to 2002. However, in all of those years investment revenue more than compensates for the negative underwriting results and net profits after tax are positive.

Table 1  Direct general insurer’s investment revenue in Australia ($ millions AUD)

<table>
<thead>
<tr>
<th>Item</th>
<th>1998</th>
<th>1999</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underwriting result</td>
<td>-841</td>
<td>-1,160</td>
<td>1,145</td>
<td>-517</td>
<td>-146</td>
</tr>
<tr>
<td>+ Investment revenue</td>
<td>2,034</td>
<td>2,149</td>
<td>2,080</td>
<td>2,221</td>
<td>1,142</td>
</tr>
<tr>
<td>+ / (-) Other Adj.</td>
<td>(517)</td>
<td>(437)</td>
<td>(527)</td>
<td>(658)</td>
<td>(758)</td>
</tr>
<tr>
<td>Net profit after tax</td>
<td>676</td>
<td>552</td>
<td>408</td>
<td>1,045</td>
<td>514</td>
</tr>
</tbody>
</table>

Data source: APRA.

However, financial theory supports the argument that higher investment returns would be associated with higher risk. Therefore, insurers with higher investment revenue per premium revenue should be risking more. Finally, one may conclude that insurers who risk more, because of their higher risk appetite, should also take more risks in their insurance business, so that they reinsure less. This gives the following assumption.

Hypothesis 4 (H4): A higher investment return implies that the insurer has more appetite for risk and, therefore, would demand less reinsurance.

Proxy for H4: the ratio of investment return to premium ($\text{INVEST}$).

Finally, Table 2 summarizes the expected results for each of the proxy variables with respect to their relation to the extent of reinsurance activity, measured by the ratio of reinsurance expense to total premium ($\text{REINS}$).

Table 2  Proxy variables and expected results

<table>
<thead>
<tr>
<th>Variable</th>
<th>Definition</th>
<th>Expected relation with REINS</th>
</tr>
</thead>
<tbody>
<tr>
<td>LEV</td>
<td>The ratio of total liabilities to total assets (before reinsurance)</td>
<td>+</td>
</tr>
<tr>
<td>LnSIZE</td>
<td>Natural logarithm of insurer’s total book asset value</td>
<td>+/-</td>
</tr>
<tr>
<td>TAX</td>
<td>The ratio of corporate taxes to premium</td>
<td>No relation</td>
</tr>
<tr>
<td>INVEST</td>
<td>The ratio of investment return to premium</td>
<td>+</td>
</tr>
<tr>
<td>D group</td>
<td>Dummy variable for insurers members of a group of companies</td>
<td>+/-</td>
</tr>
<tr>
<td>D reinsurer</td>
<td>Dummy variable for reinsurers</td>
<td>+/-</td>
</tr>
<tr>
<td>D captive</td>
<td>Dummy variable for captive insurers</td>
<td>+/-</td>
</tr>
</tbody>
</table>

3. Empirical studies

This section reviews the results and empirical methods of six major previous studies on the demand for (re-)insurance. More specifically, this section shows how the most recent studies use panel data methods (instead
Demand for reinsurance: Evidence from Australian insurers

of cross-sectional regressions) but there has been little reporting of diagnostic tests on panel heteroskedasticity, correlation across panels and serial correlation. These error characteristics are likely to be present in data sets on (re-)insurance demand and it is important that they accounted for in empirical analysis.

Table 3 shows the empirical results from previous studies on the corporate demand for insurance or reinsurance. The far left-hand side column shows the proxies used for variables that could explain this demand. The abbreviations S(+), S(-) and NS mean: significant positive relation; significant negative relation and not significant relation, respectively. The blanks mean that the relations were not tested.


Regarding the statistical methods, Mayers and Smith (1990), Yamori (1999) and Hoyt and Khang (2000) base their studies on cross-section regression analysis. These three articles use data sets from 1981, 1986 and 1990, respectively. However, only Hoyt and Khang (2000) report the econometric model used, which is Ordinary Least Squares. This last article is also the only one to report some diagnostics.

Table 3  Empirical results: Corporate demand for (re-)insurance

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Mg. tax rate</td>
<td>NS</td>
<td>NS</td>
<td>S(-)</td>
<td>S(-)</td>
<td>S(-)</td>
<td>S(-)</td>
</tr>
<tr>
<td>Tax shields</td>
<td>S(+)</td>
<td>NS</td>
<td>S(+)</td>
<td>NS</td>
<td></td>
<td>S(-)</td>
</tr>
<tr>
<td>Depreciation\ Assets</td>
<td>S(+)</td>
<td>NS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Managerial ownership</td>
<td>NS</td>
<td>S(-)</td>
<td>S(+)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Closely held</td>
<td>S(+)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Market-to -book ratio</td>
<td></td>
<td>S(+)</td>
<td>S(-)</td>
<td>S(+)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Debt ratio</td>
<td>S(+)</td>
<td>NS</td>
<td>S(+), S(-)</td>
<td>S(+)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Credit rating</td>
<td>S(-)</td>
<td>S(+)</td>
<td>NS</td>
<td>S(+)</td>
<td>S(-)</td>
<td></td>
</tr>
<tr>
<td>Size</td>
<td>S(-)</td>
<td>S(+)</td>
<td>S(-)</td>
<td>S(-)</td>
<td>S(-)</td>
<td>S(-)</td>
</tr>
<tr>
<td>Regulation</td>
<td>S(+)</td>
<td>S(-)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Line of Bus. Conc.</td>
<td>S(-)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Geographic concentration</td>
<td>S(-)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time controls</td>
<td></td>
<td>NS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asset Volat.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>S(+)</td>
</tr>
<tr>
<td>Length of Tail</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Correl. Invest. Ret. vs. claims</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>S(-)</td>
</tr>
<tr>
<td>Systematic risk</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>S(+), S(-)</td>
</tr>
<tr>
<td>Unsystematic risk</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Demand for reinsurance: Evidence from Australian insurers


Aunon-Nerin and Ehling (2005) use OLS regressions in which p-values are White’s heteroskedasticity consistent. They also provide information about the absence of multicollinearity. However, they contrast their OLS results with those of a fixed-effects model, but they do not provide diagnostic tests to determine if these models are appropriate. In their fixed effects model they find statistically insignificant estimates for most variables.

It can be seen in Table 3 that none of the articles were able to test all proxy variables. Also, it can be noticed that, for proxy variables tested in more than one article, almost all variables present ambiguous results among the articles (with the exception of “Line of Business Concentration” and “Geographic Concentration”). Among all the ambiguous results, the most unexpected one was the negative relation between insurance purchases and leverage (debt ratio) found by Zou, et al (2003, p.307) for China. To explain this result, the authors argue that “in China, neither creditors nor company managers seem to be able to use property insurance to effectively reduce the risk for financial distress associated with high financial leverage”.

4. The data

The data set is based on the annual reports of Australian insurers collected from APRA (Australian Prudential Regulatory Authority\(^5\)) for the period from 1996 to 2001.\(^6\) The data comprises of observations from a number of insurers and their relevant annual variables for six years. Only general insurers and reinsurers are included in the data set. Life insurers are not included because the reports do not provide information about “reinsurance expense” in the life insurance business.

<table>
<thead>
<tr>
<th>Table 4  Summary statistics</th>
<th>Max.</th>
<th>Min.</th>
<th>Mean</th>
<th>Median</th>
<th>Std. Dev.</th>
<th>Skewness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reinsurance ratio (REINS)</td>
<td>1.0000</td>
<td>0.0000</td>
<td>0.2823</td>
<td>0.1905</td>
<td>0.2675</td>
<td>0.9893</td>
</tr>
<tr>
<td>Leverage (LEV)</td>
<td>2.0763</td>
<td>0.0337</td>
<td>0.6683</td>
<td>0.7136</td>
<td>0.2555</td>
<td>0.0491</td>
</tr>
<tr>
<td>Size (LnSIZE)</td>
<td>15.9052</td>
<td>6.0450</td>
<td>11.3636</td>
<td>11.3703</td>
<td>1.8592</td>
<td>-0.1381</td>
</tr>
<tr>
<td>Tax ratio (TAX)</td>
<td>6.9625</td>
<td>-2.0518</td>
<td>0.1015</td>
<td>0.0183</td>
<td>0.4718</td>
<td>8.5241</td>
</tr>
<tr>
<td>Return on investment (INVEST)</td>
<td>0.9778</td>
<td>-0.2099</td>
<td>0.0842</td>
<td>0.0678</td>
<td>0.1027</td>
<td>5.1377</td>
</tr>
</tbody>
</table>

Although this data set enables a first study on reinsurance demand in Australia, we recognize that it imposes some limitations to our analysis. First, it would be desirable to work with a data set with information per line of business, since the level of reinsurance may differ greatly across different lines of business. Second, it would also

\(^4\) A probit model was used to analyse the decision to reinsure, the fixed-effect model analyses the volume of reinsurance contracted.
\(^5\) The data set is publicly available on pdf files at www.apra.gov.au. The title of the documents is “Selected statistic on the general insurance industry”.
\(^6\) APRA introduced a new reporting regime to General Insurers from July 2002. Under this new reporting regime, APRA has yet to determine what data will be published. Therefore, data after July 2002 is currently not available.
be desirable to have information about the types of reinsurance contracted (proportional or non-proportional). Unfortunately, this type of information is not available in the APRA data set.

The original data set consisted of 163 insurers, but the final data set was reduced to 98 insurers. Among these 98 insurers, 71 insurers have available information for the period between 1996 and 2001, 9 insurers have available information for the period between 1997 and 2001 and, finally, 18 insurers have available information for the period between 1998 and 2001. Therefore, the final data set has 543 observations. The asset value of the 98 insurers in the final data set represents 70% of all asset value of general insurers (including reinsurers) in 2001.

The reinsurance demand is measured here by the ratio of reinsurance expense to total premium revenue (REINS), hereafter “reinsurance ratio”, which represents the proportion of total premium ceded. This is the dependent variable in the econometric model. With the available data set it is possible to obtain the following explanatory variables as proxies for the factors that are expected to influence reinsurance demand: (a) the ratio of total liabilities to total assets (LEV); (b) logarithm of total asset value (LnSIZE); (c) the ratio of tax expense to total premiums (TAX); (d) the ratio of investment revenue to total investment (INVEST); (e) a dummy variable for companies that are part of a group of companies (D_group)]; (f) year dummy variables: D_1997 to D_2000; (g) a dummy variable for reinsurance companies (D_reinsurer); and (h) a dummy variable for captive insurers (D_captive).

Table 4 provides the summary statistics for these variables (except for the dummy variables). The reinsurance ratio (REINS) is on average 28.23%, which means that, on average, Australian insurers cede about 28.23% of their total premiums. However, the median reinsurance ratio is 19.05%, which means that most reinsurance ratios are less than the average reinsurance ratio. Regarding the explanatory variables, leverage and size (LnSIZE) present skewness very close to zero, implying that their distributions are quite symmetric. The average leverage is 66.83%, but the distribution is only slightly skewed to the right. On the other hand, the other two explanatory variables present high positive skewness: the tax ratio (TAX) and investment return (INVEST).

Fig. 1 shows the ratio of reinsurance to premiums from the Australian insurers from 1996 to 2001. It can be seen that this ratio varies a lot among insurers, but not so much within insurers. It can be seen that there is a larger concentration of insurers with reinsurance ratio between zero and 0.4. The major objective of this study is to

---

7 Some insurers were excluded because of the following reasons: (1) zero premiums in all years; (2) the insurer was not active in 2001; (3) In 2001, the insurer had been active for a period of three years or less.
8 One limitation of the data set is that does not allow us to control for the different types of reinsurance contracted (proportional or non-proportional). However, this is the type of dependent variable used in previous studies.
9 51 insurers (150 observations), out of the 98 insurers in the data set, are part of a group of companies.
10 Mayers and Smith (1990) determine an average reinsurance ratio of 38% and a median reinsurance ratio of 31% for US insurers in 1981.
11 The provisions for outstanding claims, which are part of insurers' liabilities used to calculate “leverage”, are gross of reinsurance recoveries revenue. This was confirmed after comparing different tables from which the data was obtained and also by double checking this with APRA's statistical staff. Therefore, “leverage” represents ex-ante exposure to insurance risk.
12 The original value-of-assets distribution is highly skewed to the right. The mean is (in AUD$000) 388,596, the median is 86,711 and skewness is 5.3.
14 The STATA econometric package is used to run all data and statistical analysis.
15 This figure also shows how the data is unbalanced, which is not necessarily a problem for estimation. Nevertheless, attrition (selection bias) is an important problem to be considered in panel data sets. For example, this could be the case if some insurers are not included in the sample because they have not reinsured properly and, hence, collapsed. However, it is believed that this is not the case, since there has been only one case of (non-life) insurer bankruptcy in Australia in the last 20 years. Another problem would be if the insurers that entered the data after 1996 exhibited different behaviours than those that were in at the beginning. This was checked by running individual regressions for each year from 1996 to 2001. The results are the not very different from year to year.
determine the factors that explain why different insurers have such different reinsurance ratios, i.e., why some insurers reinsure more and other insurers reinsure less. Fig. 1 also shows how the panel data set considerably increases the sample size. Most probably, a cross-section study using data from only one given year would not produce efficient estimates. Therefore, one may conclude that, given the data limitations, this study on the Australian reinsurance demand was only possible because of the use of panel data methods. The data set used provides variables that both theory and past empirical studies have determined to be relevant to explain the reinsurance demand.

Plots of the reinsurance ratio for each insurer separately (not shown here) indicated that, for most insurers, this variable does not vary a lot from year to year. This suggests that reinsurance demand might be related to company characteristics, which also vary little from year to year. Fig. 1 shows that there is considerable heterogeneity among insurers in Australia with respect to reinsurance policy. Thus, it is important for our econometric model to be able to account for such heterogeneity. We show how this is possible by estimating a model with dummy variables for each of the insurers.

5. Empirical results from Australian insurers

The Australian reinsurance data set shows error structures with characteristics such as heteroskedasticity, contemporaneous correlation and serial correlation. This is an important fact be taken into account in the estimation process. Table 5 summarizes the respective diagnostic results. The appendix summarizes important issues in panel data econometrics.

Heteroscedasticity is explained by the fact of heterogeneity among the units (insurers), so that their $\sigma^2_i$ s are different. However, it is still assumed that error variances within each unit do not differ over time. A Wald test\(^\text{16}\) is used after fitting a fixed-effects model. The null hypothesis is that $\sigma^2_i = \sigma^2$ for all $i$, which is rejected at the 1% level.

\[^{16}\text{See Greene (2000. p.598).}\]
level (See Table 5).

Correlation across panels, which is the contemporaneous correlation among the variables from different companies, is explained by the fact that exogenous shocks might affect all companies in a similar way. However, it is still assumed that observations are uncorrelated across time. After fitting a fixed effects model, the Breush-Pagan LM test is used to test if there is no correlation across firms. The null hypothesis of no cross-section correlation is rejected at the 1% confidence level (See Table 5).

<table>
<thead>
<tr>
<th>Regression diagnostics</th>
</tr>
</thead>
<tbody>
<tr>
<td>A modified Wald test for groupwise heteroskedasticity resulted in ( \chi^2 (98) = 2.2e +07 ), significant at the 0.01 level (one-tailed), suggesting the presence of heteroskedasticity in the error term (after fitting a fixed effects model).</td>
</tr>
<tr>
<td>A Breuch-Pagan LM test of independence resulted in ( \chi^2 (4753) = 7937.8 ), significant at the 0.01 level (one-tailed), suggesting dependence among the panels (after fitting a fixed effects model).</td>
</tr>
<tr>
<td>A Wooldridge test for autocorrelation in panel data, testing the null hypothesis of no first-order autocorrelation, resulted in ( F(1, 97) = 21.573 ), significant at the 0.01 level (one-tailed), suggesting the presence of first-order autocorrelation in the error term.</td>
</tr>
</tbody>
</table>

Finally, it is possible that the errors may show temporal dependence. This is possibly the case since the value of observations in one specific year are quite dependent on the value of observations past years. The most typical assumption is that the errors show first-order serial correlation. A test is implemented to verify the existence of serial correlation in the idiosyncratic errors of a linear panel-data model, as discussed by Wooldridge (2002, p.274). The null hypothesis of no first-order serial correlation is rejected at the 1% confidence level (See Table 5).

Table 6 depicts the correlations among regressors and suggests that multicollinearity is not present.

<table>
<thead>
<tr>
<th>Correlation matrix</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable</td>
</tr>
<tr>
<td>LEV</td>
</tr>
<tr>
<td>LnSIZE</td>
</tr>
<tr>
<td>TAX</td>
</tr>
<tr>
<td>INVEST</td>
</tr>
<tr>
<td>D_group</td>
</tr>
<tr>
<td>D_reinsurer</td>
</tr>
<tr>
<td>D_captive</td>
</tr>
</tbody>
</table>

5.1 Empirical results from OLS with PCSEs (with unit-specific dummies)

Table 7 shows the results from the OLS/PCSE regression. In order to account for heterogeneity among (re)insurers, this regression includes unit-specific dummies (a dummy variable per reinsurer). In fact, this is a combination of fixed-effects and PCSE methods. This model specification allows us to benefit from panel-corrected standard errors and the same time that we are able to account for heterogeneity. Serial correlation is accounted for in the estimated model by assuming that the error structure follows an AR1 process, as used by Beck and Katz (1995).

It can be seen that all regressors related to company size (LnSize, D_group, D_reinsurer, and D_captive) have significant coefficient estimates. This result implies that economies of scale play an important role in the demand for reinsurance in Australia, i.e., larger insurers, reinsurers members of a group of companies, reinsurers and captive insurers reinsure more. However, leverage (LEV), taxes (TAX), and investment return (INVEST) show no significant coefficient estimates.

Table 7  OLS with PCSE regression results (unit-specific dummies + AR1)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient estimates</th>
<th>Standard errors</th>
<th>t-statistic</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>LEV</td>
<td>-0.008</td>
<td>0.033</td>
<td>-0.27</td>
<td>0.790</td>
</tr>
<tr>
<td>LnSIZE</td>
<td>0.052</td>
<td>0.011</td>
<td>4.72</td>
<td>0.000***</td>
</tr>
<tr>
<td>TAX</td>
<td>0.007</td>
<td>0.008</td>
<td>0.86</td>
<td>0.387</td>
</tr>
<tr>
<td>INVEST</td>
<td>0.025</td>
<td>0.040</td>
<td>0.62</td>
<td>0.533</td>
</tr>
<tr>
<td>D_group</td>
<td>0.169</td>
<td>0.035</td>
<td>4.81</td>
<td>0.000***</td>
</tr>
<tr>
<td>D_reinsurer</td>
<td>0.131</td>
<td>0.026</td>
<td>4.89</td>
<td>0.000***</td>
</tr>
<tr>
<td>D_captive</td>
<td>0.476</td>
<td>0.048</td>
<td>9.77</td>
<td>0.000***</td>
</tr>
<tr>
<td>D_1997</td>
<td>-0.000</td>
<td>0.005</td>
<td>-0.11</td>
<td>0.912</td>
</tr>
<tr>
<td>D_1998</td>
<td>0.004</td>
<td>0.006</td>
<td>0.79</td>
<td>0.427</td>
</tr>
<tr>
<td>D_1999</td>
<td>0.005</td>
<td>0.008</td>
<td>0.60</td>
<td>0.551</td>
</tr>
<tr>
<td>D_2000</td>
<td>0.000</td>
<td>0.009</td>
<td>0.03</td>
<td>0.975</td>
</tr>
<tr>
<td>D_2001</td>
<td>0.017</td>
<td>0.010</td>
<td>1.61</td>
<td>0.108</td>
</tr>
</tbody>
</table>

Notes: The symbols *, ** and *** mean, respectively, statistical significance at the 10%, 5% and 1% level.

In relation to company size, Yamori (1999) also finds a positive relation between corporate insurance purchases and company size in Japan. Some previous studies for the U.S. reinsurance market show evidence that “size” is negatively related to reinsurance purchases.18

Mayers and Smith (1990, p.33) find evidence that group membership is generally associated with larger apparent usage of reinsurance, mainly due to regulatory issues. In the case of this study, group membership is a proxy for economies of scale.

Interestingly, OLS/PCSE results do not give statistically significant estimates for the coefficient of leverage (LEV). In fact, previous empirical studies provide very different results about the importance of leverage in the corporate demand for insurance. Hoyt and Khang (2000) and Garven and Lamm-Tennant (2003) show a positive relation between leverage and corporate insurance demand.

This relation is negative in the study by Zou, Adams and Buckle (2003) and non-significant in the study by Aunon-Ehling (2004).

Regarding the impact of taxes, the results are consistent with the results found by Yamori for the Japanese market. Like in Japan, Australian companies are not subject to a convex tax schedule and for this reason corporate taxes do not have an impact on the demand for reinsurance.

Regarding “investment return”, the hypothesis is that companies with higher investment returns have better risk management practices and therefore should also reinsure more than companies with lower investment returns. However, the results show no significant evidence of this relation.

### 5.2 Empirical results from non-optimal models

Because the data set violates most OLS assumptions, Table 8 provides a good example of spurious regression. OLS requires some weak hypothesis for its consistency, but heteroskedasticity and serial correlation are enough to rule out the asymptotically validity of OLS standard errors, t statistics, and F statistics. For this reason, the t statistic for LEV (leverage) is inflated and the p-value is zero. The same occurs with the variable for size (LnSize).

Table 9 shows the results for a “random effects” regression. As shown before, the random-effects model

---

assumes a more sophisticated structure than the OLS model, since the error structure has a composite error term. However, the data violates many of the random-effects model’s assumptions. The random-effects estimates differ from those from OLS estimation because now coefficient estimates for \(LEV\) (leverage) are statistically insignificant.

### Table 8  OLS regression results (no AR1)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient estimates</th>
<th>Standard errors</th>
<th>t-statistic</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>LEV</td>
<td>0.362</td>
<td>0.046</td>
<td>7.80</td>
<td>0.000***</td>
</tr>
<tr>
<td>LnSIZE</td>
<td>-0.029</td>
<td>0.007</td>
<td>-3.92</td>
<td>0.000***</td>
</tr>
<tr>
<td>TAX</td>
<td>0.006</td>
<td>0.023</td>
<td>0.26</td>
<td>0.793</td>
</tr>
<tr>
<td>INVEST</td>
<td>0.110</td>
<td>0.108</td>
<td>1.03</td>
<td>0.303</td>
</tr>
<tr>
<td>D_group</td>
<td>-0.002</td>
<td>0.033</td>
<td>0.10</td>
<td>0.919</td>
</tr>
<tr>
<td>D_reinsurer</td>
<td>0.005</td>
<td>0.041</td>
<td>-0.16</td>
<td>0.874</td>
</tr>
<tr>
<td>D_captive</td>
<td>0.193</td>
<td>0.059</td>
<td>3.29</td>
<td>0.001***</td>
</tr>
<tr>
<td>D_1997</td>
<td>0.011</td>
<td>0.041</td>
<td>0.28</td>
<td>0.780</td>
</tr>
<tr>
<td>D_1998</td>
<td>0.018</td>
<td>0.039</td>
<td>0.48</td>
<td>0.634</td>
</tr>
<tr>
<td>D_1999</td>
<td>0.005</td>
<td>0.040</td>
<td>0.14</td>
<td>0.885</td>
</tr>
<tr>
<td>D_2000</td>
<td>-0.001</td>
<td>0.039</td>
<td>-0.04</td>
<td>0.967</td>
</tr>
<tr>
<td>D_2001</td>
<td>0.022</td>
<td>0.040</td>
<td>0.55</td>
<td>0.580***</td>
</tr>
<tr>
<td>Const</td>
<td>0.344</td>
<td>0.080</td>
<td>4.29</td>
<td>0.000***</td>
</tr>
</tbody>
</table>

Notes: The symbols *, ** and *** mean, respectively, statistical significance at the 10%, 5% and 1% level.

### Table 9  Random effects regression results

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient estimates</th>
<th>Standard errors</th>
<th>t-statistic</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>LEV</td>
<td>0.030</td>
<td>0.031</td>
<td>0.97</td>
<td>0.336</td>
</tr>
<tr>
<td>LnSIZE</td>
<td>0.030</td>
<td>0.010</td>
<td>2.96</td>
<td>0.003***</td>
</tr>
<tr>
<td>TAX</td>
<td>0.010</td>
<td>0.009</td>
<td>1.09</td>
<td>0.276</td>
</tr>
<tr>
<td>INVEST</td>
<td>0.036</td>
<td>0.052</td>
<td>0.70</td>
<td>0.487</td>
</tr>
<tr>
<td>D_group</td>
<td>-0.112</td>
<td>0.059</td>
<td>-1.89</td>
<td>0.058</td>
</tr>
<tr>
<td>D_reinsurer</td>
<td>-0.013</td>
<td>0.079</td>
<td>-0.18</td>
<td>0.860</td>
</tr>
<tr>
<td>D_captive</td>
<td>0.186</td>
<td>0.129</td>
<td>1.44</td>
<td>0.151</td>
</tr>
<tr>
<td>D_1997</td>
<td>-0.004</td>
<td>0.014</td>
<td>-0.29</td>
<td>0.770</td>
</tr>
<tr>
<td>D_1998</td>
<td>0.002</td>
<td>0.014</td>
<td>0.17</td>
<td>0.866</td>
</tr>
<tr>
<td>D_1999</td>
<td>0.001</td>
<td>0.014</td>
<td>0.12</td>
<td>0.906</td>
</tr>
<tr>
<td>D_2000</td>
<td>-0.007</td>
<td>0.014</td>
<td>-0.49</td>
<td>0.621</td>
</tr>
<tr>
<td>D_2001</td>
<td>0.005</td>
<td>0.015</td>
<td>0.33</td>
<td>0.742</td>
</tr>
<tr>
<td>Const</td>
<td>-0.344</td>
<td>0.107</td>
<td>-0.32</td>
<td>0.748</td>
</tr>
</tbody>
</table>

Notes: The symbol *** means statistical significance at the 1% level.

Table 10 shows the estimation results from the fixed-effects model. As already discussed, because of the model assumptions, any time invariant regressors are incorporated in the intercept. That is why Table 10 does not show any estimated coefficients for the dummy variables D group and D reinsurer. Like the random-effects estimated results, the fixed-effects estimates are insignificant for the variable \(LEV\) (leverage) and still significant at the 1% level for the variable \(LnSize\) (size). Again, fixed-effects estimates will be misleading since the data set violates most fixed-effects assumptions.

It is worth mentioning that, since the data set characteristics violate many OLS, fixed-effects and
random-effects assumptions, there is no point in showing diagnostic tests to evaluate which of them is superior. The fact is that none of them are appropriate for this data set. It is also worth highlighting the different conclusions that could be drawn from the analysis if the correct model is not used.

**Table 10  Fixed effects regression results**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient estimates</th>
<th>Standard errors</th>
<th>t-statistic</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>LEV</td>
<td>-0.007</td>
<td>0.032</td>
<td>-0.24</td>
<td>0.809</td>
</tr>
<tr>
<td>LnSIZE</td>
<td>0.060</td>
<td>0.012</td>
<td>4.83</td>
<td>0.000***</td>
</tr>
<tr>
<td>TAX</td>
<td>0.010</td>
<td>0.009</td>
<td>1.13</td>
<td>0.258</td>
</tr>
<tr>
<td>INVEST</td>
<td>0.026</td>
<td>0.052</td>
<td>0.51</td>
<td>0.609</td>
</tr>
<tr>
<td>D_group</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>D_reinsurer</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>D_captive</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>D 1997</td>
<td>-0.007</td>
<td>0.014</td>
<td>-0.50</td>
<td>0.618</td>
</tr>
<tr>
<td>D 1998</td>
<td>-0.002</td>
<td>0.013</td>
<td>-0.17</td>
<td>0.866</td>
</tr>
<tr>
<td>D 1999</td>
<td>-0.005</td>
<td>0.014</td>
<td>-0.36</td>
<td>0.72</td>
</tr>
<tr>
<td>D 2000</td>
<td>-0.017</td>
<td>0.014</td>
<td>-1.15</td>
<td>0.253</td>
</tr>
<tr>
<td>D 2001</td>
<td>-0.009</td>
<td>0.015</td>
<td>-0.59</td>
<td>0.556</td>
</tr>
<tr>
<td>Const</td>
<td>-0.394</td>
<td>0.136</td>
<td>-2.90</td>
<td>0.004***</td>
</tr>
</tbody>
</table>

Notes: The symbol *** means statistical significance at the 1% level.

6. Conclusion

This paper shows a first study on reinsurance demand with Australian data. Although the data set available is not relatively large, the use of panel data methods with careful data diagnostics enables an analysis with robust results. Diagnostics results show evidence that the error structure has heteroskedasticity, contemporaneous correlation and serial correlation. Therefore, OLS with PCSEs is chosen as an appropriate estimation model in this case. Additionally, the chosen model includes company-specific dummies to account for the effect of heterogeneity among (re)insurers.

It is shown that reinsurance demand in Australia is mainly motivated by variables related to company size. The results imply that larger insurers, insurer members of a group of companies, reinsurers and captive insurers reinsure more. Another important result is that leverage is not significant related to reinsurance purchases. The same is true for taxes, and investment return.

In order to provide a comparison with other possible econometric models, this paper shows the results from models which are not optimal to the data characteristics. It is shown that estimated results from these models can give very different results for the coefficients of leverage and size. The results from this study reinforce the role that economies of scale play in the reinsurance market in Australia.

References:


Appendix:
Panel Data Models:

For example, assume our panel data model to be estimated is

\[ y_{it} = \beta_1 x_{it1} + \beta_2 x_{it2} + \ldots + \beta_K x_{itK} + \varepsilon_{it} \]  

where \( i = 1, 2, \ldots, N \) are the number of observation units, \( t = 1, 2, \ldots, T \) are the number of time periods, and \( k = 1, 2, \ldots, K \) are the number of explanatory variables, which may include a constant.

A more compact representation can be obtained by using matrix notation.

Grouping all time periods \( t = 1, 2, \ldots, T \) we get

\[ 
\begin{bmatrix}
  y_{i1} \\
  y_{i2} \\
  \vdots \\
  y_{iT}
\end{bmatrix} = 
\begin{bmatrix}
  x_{i11} & x_{i12} & \cdots & x_{i1K} \\
  x_{i21} & x_{i22} & \cdots & x_{i2K} \\
  \vdots & \vdots & \ddots & \vdots \\
  x_{iT1} & x_{iT2} & \cdots & x_{iTK}
\end{bmatrix} 
\begin{bmatrix}
  \beta_1 \\
  \beta_2 \\
  \vdots \\
  \beta_T
\end{bmatrix} + 
\begin{bmatrix}
  \varepsilon_{i1} \\
  \varepsilon_{i2} \\
  \vdots \\
  \varepsilon_{iT}
\end{bmatrix}
\]  

where \( y_i \) is a \( T \times 1 \) vector of the dependent variable for the \( i \)th subject, \( X_i \) is a \( T \times K \) matrix of explanatory variables, and \( \beta \) is a \( K \times 1 \) vector of parameters to be estimated.

\( \varepsilon_i \) is a \( T \times 1 \) vector of error terms for the \( i \)th subject. Therefore, we have a \( T \times T \) covariance matrix of the errors \( \Omega = E[\varepsilon_i \varepsilon_i'] \), \( i = 1, 2, \ldots, N \).

Estimation of equation 2 by OLS is optimal only if the error processes are homoskedastic and independent of each other. Regardless of any structure in the error process, we can still estimate equation 2 by Generalised Least Squares (GLS), if we know the covariance matrix \( \Omega \). The GLS estimates of are

\[ \hat{\beta}_{GLS} = \left( \sum_{i=1}^{N} X_i' \Omega^{-1} X_i \right)^{-1} \left( \sum_{i=1}^{N} X_i' \Omega^{-1} y_i \right) \]  

Because most times the covariance matrix of the errors, \( \Omega \), is not known it is necessary to use an estimate, \( \hat{\Omega} \). In Feasible GLS (FGLS) estimation we replace the unknown matrix \( \Omega \) with a consistent estimator. The asymptotic properties of the FGLS estimator are also established as \( N \rightarrow \infty \) because its first-order asymptotic properties are analogous to those of the GLS estimator. However, deriving finite sample properties of FGLS is generally difficult and therefore it is difficult to assess the performance of FGLS in finite samples (Wooldridge, 2002, p.157).

In many applications the FGLS methodology is not a problem because the error process may have few enough parameters that can be estimated with some degree of reliability. However, this is not the case for panel data models, where the error process has a large number of parameters. Therefore, this oversight may cause estimates of the standard errors of estimated coefficients to underestimate their true variability.

To clarify, let \( \Sigma = E[\varepsilon_i \varepsilon_i'] \), so that for each time period \( t = 1; 2, \ldots, T \) we have

\[ 
\begin{bmatrix}
  E[\varepsilon_{it} \varepsilon_{it}] & E[\varepsilon_{it} \varepsilon_{i2t}] & \cdots & E[\varepsilon_{it} \varepsilon_{iNt}] \\
  E[\varepsilon_{i2t} \varepsilon_{it}] & E[\varepsilon_{i2t} \varepsilon_{i2t}] & \cdots & E[\varepsilon_{i2t} \varepsilon_{iNt}] \\
  \vdots & \vdots & \ddots & \vdots \\
  E[\varepsilon_{iNt} \varepsilon_{it}] & E[\varepsilon_{iNt} \varepsilon_{i2t}] & \cdots & E[\varepsilon_{iNt} \varepsilon_{iNt}]
\end{bmatrix}
\]  

If we have panel heteroscedasticity then \( E[\varepsilon_i^2] \neq E[\varepsilon_i^2] \) but \( E[\varepsilon_i^2] = E[\varepsilon_i^2] \), so that \( E[\varepsilon_i^2] = \sigma_i^2 \) for all \( t=1, 2, \ldots, T \). This means that the error variances are different across units, but that they are the same for each unit for all time periods.
If we have contemporaneously correlated errors, then \( E[e_{at}e_{jt}] = E[e_{at}e_{jt}] \neq 0 \) but \( E[e_{at}e_{jt}] = 0 \), so that \( E[e_{at}e_{jt}] = \sigma_y \) for all \( t = 1, 2, \ldots, T \). That means that errors from different units are correlated only they are contemporaneous, and that this correlation is the same for all time periods.

With panel heteroscedasticity and contemporaneously correlated errors, the \( N \times N \) matrix \( \Sigma \) is

\[
\Sigma = \begin{bmatrix}
\sigma_1^2 & \sigma_{12} & \cdots & \sigma_{1N} \\
\sigma_{21} & \sigma_2^2 & \cdots & \sigma_{2N} \\
\vdots & \vdots & \ddots & \vdots \\
\sigma_{N1} & \sigma_{N2} & \cdots & \sigma_N^2 \\
\end{bmatrix}
\]  

(5)

Therefore, the error covariance matrix for the full \( NT \) observations is

\[
\Omega = \Sigma \times I_T = \begin{bmatrix}
\sigma_1^2 I_T & \sigma_{12} I_T & \cdots & \sigma_{1N} I_T \\
\sigma_{21} I_T & \sigma_2^2 I_T & \cdots & \sigma_{2N} I_T \\
\vdots & \vdots & \ddots & \vdots \\
\sigma_{N1} I_T & \sigma_{N2} I_T & \cdots & \sigma_N^2 I_T \\
\end{bmatrix}
\]

(6)

This is a \( NT \times NT \) variance covariance matrix of the errors having zeros for all noncontemporaneous observations and free parameters allowing for contemporaneous pairwise correlation of the errors and heteroscedasticity. Because \( \Sigma \) is a \( N \times N \) matrix there are \( (N \times (N + 1))/2 \) covariances to be estimated by using \( NT \) observations each.

Therefore, the Feasible GLS estimator, obtained by using an estimate of \( \Omega \), is

\[
\hat{\beta}_{FGLS} = \left( \sum_{i=1}^N X_i \hat{\Omega}^{-1} X_i \right)^{-1} \left( \sum_{i=1}^N X_i \hat{\Omega}^{-1} y_i \right)
\]

(7)

where \( \hat{\Omega}^{-1} = \hat{\Sigma}^{-1} \times I_T \).

The problem is that, in order for Feasible GLS to be used, the estimate of the \( N \times N \) matrix \( \Sigma \) has to be invertible, but its rank is the minimum of \( N \) or \( T \).

Hence, \( T \) has to be at least as large as \( N \). However, some studies have shown that even when \( T \) is greater than \( N \), FGLS can generate misleading results (Beck & Katz, 1995).

**Random effects and fixed effects**

Another possible way of solving the problem of estimating the variance covariance matrix \( \Omega \) through the estimation of the matrix \( \Sigma \) is to impose some structure on the errors. We show below how this is done in the random-effects model.

Assume the following model specification:

\[
y_{it} = x_{it} \beta + c_i + u_{it}
\]

(8)

where \( x_{it} \) is a \( 1 \times K \) vector of observable variables, \( c_i \) is a unit-specific unobservable effect and \( u_{it} \) are called the idiosyncratic errors, because they change across \( t \) as well as across \( i \). The random-effects model assumes that \( c_i \) is not correlated with the regressors \( x_{it} \). Therefore, \( c_i \) can be treated as part of the error term, so that we have a composite error term \( v_{it} = c_i + u_{it} \). The key is that the random-effects model’s assumptions (Wooldridge, 2002, p.257) made on the error structure generate the following variance-covariance matrix:

\[
\Omega = E(v_{it}v_{jt}') = \begin{bmatrix}
\sigma_c^2 + \sigma_u^2 & \sigma_c^2 & \cdots & \sigma_c^2 \\
\sigma_c^2 & \sigma_c^2 + \sigma_u^2 & \cdots & \sigma_c^2 \\
\vdots & \vdots & \ddots & \vdots \\
\sigma_c^2 & \sigma_c^2 & \cdots & \sigma_c^2 + \sigma_u^2 \\
\end{bmatrix}
\]

(9)

Therefore, in the random effects model the Feasible GLS method of estimation is used but \( \Omega \) depends only on two parameters, \( \sigma_c^2 \) and \( \sigma_u^2 \), regardless of the size of \( T \). Looking at the matrix \( \Omega \) above it is straightforward to see that the random-effects model assumes no panel heteroskedasticity. Also, the correlation between the noncontemporaneous composite errors \( v_{at} \) and \( v_{jt} \) does not
depend on the difference between \( t \) and \( s \), i.e., \( \text{Corr(visit)} = \sigma_v^2 / (\sigma_v^2 + \sigma_u^2), \ s \neq t \). However, the idiosyncratic errors \( u \) are assumed not to be serially correlated.

The fixed-effects model assumes the same specification given by equation 8. However, the difference is that the individual effects \( c_i \) are assumed not correlated with the regressors \( x_{it} \), so that they work out as a group-specific constant term in the regression model. The fixed-effects model is usually referred to as a least squares dummy variable (LSDV) model. Its estimation by OLS assumes the usual error structure of a classical regression model (Greene, 2003, p.287), which include no groupwise heteroskedasticity and no contemporaneous correlation. The term “fixed” means that \( c_i \) does not vary over time, not that it is non-stochastic. In the random-effects model, on the other hand, \( c_i \) a group specific random element, similar to \( u \) except that for each group there is a single draw that enters the regression identically in each period.

One advantage of the fixed-effects model is that it consistently estimates partial effects in the presence of time-constant omitted variables, which are captured by the term \( c_i \). However, the fixed-effects model has the drawback that we cannot include time-constant factors in \( x_{it} \), such as group dummy variables. In fact, if \( c_i \) can be arbitrarily correlated with each element of \( x_{it} \), then there is no way to distinguish the effects of time-constant observables from the time-constant unobservable \( c_i \).

**Correcting the OLS standard errors**

The PCSE methodology takes into account that if the errors in equation 2 present groupwise heteroskedasticity and/or contemporaneous correlation, then OLS estimates of \( \hat{\beta} \) will be consistent but inefficient. Therefore, the OLS standard errors will be inaccurate, but they can be corrected so that they provide accurate estimates of the variability of the OLS estimates of \( \hat{\beta} \).

In presence of groupwise heteroskedasticity and contemporaneous correlation, the correct formula for the sample estimate of the sampling variance of the OLS estimates is given by

\[
\text{EstVar}(\hat{\beta}) = (X' X)^{-1} X' \Omega X (X' X)^{-1}
\]

(10)

The standard error of the estimator \( \hat{\beta} \) is given by the square root of the \( k \)th diagonal element of this matrix. Equation 10 is different from the case in which there is no heteroskedasticity or correlation, where the sample estimate of the sampling variance of OLS is given by Greene (2003, p. 49, p. 323)

\[
\text{EstVar}(\hat{\beta}) = \hat{\sigma}^2 (X' X)^{-1}
\]

(11)

where \( \hat{\sigma}^2 \) is the OLS estimator of the common error variance, \( \sigma^2 \). Therefore, if the errors do not meet standard distributional assumptions, then equation 11 provides incorrect standard errors. In this case, the correct way to compute OLS standard error is to use equation 10. This equation can be used in combination with the panel structure of the errors to provide accurate panel-corrected standard errors (PCSEs). In the case of panel data models with contemporaneously correlated and panel heteroscedastic errors, \( \Omega \) is an \( NT \times NT \) block diagonal matrix with an \( N \times N \) matrix of contemporaneous covariances, \( \Sigma \), along the diagonal.

Therefore, to estimate equation 10, we need to estimate \( \Sigma \). Given that the OLS estimates in equation 1 are consistent, we can use the OLS residuals from that estimation to provide a consistent estimate of \( \Sigma \).

Let \( e_{it} \) the OLS residual for unit \( i \) at time \( t \). An element of \( = \) can now be estimated by

\[
\hat{\Sigma}_{i,j} = \frac{\sum_{t=1}^{T} e_{ij} e_{ij}'}{T}
\]

(12)

where the estimate \( \hat{\Sigma} \) is formed with all these elements. Finally, we can use this to find the estimator \( \hat{\Omega} \) by creating a block diagonal matrix with the \( \hat{\Sigma} \) matrices along the diagonal. We can then plug this matrix into equation 10 and obtain the panel corrected standard errors (Greene, 2003, pp. 322-323).
Process principle—The way to company’s competitiveness*

Gustav Tomek, Věra Vávrová

(Department of Economics, Management and Humanities, Czech Technical University in Prague, Technická 2, 166 27 Prague 6, The Czech Republic)

Abstract: Seeking ways to increase company’s competitiveness under current economic and social conditions brought us to investigate internal and external barriers. These reflect contradictions between participants to creation of company’s output both in internal and external value creation process. These contradictions were identified and their causes are determined. That requires also considering about the trends that are characteristic of the current development in marketing where versatile development of customer orientation dominates. The general governing principle of overcoming the barriers to the growth of company’s competitiveness is applied by the process approach in organisation and management. The mater is namely using the potential of supply chain management, as well as product and manufacture management, last but not least systematic creation of customer value with the objective of creating a loyal customer and employee.

Key words: competitiveness; supply chain management; product management; manufacture management; customer value

1. Introduction

Our research activities led us to define the factors that affect the increasing of company’s competitiveness. A number of hypotheses have been verified since 1999 within the frame of a research project, supported by the Ministry of Education of the Czech Republic—Company management and its competitiveness, as well as other research projects, e.g. Research of low-cost restructuring of principal intra-company relations in small and medium-sized companies—contradictions with marketing and Research of applying decisive market competences and removal of potential contradictions in small and medium-sized companies, marketing role in a company. In the frame of the research in recent years, approximately 300 different companies, mostly focused on electro technical manufacture were contacted in a two-year interval. The starting point was an analysis of contradictions both in the company’s value-creation chain and complex supply chain. The decisive barrier upon increasing company competitiveness is represented by internal intra-company conflicts. Upon application of “marketing business concept”, new conflicts originate in management as well as frequent “areas of friction”, both in horizontal and vertical lines, proliferating tense relations, e.g. between production management and procurement management, production preparation and buying, marketing—sales and production preparation or production as such, between production management and quality management, as well as management of auxiliary and

* This essay originated as a result of a research project entitled “Decision Making and Control for Manufacturing III, TU 11 Management of a company and its competitive ability” MSM 6840770038 CZ.

Gustav Tomek, DrSc., professor, Department of Economics, Management and Humanities, Czech Technical University in Prague; research fields: management, marketing, product management, production control, supply chain management.

Věra Vávrová, CSc., associate professor, Department of Economics, Management and Humanities, Czech Technical University in Prague; research fields: management, marketing, product management, production control, supply chain management.
servicing processes. There are also common conflicts between production and financial, economic departments or other subsystems.

The cause of the contradictions is obvious the insufficient uniformed concept of management, problems originating from unclear or even conflicts setting-out of objectives for individual departments. Further contributing factors also include insufficient professional competence, time pressure, working overload of staff or entire departments. These are fuelled by insufficient personality prerequisites, application of bureaucratic approaches, as well as the lack of mutual trust. Specifically, the above-mentioned factors reflect as a personal distance, egoism, space gap etc.

Conflicts may also be caused by company marketing itself. Marketing should operate as impulse initiator in the frame of growth and innovation processes, and then it has to deal with the following issues in its own yard:

1. Various ideas, which may originate between marketing and actual sales;
2. Avoidance of blaming negative attitude of the others for impossibility to implement its concepts;
3. Necessity to permanently prove in a measurable manner its own contribution to value creation.

A similar braking effect to company’s competitiveness growth is ascribed to conflicts with other elements of the supply chain, logistics organisations, sales agents, possibly also end consumers. Overcoming these contradictions moreover enables the growth of individual entities’ specialisation and the creation of their new competences as a result of mutual co-operation, learning and activities co-ordination. This is also related to releasing working capital by decreasing the level of inventory etc.

Seeking sources or increasing company competitiveness must respect new trends in marketing. These include new conditions induced by social and demographic changes, which lead to differentiation and individualisation of needs, new forms of life and work, attitudes towards using of free time, changes of value hierarchy etc. All of that are accompanied by market, needs and capital globalisation. The measures taken of economy, whereby companies accommodate to this new situation, require simultaneously formation of long-term customer relations. The matter is a new orientation in customer relations, which are characteristics of establishing long-term co-operation, interactive relation to product creation, dialogue between both parts of the market, emphasis on innovation, usage of new offers of information technology, users with a real vision and those who within the frame of their marketing competences support moral and ethical behaviour.

A significant way to overcome the so-called internal and external contradictions, as well as accommodate to the new trends in marketing is a thorough application of process management principles when individual company and out-of-company activities are perceived as a part of the processes, where mutual co-ordination based on information sharing and co-ordination towards a common objective lead to effective processes both in companies and in the frame of mutual company relations.

2. Characteristics of process-based approach to organization and management

Generally speaking, process management / process-based organisation means:

1. Reducing levels of hierarchy;
2. Creating temporary parallel structures;
3. Delegating powers upon asserting self-control;
4. Creating structure according to staff.

The purpose of this way is achieving flexibility, cleaning relations of bureaucracy and strengthening these on
the horizontal line, supporting orientation on human factor. Effective market orientation, i.e. its application in the sense of acquiring a competitive advantage, requires using of a synergic effect, which is determined first by participants in the value-creation process of a company, and supply chain from sub-contractors, via contractors, logistics service providers, to sale agents and end users. The objective of increasing company’s competitiveness is achieving such a product, which has a significant value for the customers and simultaneously creates favourable economic conditions for the company itself. Customers’ needs and requirements must constantly be monitored and implemented, built up. If satisfied, company position in the market and company’s value will be increased. Such a view is obviously impossible without monitoring all other factors, namely technology and production, which impact company’s competitiveness. One of the preconditions is understanding marketing development tendencies, determined by changes of market structure, to ensure impact on relations marketing, and last but not least on supporting orientation to information etc.

Each task, which cannot be fulfilled by individuals, requires formation of mutual work relations. That can be achieved firstly by joining efforts in such a way that the co-operating persons bring the same output, and secondly by providing different input for a common goal, as follows from their varying specialisation. Internal organisation, i.e., intra-company management of individual activities, is the subject matter of the organisation theory. In principle, the matter is always how to ensure if the company is able to produce the appropriate products (achieve a certain output) and market them. Simultaneously, it is impossible to overlook that the products to be manufactured are not predetermined exogenously. It is a result of a number of decisions. In the frame of these decisions, it is necessary to consider the potential co-operation as external organisations too. Thereby the issue of co-ordination becomes both internal and external. An analysis, carried out within the frame of the research, focusing on individual processes forming the main process structure of a company’s marketing function, proves that such processes co-ordination, assuming responsibility for process course, finding motivational tools, measures for monitoring the process as a whole, securing continuous communication and co-operation, can be implemented in an organisation exactly through applying the process-based principle.

The ways of creating company competitiveness based on applying process-based approach can be shown on the following scheme in Fig. 1.

![Fig. 1 The way to increased competitiveness](image)

3. Supply chain management

Companies are exposed to extensive and ever-spreading requirement for complexity (complex products,
number of options, individualised needs, supplier specialisation), upon simultaneously growing dynamics, with which the requirements change in short periods (shortening lead periods, tight deadlines in production preparation, shortening product life cycles). It is exactly common that supply chain management enables such solutions. Necessary flexibility across company borders enables accommodation and mutual approval of the course of individual value-creation processes.

A number of companies find it unbearable, both from finance angle and personnel angle, to use their own resources to secure all activity related to development, production, operation, and maintenance plus other potential activities. Therefore, they are trying to transfer some of the activities to external suppliers. Obviously the question is which key activities can be taken out of the company, so as to avoid undesired dependency on such suppliers and still fulfil the conditions of economic effectiveness of buying or own production. Dealing with such interconnected issues belongs to the matter of decision-making about outsourcing. Overview of its pros and cons is in Fig. 2.

This process enables real discussions about lean production, synchronised supply systems (just-in-time), creation of firm links among production partners, fractal production etc. The system of work is oriented on actual requirements, on optimum usage of means. It also enables seeking and effecting necessary changes and potential improvements. Planning levels are reduced. The plan can be fine-tuned on the level of production unit. A more customer-oriented approach is assumed as well as a higher self-satisfaction on part of the employees. Intra-company networks get interconnected.

### 3.1 Value-creation chain management

Process-based approach to management can be applied:

1. Both within a company (internal supply chain);
2. And within the overall value-creation chain exceeding the company, i.e., from the first supplier to the last consumer (external supply chain).

Based on this approach, we can then differentiate between “external supply chain” and “internal supply chain”, as shown schematically in Fig. 3.

The relations pictured imply that internal supply chain represents the company’s basic value-creation chain and thus becomes the subject-matter of analyses also outside the overall supply chain. SCM (Supply Chain Management) is a still developing field, which utilises many concepts oriented originally on other spheres of management, such as logistics, marketing, financial management, production management, procurement,
information systems, operation research and so on.

Supply chain is directed towards the fulfilment of customer wishes and requirements. It is a general term for all parts elements—involved directly and indirectly in this process. Thus it includes specifically not only the producers and suppliers, but also transportation companies, storage facilities, sales outlets and last but not least actual customers. From company’s point of view, this chain should be joined by all company elements which participating in the process of customer acquisition and fulfilling customer wishes and requirements. These elements include marketing, research and development, production, procurement, logistics, sales and sales support, and finance.

The basic task in supply chain management is reaching an arranged flow of product, which starts upon acquiring initial raw materials, continues via other elements adding in more (processing branches) or less (sales agents) value and heads towards the end consumers.

What is the difference among management approach to supply chain, individual separate logistic and other activities? Next to the so-called offer flow, which represents supplies of products in one direction, moreover contains the demand flow and cash flow, which flow mostly in the opposite direction in the chain. The system is able to function exactly upon implementation of all these flows. Purposeful, competitive, if we like, movement of products, is not possible without customer demand, which represents the movement power here, and equally it is not possible without the cash flow being the motivation of implementing this flow. The decisive key to supply chain management consists in synchronising all three basic flows, which we can generally call:

- Material;
- Financial;
- Information.

In order to have a complete picture, we must mention that there are also back-directed material flows in the form of goods returned, servicing and maintenance, recycling and liquidation of products.

3.2 The problem of co-ordination

As indicated on Fig. 4, the purpose of the co-ordinator’s role is namely actual co-ordination, the benefit of which consists namely in:

1. Defining the material and its differentiation from the autonomous;
2. Selecting partners;
3. Establishing relations with new partners;
4. Maintaining these relations;
5. Creating a new identity, creating a protective barrier.

Partnership provides co-ordination in its efforts for network effectiveness with brand new possibilities:

---

**Fig. 3  External and internal supply chain**
(1) Brings complementary capabilities;
(2) Multiplies know-how;
(3) Decreases risks.

Market entities of different hierarchic level join in the network. Still, network organisation represents a separate new principle. Previously fully competitive, today, however, co-operation structures join and their management can be handled using a very wide range of co-ordination methods.

Elements of strictly mutually subordinate management and removal of mutual competition will be applied where higher specificity of a common process, high frequency of individual mutual supplier-buyer relations, and therefore also a potential origination of a much larger uncertainty are involved. On the contrary, where specificity of a network’s purpose is lower, as well as frequency of mutual supplier-buyer relations, and thereby also origination and scope of potential uncertainty, the skill of co-ordination is using market relations for the purpose of securing flawless operation of the network. If we call network management principle a hybrid one, what we mean is that individual entities included in the network are joined more freely than in a hierarchically controlled management structure, but simultaneously their connection is stronger than in the frame of common market
relations.

Planning and management must utilise the potential indicated in Fig. 5.

4. Product management

The principle of marketing implies that the producer (product provider) must concentrate its efforts on the existing and latent customers’ wishes so as to offer solutions and thereby provide satisfactions. That can be achieved by specific products, services and information etc. Management marketing concept expressed this way. Nevertheless, it has its objective, which is in the simplest form achieving such sales of products to creating due turnover, which compared to costs incurred brings profit. Still, it is important to realise that product management, e.g. formulated this way, is in no way purposeless. Mutual relations of the above-stated objective can be expressed in Fig. 6, which implies that the first objective claimed from product management is development and creation of products complying with the needs, whereby as the company’s objective sales, i.e. turnover are generated based on the need of the products. In order to achieve the final goal, i.e. profit, it is necessary to ensure that the given turnover to be achieved with regard to the company (manufacturer) costs.

![Fig. 6 Support of company objectives and product management](image)

The ability of a product actually satisfying the needs of the demand source follows from the joint (synergic) effect of individual marketing measures. The offer of a solution through a synergic effect of individual product elements actually results in the product becoming a market-accepted object. The matter here is physical unity (a physical product) and output (service) focus, forming a strong tie of properties according to individually different expectations of use value. It means that product management reflects all considerations, decisions, and behaviour of the offering party, which is related to combinations and variations of individual product properties. The set of output offered by a company is formed by the overall offers, which we understand in a manufacturing company to be a sales plan or production plan (with a certain depth, width and possibly also height), as well as an assortment plan in trade.

Opportunities of product management activities must be understood first as a space for accepting a certain
product policy, and second as decision-making limits or programme determination. This issue is demonstrated in Fig. 7.

Manufacture of products capable of competition requires:

1. Knowledge of both existing and potential customers’ needs;
2. Research and development support;
3. Production equipment in the form of suitable technology;
4. Ability of the production department to arrange for the quality desired;
5. Enough capacity, possibly arranging for effective co-operation or purchasing certain parts and technological processes (outsourcing);
6. Existence of the potential of cost reduction;
7. Securing all production factors on the level requested;
8. Existence of duly qualified staff;
9. Required level of productivity;
10. Ability to secure the required product range;
11. Ability to ensure the requested sales and after-sales services (service policy);
12. Use price policy capable of competition;
13. Create an innovative climate in all elements of the value creation chain on an on-going basis.

Product management, which has a unique co-ordination role in this list of tasks, is precisely due to the range and complexity of relations, necessarily intertwined with vertical and horizontal relations. Horizontal relations represent all product policy functions as will be covered later. Vertical relations then represent common hierarchy-based management, which presumes:

1. Continuous mutual (bilateral) communication between supervisors and subordinated elements of management;
2. The right of the supervisory levels to determine basic directions and fundamental space for decision-making to subordinate levels;
3. Dependency of higher decisions success on fulfilling tasks on lower levels.

Product management implements a progressive approach to company’s value-creation process:

1. A company is an organism of interlinked and mutually conditioning activities;
2. A competitive advantage is the result of the synergic effect of the entire chain of activities;
3. A company has to ensure creation of benefit for the customer in all elements of the chain;
4. Customer’s voice must be heard against the entire product creation flow.

In accordance with these activities, the company focuses its analyses on:

1. The potential of differentiation from the customer’s point of view—identification of value activities leading to increasing benefit for the customer;
2. Costs reduction options—places and causes of incurring costs.

Individual analytical tools must be used with regard to analysis specialisation, i.e. expected strategy. According to that, it is possible to carry out:

1. A customer-oriented analysis;
2. A company-oriented analysis;
3. A competition-oriented analysis.

A certain overview may be provided by division of individual analytical methods, as shown in Fig. 8.
5. Production management

The issue of all-inclusive concept and creative implementation of management focused on internal company value-creation, possibly external supplier-buyer chain, is expressed by the term “operative management of production” and it should be understood within the frame of it. This term had been introduced in the Czech professional terminology by authors of this article years ago, and is now commonly accepted. The importance of this principle grows in relation to accepting marketing concept in manufacturing plants where it represents a practical solution to its introduction in the areas of actual company’s value-creation process management. Specifically speaking, implementation of integrated management is involved: marketing–sales–production–procurement.

Attitudes to planning and management of production reflect the tendencies and models, which comply with various stages of development, but also understanding of system concept of management activities. Alternative or follow-up approaches are usually marked the following:

1. Orientation to production factors;
2. Orientation to decision-making;

The first attitude complies with the classic concept, considered one of the starting points of the science on company economy when the basis of output creation management, i.e., production management is securing an optimal combination of production factors. There are basic factors (material, performance, operating means) and arrangement factors (management, planning, and organisation) differentiated. The management centre thus naturally becomes the actual transformation process, i.e., implementation of production.

Separate specifications of arrangement factors raise a certain amount of criticism. Orientation to decisions means the existence of decision-making processes and activities on all management levels. That must not only comply with appropriate organisation frameworks and relations, but also obviously informal relations both within the vertical and horizontal company structure. Decision-making can in no case remain indifferent to the economic principle. It means that, even here is a requirement for optimal combination of production factors and their applications. Production process is dependent on decision-making co-ordination among all of its participants.

If we respect the development in these principles including system orientation, which specifies a company as mutually interconnected subsystems, we exactly arrive at the concept of production operation management as a
company management subsystem. The principle is a complex system solution of the issue on the level of production operative management. Operative management system includes the following sub-systems:

1. Operative planning of sales, production, and procurement;
2. Operative production records-keeping;
3. Production controlling including production process and procurement management methods;
4. Variation procedures.

A set of operation plans for sales–production–procurement creates environment for integration of intra-company relations in market demands. Therefore it is a certain bridge within the microenvironment.

6. Customer value—Customer and employee loyalty

All efforts aimed at contacting with customer, tying the customer to the company and integrating him into interactive relations, which lead to full recognition of customer requirements and their fulfilment upon their participation, and to find the target purpose in creating a loyal customer. If we consider such a customer as the source of company growth, then we can also easily recognise the fact that a loyal customer influences satisfaction, i.e. loyalty of company’s own employees.

We can characterise customer loyalty using the following attributes:

1. Spontaneous loyalty to the company;
2. Permanent ties to the company;
3. Emotional relation to the company;
4. Decisiveness upon protecting the company in public.

Employee loyalty can similarly be characterised as:

1. Permanent loyalty to the company;
2. High involvement with the company;
3. Identification with company objectives and strategies;
4. Asserting the company’s goodwill in public.

The issue of customer and employee loyalty appears as a new challenge to companies namely these days when the still increasing power of the customer is apparent – no matter we look at the end consumer or sales agent (trade). That is why the prerequisite for creating and acquiring positive loyalty effects is full of customer orientation.

Human requirements, i.e., longing for their realisation, to a certain extent are matters of psychology and sociology. The offer of fulfilling the requirements may thus be more purposeful if these are fully understood and comprehensively defined. Loyalty then has a chance if there is a feeling of identification with a company of the same thinking. It is actually determined by the effort for a feeling of security, which Maslow puts in the second place on the well-known scale of human values right after satisfaction of physiological motives.

Customer requirements are, however, not based only on the motives (hunger, security, belonging to a group) or emotions (loyalty, satisfaction, fear, gratitude), but also on values (emancipation, order, freedom) and attitudes (prestige, performance, culture environment).

Based on these aspects, it is necessary to analyse the customer’s concept of loyalty, which may be:

1. To the company as such;
2. To the brand, products, post-sales services etc.;
(3) To co-operating company employees;
(4) To the company culture.

That then implies the initial target of a strategy for achieving customer loyalty. An important role is played here by product, product range, and services policy, as well as communication policy and its appropriate strategy. Companies should systematically deal with planning and asserting activities, which aim at creating customer loyalty. These measures must base on an analysis of advantages that the customer loyalty will bring, namely:

1. Increasing repeated and additional purchases;
2. Lower sensitivity to price changes;
3. Lower potential for being influenced by competition;
4. Speeded-up decision-making process upon customer’s shopping behaviour;
5. Decreasing costs of customer acquisition;
6. Customer target group homogenisation growth;
7. Decreasing sales risk;
8. Higher satisfaction on the part of own employees.

Fig. 9  Relation between satisfaction/dissatisfaction of customers and employees

As regarding employees and their requirements, they are motivated namely by the need to be a part of a process, which is fully transparent, and enables them apply their own creativity, but also the awareness of responsibility (own importance) allowing their further personality growth. This can be specified or exampled as requirements: For information, due ranking in an appropriate work position, friendly relations at workplace, security, and trust, participation in management, opportunity of advancing in education, and career growth. Correlations between customer and employer satisfaction is best shown in Fig. 9.
7. Conclusion

Finally, some specific results of the research are activities described as follows:

(1) 72% of companies assess co-operation between marketing and sales as excellent (see Table 1).

<table>
<thead>
<tr>
<th>Companies of the entire set – in %</th>
<th>Fully &amp; thoroughly</th>
<th>Only partly</th>
<th>Very little</th>
<th>Not at all</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production</td>
<td>66</td>
<td>21</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>Procurement</td>
<td>60</td>
<td>25</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>Production technical preparation</td>
<td>53</td>
<td>27</td>
<td>8</td>
<td>12</td>
</tr>
<tr>
<td>Research &amp; development</td>
<td>52</td>
<td>26</td>
<td>6</td>
<td>16</td>
</tr>
<tr>
<td>Logistics</td>
<td>49</td>
<td>31</td>
<td>6</td>
<td>14</td>
</tr>
</tbody>
</table>

(2) More than three quarters of companies deal with strategic management, i.e. not only in terms of objectives, but also as regards on-going market research and strategy of individual marketing mix tools—Objectives are mostly oriented on competitiveness and new markets (see Table 2).

<table>
<thead>
<tr>
<th>Companies of the entire set – in %</th>
<th>Fully &amp; thoroughly</th>
<th>Only partly</th>
<th>Very little</th>
<th>Not at all</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales /Distribution</td>
<td>83</td>
<td>11</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Production</td>
<td>74</td>
<td>15</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>Production technical preparation</td>
<td>68</td>
<td>25</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Procurement</td>
<td>67</td>
<td>26</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Research and development</td>
<td>58</td>
<td>23</td>
<td>8</td>
<td>11</td>
</tr>
<tr>
<td>Logistics</td>
<td>53</td>
<td>36</td>
<td>4</td>
<td>7</td>
</tr>
</tbody>
</table>

(3) Somewhat worse is the knowledge of such objectives on the part of employees where the long-term company objective is known only to 60% of persons involved. Short-term objectives, on the other hand, are used in as many as 74%. It is interesting to see that as regards strategic objective application, companies with dedicated marketing departments always achieve a slightly higher percentage.

(4) Spontaneous answers to the question of the most important activity in terms of marketing idea, clearly speak in favor of communication with the customer (meant, unfortunately, mostly as advertising), customer satisfaction and product quality. Focus on monitoring development trends, reaction to customer requirements and personal contact with customer, and also on-going marketing research appear as quite solitary answers (see Table 3).

<table>
<thead>
<tr>
<th>How accommodating the company is to customer comments</th>
<th>Fully &amp; thoroughly</th>
<th>Only partly</th>
<th>Very little</th>
<th>Not at all</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>79</td>
<td>21</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>How the company focuses on increasing product benefits to the customer</td>
<td>77</td>
<td>21</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>The rule “The customer is always right!” is spontaneously accepted by the entire company</td>
<td>67</td>
<td>31</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>How the idea of innovations is asserted in the company</td>
<td>59</td>
<td>37</td>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>

(5) The cause of the barriers to marketing development is usually mentioned to be, and that with a high
difference in points, lack of financial resources, which does not quite speak for the “marketing ideals”, also mentioned is insufficient communication with management, lack of marketing qualification, inertia in people’s thinking, missing motivation and lacking involvement—and even a (not rare) opinion that it is rather top management than employees themselves who needs to be persuaded about company’s flexibility (see Table 4).

<table>
<thead>
<tr>
<th>Table 4</th>
<th>Company flexibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Companies of the entire set—in %</td>
<td>Fully &amp; thoroughly</td>
</tr>
<tr>
<td>Is co-operation of technicians, production staff, economists, and sales force utilised upon product creation</td>
<td>69</td>
</tr>
<tr>
<td>Is production specialisation preferred in the company</td>
<td>61</td>
</tr>
<tr>
<td>Is teamwork-involvement of several departments—utilised</td>
<td>57</td>
</tr>
<tr>
<td>Are informal relations between departments and people applied upon problem solving</td>
<td>52</td>
</tr>
<tr>
<td>To what extent does the company use common forms of production co-operation</td>
<td>45</td>
</tr>
<tr>
<td>To what extent is the company using supplies based on the system of exact direct supply to the very production line—the workplace</td>
<td>23</td>
</tr>
</tbody>
</table>

(6) Theory may play a more important role as regards use of methods for seeking product ideas, as well as upon analyzing shopping behavior and customer satisfaction, which for the time being concentrated namely on prices.

(7) Respondent answers also gave evidence to a gradually increasing awareness of the necessity of co-operation between fundamental links of the value-creation chain—sales, production, procurement, as well as others, upon fulfilling requirements or company flexibility. Specifically on this issue:

A positive fact is that the basic marketing idea is perceived by the company as the only way to company development and fulfillment of its strategic objectives. The negative part is, though, that not all the levels of management and all functional spheres of the company consider marketing concept of management equally significant. In fact, they even accommodate some of its fundamental principles in a way to their subjective attitudes. Another important finding is that significant effort to accommodate to the market and modern trends in company management, including the use of information technologies, lead to neglecting what forms the bone and artery structure of this integration-based company management to such an extent that there appear also negative attitudes to care for standard management base, i.e. limits and standards, which within the frame of the company stipulate not only the methods and forms of organisation and management, but namely material and other standards of input elements, standardisation of technological and other procedures, and namely relations among production element consumption and their time, material, and space assessment from the viewpoint of organisation and management of the actual production process. Marketing employees then often assume euphorically tuned attitudes to communication policy, psychological- and sociological-kind analyses etc. and thus unwillingly separate themselves from the reality of the decisive elements of the value-creation chain. The power of marketing rises with its background, which can only be created by a company managed in an integrated manner, based on a uniform marketing concept, standardisation of all elements and relations, respecting the process-based attitude to management from the initial suppliers, via all forms of co-operation in the value creation chain to sales agents and end user of the product. A company perceived this way will then gladly be supported both by a loyal customer and own employee.

(to be continued on Page 57)
Property development firms IPOs in Brazil: Was there overpricing or not?

Claudio Tavares de Alencar; João da Rocha Lima Júnior
(Polytechnic School, University of São Paulo, São Paulo 05508-900, Brazil)

Abstract: Between September 2005 and October 2007, representative companies of the Brazilian residential real estate market adopted a strategy intended to increase their investment capacity by Initial Public Offer (IPO). The setting at that time was favorable for constructing residential real estate designed for the middle class, in view of two main factors: First, in 2005, a restructuring of the Brazilian finance system had relaxed requirements needed to receive financing for the purchase of residential property; Second, there was substantial demand in the middle class market because most developers had been focusing on the upper class market in order to guarantee the sale resources in the production phase. Thus, it was necessary to enhance the investment capacity of the real estate companies to attend the middle-class demand. These two factors, associated with a favorable outlook for the Brazilian, as well as the global economy, encouraged those representative companies to rapidly increase their investment capacity by IPO in a short time. The focus of this article is to analyze the quality of the investments in the stock of these real estate companies (21 offers were taken into account in the analysis). In order to identify what these companies’ expectations were and how they supported their decisions to enter BOVESPA with their designated prices and amounts, correlating offers against the BOVESPA Index (market index) were also analyzed. The results allow concluding that these offers were not supported by validated procedures of pricing, but rather were just speculative offers, even though we do take into account the investment grade granted to the Brazilian economy within the period concerned in our analysis.

Key words: Initial Public Offerings (IPOs); under-pricing; property investment companies; property development companies

1. Introduction

When the two agencies, Fitch and S&P, conceded the rating of BBB for the Brazilian national debt that elevated the quality of basic investments in reals to the category of investment grade. This low level of risk allows international funds destined for otherwise conservative investments in the Brazilian market to have an eye out for better alternatives.

As the two ratings converged in May 2008, the initial reaction from the Brazilian real estate market was an elation, inflamed by the trade media and on-the-spot financial experts. After all, these now accessible conservative investments represent the bulk of financial resources available for long-term investments. Keeping in mind, the main objective of such investments is the preservation of wealth, this means the resources are destined for basic undertakings in the real estate market such as rental properties or residential ventures in the form of mortgage financing for the acquisition of real estate. At the time of this study, there was natural restraint resulting from the
current economic insecurity caused by the sub-prime mortgage market in the United States.

The migration of such resources is nowhere near immediate, much less these, which are the lowest level of investment grade, withstanding the appearance of a new business oasis.

Basic real estate investments are valid for long-term financial return cycles. Although, in Brazil the observed rates of financial attractiveness are considerably higher than those of major markets, freezing resources into concrete and steel for the generation of sustained long-term income is contingent on placing confidence in prolonged cycles of a stable economy and/or demand. On the other hand, the fragility of the documents of analysis attesting to the quality of the real estate opportunities produced by Brazilian businesses is easily recognizable, and certainly is of no stimulus for the conservative money looking for financial safeguards, to anchor itself in Brazil.

Investments in products derived from financing the residential market are dependent on two factors: (1) The existence of proven instruments for the securitization of credit portfolios with a performance background and protection from credit risks; (2) The assurance of a strong secondary market where the security bonds can easily be sold/liquefied. Real estate credit in Brazil is in the hands of the banking system and the amount of CRI’s. Debentures or shares of FIDC’s in circulation do not represent enough volume to warrant confidence in an established market for this segment.

In confronting the evidence that the Brazilian real estate sector warranted an investment grade rating, the first strong reaction noted was an increase in stock values of the real estate companies listed in BOVESPA, which is the subject of this paper.

2. IPO’s literature

Although similar to the objective of this article but with a different focus of analysis, there are articles by some researchers who have evaluated indexes related to the IPO’s of real estate businesses outside Brazil. These publications are related to the stocks of REIT’s IPO, while the present article considers the indexes of the stock of Brazilian residential real estate businesses.

Gerbich, Levis and Venmore-Rowland (1999) assessed the performance of investments in the stock of companies and businesses that invest in the real estate market of the United Kingdom. The indexes of these two business types\(^1\) was compared together with an evaluation of the correlations between their stock indexes with other market indexes, one of which were the indexes of direct investment in real estate (the majority of indexes for direct investment in real estate were taken from investments made by institutional investors of the United Kingdom).

The performance of the IPO’s of real estate development companies was also investigated by Chan, S. H. et al (2001). In their research (Chan, S. H., et al., 2001), 399 IPO’s launched on the Hong Kong stock market between 1986 and 1997 were evaluated in relation to their performance the first day on the market by comparing the IPO’s of real estate development companies and the IPO’s of businesses unrelated to the real estate market. The conclusion was that their performances are quite similar. Along the same lines, the research of Brounen, D. and Eichholtz, P. (2002) evaluated the response of 54 French, British and Swedish real estate company IPO’s the first day on the market and during periods of 12 months between 1986 and 1999 concluding that, although the first

\(^1\) The authors show that real estate development companies (which develop real estate for commercialization) and companies that invest in real estate (for the long-term generation of income) present different risks, and for this, present different performances during the period analyzed (accumulated return and price of stock variations).
day’s returns were higher than expected, the accumulated results were negative for periods of 12 months.

Dimovski, W. and Brooks (2006) evaluated 37 REIT’s IPO’s in Australia during the period from 1994 to 1999 determines which of those were under-evaluated and which were over-evaluated. Of the 37 IPO’s analyzed, 15 were considered to be over-evaluated. Surprisingly, the research concluded that the value of the stock did not present significant variations in relation to its initial price. The authors believe that the main reason for this circumstance appears to be the lack of any capital gains tax if 100% of the profit is distributed as a dividend. This condition facilitates the process of valuation, therefore leading to heightened interest in the stock on the part of institutional investors. Together, these factors reduce uncertainties and consequently the likelihood of speculation, possibly resulting in less oscillation of the stock’s price.

3. Evidences

Since May 2006, the NRE has been calculating and releasing the sector Index of Real Estate (IRE), which reflects the average price of the stocks of real estate companies listed in BOVESPA. The index is composed of the price of the stock of real estate companies operating in the residential segment and the companies that invest in real estate projects for the purpose of generating income. The stock of those companies that commercialize real estate are not calculated into the index.

![Brazilian real estate indexes and the IBovespa](image)

The IRE\(^2\) is made up of three different market segment indexes: (1) IRE R50+, which reflects the performance of the stock prices of residential real estate companies and represents more than 50% of the total volume traded in that sector of BOVESPA. The three oldest real estate companies listed in that sector of BOVESPA (cyre3, gfsa3 & rsid3) are responsible for that volume, and are also listed in IBOVESPA; (2) IRE R50– is associated to the performance of the stock of the remaining 18 residential real estate companies traded on

\(^{2}\) Available at www.realestate.br.
BOVESPA; (3) IRE BI, which represents the fluctuations of the stock prices of the 6 companies that invest in real estate development portfolios for the purpose of generating income.

Fig.1 illustrates the performance of the three indexes separately, of the IRE itself and of IBOVESPA, covering an initial period from July 2007 when investors began perceiving higher risks looming for the international market with the worsening of the United States mortgage crisis, and following the concession of investment grade status by Fitch Ratings and Standard and Poor’s (May 2008).

In all the figures presented in this article, the index numbers use a base of 100 in the first month’s presentation of data to better illustrate the effects of investment grade on the price of stocks.

Fig. 2 shows the sector indexes detached from IBOVESPA. Presenting the indexes detached means quantifying the movements isolated from the sector, discounting the macro-economic effects caused by crisis and/or market euphoria reflected in the index variation of IBovespa. When the detached index has a negative gradient or presents a standard below 100, it reveals fragility of the sector. In this hypothesis, the sector is not taking full advantage of a bull market or it falls more than the stocks themselves are falling. With a positive gradient or maintaining a standard above 100, the sector proves to be more resistant to the market fluctuations, falling less or rising higher.

The analysis of these movements indicates:
• All indexes, including those of IBOVESPA, were affected negatively in August 2007, in the market’s view the most critical month for the failure of financial institutions holding sub-prime bonds (see Fig.1);
• IBOVESPA, IRE and IRE R50+ show a certain recovery until the end of 2007 with the sector’s indexes falling until April 2008. The sector indexes and IBOVESPA present a sharp rise in May 2008, most surely in reason of the investment grade rating;
• All indexes fall sharply from May to August 2008;
• The indexes of Fig. 2 show the sector’s rally was short-lived with stock prices falling sharply, much more than the decline of IBOVESPA. This reflects market skepticism concerning the price of real estate company stock
listed in IBOVESPA. It is always good to note that the selling price of any stock transaction, excluding speculation, reflects the prevailing market value.

- Isolation of the most representative fluctuations of stock prices for the residential sector (IRE R50+) reveal the greatest decline in stock value to have been among smaller companies and those of real estate. In the cycle between July 2007 and August 2008 IBOVESPA fell by 1.4%, the market value of large companies fell by 21.6%, while small companies and real estate base companies fell a whopping, 50.7% and 42.0% respectively.

- The perceived value of real estate based companies is much more linked to the exaggerated pricing occurring during the IPO’s than it is to the devaluation of portfolios which, for the most part, increased in value during the cycle. This occurred because the rental price of office space and the performance of shopping centers are producing high revenues, resulting in profits for the stockholders of property companies.

Analysis of price behavioral patterns by means of the indexes does not give real insight into the basic essentials of each real estate development company. However, it does support evidence that the monthly economic trading volume of each stock in this sector is the determining variable in this phase of analysis for holding the stock’s price up. This is true even when the prices are far below those of the IPO’s, analysis of the adopted strategies is favorable or unfavorable, and publication of the companies’ financial balance occurs in this period.

This tendency becomes even more evident when the performance of IRE B1 is compared with the history of stocks from similar companies, in a variety of international markets. This is most notably true with the Real Estate Investment Trusts (REIT) of the United States, Europe, Southeast Asia and Australia. The behavioral patterns of these REIT’s present solid values for short periods of trading and are most susceptible to macroeconomic factors, especially the referential interest rates.

An alternative method of reading (analyzing) the market is to follow the stratification of BOVESPA, classifying the companies as Mid Large Cap and Small Cap, a criteria which separates the large capitalizations (85% of the market of BOVESPA) from the smaller ones (the remaining 15%). In this paper, the companies are similarly classified as ML Cap, the most expressive real estate stock but which also has liquidity on BOVESPA. They are, Cyre3, Gfsa3, Rsid3, Brml3, Pdgr3, Agin3 & Mrv3. The others are classified as small cap, with the real estate agencies always excluded. Fig. 3 and Fig. 4, with the same format as Fig. 1 and Fig. 2, show real estate stock to be the most vulnerable one for market volatility, and small cap companies the most severely penalized.

Fig. 3 continues to show that the market believes the investment grade status will not lead the real estate sector to any higher plateau, or that, pricing of the stock is already sufficiently aggressive to the point that the value of the companies will not surpass what has already been established. This perception was so strong that in May 2008, with the market operating in a state of euphoria, the stocks did not even reach the prices of July 2007 and, further, between June and August 2008, they fell, just like BOVESPA. Fig. 2 reveals the IRE fell even more than IBOVESPA during these three months, the market reacting negatively against pricing inflated by the investment grade rating. The stock of Small Cap falls with the strong decline of August and ML Cap withstands the onslaught better, but there is no evidence of the expected valuation occurred.

As for questioning whether the entire real estate segment presents a sharp decline in prices is debatable or not, because real estate companies, in particular the Small Cap, are incapable of defending adequate prices for themselves. Two factors stand out: (1) The optimistic scenarios presented for valuation during IPO’s begin to fade in the face of the market’s reality; (2) The recent manner in which the quality of real estate company performance has been analyzed (read) has led to evaluations that attribute perennial behavior to the companies. However, the evaluations do not take into consideration that the periods submitted for analysis by the companies are quite
inferior to the actual cycles of business themselves, and therefore cannot be considered systematic. It can be said of some of the companies, that they were born after IPO, because with their investment capacity multiplied up to ten fold, they are still in the process of structuring to be able to plan, decide and operate at the new level. This means that the results are still bearing the costs of expansion. Further more, the systems are certainly not fully operational to justify considering a six-month behavioral cycle, a short period of time for business dealings and in the life of the company, as a valid indicator for projecting future performance. The severe punishment taken by prices, as seen in the index of Small cap of Fig. 4, can be the result of a very conservative evaluation (leitura) as to the capacity of the companies to begin producing adequate results for the stockholders, in face of the promises projected at IPO.

![Fig. 3 IRE mid large (ML) cap and IRE small cap (SC)](image)

Price behavior and the misguided upward movement spurred by investment grade status is clearly illustrated by verifying the variation of prices between January and August 2008.

Fig. 5 and Fig. 6, with formats similar to those preceding, show the indexes: (1) IBovespa; (2) The indexes of the largest real estate company within the sector at BOVESPA (Major ML cap); (3) The indexes of the company with the best performance in price since the launching of its IPO (Best ML cap), although, for the most part, the prices of its stock are below the IPO’s; (4) The indexes of the company with the worst performance in price since its IPO, a small cap (Worst small cap).

The largest company, perhaps in reason of being listed in IBovespa, oscillated yearlong in proximity with the market. Conversely, the favorable effect of investment grade was short-lived (the first week of May) and was followed by a plunge greater than that of the market (see Fig. 6), recovering only in August;

Likewise, the company with the most stable price fluctuates in symphony with the market’s oscillations, reaping a smaller valuation from the effect of investment grade, which dissolves quickly in the wake of the market’s decline;

The company with the worst performance takes momentary advantage of investment grade for two weeks,
but falls sharply after July 2008.

In other words, even with an analysis (readings) isolating the extremes, it is evident there is no enduring effect resulting from investment grade. This is an indication that the prices are not sustainable at the levels proposed at the launching of the IPO’s or, there are no investors willing to put faith in the reduction of Brazil’s national risk conceded by the upgrade to investment-grade credit rating.
The real estate market is passively affected by the demands of the economy. Therefore, with a sustained economic growth after absorbing the effects of the global pinch, the real estate market could possibly witness a positive reaction, although moderately, due to its extended business cycles. This effect could favor the price of property company stock, with the investment grade contributing to the acquisition of long-term capital. The real estate development business may still have a long way to go before the companies adjust to this new business domain by learning to adequately plan the offer of its products, manage decisions and processes on a scale equivalent to its size (not presently occurring) and unpacking the real estate kept in land banks where it produces nothing. There are still many unanswered questions as how developers will redesign offers to include the increasing costs of production, costs and which are greater than the incomes of the target public.

![Fig. 6  ML and SC indexes detachment from IBovespa](image)

4. Final remarks

The diverse information, which can be taken from this assortment of stock offers in OPA’s of RD in Brazil between September 2005 and April 2007, permit concluding there is no evidence indicating that the offers were submitted to any type of formal pricing.

Let us consider the principles that should be followed for the valuation of shares/stock: (1) Design behavioral scenarios founded in observed strategic planning, or, in its absence, standards of performance and behavior rigorously supported by historic examples of the company’s performance, which is undergoing pricing, using average sector standards for benchmarking; (2) Establish a certain rate of attractiveness prevalent on the market for the investment offered; (3) Formulate a price range taking into consideration scenarios stressed against the referential, assuming positions that are more aggressive and more conservative.

In the authors’ opinion, those responsible for structuring the OAP’s did not use the most recognized technique for valuation but relied on the multiples of Ebitda or RDA to set a price for the companies’ stocks, which represents a technical error. This method of pricing homogenizes behavior without giving any value to the
intrinsic quality of each organization, their strategic plans of attack in a competitive market, their management capabilities or the results.

From the models studied, which comprises all the OPA’s in this cycle, no evidence was found indicating the use of any method for determining the price of the offers, not even the second hypothesis, which does not constitute a sustained method but is merely a simplifying procedure. The data put forth in this article permits concluding that the market has relied exclusively on speculation motivated by the liquidity present in the global economy, an international image of stability and sustained economic growth for Brazil to produce the OPA's of the RD, the majority in IPO. Moreover, with the companies listed at Bovespa not presenting any evidence they are capable of producing sufficient results to sustain interest in the stock at the established prices and investors will become frustrated. Therefore indicating that placement of the IPO’s was just an isolated action, which will not permit the companies to take advantage, in the future, of the capital market as an instrument for accessing the necessary resources for their development.

References:

(Edition by Ruby and Chris)
ESDS: An E-business SOA service replica distribution scheme

SHUAI Qing-hong
(School of Economic Information Engineering, Southwestern University of Finance and Economics, Chengdu 610074, China)

Abstract: How to effectively distribute service replicas to its nodes is of much importance in an E-business SOA (service-oriented architecture) system. In many cases, the SOA service replicas are randomly placed, and any SOA service replicas have no relation with any nodes in which they are. So these service replicas are very difficultly accessed, and the flexibility of the system is poor. This paper presents such a novel service replicas distribution scheme. Instead of traditional method, this scheme is mainly based on the group structure that makes every node relate to the characteristics of the service replicas. The proposed scheme is very flexible to change the structures of the service applications. So the scheme can be employed by many scenarios where service replicas are needed.

Key words: E-business; SOA; group; service replica

1. Preliminary

The Internet has experienced an explosive growth over the last decade. Making information available to a rapidly growing user population with a high SOA service quality is quickly becoming a very important and challenging problem. Wide-area distributed SOA systems often replicate entities in order to improve reliability, access latency, or availability (HAN Shi-an & LIN Lei, 2004; HU Liang, 2004). But most SOA replica services only provide content replica. These SOA services are mostly passive and they only wait for the requests of clients. Based on the mechanism, the applications of clients must account for some problems such as replica access latency, replica location and transparency. Recently we have seen some proposals giving solutions to these problems.

The rest of the paper is organized as follows. Section 1 gives preliminary concepts and group basics. Section 2 presents the new service replicas distributing scheme as ESDS based on group structure. Section 3 presents some previous schemes and applications. Section 4 denotes a simulation to compare our scheme with a traditional one. Section 5 concludes the paper and presents future work.

In this section, some related concepts of semi-group and group (HAN Shi-an & LIN Lei, 2004) are given:

Definition 1 (Semi-group): Given a non-empty set \( S \) on which a binary operation \( \cdot : S \times S \rightarrow S \) is defined and “\( \cdot \)” is a mapping:

\[ \forall a, b \in S; a \cdot b = c \in S \]

The cardinal number \( |S| \) is called the order of the semi-group \( S \). We can write \((S, \cdot)\) simply as \( S \).

Definition 2 (Subsemi-group): If \((S, \cdot)\) is a semi-group, then a non-empty subset \( A \) of \( S \) is called a subsemi-group of \( S \) if it is closed with respect to multiplication:

\[ \forall a, b \in A, a \cdot b = c \in A \]
Definition 3 (Group): If \((S, \otimes)\) is a semi-group, then \((S, \otimes)\) is called a group if it has the following properties:
\[
\exists e \in S, \forall a \in S, a \otimes e = e \otimes a = a
\]
\[
\forall a \in S, \exists a^{-1} \in S, a \otimes a^{-1} = a^{-1} \otimes a = e
\]
Especially, \(e\) is called the identity element of the group \(S\).

Definition 4 (Subgroup): If \((S, \otimes)\) is a group, then a non-empty subset \(A\) of \(S\) is called a subgroup of \(S\), if it is closed with respect to multiplication:
\[
\forall a, b \in A, a \otimes b = c \in A
\]

Definition 5 (Generating set): If \(|\{U_i\}_{i \in I}|\) is a non-empty family of subgroups of a group \(S\), then it is easy to see that \(\bigcap_{i \in I} \{U_i\}\) is either empty or itself is a subgroup of \(S\). If \(A\) is an arbitrary non-empty subset of \(S\), then the family of subgroups of \(S\) containing \(A\) is non-empty. Hence the intersection of the family is a subgroup of \(S\) containing \(A\). We denote it by \(\langle A \rangle\), the semi-group \(\langle A \rangle\) consists of all elements of \(S\) that can be expressed as finite products of elements in \(A\). If \(\langle A \rangle = S\), we shall say that \(A\) is set of generators for \(S\) or a generating set of \(S\).

Definition 6 (Monogenic group): If \(A\) is a finite set \(\{a_1, a_2, a_3, \ldots, a_n\}\), we shall write \(\langle A \rangle\) as \((a_1, a_2, a_3, \ldots, a_n)\). Especially it is the case where \(A = \{a\}\), when \(\langle a \rangle = (a^1, a^2, a^3, \ldots, a^n)\). We refer to \(\langle a \rangle\), as the monogenic subgroup of \(S\) generated by the element \(a\). The order of \(a\) is defined as the order of the subgroup \(\langle a \rangle\). If a group \(S\) has the property that \(S = \langle a \rangle\) for some \(a\) in \(S\), we say that \(S\) is a monogenic group. \(a\) is called by the generator of the monogenic group \(A\).

Definition 7 (Group homomorphism mapping): If \(f : S \rightarrow T\) is a mapping from a group \((S, \otimes)\) into a group \((T, \oplus)\), we say that \(f\) is a homomorphism, if it has the following properties:
\[
\forall a, b \in S, f(a \otimes b) = f(a) \oplus f(b)
\]

Definition 8 (Coset): If \(H\) is a subgroup of a group \(S\) and \(a \in S\), \(Ha = \{ha \mid h \in H\}\), we say that \(Ha\) is a coset of \(S\) and \(a\) is the representative of \(Ha\).

Definition 9 (Normal subgroup): Given \(H\) is a subset of \(S\), \(A\) is called a normal group of \(S\) if it has the following property:
\[
\forall a \in S, Ha = aH
\]

Definition 10 (Abelian group): Given \((A, \otimes)\) is a group, it is called a abelian group if it has the following property:
\[
\forall a, a_i \in A, a \otimes a_i = a_i \otimes a_i \in A
\]

Lemma 1. The subgroup of abelian group is normal subgroup.

2. Previous schemes and applications

In this section, we introduce some previous schemes and applications based on group. It is important to employ multicast communication in distributed e-business SOA systems. Recently, the technique has been employed in many fields (HU Liang, 2004; Legrand, 2004; Tanenbaum, A. S, 1995; YIN Jun-wen, 2001):

Firstly, some applications employ active replication, passive replication or multi-version to copy the important SOA services as multi-replica and distribute to the different nodes in distributed E-Business SOA system. When a client sends a request to an important SOA service of the system, it actually sends a message to the group of replica. Because each of the group can provide the same SOA service, if a node breakdowns then it will not reflect other nodes. Only one node running, the requests of clients can be replied.
Secondly, CSCW has been employed in many business fields. These applications always are consisted of many nodes and the nodes must correspond with each other. For many partitions of the nodes, multicast communication must be employed to serve for these partitions.

Thirdly, distributed objects can be located in a distributed E-Business SOA system. For example, clients probably search a file in a distributed operation system V-Kernel, and they broadcast a message to all servers for it. All servers receive the message, but only file servers need to reply. It is easy for clients to find an object in a system, which can provide multicast communication SOA service.

Fourthly, multicast communication can be employed to balance load in a distributed SOA system. When a server overruns, a distributed SOA system should select other servers to replace it or subtract some load to them. Multicast communication is important to select a favorable subgroup.

But many problems are found in the schemes and applications:

Firstly, managing the relation of the SOA service replica in a distributed SOA system is difficult. When the scale of a system has been changed, each node of it has difficulty in adapting itself to the system.

Secondly, Multicast communication has difficulty in selecting a favorable subgroup, which will accept a message multicasted. And broadcast will waste much bandwidth and reflect those nodes, which will not reply specific requests.

Thirdly, failure detection brings on a series of faults. When a node recovers from a system breakdown, it will probably “forget” all SOA services, which it shall provide. That is to say it is “Lost Memory”. But in most cases, they will not adapt themselves to the system and search those SOA service distributed to them. For infinite search the SOA service belonged to them, they also will go into an infinite cycle.

As presented above, we know that these restrictions have narrowed the application areas base on group. We must present a new scheme to solve these problems.

3. The proposed scheme

The proposed SOA service replica distribution scheme is based on the group theorem.

Let \( S = \{s_0, s_1, s_2...s_m\} \), and \( s_i \) is a kind of SOA service in a distributed e-business SOA system that has \( m \) nodes. Each \( s_i \) has some replica to serve for our system exterior request. The SOA service replica distribution scheme is as follows:

Every \( s_i \) has some replica distributed in our system. \( s_i \) is defined by a ternary group \( s_i = (sname_i, sid_i, srn_i) \). \( sname_i \) is the name of \( s_i \), \( sid_i \) is the identity of \( s_i \); \( srn_i \) is the number of the replicas, which \( s_i \) has in our system. And every \( s_i \) has a set of nodes \( A_i \).

Let \( A_i \) be a set of nodes \( \{a_1, a_2...a_n \} \) and \( a_i \) is the identity of one node. \( \emptyset \) is the null that any SOA service can be provide. We can access to the replica of \( s_i \) in the set \( A_i \) if we have an identity \( a_i \). And these nodes work independently, but \( a_i \) is relative to each other. Especially in our scheme, \( a_i \) is equal to the \( sid_i \) of the \( s_i \) of which it have replica. And the \( srn_i \) saves \( |A| \).

In following section, we simplify \( A_i \) as \( A \).

Definition 12 (Selection Operation): “\( \odot \)” is a binary operation on \( A \) and the operation is defined as:

1. \( a_i \odot a_j = a_{i+j} \), if \( 0 \leq i,j \leq |A| \) and \( 0 \leq i+j < |A| \); \( a_i \odot a_j = \emptyset \), if \( 0 \leq i,j \leq |A| \) and \( i+j \geq |A| \);
2. \( a_i \odot \emptyset = \emptyset \odot a_i = a_i \)
(3) $\emptyset \circ \emptyset = \emptyset$

We call the operation “$\circ$” by selection operation.

The set $A$ on which a binary operation $A \circ A \to A$ and the mapping “$\emptyset$” consist of a group. The proof is as follows:

1. $A$ is a non-empty set. If $n=0$, $A = \{\emptyset\}$.
2. $a_i \circ a_j = a_{i+j}$ if $0 \leq i, j \leq |A|$ and $0 \leq i+j < |A|$;
   $a_i \circ a_j = \emptyset \in A$ if $0 \leq i, j \leq |A|$ and $i+j \geq |A|$;
   So $(A, \circ)$ is a semigroup.
3. $a_i \circ \emptyset = \emptyset \circ a_i = \emptyset$ and $\emptyset \circ \emptyset = \emptyset$, so $\emptyset$ is the identity element $e$.
4. $a_i \circ a_j = \emptyset$ if $0 \leq i, j \leq |A|$ and $i+j \geq |A|$.
   And $\emptyset \circ \emptyset = \emptyset$, so every element $a$ of $A$ has a converse element.
   So $(A, \circ)$ is a group.
5. Every element can be attained from $a_1$:
   $$a_i = a_1 \prod_{j=1}^{i-1} a_j \text{ if } i < |A|; \text{ And } \emptyset = a_1 \prod_{j=1}^{i-1} a_j \text{ if } i = |A|.$$

So $(A, \circ)$ is a monogenic group. And $a_1$ is the generator of the monogenic group.

According to the definitions, we have proved that $(A, \circ)$ is a monogenic group. The group $A$ provides a kind of SOA service to request. And its subgroups and its every element can provide the same SOA service. So the scheme based on group structure can solve the problems presented above. The rest of the section discusses about solving the problems presented above.

SOA service access probability: When a distributed E-business SOA system based on group runs well, all requests of clients will be averagely distributed to those nodes. If a node breakdown, those clients who send requests to it will generally repeat to send it requests until overtime. Then those clients will not receive responses and notify the system what has happened. The system perhaps provide another node to clients and clients will repeat to send requests.

Instead of traditional schemes, our scheme is based on group and the nodes received these requests sent to the group in equal probability. So a request for a kind of SOA service is sent to a node, and the next request is not always sent to the same node. Given a node breakdown and it doesn’t reply the request. Then, the next request is sent for the same kind of SOA service and it will probably be sent to another node instead of being continuously sent to the same node. Given $k$ requests will be sent for the same kind of SOA service from clients. For example, the SOA service access probability is $1 - \left(\frac{1}{2}\right)^k$, when one node breakdowns. There, $\left(\frac{1}{2}\right)^k$ is the probability that all requests are unfortunately sent to the fault node.

According to our scheme, the requests for a kind of SOA service will not always sent to a node that has breakdown. And the reply will be achieved before being aware of the error. So the latency caused by repeated requests decreased. A stimulation of the scheme will be given in the section 4.

Recovery of “lost memory”: When one node recovers from a system breakdown, it will not find these SOA services that it should provide to the distributed E-business SOA system. It is called “Lost Memory” as presenting above. In our scheme, the problem is solved by the properties of the monogenic group.

The identity $a_i$ of every node is fixed and it will not be lost. When a node recovers from a system breakdown, it only has the identity $a_i$ of itself. Then it requests all $s_i$ from our system. If it has received a $s_i$, the node gets a ternary group $s_i$ (sname, sid, srni), and the $sid$ saves the generator of the set that provide the SOA service $s_i$. The
node $a_i$ checks whether the $sid_i$ is the generator of the group that it belongs to. If the $sid_i$ is its generator, it starts up the SOA service. It actively gets the SOA service replica from our system if it does not have the SOA service replica.

We only need to prove that every node can always be or not be generated by a $s:(sname, sid, srn)$ in finite steps. The proof is as follows:

$sid_i$ is the generator of the set which includes the node $a_i$.

$srn_i$ is equal to the order $|A|$ of the node set.

And each element of $A$ has the properties:

$$a_i = \prod_{j=1}^{i-1} a_j \quad \text{if } i < |A|; \quad \emptyset = \prod_{j=1}^{i} a_j \quad \text{if } i = |A|.$$ 

If $a_i$ belongs to $A$, then there must be $i < |A|$ and $a_i = a \prod_{j=1}^{i-1} a_j$.

If $a_i$ does not belong to $A$, then $\emptyset = a \prod_{j=1}^{i} a_j$ when $i = |A|$. However, the calculation for $a_i$ will not go beyond the limits of $srn_i$. So $a_i$ can start up these SOA services in finite steps.

Load balancing based on subgroup: Group structure has some characteristics to classify the elements of groups. In our scheme, we employ coset to realize load balancing. Normal subgroup is a set of elements that have the same characteristics. If a subgroup of nodes can consist of a normal subgroup, we can distribute load to every node of the set and balance load. When the load of a node overruns its limitation, our system can classify the nodes that provide the same SOA service to balance load by normal subgroup. We select the node whose load overrun as the representative of the normal subgroup. Our system can dynamically generate and balance load, because every kind of SOA service has its set of replica and we can select some nodes including the overrunning node to generate a subgroup to share in the load.

Given $H$ is a subgroup of $A$, and if $aH_i$ or $a_iH$ is also a subgroup of $A$, then we can distribute the load of $a_i$ to the subgroup $H$. The proof is as follows:

There, $A$ is a group, and $a$ is randomly selected from $A$ and $H$ is a subgroup of $A$. Because the load is distributed from a specific node $a$, $H$ includes $a$. We must prove that $Ha$ and $aH$ is the subgroups of $A$.

Firstly, $\forall a, a_i \in A \quad a_i \odot a = a_i \odot a = a \odot a_i \quad \forall A$, so $A$ is an Abelian group;

Secondly, according to Lemma 1, $H$ is a normal group and $Ha = aH$;

Thirdly, if $a \in H$ and $H$ is a group, then $a^{-1} \in H$.

• $aH \subseteq H \odot H = H$;
• $H = (a \odot a^{-1}) \odot H = a \odot (a^{-1} \odot H) \subseteq aH$;

So $Ha = aH = H$

So $Ha$ and $aH$ are subgroups of $A$. That is to say the system can distribute load to a subgroup.

4. Stimulation results

In order to evaluate the scheme, we developed a simulator based on it. This simulator provides a modular simulation framework through which we can compare our scheme with these traditional methods. In the simulator, we assumed a group, which provide SOA services according to our scheme. According to the traditional methods (WEI Ying-mei, 2001), if a request is not replied, then the next two requests will be sent to the same node. The node will be regarded as a node break down, if the three requests are not replied. And clients will request to the
next nodes. There are 30 nodes in the simulator for the two schemes. Within these models, some nodes that are randomly selected will breakdown to evaluate them.

Fig.1 shows the average response time of them. Every pair of data shows the comparison of the two schemes, which have the same number of the nodes that has broken down. We plot the simulation time on X-axis and the average response time on Y-axis.

![Fig. 1  Average latency of two schemes](image)

According to the different requests and the number of fault nodes, the average latency is different. As we see above, the average latency of our scheme is shorter than that of the traditional scheme. Because in the traditional scheme, some indexed sequential nodes break down, and clients repeat to request to them and the latency is greatly increase. Within 0th and 9th pairs of data, the latency of ours is almost 1/2 shorter than that of the traditional scheme. Within 7th pair of data, the latency of them is the same without fault nodes. As we can see, the performance of our scheme is higher than the traditional, especially in indexed sequential nodes.

5. Conclusion

Group is a great field of algebra. It has some promising properties to improve the performance of service replicas distribution schemes. In the paper, we address some problems in traditional schemes and present a novel scheme based on group structure. And it can be used to improve SOA service access time, service availability and so on.

Our simulation results are very promising, and showed that the performance of the novel scheme is greatly improved. We note that our scheme has significant advantages. First, it can improve service access probability, and second it can recover from “Lost Memory”. At last, it can generate a normal group to balance load instead of the entire system.

References:

(Edited by Annie and Gracie)
The spill over effects of monetary policies and the welfare effects of the currency appreciation in an open economy—A simple discussion

Lixin Sun, Jim Ford, David Dickinson

(Department of Economics, University of Birmingham, Birmingham B15 2TT, UK)

Abstract: Based on new open-economy macroeconomics, this paper provides simple discussions about the equilibrium conditions of labour market, goods markets and money market in a two-country world model economy. Given one-period wage sticky assumption, the following conclusions are obtained, the monetary policy can impact labour supply and thereby the equilibrium of labour market in the short run; The spill over effect of monetary policy in home and foreign countries implies an important international transmission channel in terms of equilibrium relationships between home and foreign countries, which also demonstrates the welfare effects of currency appreciation.

Key words: new-open economy macroeconomics; monetary policy; welfare effects; currency appreciation

1. Introduction

In this paper we employ an extended form of the standard paradigm from “New open-economy macroeconomics model” developed by Obstfeld and Rogoff (1995a) to analyze the welfare effects of appreciation of home currency, and the interdependence of monetary policies in a framework of two-country world model. We find that in the short run, assuming one-period wage sticky, monetary policy can impacts real macroeconomic variables, such as labour supply and consumption. The spill over effects of monetary policy imply an important international monetary policy transmission channel, and the currency appreciation can increase the economic growth and the welfare of residents.

There are two countries in this model economy, home country and foreign country (the macroeconomic variables of foreign country are denoted by an upper asterisk), where there exists a consumer-producer economy respectively. The households or represent economic agents in two countries have same preferences, the firms have same production function. In each country there is a continuum of home agent, with population size normalized to 1([0,n] for home and [n,1] for foreign country); Each firm produces a traded good under monopolistic competitive market structure under nominal sticky assumptions. Each country has its own policy authority which is independent of each other in policy making. Governments maximize their own national wealthy or aggregate national utility. A complete international capital market is also assumed in this paradigm.

The reminder of this paper is arranged as following, section 2 describes an extended form of new
open-economy macroeconomic model; Section 3 provides the first order conditions and markets equilibriums; Section 4 discusses the interdependence of monetary policies in open economy and the welfare effects of the currency appreciation. Last section makes conclusions.

2. The model

2.1 Households and preferences

The preferences of the home agent \( j \in (0,1) \) in an infinite horizon are given by

\[
U_j(t) = E(t) \int_0^\infty e^{-\beta t} \left\{ \frac{C_j(t)^{1-\gamma}}{1-\gamma} + \frac{\chi_j}{1-\sigma} \left[ M_j(t) \right]^{1-\sigma} + \frac{\varphi_j}{1-\sigma} \left[ G_j(t) \right]^{1-\sigma} + \frac{\kappa_j}{\eta} [1 - L_j(t)]^{\eta} \right\} dt
\]

(1)

Where \( 0 < \beta < 1, \gamma, \epsilon, \sigma > 0, \eta \geq 1 \), \( \beta \) is the subject discount rate or time preference, \( \gamma \) is the elasticity of inter-temporal substitution, \( \epsilon \) is an elasticity of utility with respect to real money, \( \sigma \) is an elasticity of utility with respect to public goods, \( \eta \) is elasticity of utility with respect to leisure; \( \chi, \varphi, \kappa \) represent monetary, fiscal and labour shocks respectively.

The index \( C_j(t) \) aggregates the consumption of the home and foreign goods (Differentiated goods are produced in home \([0,n)\) and foreign \((n,1]\) respectively) by home agent, using CES forms:

\[
C_j(t) = \int_0^n c_j(z)^{(1-\theta)/\theta} dz + \int_n^1 c_j(z)^{(1-\theta)/\theta} dz^\theta \], \( \theta > 1, \)

(2)

Where \( \theta \) is the elasticity of the substitution of goods consumed between home and foreign countries.

The Home price level \( P(t) \) can be expressed by

\[
P(t) = \left[ \int_0^n p(z)^{(1-\theta)/\theta} dz + \int_n^1 [S_p(z)^*]^\theta dz^\theta \right]^{(1/(1-\theta))}
\]

(3)

Where \( p(z) \) is the price of good \( z \); \( S \) denote the nominal exchange rate.

Assuming LOOP(Law of One Price)holds here, which means

\[
p(z) = S p^* (z), P(t) = S(t) P^* (t)
\]

(4)

\( M_j(t)/P(t) \) represents the real money balance held by home agent \( j \). Government finances its budget by taxes (lump-sum) levied on household and seigniorage, then we can obtain

\[
\frac{M_j(t) - M_j(t-1)}{P(t)} + T_j(t) = G_j(t)
\]

(5)

Where \( T_j(t) \) is net taxes paid by home agent; \( G_j(t) \) is the share of government expenditure on public goods (defence, infrastructure, environment) for home agent \( j \) at time \( t \).

Therefore the third term in equation (1) \( \frac{\varphi_j}{1-\sigma} [G_j(t)]^{1-\sigma} \) represents the utility of public goods by government expenditure (positive externality) enjoyed by home agent \( j \).

Home nominal interest rate can be defined by real interest rate and price level(Fisher Equation):

\[
1 + i(t) = \frac{P(t+1)}{P(t)}[1 + r(t)]
\]

(6)

Where \( r(t) \) is the real interest rate and \( i(t) \) denotes the nominal interest rate.

Because the LOOP (4) holds, say purchasing power parity holds, the uncovered interest parity (UIP) can be
The spill over effects of monetary policies and the welfare effects of the currency appreciation in an open economy—A simple discussion

expressed as:

\[ 1 + i(t) = \frac{S(t + 1)}{S(t)} [1 + i^*(t)] \]  

(7)

The last term \( \frac{K}{\eta}[1-L_j(t)]^\eta \) in equation (1) captures the utility of leisure, where \( \eta \) is the elasticity of utility of leisure, \( L_j(t) \) represents the work hours provided by home agent \( j \), the aggregating home work hours (labor supply) can be expressed in CES forms as:

\[ L(t) = \left[ \int_0^\infty L_j(t)^{\frac{\sigma_j}{\sigma_j - 1}} dj \right]^{\alpha_j/(\sigma_j - 1)} \]  

(8)

So foreign labor supply is

\[ L^*(t) = \left[ \int_0^\infty L_j^*(t)^{\frac{\sigma_j}{\sigma_j - 1}} dj^* \right]^{\alpha_j/(\sigma_j - 1)} \]  

(9)

Similarly, the Home agent’s real wage can be expressed by \( \frac{W(t)P(t)}{P(t)} \) and the home aggregating real wage is

\[ \frac{W(t)}{P(t)} = \left[ \int_0^\infty \left( \frac{W_j(t)}{P(t)} \right)^{1-\sigma} dj \right]^{1/(1-\sigma)} \]  

(10)

The home agent maximizes his discount present value (1) of mainstream utility subject to the following budget constraint:

\[ P(t)C_j(t) + P(t)B_j(t) + M_j(t) + P(t)T_j(t) = P(t)(1+r(t))B_j(t-1) + W_j(t-1)L_j(t-1) + M_j(t-1) + d(t-1)K_j(t-1) \]  

(11)

Where \( r \) is the market rate of return, \( d(t)K_j(t) \) is the cash dividend paid by the firm \( j \), \( B_j(t) \) is the bond held by the consumer \( j \) at time \( t \), which is issued in an international market. Here we assume the end-period wage payment.

2.2 The firms and production function

Using the producer-consumer paradigm which means there exists same number of consumers as the number of the producers, we index the number of the firms into \([0, 1]\) (home firms \([0,n)\), foreign firms \((n,1]\)). Each firm produces a differentiated traded good under the monopolistic competitive market. The production function is a Cobb-Douglas technology:

\[ F_j(t) = A(t)K_j(t)^\alpha L_j(t)^{1-\alpha} \]  

(12)

Where \( K_j(t) \) is the capital held by firm \( j \) at time \( t \), we assume no capital depreciation here. \( A(t) \) is the technology parameter (total factors productivity).

\[ K_j(t + 1) = K_j(t) + I_j(t) \]  

(13)

Firm \( j \) raise fund from the international market by issuing risk-free bond which is invested by home agents. Assuming constant return to scale, then MPK (marginal product of capital) and MPL (marginal product of labour) are

\[ A(t)K_j(t)^{\alpha - 1} = r(t) \]  

(14)

\[ A(t)L_j(t)^{\alpha} = W_j(t) \]  

(15)

Where \( K_j(t) \) denotes the capital labour ratio \( K_j(t) / L_j(t) \).
Let $d(t)$ represent the real rate of profit associated with a unit of capital at time $t$; $r(t)$ is the real rate of interest at time $t$; Tobin’s Q, which can be expressed by the discounted present value of streams of profits from the firms, is:

$$Q_j(t) = \int_0^\infty e^{-rt}d(t)K_j(t)dt$$

(16)

If $d(t)$ and $r(t)$ are constant

$$q_j(t) = \frac{d(t)}{i(t) - \pi(t)}$$

(17)

Where $q_j(t)$ represents the value of unit capital, in steady state $q_j(t)=1$, therefore

$$r(t) = F'(K(t)) = d(t)$$

(18)

The firm $j$ must purchase oil (energy) in the production. Finn (1995, 2000) developed the relationships between the energy and the capital utilization. The oil is connected with the capital utilization, which means

$$O_j(t) = a_j(t)K_j(t)$$

(19)

Where $O_j(t)$ represent the value of the oil demanded by the firm $j$ and $a_j(t)$ is the ratio of oil and capital, $a_j(t)>0$. Equation (19) implies that the more capital is used, the more oil is required (Finn, 1995; Finn, 2000).

The home oil demand can be calculated by CES form

$$O(t) = [\int_0^\infty O_j(t)^\theta dt]^{1/\theta}$$

(20)

We can obtain the aggregate output of home firms as following

$$Y(t) = [\int_0^\infty Y_j(t)^{(\theta-1)/\theta} dt]^{\theta/(\theta-1)}$$

(21)

Where $Y_j(t)$ is the output of firm agent $j$ with the production technology (12).

Then firm $j$ maximizes its discount present value of the mainstream of profits

$$Q_j(t) = E(t)\int_0^\infty e^{-\beta t}z(t)K_j(t)dt = E(t)\int_0^\infty e^{-\beta t}[P(t)Y_j(t) - W_j(t)L_j(t) - I_j(t) - O_j(t)]dt$$

(22)

Subject to

$$F_j(K_j(t), L_j(t)) \geq Y_j(t)$$

(23)

2.3 Government and monetary policy

Assuming that home country and foreign country hold similar economic structure and conduct same monetary policy and fiscal policies, we only show the relationships in home country.

Home government budget constraint can be expressed

$$\frac{M(t) - M(t-1)}{P(t)} + T(t) = G(t)$$

(24)

We assume that home country money authority takes nominal interest rate as the money policy tool and targets the inflation rate and output discretionally, which implies that the central bank follows the Taylor’s rule as

$$i_t = \pi_t + \delta_1(\pi_t - \bar{\pi}) + \delta_2(Y - \bar{Y})$$

Where $\bar{\pi}$ and $\bar{Y}$ are targeting inflation and output respectively.

3. First-order conditions and equilibriums
In each country, labor market, goods market, and money market are clearing in term of above relationships and assumptions.

The first-order conditions are summarized in appendix.

**3.1 Labor market**

The first-order condition for labor supply in labor market is

\[
L_j^{\eta-1}(s,t) = \frac{\chi W_j(t-1)}{\kappa [\frac{M_j(t)}{P(t)}]^\alpha}
\]

Equation (25) implies \((\eta > 1)\) that the labor supply of home represent is proportional positively to the nominal wage income (Human wealth), negatively to the real money (Finance Wealth) held by Home agent. Therefore the Monetary policy has an negative effect on labor supply under sticky nominal wage assumption: When money supply rises (expansionary monetary policy), the numerator of equation (25) will hold constant (sticky nominal wage assumption, but real wage will decline), the denominator of above equation will increase which decreases the labor supply, because the house agents hold more nominal finance wealthy(the illusion of money). If no sticky wage exists, the combining effect of wage income and real money depends on which one dominates.

From equation (15) the labor demand function can be obtained as

\[
L_j(d,t)^\alpha = \frac{(1-\alpha)A(t)K_j^{\alpha}(t)}{W_j(t)}
\]

Equation (26) shows that the demand for labor is positively correlated with the capital investment and productivity, negatively related to the wage rate.

The labor market clearing condition (Under sticky wage) is

\[
\bar{L}_j = L_j(s,t) = L_j(d,t) = \frac{\kappa^{1-(\alpha+1)}}{\kappa [\frac{M_j(t)}{P(t)}]^\alpha} \frac{K_j^{\alpha}}{[\frac{M_j(t)}{P(t)}]^\alpha}
\]

Equation (27) shows that the equilibrium labor is positively proportional to productivity and capital stock, negatively proportional to the wealth accumulated.

From the symmetry assumption, the foreign country has similar equilibrium in labor market.

Equation (27) implies that the monetary policy can affect the equilibrium of labour market by impacting labour supply and demand.

**3.2 Goods market**

Because the sum of the current account in the world is zero therefore we have

\[
Y(t) + r(t)nB_j(t) - C(t) - I(t) - G(t) = -[Y^*(t) + r^*(t)(1-n)B_j^*(t) - C^*(t) - I^*(t) - G^*(t)]
\]

In this frame work, although \(Y^*(t) = Y(t) + Y^*(t)\) holds, it is noted that the following relationships are different from that in close economy:

\[
Y(t) \neq C(t) + I(t) + G(t)
\]

And

\[
Y^*(t) \neq C^*(t) + I^*(t) + G^*(t)
\]

When interest rate parity holds, \(r(t) = r^*(t)\), then the world goods market equilibrium is
The spill over effects of monetary policies and the welfare effects of the currency appreciation
in an open economy—A simple discussion

\[ Y^w(t) = C^w(t) + I^w(t) + G^w(t) \]  

(28)

Where \( Y^w, C^w, I^w, G^w(t) \) are world output, world consumption, world investment and world expenditure by governments respectively.

3.3 Money market

The first-order condition for equation (1) is

\[ C_{j}^{-\gamma} = \chi \left[ \frac{M^*_j(t)}{P(t)} \right]^{-\epsilon} P(t) \quad \text{and} \quad C_{j}^{*\gamma} = \chi \left[ \frac{M^*_j(t)}{P^*(t)} \right]^{-\epsilon} P^*(t) \]

we can obtain

\[ \left( \frac{C_{j}(t)}{C_{j}^*(t)} \right)^{-\gamma} = \chi \frac{S(t)^{1+\epsilon}}{X} \left[ \frac{M^*_j(t)}{M^*_j(t)} \right]^{-\epsilon} \]

Taking log, using lower case denotes the log forms we can obtain

\[ c_j(t) - c_j^*(t) = \frac{\epsilon}{\gamma} [m_j(t) - m_j^*(t)] - \frac{1+\epsilon}{\gamma} s(t) \]  

(29)

Equation (29) implies an important international monetary transmission channel which will be detailed discussed in section 4.

3.4 Assets market

Obviously, the international-asset-market-clearing condition is

\[ nB_j(t) + (1-n)B_j^*(t) = 0 \]  

(30)

4. The interdependence of money policies and the welfare effects of the currency appreciation

From the first-order condition for equation (1) subject to equation (2), we can obtain

\[ \left( \frac{C_{j}(t)}{C_{j}^*(t)} \right)^{-\gamma} = \chi \frac{S(t)}{X} \left[ \frac{M^*_j(t)}{M^*_j(t)} \right]^{-\epsilon} \]

Taking log on above equation and differentiating with respect to time, obtaining

\[ \dot{c} - \dot{c}^* = \frac{\epsilon}{\gamma} (\dot{m} - \dot{m}^*) - \frac{1+\epsilon}{\gamma} \dot{s} \]

(31)

Where lowercase variables represent the log form of variables (\( z = \log(Z) \)) and we use \( \dot{z} = \frac{dz/dt}{z} \).

Firstly, assuming that foreign country variables are given, say \( \dot{c}^* \) and \( \dot{m}^* \) keeping stable, equation (31) shows that the expansionary home monetary policy increase the economic growth of home country,

\[ \dot{m} \uparrow \Rightarrow \dot{c} \uparrow \Rightarrow \dot{y} \uparrow \]

Secondly, the effect of expansionary foreign monetary policy on home economy depends on the ratio of foreign consumption growth and monetary growth: If they change at ratio of \( \frac{\dot{c}}{\dot{m}} \) (namely, \( \dot{c} = \frac{\epsilon}{\gamma} \dot{m} \)), the foreign monetary policy shock has no effect on home economy, if \( \dot{c} > \frac{\epsilon}{\gamma} \dot{m} \), the expansionary foreign monetary policy shock has a positive spill over effect on home economy(Benefits-thy-neighbour), if \( \dot{c} < \frac{\epsilon}{\gamma} \dot{m} \), the expansionary foreign monetary shock has a negative spill over effect on Home economy(Beg-thy-neighbour), so the spill over effects of monetary policy of one country on another country depends on its internal economic structure and its internal monetary policy transmission channel.
Thirdly, ceteris paribus, the appreciation of home currency will increase the welfare of home agents because 
\[ \hat{s} \downarrow \text{(home currency appreciation)} \Rightarrow \hat{c} \uparrow \]

5. Conclusions and summary

Based on new open-economy macroeconomics, the model we set up can be used to achieve the equilibrium conditions for labour market, goods markets and money market in a two-country world model economy. These conditions and the further results from these conditions show the monetary policy can impact labour supply and thereby the equilibrium of labour market in the short run given one-period wage sticky assumption; The interdependence effects of monetary policies or spill over effect of monetary policy in home and foreign countries demonstrates that, first, the expansionary home monetary policy increase the economic growth of home country; Second, whether an expansionary monetary policy has a Beg-thy-neighbour or Benefits-thy-neighbour effect in open economy, depends on the ratio of the consumption growth and monetary growth in its economic structure; If the aggregate consumption can absorb the monetary shocks, no effects on the neighbour’s economy; Third, the appreciation of home currency has an positive home welfare effects. These interesting initial results by the model imply that the further discussions and developments on this framework are necessary and expected.

References:

Appendix: The first order solution for equilibriums of labour and money market

Max. \[ U_j(t) = E(t) \int_0^\infty e^{-\lambda(t)} \left( C_j(t)^{\gamma} \left( \frac{1}{1-\gamma} \right) \right) + \frac{M_j(t)}{P(t)} \left[ G_j(t) \right]^{\sigma} + \frac{\kappa}{\eta} \left[ 1 - L_j(t) \right]^\eta \] \[ dt \quad (A1) \]
Subject to
\[ P(t)C_j(t) + P(t)B_j(t) + M_j(t) + P(t)T_j(t) = \]
\[ P(t)(1+r(t))B_j(t-1) + W_j(t-1)L_j(t-1) + M_j(t-1) + d(t-1)K_j(t-1) \]
\[ \lambda = U_j(t) = E(t) \int_0^\infty e^{-\lambda(t)} \left( C_j(t)^{\gamma} \left( \frac{1}{1-\gamma} \right) \right) + \frac{M_j(t)}{P(t)} \left[ G_j(t) \right]^{\sigma} + \frac{\kappa}{\eta} \left[ 1 - L_j(t) \right]^\eta \] \[ dt \]
\[ -\lambda(t) \begin{cases} \left[ P(t)C_j(t) + P(t)B_j(t) + M_j(t) + P(t)T_j(t) - \right] \\
\left[ P(t)(1+r(t))B_j(t-1) - W_j(t-1)L_j(t-1) - M_j(t-1) - d(t-1)K_j(t-1) \right] \end{cases} \]

First order condition:
\[ \frac{\partial \lambda(t)}{\partial C_j(t)} = e^{-\lambda(t)} \cdot C_j^{\gamma} - \lambda(t)P(t) = 0 \quad (A3) \]
\[ \frac{\partial \lambda(t)}{\partial \alpha(t)} = 0 \Rightarrow P(t)C_j(t) + P(t)B_j(t) + M_j(t) + P(t)T_j(t) = \]

56
The spill over effects of monetary policies and the welfare effects of the currency appreciation in an open economy—A simple discussion

\[ P(t)(1 + r(t))B_j(t - 1) + W_j(t - 1)L_j(t - 1) + M_j(t - 1) + d(t - 1)K_j(t - 1) \]  
(A4)

\[ \frac{\partial L_{a_j}}{\partial M_j} = 0 \Rightarrow e^{-\beta t} \frac{M_j(t)}{P(t)} \]  
(A5)

\[ \frac{\partial L_{a_j}}{\partial L_j(t)} = 0 \Rightarrow e^{-\beta t}[-\kappa L_j^{-1}(t)] + W(t) \lambda(t) = 0 \]  
(A6)

(Sticky assumption: \( W(t) = W(t - 1) \Rightarrow L(t - 1) = L(t) \))

From (A5) \[ e^{-\beta t} \frac{M_j(t)}{P(t)} \]  
(A7)

Substituting (A7) into (A3) we can obtain

\[ C_j = \chi \left[ \frac{M_j(t)}{P(t)} \right]^{-\varepsilon} P(t) \]  
\[ C^*_j = \chi^* \left[ \frac{M_j^*(t)}{P^*(t)} \right]^{-\varepsilon} P^*(t) \]  
(A8)

From (A8) the following expression can be obtained:

\[ \frac{C_j}{C^*_j} = \frac{\chi^*}{\chi} \frac{S(t)^{\varepsilon} \left[ \frac{M_j(t)}{M_j^*(t)} \right]^{\varepsilon}}{\left[ \frac{M_j(t)}{P(t)} \right]^{\varepsilon}} \]  
(A9)

For Labor Market, from (A6) and (A7) we can get

\[ L_{j-1}(t) = \frac{W(t - 1)}{\kappa} \chi \left[ \frac{M_j(t)}{P(t)} \right]^{-\varepsilon} \]  
(A10)

(continued from Page 34)

Application for theoretical and real situations can be summed up in confirming the following hypotheses concerning the attributes leading to increasing company’s competitiveness:

1. On-going communication and establishing relations with suppliers, logistic services, co-operating parties and sales agents as well as creation of mutually co-ordinated relations;
2. Thorough recognition of customer needs;
3. Creation of innovative climate, in which the customer is actively involved;
4. Creation of a loyal customer;
5. Involvement of employees who become responsible for the company’s success;
6. Increasing information flow level;
7. Asserting the change from functional to process-based approach.

References:


(Edited by Ruby and Gracie)
Avatar-based learning in Second Life

Samia L. Jones
(Texas A&M University, Doha 23874, Qatar)

Abstract: Over the years, Second Life has provided ways for the world of academia to put creativity lending to immersive education, distance learning, knowledge sharing, faculty networking and many other ways to enhance the collective educational community’s efforts in the real world. The success of such projects within Second Life can be credited to many innovative educators, academics and students who have chosen to utilize Second Life in education. Second Life was honored at the 59th Annual Technology & Engineering Emmy Awards for advancing the development of online sites with user-generated content in 2008. Second Life is an open platform where information is generally freely available to all residents. This freedom is a mixed blessing. While on the one hand, free and open content promote creativity through what is known as “derivative works”, which means work based on something someone has done previously, on the other hand it has a tendency of not crediting people properly for original innovative work. This research aims to investigate perceptions of using and continuance decisions of using Second Life Virtual Classroom as learning tools in the existing life. The research will use web based questionnaire to gather respondents. Particularly, the questionnaire surveys participants’ perceptions of the usefulness, ease of use, perceived value, perceived quality, satisfaction, and expectation of Second Life Virtual Classroom as learning tools and their intention to re-use Second Life Virtual Classroom in education. It also questions the factors that influence participants’ perceptions.

Key words: virtual classroom; Second Life; learning

What is Second life?
Second Life is a 3-D virtual world developed by Linden Lab on 2003 and is accessible free via the internet by downloading a client program called the Second Life Viewer. It enables its users, called Residents, to interact with each other through avatars. Residents can explore, meet other residents, socialize and participate in individual or group activities.

The world in Second Life
From the moment a student enter the World he/she will discover a vast digital continent, teeming with people. He/she will also be surrounded by the creations of other fellow residents.

Who uses Second life?
Second Life is used as a platform for education by many institutions, such as colleges, universities, libraries and government entities. There are over one hundred regions using it for educational purposes covering many subjects. Instructors and researchers in Second Life like it because it is more personal than traditional distance learning.

Why use Second Life?
Second Life provides a unique and flexible environment for educators, who are interested in distance
Avatar-based learning in Second Life

learning, computer-supported cooperative work, simulation, new media studies and corporate training. Second Life provides an opportunity to use simulation in a safe environment to enhance experiential learning, allowing individuals to practice skills, try new ideas, and learn from their mistakes. The ability to prepare for similar real-world experiences by using Second Life as a simulation has unlimited potential!

Students and educators can work together in Second Life from anywhere in the world as part of a globally networked virtual classroom environment. Using Second Life as a supplement to traditional classroom environments also provides new opportunities for enriching existing curricula.

1. Introduction

Over the years, Second Life has provided ways for the world of academia to put creativity lending to immersive education, distance learning, knowledge sharing, faculty networking and many other ways to enhance the collective educational community’s efforts in the real world. The success of projects surrounding these efforts within Second Life can be attributed to many innovative educators, academics and students who have chosen to utilize Second Life for these purposes.

Linden Lab announced that Second Life Residents logged time were nearly 400 million hours in 2008, growing 61% over 2007, which highlights the tremendous growth rate in user engagement that Second Life maintained throughout 2008. Using hours increased steadily each quarter, culminating in a record-setting 112 million using hours in Q4 (see Fig. 1). In addition:

- Peak concurrent users were up 31% over 2007;
- Land owned by Residents increased 82% over 2007;
- Exchange Volume increased 33% over 2007;
- User-to-user transactions in Q4 increased 54% over Q4 of 2007.

In Second Life, anything is possible. Users create an online person, known as an avatar, which moves freely through the imagined world, making friends, socializing and buying property with the game’s virtual currency, the Linden dollar. But Second Life is different enough (flying! teleporting! cloning!) that it functions on what you can do and learn about yourself by exploring your different desires.

Many studies reveal that self-perception affects behavior. No surprise that what we think about ourselves affects the confidence with which we approach the world. What is a surprise that this applies in the virtual world
too? There are so many people spending so much time in the unreal world. Some 13 million people have visited Second Life at least once, with about 450,000 residents online in a given week. At any given moment, 38,000 users are logged on to the site. People spend on average about 20 hours a week in alternate worlds.

In one experiment, published in Human Communication Research last year, researchers assessed how an avatar’s attractiveness affected human behavior, both online and off. Thirty-two volunteers were randomly assigned an attractive or an unattractive avatar (attractiveness was rated by undergrads in a survey beforehand) and instructed to look at them in a virtual mirror for 90 seconds. Then they were asked to interact with other avatars, controlled by the experimenters, in a classroom-like setting. Overall, subjects using good-looking avatars tended to display more confidence, friendliness and extroversion, just as in the real world: They approached avatar strangers within three feet, and in conversations tended to disclose more personal details. Ugly-duckling avatars, meanwhile, stayed five and a half feet away from strangers and were more tight-lipped.

If pretty builds confidence, what does height do for you? To find out, Yee recruited 50 volunteers, randomly assigned them short or tall avatars, then instructed them to divide a virtual pool of $100 with another participant—one player would suggest how to split the pot, and the other could accept or reject the offer, with each person getting nothing if offers were rejected. People with tall avatars (three or four inches taller than the stranger avatar) negotiated more aggressively than the short ones, while short avatars were twice as likely as the tall ones to accept an unfair split—$25 versus $75. Again, the behavior held up in real life.

Virtual behavior may even affect real-world health. Stanford graduate student Jesse Fox randomly assigned avatars to 75 volunteers and divided them into three groups: One group watched their look-alike avatars run on treadmills for about five and a half minutes; Another group saw their virtual counterparts lounge around; And the third watched avatars who did not look like them, but were of the same age and sex, run on treadmills. A day later, Fox found that participants who watched avatars of their own likeness exercising had themselves exercised an hour more in the intervening 24-hour period than people in the other two groups. (It is worth noting that the volunteers were all Stanford undergraduates, who were likely more active and fitter to start than the average adult.)

“What I’m hoping to find out by picking apart these mechanisms is what motivates people and why this works,” says Fox. “If you are energized by seeing yourself run, maybe you can put an avatar on the bottom of your computer screen for five minutes and it would persuade you to go to the gym.”

The possibilities are “virtually” endless. Of course, the effect could potentially work both ways for good or for bad. “In a therapy setting, we could use these virtual environments to get people to become more confident,” says Yee. “But they can also be used in advertising and as propaganda.”

Kristina Dell says: I’m considering giving my avatar a cottage by the sea and a job doing charitable work. Maybe some of the positive vibes will rub off into my real life.

2. Goal of project

This project explores the use of the online digital world, Second Life, as a virtual environment of teaching and learning in an engaging fashion. The leading 3D online virtual world technology behind second life is used by thousands of educators and academics across the globe.

The goal is to find a proof of using the Concept of Second Life to stimulate new curricular uses of leading edge information technologies.

So, the intent of the project is to demonstrate innovative approaches for integrating technology into teaching
and learning while focusing on learning outcomes.

Our students face a future that will be increasingly dominated by global digital communication and support systems, and thus they should be skilled at learning, interacting and solving problem in both the digital and real-time environments.

The project offers a highly integrated learning environment that will merge the lectures and open courseware resources using video podcast or power point presentations to enhance the courses. Here, we used mathematics and programming courses.

In mathematics, the entire SL building process is based on the notion of a prim, or a primitive geometric shape. In combination, these primes become hair, clothing, houses, cars, sailboats, fog and animals. Moreover, Linden Scripting Language (LSL) is a simple programming language that can be learned easily by anyone with minimum programming knowledge.

3. What is needed to start a class in Second life?

- Account: a Second Life account.
- Download Second Life client.
- Money: Some LS (Linden dollars), in order to pay Linden Labs (owner of Second Life) for uploading images. About LS$10 for every uploaded image, which is a small amount of real dollars. The Linden can be purchased at roughly the rate of $3.00/LS$1000 at www.secondlife.com
- Orientation: Your appearance with respect to appearance, there are hundreds of in-world malls and clothing stores.
- My students react positively to the appearance-changing. They were able to make themselves appear any way they want and change their body image projections of self, etc.
- Choosing last names: Residents in SL choose a last name from a drop-down list of choices when they join.
- Join the course group and make friends.

4. Avatar and identity

One of the first assignments I had my students do is to interview each other about their personal appearance in SL. Because this issue touches on so many other fascinating topics within the world, the author thought this exercise would be a good method for discussion and for learning about the world.

This is some of the tasks students were asked to do at the first time in Second Life:

(1) Take a snapshot of yourself inside Second Life;
(2) Find a library in Second Life; take a snapshot of yourself reading a book;
(3) Get a snapshot of a non-human avatar;
(4) Take a snapshot of yourself doing at least 3 different moves;
(5) Find a car and test drive it.

This is some of activates students were asked to do:

(1) Asking avatars about their personal appearances is a good practice for later in world interviews on more difficult topics;
(2) Exploring the appearance modification options within the software is a great way to learn how the software works;
(3) Spending money on personal appearance items (or not!) is a great way to learn about the in-world value of money, how scripting and textures work, and about different in-world business opportunities;

(4) Considering what sorts of appearances would earn positive appearance “ratings” points could be a valuable exercise.

5. Sample exercise (build a computer)

Building a computer is a simple way to introduce students to the principles of building in world so that they can appreciate the time and skills that go into making the SL objects.

(1) There is a nice building tutorial located at the Ivory Tower of Primitives. This can be found using the “Search” feature within Second Life;

(2) Building a computer can be easily scaled from simple to complex, depending on the skill level of each individual student. Simple computer will closely follow the Ivory Tower tutorial. More complex computers will include scripting, textures, etc;

(3) The students can put some personality into their computers, and describe the process of building as well as the difficulties with realizing their vision using the software.

Computers built by my students included everything from a desktop, laptop, notebook, and even PDA.

6. Students interactive activity

The course web site resources have a direct link to locations in Second Life.
Each podcast/power point lecture module has 1-3 discussion questions. Students are organized in SL to discuss the current set of questions. The time of these meetings, typically in the evening is usually adjusted to maximize student access (see Fig. 2 and Fig. 3).

7. Evaluation

To evaluate the experience in Second Life, my questions to students are:
- Did your avatar in the virtual life affected real you in the real life?
- Do you feel more confident talking about mathematics without anxieties?
- And any comments were welcomed from students.

8. Results

The assessments will specifically analyze the ability of avatar-based learning environments to address gender, cultural, and racial issues in the classroom.

The results are overwhelming of 99% yes to both questions which is agreeable with the research of health study by Stanford graduate student Jesse Fox and the feeling of pretty and confident by Yee. As well as agreeable with the experiment, published in Human Communication Research, those subjects using good-looking avatars tended to display more confidence, friendliness and extroversion.

When students were asked what you learned in your Second Life, here are some comments:
- I learned about myself on Second Life after spending half an hour learning how to walk. I discovered that I’m too lazy.
- Another says it took me more than an hour to draw my hair because when I look good I will be smarter.
- Another, I spend more than two hours creating my avatar to look best.

9. Conclusions

- Students were very productive and engaged in the learning experience.
- Average student’s attendance during any session is 98% of the time.
- A subculture difference has no appearance in the virtual world for exploring cultural alternatives.
- The strengths of Second Life group collaborative do not exist in any online platforms.

10. Definitions

- Avatars and identity
  Avatar and identity within games is either a description of an existing identity or as an exploration of a new identity.

- SL mathematics
  The entire SL building process is based on the notion of a prim, or a primitive geometric shape. In combination, these prims become hair, clothing, houses, cars, jetpacks, sailboats, fog, objects and animals.

11. Literature

- In early 2008, a Second Life avatar was used as the cover art for Dr. Theodore Rockwell’s fiction novel—The
Avatar-based learning in Second Life

virtual librarian. The novel was introduced and promoted via Second Life by the SL agency.

- The scifi book—ANIMA: A novel about Second Life written by the avatar Dalian Hansen was published in July 2007. It was the first complete work of fiction based on the 3D virtual environment of Second Life, and the plot included real world connections. It is a book of a trilogy that will include—Animus: Of animus and men and Persona: Persona public.

- In Sam Bourne’s 2007 thriller novel—The last testament, Second Life, plays an important part in the story and in cracking of codes.

- Notre Seconde Vie is a book from the French writer Alain Monnier which was translated to “our Second Life”. The novel poses the question “will the Internet replace reading paperbound books one day?”

- The 2007 novel—Another life, by Peter Anghelides, based upon the television series Torchwood, features a Second Life-inspired virtual world called Second Reality. Although the literary version is far more advanced than the real Second Life, several features of the real-life Second Life are referenced, including the ability to customize avatars, and at one point in the novel a character is banished to an area similar to Second Life’s punishment area, “The Corn Field”.

References:

(Editied by Ruby and Gracie)