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An Investigation of Leader Member Exchange Effects on Organizational Citizenship Behavior in Malaysia

May Chiun Lo Universiti Malaysia Sarawak

T. Ramayah Universiti Sains Malaysia

Jerome Kueh Swee Hui Universiti Malaysia Sarawak

Past literatures have found that subordinates were not passive, but rather proactive participants who would try their best to change their work environment. Literature on manager-employee attitudinal congruence has generally found that attitude similarities between managers and employees are linked positively to job-related outcomes. This research attempts to analyze the relationship between leader-member exchange (LMX) and Organizational Citizenship Behavior (OCB) among executives and managers employed in the East Malaysian manufacturing organizations. The manufacturing companies chosen in this study included both local and multinational companies covering various sectors. In addition to the direct effect of LMX on OCB, this study has also explored the moderating effect of the supervisor's gender on the above relationship. The findings suggested that LMX has significant impact on citizenship behavior performed by subordinates but the gender of the supervisor did not appear to moderate the relationships between LMX and OCB. Implications of the findings were discussed further.

Management behavior is an important area of study as it can provide assistance or guidelines to management on the appropriate method of developing the most effective workforce. The ability of supervisors to influence subordinates within organizations has become a requisite competency and may be critical to job-related success for managers. Lord and Brown (2001) revealed that leadership works best when there is a match between the identity level of followers and the focus of leaders, as people of similar behavior tend to be attracted to each other. Past research on manageremployee attitudinal congruence has generally found that attitude similarities between managers and employees are positively linked to job-related outcomes. Supervisorsubordinate interactions and unequal power distributions are some pervasive features of modern organizations. Understanding these effects, by and large, will offer insights into employees' behaviors. The major concern of organizations today is to establish effective leadership management, and the core element in developing effective leadership management is the quality level of exchange relationship between superiors and subordinates.

The leader-member exchange (LMX) and Organizational Citizenship Behavior (OCB) have become the foundation of a new era of managing a diversified workforce in the advent of a globalized world. It is believed that understanding the process paths by which LMX relationships impact important performance behaviors, (for example, OCB) are crucial to advancing leadership in the organization. Sarawak, a state located in East Malaysia, has gone through rapid transformation from the primary sector, such as agriculture and mining, to a highly skilled manufacturing sector in the 1990s. Thus, understanding the relationship between supervisors and subordinates would serve as a platform for supervisors to assist them in developing the OCB culture among their subordinates through favorable LMX or social exchange relationships between superiors and their subordinates.

The major objective of this particular research is to promote awareness among the superiors with regards to the importance of understanding and practicing LMX as an effective medium of interaction between superiors and subordinates as well as fostering OCB among subordinates. The major concern of this research is to determine whether the LMX theory and OCB are applicable in the manufacturing companies located in Sarawak. This research attempts to answer the following questions:

- Does Leader-Member Exchange (LMX) affect Organizational Citizenship Behavior (OCB) among employees?
- Does gender of the supervisors moderate the relationship between LMX and OCB?

Literature Review

Leader-Member Exchange (LMX)

LMX theory was first illustrated in the works of Dansereau, Graen, and Haga (1975) 30 years ago, and has recently been gaining momentum. Many studies have been conducted to investigate the role supervisors play in their relationship with subordinates. Essentially, the supervisor, the subordinate, or both, will evaluate the relationship according to the quality of the interaction, and these perceptions have a

fundamental influence on individual outcomes. As mentioned by Murry, Sivasubramaniam, and Jacques (2001), the positive exchanges are typically reciprocated with positive outcomes from the subordinates. Each member of the dyad has the other's best interest at heart and this is reflected in more supportive behavior.

LMX describes the relationship between a leader and a subordinate and how they influence each other in an organization and their interdependencies (Yukl, 1998; Scandura, 1999). Early works in LMX have found two types of relationships between the subordinate and supervisor, namely the in-group and the out-group. In-group refers to linkages based on expanded and negotiated role responsibilities, which are not specified in the employment contract; conversely out-group is based on the formal employment contract. Subordinates in the in-group claimed to have more power as they receive more information, are more influential and confident, and have personal concern from their leaders as compared to the out-group subordinates (Liden, Wayne, & Sparrowe, 2000). In-group members are willing to do extra tasks to which their leaders will reciprocate (Graen & Scandura, 1987), but out-group members receive lesser attention and support from their leaders and thus might see their supervisors as treating them unfairly.

Literature in the past has revealed that supervisors do differentiate between their subordinates in terms of the exchange. It is an advantage to be in a high LMX as it is associated with higher trust, greater warmth and support, and there is more frequent interaction between the members of the dyad (Dansereau et al., 1975; Brower, Schoorman, & Tan, 2000). Most current LMX research departs from previous LMX research by looking into other analysis as long as the relationship remains the focus. Recently, LMX has been related to behaviors such as organizational citizenship behaviors (Settoon, Bennett, & Liden, 1996; Wayne, Liden, Graf, & Ferris, 1997; Deluga, 1998; Hui, Law, & Chen, 1999), task performance (Howell & Hall-Merenda, 1999; Hui et al., 1999; Settoon et al., 1996; Wayne et al., 1997), turnover intention (Ansari, Daisy, & Aafaqi, 2000), organizational outcome (Omar, 2001), and influence tactics (Liew, 2003).

LMX literature has found that subordinates in high-quality exchange relationships received more desirable assignments, more rewards, and had greater support from their supervisors. This is congruent with social exchange theory, where individuals who are engaged in high-quality relationships will behave in such a way that their exchange partner will also get the benefits (Murphy, Wayne, Liden, & Erdogan, 2003).

Organizational Citizenship Behavior (OCB)

Organizational citizenship behavior, which is also known as extra-role behaviors, is the act of performing beyond the stated job requirement. Subordinates impulsively go beyond the employment contract and carry out non-obligatory tasks without expecting explicit rewards and recognition (Organ, 1988). This implies that employees who engage in citizenship behaviors are more likely to be favorably perceived by their supervisors and work colleagues in their organization.

Bolino (1999) has pointed out that if the employees realized that they have limited control on in-role performance, they would be more likely to rely upon extra-role behaviors to enhance their image and distinguish themselves from others. In addition to that, citizenship behaviors can be explained based on the psychological contract between employees and organizations where the core element in the contract is reciprocity obligations between employees and organizations (Masterson & Stamper, 2003; Thomas, Au, & Ravlin, 2003). Organizations have the obligation in terms of providing employees benefits, such as career advancement, promotions, job security, training, and increased salary. In return, the employees' responsibility to the organization will include loyalty, helping colleagues, willingness to work overtime, and accepting tasks that are beyond normal job requirements. In summary, OCB is the extra-role behavior exhibited by the employees, which goes beyond the formal job requirement without expecting recognition in term of either explicit or implicit rewards from supervisors. The effect of OCB is more likely to promote a positive social and working environment, while maintaining the performance of a work unit relative to the core products of the organization.

Dimensionality of Organizational Citizenship Behavior

Motowidlo (2003) revealed that OCB can be viewed as a multidimensional latent variable reflecting the ability and willingness to work with, and assist in decision making in the organizations. However, Chien (2004) pointed out that past research has not generated conclusive evidence of the dimensionality of OCB. Thus, the widely acknowledged five categories that OCB contributes to organizational effectiveness include altruism (helping), courtesy, conscientiousness, civic virtue, and sportsmanship (Organ, 1988). These dimensions will be used in this study.

Smith, Organ, and Near (1983) define altruism as voluntary behaviors where an employee provides assistance to an individual with a particular problem to complete his or her task under unusual circumstances. Courtesy includes behaviors which focus on the prevention of problems and the taking of necessary steps so as to lessen the effects of the problem in the future. Organ (1988) defined sportsmanship as the behaviors of warmly tolerating the irritations that are an unavoidable part of nearly every organizational setting. According to Deluga (1998), civic virtue includes subordinate participation in organization political life and supporting the administrative function of the organization. Meanwhile, conscientiousness is considered as one of the personalities of the "Big Five Dimensions of Personality," which is used to indicate that a particular individual is organized, accountable, and hardworking. Studies have also revealed that conscientiousness can be related to organizational politics among employees (McCrae & Costa, 1987).

The Impact of Organizational Citizenship Behaviors on Organizational Effectiveness

Prior studies have shown that OCB has significant impact on the organizations' output. In research conducted by Podsakoff, Ahearne, and Mackenzie (1997), they found that there is a positive correlation between OCB and an organization's outcomes. This is due to the OCB being able to foster the effectiveness of organizations in terms of achieving a higher level of work group performance from the perspective of quantity and quality of work. According to Aquino and Bommer (2003), OCB can enhance the social attractiveness in a work unit. As OCB is normally labeled as positive behaviors, those who exhibit OCB may become more socially attractive which makes them more likely to be appreciated as friends or partners. Consequently, this may create a favorable working environment in a work unit.

Gender

Lizzio, Wilson, Gilchrist, and Gallois (2003) revealed that male managers would sanction themselves to use formal authority to deal with issues as compared to female managers, who are more likely to adopt more interpersonally complex and facilitative modes of intervention. Karakwosky, McBey, and Miller (2004) found that men in male-dominated groups exhibited higher levels of power displays as compared to women in female-dominated groups.

According to Wayne, Liden, and Sparrowe (1994), there are two approaches to gender effects on LMX; one is known as the similarity-attraction approach revealed by Byrne (1971). The approach conceptualized that similarity between leader and member may lead to increased liking and thus influence their exchange relationship. Meanwhile, the other approach which is known as the situational approach is related to proving that situational variables such as formal authority, experience and influence may affect the gender effect in developing the exchange relationship between leader and member.

According to Xin and Pelled (2003), role conflict may arise from task conflict and emotional conflict that may leave a significant impact on the social exchange between superiors and subordinates. Therefore, the outcome of their study indicated that female leaders with female members develop a favorable relationship in terms of high ratings and liking by leaders and have a very low level of role conflict and ambiguity.

LMX and OCB

Social exchange theory complements the foundation of LMX as the theory emphasizes the purpose that leaders and members attempt to develop and to maintain the exchange relationship (Graen & Scandura, 1987; Graen & Uhl-Bien, 1995; Sparrowe & Liden, 1997). Graen and Scandura (1987) concluded that leaders and members must provide something, which is perceived to be valuable by each party, and that the exchange must be balanced. In addition, employees not only require tangible materials but would also need social support in terms of psychological and emotional support. Further studies also supported that the exchange between leaders and members covers a range of specific resources such as information to emotional support. High quality LMX comes from the perception of the value of material being exchanged between leaders and members (Graen & Uhl-Bien, 1995).

Prior studies have revealed that LMX is influenced by the five main factors, which in turn become the determinant of the quality of the exchange relationship between leaders and members. As a result, the five dimensions may affect the quality of LMX in a work unit and thus influence the level of OCB exhibited by the employees. If the employees perceived the quality of LMX as high, this may encourage them to perform citizenship behaviors for the work unit and organizations. Scandura and Graen (1984) revealed that the cycle of citizenship behavior for reciprocal accomplishment of goals helps further strengthen the quality of the LMX. This is supported by other researchers, where they suggested that in-group members or a work unit that has a high quality LMX may receive various types of rewards that are formal and informal (Settoon et al., 1996). Members would perform extra-roles by providing citizenship behavior to the supervisors, who in exchange provide more mutual support and greater opportunities to the members. Correspondingly, according to Deluga (1998), as a subordinate who performs OCB will not be formally rewarded, he or she may be informally rewarded in terms of supplementary resources and support from the leader. Consequently, the subordinate will be motivated to continue to maintain the favorable relationship. Despite that, Aquino and Bommer (2003) noted that the person who received some benefits from others may indirectly have the tendency to return or feel obligated to return the favor and this interaction is known as positive reciprocity. This kind of interaction can also be applied in the context of relationship between LMX and OCB. This is because when the leader trusts a particular subordinate and provides certain advantages to him or her in terms of greater authority, more support and so forth, consequently the subordinate may develop a feeling that he or she wishes to pay the favor back to the leader. This can be done by performing behaviors.

Taken together, LMX has significant influence on the level of OCB among employees as a high quality of LMX may motivate employees to exhibit extra-role behaviors without any formal rewards from the organization. The theoretical framework is listed in Appendix 1.

Research Methodology

The respondents of this study are executives employed in manufacturing companies located in Sarawak, Malaysia. Sarawak was selected to be the site for data collection because it has gradually become a major destination for foreign investment, particularly in the manufacturing sector, due to the recent establishment of Sama Jaya Free Industrial Zone (SJFIZ). A total of 10 manufacturing companies have been identified for this study: The questionnaires have been classified into two sections where the first section is to determine the social exchange relationship between superiors, and subordinates in a work unit. Meanwhile the other section of the questionnaires is to identify the level of OCB performed by subordinates in a work unit.

The questionnaire used in this study consists of three parts. Section 1 required the respondents to rate a total of 20 items on the five dimensions of OCB namely, altruism (helping), courtesy, conscientiousness, civic virtue, and sportsmanship. Section 2 contains 12 items which require the respondents to assess their relationships with their supervisors; and finally Section 3 contains 12 items regarding the demographics of the respondents such as gender, gender of respondents' leaders, races, age, educational background, working experiences, monthly gross salary, nationality, type of company, and years of working together with leaders.

The relationship between superiors and subordinates was measured based on the questionnaires LMX-MDM developed by Liden and Maslyn (1998). This questionnaire has twelve items, which can be categorized into four dimensions so as to provide a multidimensional approach. From the perspective of OCB, there will be 20 questions used to determine the level of citizenship behaviors among subordinates based on five main dimensions. A Likert-like scale was used to measure both LMX and OCB elements, which ranks from 1 (Strongly Disagree) to 7 (Strongly Agree).

The total number of questionnaires disseminated was 130 sets to the

manufacturing companies located in Sarawak, with employee numbers of more than 150 persons. 113 set of questionnaires or 86.9% were collected while 17 sets of questionnaires were not collected. From the 113 sets of questionnaires, 10 sets were incomplete, and another 9 sets were answered by non-Malaysians. As a result, the total number of questionnaires that was usable for this research was 94 sets, constituting a return rate of 72.3%.

Findings

Table 1 shows the demographic profile of the respondents.

Demographics		Frequency	Percentage
Subordinates' Gender	Male	58	62
	Female	36	38
Superiors' Gender	Male	65	69
	Female	29	31
Period of Working	Less than 1 year	5	5.3
with Superior	1-2 years	46	48.9
	3-4 years	33	35.1
	More than 5 years	10	10.7
Race	Chinese	57	60.6
	Malay	18	19.1
	Others	· 19	20.3
Age (years)	16-20	1	1
	21-25	26	27.7
	26-30	35	37.2
	31-40	29	30.9
	41-50	3	3.2
Education Background	High School	31	33
	Diploma	37	39.4
	Degree	25	26.6
	Others	1	1
Work Experience	1-5 years	61	64.9
	6-10 years	24	25.5
	More than 10 years	9	9.6
Monthly Gross Salary	Less than RM1,500	31	33
	RM1,500-RM3,000	52	55.4
	RM3,001 - RM4,500	10	10.6
	RM4,501 - RM6,000	1	1
Nationality	Malaysian	94	100
Company Status	Locally Owned Company	78	83
	US Based Company	11	11.7
	Others	5	5.3

Table 1: Demographic Characteristic of Respondents

The Cronbach's alpha coefficients for LMX were .72 to .91, and for OCB were from .58 to .80. Sportsmanship had only two items, which probably accounted for its low Cronbach's alpha coefficient. Generally, the values indicated good internal consistency estimates of reliability of the grouped items for both factors. The findings of the reliability analysis are summarized in Table 2.

Variables	No. of Items	Cronbach's alpha
LMX		
Affect	3	.90
Loyalty	3	.78
Contribution	3	.72
Respect	3	.91
ОСВ		
Altruism	4	.80
Conscientiousness	6	.64
Sportsmanship	2	.58
Civic Virtue	4	.80
Courtesy	4	.76

 Table 2: Results of Reliability Analysis

Table 3 illustrates the intercorrelations among the subscales obtained using the Pearson correlation to determine whether the subscales were independent measures of the same concept. Generally, intercorrelations among the four factors for LMX registered values ranging from .51 to .67 (p< .01), whereas, the intercorrelations for the subscales of OCB ranged from .39 to .59 (p < .01.) On the whole, the results have demonstrated acceptable levels of correlation.

Variable	1	2	3	4	5	6	7	8	9	10
1. Gender	1.00									
2. Affect	.07	1.00								
3. Loyalty	.05	.61**	1.00							
4. Contribution	.06	.64**	.52**	1.00						
5. Respect	.09	.63*	.51**	.67**	1.00					
6. Altruism	01	.38**	.28**	.56**	.39**	1.00				
7. Conscientiousness	07	.32**	.22*	.40**	.33**	.50**	1.00			
8. Sportsmanship	25*	.14	.25*	.31**	.09	.43**	.52**	1.00		
9. Civic Virtue	24*	.34**	.37**	.49**	.44**	.38**	.59**	.49**	1.00	
10. Courtesy	10	.15	.17	.30**	.20*	.44**	.48**	.48**	.43**	1.00

 Table 3: Intercorrelations of the study variables

Note. N = 94, **p<.01, *p<.05.

The factor analysis gave rise to a factor structure with 2 interpretable factors with eigen values exceeding 1.0. The Kaiser-Meyer-Olkin measures of sampling adequacy stood at .86 and the diagonal entries of the anti-image correlation matrix were above .50. The Barlett's test has indicated significance of overall correlations within the correlation matrix with a value of 831.08. The two factors explained 53.24 and 11.39 percent respectively of the variance with Cronbach's alpha of .90 and .87 respectively. The factor loadings are exhibited in Table 4 where they ranged from .64 to .86.

Respect and contribution merged as one factor to denote the feelings of respect and willingness to contribute that a member holds for a leader. On the other hand, loyalty and affect were grouped under the factor that indicated that the level of respect a member has for a leader was determined by the level of affect that the members felt for their leaders.

	Factors	
	I	II
Factor I: Contribution Respect		
Respect 2	.86	.18
Respect 1	<u>.81</u>	.33
Respect 3	.80	.35
Contribution 2	.78	.14
Contribution 3	<u>.70</u>	.33
Factor II: Affect Loyalty		
Loyalty 1	.04	<u>.83</u>
Loyalty 3	.28	<u>.74</u>
Affect 2	.48	<u>.70</u>
Loyalty 2	.17	<u>.67</u>
Affect 3	.46	<u>.65</u>
Affect 1	.49	. <u>64</u>
Eigenvalue	6.39	1.36
Variance (%) (Total: 49.89%)	53.24	11.39
Kaiser-Meyer-Olkin MSA	3.	36
Bartlett's test of sphericity	831	.08
Reliability (Cronbach's alpha)	.90	.87

Table 4: LMX: Rotated Factors, Item Loadings, Reliabilities, Means and Standard Deviations

Note: N = 94; **p < .01; Items are grouped for presentation purpose: Underlined loadings indicate the inclusion of those items in the factor.

The 20 items were subject to a varimax rotated principal components analysis and were subsequently reduced to 12 items that comprised four interpretable factors with eigenvalues greater than 1.00. In total, the four factors explained a total of 59.64% of the variance. A summary of the results of the analysis is presented in Table 5.

A 3-step hierarchical multiple regression analysis was carried out to test the hypotheses that comprised the direct and moderating effects of LMX, gender, and OCB. Tables 4, 5, 6, and 7 present the results of the analysis.

		Facto	ors		
	I	11	111	IV	
Factor I: Civic Virtue					
Civic Virtue 2	<u>.76</u>	01	.17	.23	
Civic Virtue 1	<u>.76</u>	.02	03	.14	
Civic Virtue 4	<u>.68</u>	.05	.24	.10	
Factor 11: Altruism					
Altruism 2	.01	<u>.84</u>	.21	.14	
Altruism 1	03	<u>.82</u>	.17	01	
Altruism 3	.42	<u>.70</u>	.13	07	
Factor III: Courtesy			<u> </u>		
Courtesy 2	.03	.09	<u>.84</u>	.16	
Courtesy 1	.16	.23	<u>.73</u>	.07	
Courtesy 4	.22	.04	<u>.71</u>	.32	
Courtesy 3	.44	.36	<u>.49</u>	.06	
Factor IV: Conscientiousness					
Conscientiousness 6	02	36	.01	<u>.67</u>	
Conscientiousness 5	.28	.22	.11	<u>.66</u>	
Eigenvalue	6.80	2.01	1.64	1.46	
Variance (%) (Total: 59.64%)	32.05	10.08	8.21	7.30	
Kaiser-Meyer-Olkin MSA			.82		
Bartlett's test of sphericity		976.34			
Reliability (Cronbach's alpha)	.75	.85	.76	.42	

Table 5: OCB: Rotated Factors, Item Loadings, Reliabilities, Means and Standard Deviations

Note: N = 94; **p < .01; Items are grouped for presentation purpose: Underlined loadings indicate the inclusion of those items in the factor.

Independent Variable	Std Beta Step 1	Std Beta Step 2	Std Beta Step 3
Model Variables			
Contribution Respect	.35**	.35**	.22
Affect Loyalty	.13	.13	.54
Moderating Variable			
Gender		.01	.64
Interaction Terms			
Contribution Respect*Gender			.25
Affect Loyalty*Gender			97
R ²	.20	.20	.21
Adj R ²	.19	.18	.18
R ² Change	.20	.00	.01
F Value	12.75**	.00	1.86

 Table 4: Hierarchical Regression Results Using Leaders' Gender as a Moderator in the Relationship between LMX and Altruism

**p<.01, *p<.05

Altruism is one of the five dimensions investigated in OCB. Step 1 was found to be significant (p<.01). Hence, the direct effects of the predictors significantly explained 20% of the variability in altruism. Only one dimension in LMX, namely contribution respect, was found to be significantly related to altruism. The incremental variance of 1% in step 3 was not significant. This indicated that the interaction effects of LMX and gender of the supervisors did not add any significant contribution in explaining the variation in altruism.

Table 5: Hierarchical Regression Results Using Leaders' Gender as a Moderator in the	
Relationship between LMX and Conscientiousness	

Independent Variable	Std Beta Step 1	Std Beta Step 2	Std Beta Step 3
Model Variables			
Contribution Respect	12	13	08
Affect Loyalty	.02	.03	.21
Moderating Variable			
Gender		14	.34
Interaction Terms			
Contribution Respect*Gender			.13
Affect Loyalty*Gender			.42
R ²	.01	.03	.04
Adj R ²	01	.00	01
R ² Change	.01	.02	.01
F Value	.62	1.94	.26

**p<.01, *p<.05

Tables 5 and 6 tabulated the regression results between LMX and two dimensions of OCB. In analyzing the conscientiousness and courtesy dimensions of OCB, the main effect of the predictors was not significant. No interaction terms were statistically significant. These results conclusively suggest that supervisors' gender did not moderate the relationships between the predictor variables and two dimensions of OCB.

Independent Variable	Std Beta Step 1	Std Beta Step 2	Std Beta Step 3
Model Variables			
Contribution Respect	.21	.21	.04
Affect Loyalty	.04	.05	.38
Moderating Variable			
Gender		11	.30
Interaction Terms			
Contribution Respect*Gender			.34
Affect Loyalty*Gender			80
R ²	· .06	.07	.08
Adj R ²	.04	.04	.03
R ² Change	.06	.01	.01
F Value	2.96*	1.24	.44

 Table 6: Hierarchical Regression Results using Leaders' Gender as a Moderator in the Relationship between LMX and Courtesy

**p<.01, *p<.05

 Table 7: Hierarchical Regression Results using Leaders' Gender as a Moderator in the Relationship between LMX and Civic Virtue

Independent Variable	Std Beta Step 1	Std Beta Step 2	Std Beta Step 3
Model Variables			
Contribution Respect	.42**	.42**	.55
Affect Loyalty	.06	.07	01
Moderating Variable			
Gender		.23**	17
Interaction Terms			
Contribution Respect*Gender			27
Affect Loyalty*Gender			21
R ²	.21	.27	.27
Adj R ²	.19	.25	.23
R ² Change	.21	.06	.00
F Value	13.65**	7.10**	.07

**p<.01, *p<.05

The ANOVA table revealed that the model as a whole was not significant. However, step 1 and step 2 were found to be significant with F=13.65, p<.01 and F=7.10, p<.01 respectively. Hence the direct effects of the predictors, especially the combination of contribution respect dimensions of LMX and the supervisors' gender, were the significant contributors to civic virtue. This indicated that supervisors' gender was directly predicting the civic virtue aspect of OCB and did not moderate the relationship between LMX and civic virtue.

Discussion

LMX and OCB are two essential components related to establishing favorable relationships between superiors and subordinates, and therefore motivate subordinates to perform extra-role behaviors. This research study has answered the call to clarify the nature of the relationship between LMX and OCB. We offer strong support to date for a central premise of OCB theory that LMX is partially an expression of subordinate gratitude and reciprocity for positive work-related behaviors originating from a high-quality relationship with one's supervisors. A number of researchers have revealed that there are significant relationship developments between LMX and OCB in a work unit where high quality of LMX would lead to positive behaviors or OCB being exhibited by subordinates.

In this particular study, the outcomes of the analysis indicated that LMX has a significant relationship with OCB in a work unit based on the data sample covering manufacturing companies in Sarawak. This was also supported by other researchers such as Deluga (1994) as well as Hui et al. (1999), where they found that LMX and OCB have a positive relationship in a work unit. The results also revealed that perceptions of equitable treatment by supervisors would gain respect from subordinates and subsequently would drive subordinates' decision to contribute and demonstrate higher levels of OCB.

As hypothesized, contribution respect has a direct relationship with two dimensions of OCB. This finding seems logical and further supported by Norris-Watt and Levy (2004) where the subordinates are more likely to treat the supervisors with more altruistic behaviors if the supervisors provide them with a more positive feedback environment. It seems reasonable that an employee's attachment to the supervisor resulting from continuing reciprocal exchanges and respect over time will enhance the altruism and civic virtue aspects of OCB, as the supervisor is perceived by the employee as the key organizational agent of the organization. However, only two dimensions of LMX, namely respect and contribution factors, were found to have consistent and statistically significant relationships with civic virtue and altruism aspects of OCB. The rationale could be due to the fact that contribution is measured on the effort and investment contributed either explicitly or implicitly to the work unit (Dienesch & Liden, 1986). Thus, contribution is the most important factor that will lead to higher performance of OCB. Findley, Giles, and Mossholder's (2000) findings explained that direct interactions with supervisors, where supervisors observed and listened to their employees, would increase the respect of the subordinates towards their supervisors and further lead to an increase in OCBs by subordinates.

In contrast, affect and loyalty factors of LMX seem not to be affecting any dimension of OCB, leading to a weaker relation between the LMX and OCB. These findings could be due to the fact that Malaysian society is a collectivist, relationshiporiented, and hierarchical society (Abdullah, 1992; Ansari, Ahmad, & Aafaqi, 2004). As noted by Abdullah (1996), in the Malaysian context, an organization or a corporate entity not only strives to achieve higher profit and achieve a specific task, but also to demonstrate a sense of social responsibility for the advancement of the community. Comparatively, Western mangers were found to be more direct and task oriented (Yukl, Fu & McDonald, 2003).

Furthermore, this result is also congruent with the findings of Deluga (1994), as well as Settoon et al. (1996), where the significant relationship between LMX and OCB in this study is due to the high quality of social exchange developed between superiors and subordinates that has motivated the subordinates to perform citizenship behaviors in their respective workplaces.

This study has shown that these are strong positive correlation values for LMX determinants such as professional respect and contribution. This indicated that a high quality of social exchange is established between superiors and subordinates. This denotes that high quality of LMX between superiors and subordinates would induce the subordinates to attain a high level of OCB and vice versa. Therefore, this finding was also supported by other research such as Hui et al. (1999), where subordinates with a high degree of LMX, otherwise known as the in-group, will perform with a higher degree of OCB. The main reason could be due to the fact that the interaction presented between superiors and subordinates is a reciprocal relationship and thus relies very much on the degree of exchange in term of access to information, support, time, and greater authority (Scandura & Graen, 1984; Deluga, 1998).

Consequently, the favorable exchange relationship will bring about the citizenship behaviors from subordinates. The act of performing extra-role behaviors by subordinates is influenced by the fact that when subordinates receive or accept favours from their superiors, (e.g. greater autonomy or minimum supervision), this will cause the subordinates to feel obliged to restore the good deed of their superiors by performing OCB. This is further supported by Aquino and Bommer (2003), where this relationship is known as positive reciprocity.

Conclusions

Our results suggest that how subordinates in Malaysia perceived the quality of relationship with their leader influences their contributions to OCB. Based on these results, it may be concluded that the predictors were directly predictive of OCB, particularly the contribution and respect dimension of LMX. The moderating effects of gender on the interaction terms of other predictors were only partially significant for OCB, indicating that gender did not affect most of the relationships between LMX and OCB. This is mainly because subordinates who performed citizenship behaviors in the workplace did so because of the high quality of social exchange, which existed between superiors and subordinates. In a leadership study by Ronk (1993), no difference was detected between male and female leadership styles based on

personality traits and their leadership quality (Campbell, Bommer, & Yeo, 1993).

As noted by Randall, Cropanzano, Bormann, and Birjulin (1999), owing to the support received from the supervisors, the subordinates' performance could be enhanced because support appears to engender more positive work attitudes. Our results were also supported by prior studies which revealed that LMX has a significant relationship with OCB, which indirectly contributed to the organizations' outcomes (e.g., Dansereau et al., 1975; Liden & Graen, 1980; Vecchio & Gobdel, 1984; Deluga, 1998; Settoon et al., 1996). Our research has also extended these findings in showing that OCB is likely to be enhanced by improving employee attitudes via enhanced contribution respect of LMX quality.

Limitations and Implications

The design of this study is not without limitations. The major limitations of this study revolve around sampling issues such as the small sample size reported here, which may have affected the current results. However, the small sample size, coupled with the significant results reported does suggest that the current findings can be reliable. Secondly, the study has relied primarily on samples drawn from the manufacturing sector, thus the findings cannot be generalized to other sectors. It could be conceivable that issues related to organizational climate might have affected some of the relations studied. Thirdly, this study was not longitudinal; cross-sectional studies only provide a static perspective on the relationship between LMX and OCB.

Lastly, this study underscores the need to uncover the similarity and dissimilarity of gender between supervisors and subordinates. The finding of Duchon, Green, and Taber (1986) suggested that gender similarity between superiors and subordinates would lead to high quality social exchange being established between superiors and subordinates. Correspondingly, this is further supported by Tsui and O'Reilly (1989), where gender similarity between superiors and subordinates would enhance the level of interpersonal liking and reduce the role of conflict and ambiguity between superiors and subordinates, thus contributing to high quality of LMX.

One obvious implication of the present study is that supervisors should be aware of the importance of developing supervisory coaching skills. If supervisors realize that their interactions with subordinates affect the subordinates' work behaviors, they can further improve their downward interaction to elicit more desired subordinate behaviors. As noted by Norris-Watts and Levy (2004), positive perception is likely to increase employees' affective commitment and OCBs, thus serving to increase overall organizational performance.

This study has contributed to the importance of OCB theory, yet future endeavors should be dedicated to comparing these findings with similar predictors and criterion in other sectors. All in all, this study suggests that LMX and OCB should be taken more seriously by managers in the manufacturing sector on account of its influential and important role in inspiring employees. Also it should be used as a means to increase one's career satisfaction or multiple aspects of organizational performance.

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Appendix I

The Linkage between Independent Variables and Dependent Variable



Source: Adapted from Liden and Maslyn (1998) and Organ (1988).

Portfolios Theories and the Management of Customized Domestic Equity Funds: Pedagogy

Thomas A. Rhee California State University, Long Beach

Such inputs as securities expected return and variance-covariance matrix in constructing protfolios are forward looking quantities, which determine ex ante Efficient Portfolio Frontier. Many hedge funds and separate equity accounts managers use unique pricing models of their own. They in turn decide on the value of these inputs, which in the end influences the portfolios performance. This paper offers pedagogy as to how portfolios can be customized in varied investment environments and under differing clients' requirements. It uses some of the most popular interest rate and other equilibrium asset pricing models.

Today, many customer investment accounts are managed separately on an individual basis dedicated to the customer's specific need. The securities industry now derives fee incomes from managing individually tailored portfolios rather than from charging trade commissions. Many different forms of hedge funds have also emerged particularly targeting high net worth individuals. The industry also introduced what is known as wrap accounts, which are externally managed investment accounts, and advice based planning platforms, where customers are directed either to a particular mutual fund or to a fund of funds called the umbrella fund. What is common in these developments is that investors seem to prefer their own customized portfolios, which are managed privately, hopefully on an exclusive basis. Several factors may contribute to this phenomenon.

The first and foremost important reason is that any well performing public fund only draws more buyers and eventually the returns will suffer in the long run. On the

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contrary, private funds that perform well are not subjected to that market abuse. Neither hedge funds nor separate account portfolios are publicly traded. Therefore, investors find it attractive to have their portfolios customized and managed by professionals. In their minds, separately managed accounts offer a viable alternative to the conventional wisdom that investors need to reconfigure their mix between an index fund and the risk-free asset constantly, as the market condition changes. And it can be quite expensive. Separately managed accounts or hedge funds charge fees based only on the size of the asset, and not on the trading frequency. Most of the time there are no uncertainties about the account's transaction cost over the contract's duration. As a matter of fact, fees charged to separate accounts or even to the majority of hedge funds are no higher than the management fees embedded in any publicly traded index fund and the cost of frequently rebalancing the portfolio of an index fund and the risk-free asset.

Principles involved in managing separate accounts so as to meet the individual's risk-return requirement or even to meet the "absolute" return objectives by any hedge fund cannot be different from those followed in forming any optimal portfolios. In this paper some of these principles will be reviewed. Consequently, it is not claimed that the technology presented in this paper is new, but a pedagogy of forming various custom tailored portfolios by putting together some popular models of interest rates and equilibrium asset prices is offered. A high level discussion on developing a portfolio management system is also presented.

Why Individually Tailored Portfolios?

Capital market theory in modern finance proposes that investors can reach an optimal portfolio position based on their risk preference by mixing the market portfolio with the risk-free asset. Since no one really knows what the market portfolio is, people are advised to buy an index fund, which is hoped to replicate the market portfolio. At the same time, some mutual funds may carbon copy the risk return profile of a portfolio with a particular mix between the market portfolio and the riskfree asset. This may explain why there is a variety of mutual funds alongside every index fund. The problem is that one size may not fit every need. This necessitates the existence of the separate account and hedge fund businesses. There are other reasons why individually tailored portfolios make sense to investors besides competitive advisory fees equivalent to the mutual fund's management charges and sales loads.

In chemistry, there is only one way to produce water, that is, by combining two atoms of hydrogen and one atom of oxygen. There are only two types of atoms used and the technology, or the proportion between the two atoms, is well known. In finance, there is almost an infinite number of ways in which to achieve an identical goal. For example, one can achieve an investor's overall risk target with a variety of securities. They can be categorized as either value or growth stocks or even as emerging market securities. When a portfolio is separately managed privately and if the portfolio performs well, there is little chance that managing the portfolio will ever have any market impact, which will reduce the fund returns. This is the reason why many hedge funds and separate account managers run portfolios in strict confidentiality unlike in the case of publicly traded mutual funds.

However, there are several important issues that must be addressed in creating and managing any efficient portfolio. In this paper, some basic results from Modern Portfolio Theory are borrowed to offer several pedagogies to run optimal portfolios. The paper begins with the concept of the efficient portfolio frontier (EPF), a set of all possible efficient portfolios, of which we will choose the best portfolio for the investor.

Constructing Efficient Portfolio Frontier (EPF)

The efficient portfolio is defined as that portfolio which gives the highest expected return on any given perceived risk. Since, the risk and returns are the *ex ante* quantities the EPF thus constructed must be *ex ante*. Sometimes, people construct *ex post* EPF by estimating the historical sample mean returns and the sample standard deviations, which may not repeat in the future.

To establish the mechanics of generating the EPF, start with an *n* number of candidate stocks, which may qualify for value, growth, large or small cap stocks, or even those that belong to particular sectors. The return on a portfolio r_p with a possible *n* number of stocks is $r_p = x$ 'r where x and r are the column vector of portfolio weights, x_i 's and individual securities returns, r_i 's. Note also that x'l = l, where 1 is a (*n*x1) column vector of 1's. The expected return and the variance of returns on a portfolio are simply

$$E[r_p] = \sum_{i=1}^{n} x_i E[r_i] = \mathbf{x}' E \qquad (Eq. 1)$$

 $\sigma_p^2 = \sum_{i=1}^n x_i^2 \sigma_i^2 + \sum_{\substack{i=1 \ j\neq i}}^n \sum_{\substack{j=1 \ j\neq i}}^n x_i x_j \sigma_{ij} = \mathbf{x}' \Omega \mathbf{x}$ (Eq. 2)

Matrices E and Ω are a (*n*x1) vector of securities' expected returns and a square variance-covariance matrix of order *n*, respectively. The EPF is generated normally by maximizing the Sharpe ratio, i.e. $\theta = \frac{E[r_p] - r_f}{\sigma_n}$

The EPF is generated normally by maximizing the Sharpe ratio, i.e. $\theta = \frac{-p^2 - f}{\sigma_p}$ with respect to x_i 's subject to the constraint that x'l=1. This is a non-linear programming problem, and if all x_i 's must be non-negative, we use solutions

suggested by Kuhn, *et al* (1951). The optimal value of $x_i = \frac{Z_i}{\sum_{i=1}^{n} z_i}$ is the solution to

an *n* number of simultaneous equations $E - r_f = \Omega z$. The notation *z* is a (*nx*1) column vector of z_i 's, where the solution vector z^* is $z^* = \Omega^{-1} (E - r_f)$. The optimal values of x_i 's are then substituted into $E[r_p]$ and σ_p , which produce one particular point in the EPF. By varying different values of r_f 's, a complete locus of EPF is then generated. Alternatively, one may want to minimize minimizing σ_p instead of maximizing the function θ , but subject to the constraint that the expected return on portfolios must meet certain minimum return requirements. Clearly, parameter structures, i.e. E and Ω , determine the shape of the EPF. Many analysts may have differing views on these parameters.

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If portfolio returns follow a particular *geometric Brownian* motion, $r_{pt} = \mu_{pt}\Delta t + \sigma_{pt}\varepsilon_{pt}\sqrt{\Delta t}$ where μ_{pt} and σ_{pt} are instantaneous *annual* drift and volatility terms, and ε_{pt} is presumed to be distributed with zero mean and unit variance, then, the forecasting value of portfolios hinges critically upon the value of μ_{pt} and σ_{pt} , that is, a vector of individual securities returns, E, and a variance-covariance matrix, Ω . But then, it requires an economic model.

(1) Multifactor Model

Consider a multifactor model similar in spirit to the one suggested by Professors Fama and French (1992; 1993). Suppose that security returns can be explained by three factors such as the market index return, price-to-book value, and firm size. In order to estimate the sensitivity of securities returns with respect to these independent variables, run a time series regression r = XA + u where r and u are $(T \ge 1)$ column vectors of individual securities returns, r_{ij} 's and regression errors, u_{ij} 's at time t, respectively. X is a matrix of time series regressors. It may also include, as in BARRA (URL: www.barra.com), variables such as industry dummies, price-earnings ratio, price to book, dividend yield, trading activity, 12-month relative strength, logarithm of market capitalization, earnings variability, EPS growth rate, price to sales, debt to equity, price volatility, and the like. Typical assumptions about the property of the model are $E[u_{it}]=0$, $E[u_{it}^2]=v_{it}^2$, $E[u_{it}X_{itt}]=0$, $\forall j \ j = \{1,2,3,4\}$ and $E[u_{it}X_{iht}]=0$ for $j \neq h$. Note that the variance varies with time, i.e. non-constant variance. The appropriate technique to resolve this non-constant variance problem is to use weighted least squares, a special case of a more general econometric technique known as generalized least squares.

The model is greatly simplified if $E[u_{il}u_{lk}]=0$, for $t \neq k$, i.e. no autocorrelation. Existence of a possible heteroscedasticity in the regression error terms means that the heteroscedasticity being as a special case of the generalized least squares, the error structure is $E[uu']=v^2C$, in matrix notation, where

 $C = \begin{pmatrix} 1 & \rho & \rho_2 & \dots & \rho^{T-1} \\ \rho & 1 & \rho & \dots & \rho^{T-1} \\ \rho_2 & \rho & 1 & \dots & \rho^{T-3} \\ \dots & \dots & \dots & \dots \\ \rho^{T-1} & \rho^{T-2} & \rho^{T-3} & \dots & 1 \end{pmatrix}$

Let us assume that the regression thus estimated is $\hat{r} = X\hat{A}$ for each stock.

The next step of securities valuation is to run another regression but at this time cross sectionally. The regression equation is $y = B\lambda + v$, assuming that there are *n* numbers of stocks. The vector $y = r - r_f$ is the risk premium on individual securities if r_f is the risk-free rate of interest. The remaining matrices are defined as follows:

$$\mathbf{B} = \begin{pmatrix} 1 & a_{11} & a_{12} & a_{13} \\ 1 & a_{21} & a_{22} & a_{23} \\ 1 & a_{31} & a_{32} & a_{33} \\ \vdots & \vdots & \vdots \\ 1 & a_{n1} & a_{n2} & a_{n3} \end{pmatrix} \quad \boldsymbol{\lambda} = \begin{pmatrix} \lambda_0 \\ \lambda_1 \\ \lambda_2 \\ \lambda_3 \end{pmatrix}$$

The regression coefficients λ 's typically have special meanings in Arbitrage Pricing Theory, i.e. λ_0 is the Jensen's alpha equivalent, and all other λ 's, the expected risk premium on portfolios sensitive to each one of the original three factors.

Portfolio returns may drift at the rate of μ_{pt} where $\mu_{pt} = \lambda_0 + \lambda_0 a_{p2t-1} + \lambda_3 a_{p3t-1}$ and $a_{pjt-1} = \mathbf{x}^{*}\mathbf{B}_{jt-1} \ \forall j$. The matrix \mathbf{B}_{jt-1} is (*n*x1). The regression error $v_{pt} = y_{pt} - \mu_{pt}$ is assumed to have a zero mean and the volatility equal to σ_{pt} . To generate a series of forecasting values for v_{pt} , it is also necessary to estimate instantaneous volatility σ_{pt} of portfolios returns. Cross sectional regressions can be repeated *T* number of times to compute standard errors for each individual security.

(2) Capital Asset Pricing Model with the Alpha Term

By far the most revealing and yet simple technique is the famous Capital Asset Pricing Model (CAPM). If $y_{it} = r_{it} - r_{ft}$ and $X_{mt} = r_{mt} - r_{ft}$, consider the following time series regression model.

$$y_{it} = \alpha_i + \beta_i X_{mt} + u_{it}$$
(Eq. 3)

The symbol r_{it} is assumed to be log price relatives for a stock *i*, i.e $\lambda n \left(\frac{P_t}{P_{t-N}}\right) \approx r_t$

and similarly, for r_{mt} as well. Sometimes, when r_{it} is regressed on r_{mt} directly without subtracting the risk-free rate, it is called the Single Index Model. If both y_{it} and X_{mt} are random variables assumed to be distributed bivariate normal, Eq. (3) is known as the bivariate regression, and the constant term α_i is the measure of Jensen's excess return on securities.

The stock price P_t is the last price in real time. The time interval N is commonly per day, i.e. N = 1. Eq. (3) assumes by convention $E[u_{it}]=0$, $E[u_{it}^2]=v_{it}^2$ and $E[u_{it}u_{ik}]=0$ for $k \neq t$, $k = \{1,...,T\}$ and $E[\varepsilon_{it}X_{mk}]=0$. Again, this is the regression with non-constant error variance with respect to time. Consequently, the regression technique is to use weighted least squares.

Ignoring the variance on the risk-free rate of interest σ_{pt}^2 for the moment, the expected return, the standard deviation and the covariance of securities returns are then given by

$$E[r_{it}] = \alpha_i + E[r_{ft}] + \beta_i E[X_{mt}]$$
(Eq. 4)

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$$\sigma_{it}^2 \approx \beta_{it}^2 \sigma_{Xt}^2 + v_{it}^2$$
(Eq. 5)
$$\sigma_{ijt} \approx \beta_{it} \beta_{jt} \sigma_{Xt}^2$$
(Eq. 6)

Since the portfolio return is $r_{pt} = \sum_{i=1}^{N} x_i r_{it}$, substituting Eqs. (4), (5) and (6) into Eqs.

(1) and (2) gives the portfolio expected return and the standard deviation of returns as follows:

$$E[r_p] = \sum_{i=1}^{n} x_i \alpha_{it} + E[r_f] + \sum_{i=1}^{n} x_i \beta_{it} E[X_{mt}] = \alpha_{pt} + E[r_f] + \beta_{pt} E[X_{mt}] \quad (Eq. 7)$$

$$\sigma_p = \left[\sum_{i=1}^{n} x_i^2 \beta_{it}^2 \sigma_{Xt}^2 + \sum_{i=1}^{n} \sum_{i=1}^{n} x_i x_j \beta_{it} \beta_{jt} \sigma_{Xt}^2 + \sum_{i=1}^{n} x_i^2 v_{it}^2 \right]^{1/2}$$

$$= \left[\beta_{pt}^2 \sigma_{Xt}^2 + \sum_{i=1}^{n} x_i^2 v_{it}^2 \right]^{1/2} \quad (Eq. 8)$$

Using matrix-vector notation, Eqs. (7) and (8) can be rewritten as:

$$E[r_{pt}] = \mathbf{x}'\mathbf{E} = \mathbf{x}'\alpha + E[r_f] + E[X_{mt}]\mathbf{x}'\beta$$
(Eq. 9)

$$\sigma_{pt}^2 = \sigma_{Xt}^2 \mathbf{x}' (\mathbf{B} + \mathbf{v}) \mathbf{x}$$
(Eq. 10)

The matrices B and v are given by

$$\mathbf{B} = \begin{pmatrix} \beta_{11} & \beta_{12} & \beta_{13} & \dots & \beta_{1n} \\ \beta_{21} & \beta_{22} & \beta_{23} & \dots & \beta_{2n} \\ \vdots & & & & & \\ \vdots & & & & & \\ \beta_{n1} & \beta_{n2} & \beta_{n3} & \dots & \beta_{nn} \end{pmatrix}$$
(Eq. 11)
$$\mathbf{v} = \begin{pmatrix} \mathbf{v}_1^2 & \mathbf{0} & \mathbf{0} & \dots & \mathbf{0} \\ \mathbf{0} & \mathbf{v}_2^2 & \mathbf{0} & \dots & \mathbf{0} \\ \mathbf{0} & \mathbf{0} & \mathbf{v}_3^2 & \dots & \mathbf{0} \\ \vdots & \vdots & & \vdots \\ \mathbf{0} & \mathbf{0} & \mathbf{0} & \dots & \mathbf{v}_n^2 \end{pmatrix}$$
(Eq. 12)

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Elements β_{ii} in the matrix are given by the cross product of betas, i.e. $\beta_{ii} = \beta_i \beta_i$. The optimal portfolio allocation is the solution to the problem that θ is maximized with respect to x_i 's as before subject to x' = 1 and $x_i \ge 0$ $\forall i$ with no short sales assumption. Elton et al (2003) offer some elementary solutions to the market model. Solutions to z_i 's and hence, x_i 's are

$$z_{i} = \frac{\beta_{i}}{\nu_{it}^{2}} \left[\frac{E[r_{i}] - E[r_{f}]}{\beta_{i}} - \sigma_{mt}^{2} \sum_{j=1}^{n} z_{j} \beta_{j} \right] = \frac{\beta_{i}}{\nu_{it}^{2}} \left[\frac{E[r_{i}] - E[r_{f}]}{\beta_{i}} - C^{*} \right] \text{ and}$$

$$C^{*} = \frac{\sigma_{mt}^{2} \sum_{j=1}^{n} \frac{(E[r_{i}] - E[r_{f}])\beta_{j}}{\nu_{jt}^{2}}}{1 + \sigma_{mt}^{2} \sum_{j=1}^{n} \frac{\beta_{j}^{2}}{\nu_{it}^{2}}}$$
(Eq. 13)

The underlying mathematics for EPF has been illustrated in Figure 1. By using CAPM as the basis while allowing for the volatility of the risk-free rate of interest. optimal portfolios are found where the straight line through the expected risk-free rate of interest becomes tangent with the EPF, which we will call the pseudo EPF. In general, the vertical axis would shift to the right as shown if the risk-free rate of interest had been volatile. Furthermore, Eq. (7) and hence Eq. (10) would have had the volatility term for the risk-free rate. Therefore, the pseudo EPF will be shifted to the left by the amount of the volatility of the risk-free rate of interest. In the meantime, Eq. (7) and therefore, Eq. (9) suggests that the pseudo EPF will move up by the expected risk-free rate to generate the true EPF. Note that the whole analysis has been simplified if $\sigma_0^2 = 0$.

Figure 1: Delineating Efficient Portfolio Frontier



Standard Deviation o

Method of Parameter Estimation

The characteristics of EPF are contingent upon the variables as shown in Eqs. (9) and (10). Eqs. (9) and (10) are sensitive to a particular pricing model employed. Therefore, we estimate ex ante values of $E[r_f]$, $E[X_{ml}]$ and σ_{xr}^2 ; and of elements in \hat{A} and v.

(1) Return Generating Process for the Expected Risk-Free Rate

As a first step, consider the three-month U.S. Treasury bill yield and compute the mean and the standard deviation. There are 21 trading days a month or 252 trading days a year. Sample sizes would vary as a function of the fund's investment period. For example, if the fund's investment period were one year, i.e. 252 trading days, we will use 252 data points. Of them, only 251 returns are "historical," and the latest return observation, or the 252nd return data, is computed in real time. Let us assume, as in Vasicek (1977), the risk-free rate of interest follows a *geometric Brownian* motion of the form:

$$dr_f = \lambda (b - r_f) dt + \sigma_f dz$$
 (Eq. 14)

The parameter *b* is the constant long-term mean return, λ is the rate at which the current r_f reverts to the mean and dz is the *Brownian* motion, i.e. $dz = \varepsilon \sqrt{dt}$.

(2) Computing the Time-Dependent Volatility of the Market Risk Premium

Next, we deal with *annualized* daily *log* price relatives for S&P 500 index, from which the historical annual mean return and the standard deviation are also computed. We do not interpolate returns for weekends and holidays. Note that the annual mean return is the daily return multiplied by 252 days and the annual standard deviation is the daily volatility times $\sqrt{252}$. In order to recognize that volatility varies with time, one may consider using the exponentially weighted moving average (EWMA) model, where the latest volatility is assigned a greater weight. The general form of EWMA is, for $0 \le \lambda \le 1$,

$$\sigma_{Xt} = \left[\lambda \sigma_{Xt=1}^{2} + (1 - \lambda) e_{Xt=1}^{2}\right]^{1/2}$$
(Eq. 15)

With EWMA, e_{Xt}^2 over a time period t is often measured by the percent change in the index itself, i.e. $\left(\frac{I_t - I_{t-1}}{I_{t-1}}\right)$. The symbol I_t represents the S&P 500 index at time t.

As an alternative, the GARCH (1, 1) model (Bollerslev, 1986; Engle, et al, 1986) postulates the variance to follow a process,

$$\sigma_{it}^2 = b_3 V + b_1 e_{it-1}^2 + b_2 \sigma_{it-1}^2 + u_{it} = b_0 + b_1 e_{it-1}^2 + b_2 \sigma_{it-1}^2 + u_{it}, \text{ where } \sum_{j=1}^{n} b_j = 1. \text{ Hence},$$

 $b_3 = 1 - b_1 - b_2$. If $b_3 = 0$, $b_1 = 1 - \lambda$, and $b_2 = \lambda$, then GARACH (1, 1) is equivalent to EWMA. The symbol V is a long-run average variance rate. Since $E[\sigma_{it}^2] = \hat{b}_0 + \hat{b}_1 e_{it=1}^2 + \hat{b}_2 \sigma_{it=1}^2$, the variance forecasts can be computed as $E[\sigma_{i,t+k}^2] = V + (\hat{b}_1 + \hat{b}_2)(\sigma_{i,t}^2 - V)$,

Rhee

where $V = \frac{\hat{b}_0}{1 - \hat{b}_1 - \hat{b}_2}$. Similarly, the time-varying covariance between *i* and *j* can be

also written either as the exponentially weighted moving average model, $\sigma_{ij,t=1}^2 = \lambda \sigma_{ij,t=1}^2 + (1-\lambda)e_{i,t}e_{j,t}, \text{ or GARCH } (1, 1), \text{ i.e. } \sigma_{ij,t=1}^2 = b_3 + b_1e_{i,t}e_{j,t} + b_2\sigma_{ij,t=1}^2.$

(3) Computing the Expected Market Risk Premium

The market risk premium $X_{mt} = r_{mt} - r_{ft}$ will be assumed to follow the usual return generating process of the form.

$$X_{mt} = \mu_{Xt} dt + \sigma_{Xt} \varepsilon_{Xt} \sqrt{dt}$$
 (Eq. 16)

The symbol μ_{x_t} is the mean return on the market risk premium.

(4) Evaluating the CAPM through Statistical Regression

Suppose that we estimate the regression Eq. (3) for stock *i* as $y = X\hat{A} + e$, where if the sample size is *T*, for each stock *i*

$$\mathbf{y} = \begin{pmatrix} \mathbf{y}_1 \\ \mathbf{y}_1 \\ \cdot \\ \cdot \\ \cdot \\ \mathbf{y}_r \end{pmatrix} \mathbf{X} = \begin{pmatrix} \mathbf{1} & \mathbf{X}_1 \\ \mathbf{1} & \mathbf{X}_2 \\ \cdot \\ \cdot \\ \cdot \\ \mathbf{1} & \mathbf{X}_T \end{pmatrix} \mathbf{e} = \begin{pmatrix} \mathbf{e}_1 \\ \mathbf{e}_2 \\ \cdot \\ \cdot \\ \cdot \\ \mathbf{e}_T \end{pmatrix} \hat{\mathbf{A}} = \begin{pmatrix} \hat{\alpha} \\ \hat{\beta} \end{pmatrix}$$

It is known that

$A = (X'C^{-1} X)^{-1} X'C^{-1} y$ (Eq. 17)

As for those stocks, which have not been listed for long enough periods, we will use data only to the extent that return figures are available. Consequently, each stock will have as many betas as the total number of investment periods to be considered, as the size of sample varies with the fund's life. Eq. (17) becomes quite simple, if there is only one independent variable just as in the CAPM regression, i.e.

$$\hat{\beta}_{i} = \frac{Sample \ Covariance \ (y_{i}, \ X_{m})}{Sample \ Variance \ (X_{m})} \ \text{and} \ \hat{\alpha} = \overline{y}_{i} - \hat{\beta} \overline{X}_{m}.$$

(5) Estimating the Expected Return on Individual Securities

In order to calibrate the expected return on individual securities, note that the security's pricing equation from the regression is $E[y_{it}] = \hat{\alpha}_i + \hat{\beta}_i E[X_{mt}]$. Since

 $E[y_{it}] = E[r_{it}] - E[r_{ft}]$, the expected return on individual security $E[r_{it}]$ is given by $E[r_{it}] = \hat{\alpha}_i + \hat{\beta}_i E[X_{mt}] + E[r_{ft}]$.

Now, we adjust values for betas, assuming that all securities betas tend to unity. We follow Blume (1975), where the long run predictive beta, $\beta_i^* = \left(\frac{1}{3}\right) + \left(\frac{2}{3}\right) \hat{\beta}_i$.

Consequently, if CAPM holds, the securities pricing equation becomes

$$\hat{E}[r_{it}] = E[r_{ft}] + E[X_{mt}]\beta_i^*$$
 (Eq. 18)

Second, we establish some connectivity between the theoretical expected return as given in Eq. (18) and the securities mean return by assuming that the securities return reverts to the mean, i.e.

$$m_{it} = \hat{E}[r_{it}] + \lambda(\overline{r}_{it} - \hat{E}[r_{it}])$$
(Eq. 19)

Now, we still have to define the instantaneous return volatility and we will assume that to be the standard error of the regression, which is v_i . See Eq. (5). If the forecasting error from the regression is $e_{it} = y_{it} - \overline{y}_{it}$, the variance on y_{it} is conveniently

measured by $v_{it}^2 = \frac{1}{T-1} \sum_{t=1}^{T} e_{it}^2$. We now have described the method of estimating the

securities return generating process as

$$dS_{it} = m_{it}dt + v_{it}\varepsilon_i \sqrt{dt}$$
 (Eq. 20)

Parameter Estimation: An Example

We now show some specific examples in estimating various parameters when constructing an ex ante EPF. We initially consider a randomly chosen 26 stocks in this example. We also assume the fund's life is one calendar year, or 252 trading days.

Step 1: Take *daily log* price relatives for the S&P 500 index and annualize them. Subtract the three-month Treasury bill rates from the annualized S&P index returns to generate a series X_{mt} . Let us assume that the mean and the standard deviation using one-year's worth of sample data are given by:

	Mean	S.D.	
3-month T-bill yield	1.34%	0.02%	
Market risk premium	- 5.45%	26.95%	

Step 2: Estimate the expectations coefficient $0 \le \lambda \le 1$. Simulate Eq. (14), assuming that on a given day, the actual three-month yield r_f was 1.03% with the 1.34% mean

and 0.02% standard deviation. Using $\lambda = 0.10$, b = 1.34% and $\Delta t = \frac{1}{252}$, calibrate the Monte Carlo trajectory. The result is shown in Table 1, where $E[r_f] = 1.07\%$, the last column.

(1)	(2)	(3)	(4)	(5)		
	Date	Random Numbers	Growth Rate	Return Forecasting		
1	6/7/2003	-0.3002	-0.0000017	0.0103		
2	6/8/2003	2.3757	0.0000242	0.0103		
3	6/9/2003	0.8746	0.0000097	0.0103		
4	6/10/2003	0.0020	0.0000013	0.0103		
5	6/11/2003	0.8030	0.0000090	0.0103		
	1.0					
			2			
			· · · ·			
248	5/27/2004	1.3151	0.0000139	0.0107		
249	5/28/2004	-0.5763	-0.0000043	0.0107		
250	6/1/2004	0.4375	0.0000055	0.0107		
251	6/2/2004	0.0062	0.0000013	0.0107		
252	6/3/2004	0.2326	0.0000035	0.0107		

Table 1: Monte Carlo Trajectory for $E[r_{ft}]$

Remarks: Column for Growth is the implementation for Eq. (14), i.e. $dr_f = \lambda (b - r_f) dt + \sigma_f dz$. It has been assumed $\lambda = 0.10$, b = 1.34% and $\Delta t = \frac{1}{252}$.

Forecasted returns at time t are the rate in the preceding period plus the rate given in column (4).

Step 3: Compute the time dependent volatility on the market index return by using Eq. (15). The latest volatility is measured by the percent change in the S&P index. If the annualized percent change in S&P 500 on a particular day is -60.57%, with $\lambda = 0.10$, *ex ante* σ_{xt} is $[0.90 \cdot 0.2695^2 + 0.10 \cdot (-0.6057)^2]^{1/2} = 0.3194$.

Step 4: Conduct a Monte Carlo simulation to generate a series for X_{mt} by using $\mu_{Xt} = -0.0545$ and $\sigma_{Xt} = 0.3194$, i.e. Steps 1 and 3. See Table 2. Based on the result from Monte Carlo simulation trials, we expect the market risk premium will be 14.49% after a period of a year.

Step 5: Compute daily *log* price relatives for each stock. All corporate actions, which may have affected the firm's distribution including, but not necessarily limited to splits, mergers and acquisitions, spin-offs, equity carve-outs, divestitures and the like except cash dividends, will have required return adjustments. However, *ex*-dividend day

returns will not be adjusted. Run a series of regressions for each stock. The resulting regression coefficients and standard errors are reported in Table 3. Table 3 also displays the securities one-year mean return, predictive betas, instantaneous mean returns for all securities per Eq. (18); and the mean reverting drift returns, i.e. Eq. (19).

Step 6: Calibrate the Monte Carlo trajectories for all securities over a one-year period forward by using Eq. (20).

(1)	(2)	(3)	(4)	(5)	(6)	
	Date	Random Numbers	Growth Rate	Cumulative Rate	Market Risk Premium Forecasting	
1	6/7/2003	0.6817	0.0135	1.0135	0.0135	
2	6/8/2003	0.7718	0.0153	1.0290	0.0290	
3	6/9/2003	-0.1674	-0.0036	1.0253	0.0253	
4	6/10/2003	0.0765	0.0013	1.0267	0.0267	
5	6/11/2003	0.7217	0.0143	1.0414	0.0414	
	4	4.1		1	1. A.	
247	5/26/2004	0.1367	0.0025	1.2344	0.2344	
248	5/27/2004	-2.5412	-0.0514	1.1710	0.1710	
249	5/28/2004	0.2991	0.0058	1.1778	0.1778	
250	6/1/2004	-1.1529	-0.0234	1.1502	0.1502	
251	6/2/2004	-0.3708	-0.0077	1.1414	0.1414	
252	6/3/2004	0.1646	0.0031	1.1449	0.1449	

Table 2: Monte Carlo Trajectory for $E[X_{mt}]$

Remarks: Column (4) the implementation of Eq. (16), i.e. $X_{mt} = \mu_{Xt}dt + \sigma_{Xt}\varepsilon_{Xt}\sqrt{dt}$. It has been assumed that $\mu_{Xt} = -0.0545$ and $\sigma_{Xt} = 0.3194$. Column (5) is given by a formula $\prod (1 + X_{mt})^t$. Column (6) is column (5) minus column one (1).

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
		Beta	S.E.	Alpha	Mean	Long Run Beta	Model Hurdle Rate	Drift Return	EXP PR
1	ABC	0.6143	0.3679	-0.0777	-0.1112	0.7429	0.0407	0.0255	0.0775
2	ACV	0.4263	0.1768	-0,0135	-0.0367	0.6175	0.0867	0.0744	-0.1489
3	BLS	1.1724	0.3880	-0.0921	-0.1559	1.1149	0.0802	0.0566	-0.0640
4	CFC	0.9056	0.2668	0.5132	0.4638	0.9371	0.6597	0.6401	0.0817
5	DELL	1.0606	0.2690	0.2136	0.1558	1.0404	0.3750	0.3531	0.0329
6	EIX	0.9473	0.5034	-0.1183	-0.1699	0.9649	0.0323	0.0121	0.0365
7	FBF	1.4209	0.2970	0.0675	-0.0098	1.2806	0.2638	0.2365	0.1139
8	FON	0.6092	0.6240	-0.0166	-0.0498	0.7395	0.1013	0.0862	-0.1924
9	GAS	1.0483	0.5730	-0.0975	-0.1546	1.0322	0.0628	0.0411	0.1128
10	GDW	0.7147	0.1669	0.1939	0.1550	0.8098	0,3220	0.3053	0.0707
11	HAS	0.7079	0.2995	0.2024	0.1639	0.8053	0.3299	0.3133	0.0794
12	HMA	0.5923	0.3297	-0.1330	-0.1652	0.7282	-0.0167	-0.0316	-0.1283
13	IFF	0.5905	0.1946	-0.0689	-0.1010	0.7270	0.0472	0.0324	0.0240
14	IGT	0.8075	0.2428	0.4408	0.3968	0.8717	0.5778	0.5597	0.0654
15	JCI	0.8518	0.1913	0.1009	0.0546	0.9012	0.2423	0.2235	0.0409
16	KSE	0.6202	0.2157	0.0558	0.0220	0.7468	0.1747	0.1594	0.0115
17	LSI	1.8622	0.6453	-0.3843	-0.4857	1.5748	-0.1453	-0.1794	-0.1041
18	MAR	1.0940	0.2647	0.0799	0.0203	1.0627	0.2446	0.2222	0.0514
19	QTRN	0.5753	0.3842	0.0720	0.0407	0.7168	0.1866	0.1720	-0.0322
20	ROH	1.1008	0.2165	-0.0471	-0.1071	1.0672	0.1182	0.0957	0.0209
21	SDS	1.3355	0.4175	-0.0081	-0.0808	1.2237	0.1799	0.1539	0.0359
22	UCL	0.6943	0.2124	-0.1229	-0.1607	0.7962	0.0032	-0.0132	0.0217
23	VMC	0.9536	0.2366	-0.1248	-0.1768	0.9690	0.0263	0.0060	0.0865
24	WWY	0.4853	0.1874	0.0268	0.0003	0.6569	0.1327	0.1194	0.0621
25	XLNX	1.8596	0.5278	0.0088	-0.0924	1.5731	0.2475	0.2135	0.0398
26	ZION	0.9184	0.2179	0.0406	-0.0094	0.9456	0.1884	0.1686	0.0108

Table 3: Parameters for Securities Return

Remarks: The standard error of the regression in Column (4) represents a measure of unsystematic risk. Column (5) is Jensen's excess return. Column (7) is the long-run beta as compared to the historical beta in Column (3). Column (8) is the equilibrium expected return promulgated by the securities pricing model. Column (9) is an implementation of the mean-reverting drift Eq. (19).

The Solution Technique

Before introducing the solution technique more formally, we now offer some intuitive economic explanations about what would be hidden behind complicated mathematical processes. The basic idea has been promulgated in Eq. (13). The idea is quite simple. Consider Figure 2. First, securities are ranked by their risk premium to beta in a descending order. This is represented by a line that declines downward. Next, a series of scenario portfolios will be formed from the portfolio with one best

stock, e.g. WWY in Figure 2, the portfolio of two best stocks, e.g. WWY and HAS, the portfolio of three best stocks, e.g. WWY, HAS, DELL, and so on until adding another stock will actually lower the portfolios risk premium to risk ratio. The portfolios curve will first rise but will eventually start to fall, as shown. The reason is that when the portfolio has only a few stocks, it is subject to volatility risk. Consequently, the portfolios risk premium to risk ratio would be low. As the number of securities to be included in the portfolio increases, the portfolio's standard deviation will fall, which raises the risk premium to risk ratio, but only to a certain extent. The portfolios risk premium to risk ratio will reach a peak eventually before it starts to fall again, as the majority of stocks to be added to the portfolio will have considerably low expected returns. As shown, the optimal portfolio includes only seven stocks. The optimal proportion of stocks in the portfolio is then the proportion that each stock contributes to the portfolios risk premium to risk ratio. And this is represented by the shaded rectangles for each stock, assuming that the entire shaded area under the curve that ranks stocks is 100%.



WWY HAS DELL GM ABC BAX AA

The general solution technique is quadratic programming with inequality constraints

$$\sum x_i = 1; \ 0 \le x_1, \ x_2, \dots, \ x_{26} \le 1$$
(Eq. 21)

We will give several more examples here. No matter what we do, however, we will maximize the objective function given by $\phi = \frac{E[r_p] - E[r_f]}{\sigma_n}$. The final answer depends
critically on the vector of individual securities expectations and variance-covariance matrices. Table 4 provides such matrices to perform necessary computations based on the particular numerical examples provided here. See Equations (9) and (10).

The second example is the case in which the proportion of any particular stock should not exceed any more than, let's say, 10%, while still disallowing short sales. Constraints can be written as

$$\sum x_i = 1; x_1, x_2, \dots, x_{26} \ge 0; x_1, x_2, \dots, x_{26} \le 0.10$$
 (Eq. 22)

The third example is when a person has a stock option and does not wish to sell his or her current shares nor add any more extra shares. Suppose that he or she wishes to maintain a 10% holding in the 5th stock, DELL. With no short sales assumption, then, constraints are

$$\sum x_i = 1; x_1, x_2, \dots, x_{26} \ge 0; x_5 = 0.10$$
 (Eq. 23)

The last two examples will allow short sales. However, we will add extra constraints that no shares of any particular stock can be bought or sold at more than 10% of our initial investment. We will use two separate definitions of short sales, one is conventional, i.e. the fourth example, and the other, Lintner's (1965), i.e. the fifth example. Those two constraints are

$$\sum x_i = 1; x_1, x_2, \dots, x_{26} \ge -0.10; x_1, x_2, \dots, x_{26} \le 0.10$$
 (Eq. 24)

$$\sum |x_i| = 1; x_1, x_2, \dots, x_{26} \ge -0.10; x_1, x_2, \dots, x_{26} \le 0.10$$
 (Eq. 25)

Table 5 presents soutions for each one of these examples.

Probability of Reaching the Target Return and Rebalancing

It should be noted that the above analysis implies certain probabilities with which to achieve the specific investment target. The procedure is quite elementary in that

$$Pr[r_p \ge r_t] = Pr\left[z_p \ge \frac{r_T - E[r_p]}{\sigma_p}\right] = 1 - Pr\left[z_p \le \frac{r_T - E[r_p]}{\sigma_p}\right] \quad (\text{Eq. 26})$$

To give a numerical example, examine Table 4 where the first quadratic programming solution resulted in the portfolio's expected return of 9.18% and the return standard deviation of 29.23%. If the target return on the account is 12% consistent with the investor's risk profiles,

$$Pr\left[z_p \leq \frac{r_T - E[r_p]}{\sigma_p}\right] = Pr\left[z_p \leq \frac{0.1200 \neq 0.0918}{0.2923}\right] = Pr[z_p \leq 0.0965] = 0.5384$$

Consequently, the probability that the portfolio will achieve at least the 12% return is $Pr[r_p \ge 12\%] = 1 - 0.5384 = 46.16\%$, or we are 53.84% certain that the portfolio's

return will not exceed 12%. Rebalancing strategies may depend on whether or not the underlying probabilities and hence, the portfolios expected return and variance change.

System Functionality

Based on the general discussion above, one can visualize the following functionality in designing a comprehensive *portfolio management* system.

(1) Manager Input

Fund life - one, two, three, five, 10 or 20 years

Fund's maximum risk in relation to the market

Fund's absolute target return, as is more conventional for hedge funds

Benchmark index - S&P 500, Wilshire, Russell, Nikkei, FTSE, etc

Investment constraints - Stop loss, liquidity, tolerance level for return computation, upper and lower bounds used for portfolio rebalancing, the maximum amount in percent that a fund can invest in a particular security, the minimum number of shares that must be held of a particular security in a fund, etc.

Rebalancing strategies - aggressive, benchmark, managed, buy and hold, etc

(2) Model Selection

Managers can use the system provided CAPM solutions or are free to build any pricing model of their choosing. For example, in Microsoft Excel, up to 20 explanatory variables can be specified, whether macro or firm specific variables, e.g. foreign exchange rate, unemployment rate, the general interest rate, inflation rate, economic growth, etc. for macro variables; and the price to book, cash flows, sales growth, ROE, inventory turnover, leverage, etc. for firm specific and yet variables in commonality. Explanatory variables can also include technical criteria such as Bollinger Band breakouts, golden cross, RSI, etc.

(3) Stocks under Analysis

These are a group of stocks in the existing portfolio. For a new portfolio, determine investment styles, e.g. momentum, value vs. growth, small vs. large cap, etc. by defining a group of stocks of interest for up to an x number of stocks.

(4) Manager Specific Outputs

Expected returns and volatility risk on each stock are displayed. Also displayed is Value at Risk (VaR) as well as Value to Gain (VtG). The results are manager specific according to the pricing model chosen. Statistics will be provided as to how significant the manager's variables are in explaining securities returns.

(5) Performance Attributes for Existing Portfolios

Past performance is compared to industry performance, just as in BARRA, and all other variables the manager specified in his or her pricing models.

(6) Portfolio Optimization Outputs

By invoking the optimization command, each manager will be given the mathematical result from the portfolio optimization module. Portfolios are optimized to minimize the risk and to maximize the expected return. Note that the result varies for different pricing models chosen.

(7) Performance Monitoring Outputs

Probability to achieve the investment target, various performance measures such as Sharpe, Treynor and Jensen's, Value at Risk for portfolios.

Conclusions

The brokerage industry has long been trying to earn fee income while slowly deemphasizing its traditional commission driven businesses. It has tried the wrap account business and mutual fund allocation models to start offering their customers advisory services. But the industry was not quite able to cross the chasm. With the emergence of the Internet and its wide acceptance as a means of communication, however, the industry is about to burst into two distinct new lines of somewhat nontraditional business. They are the online advisory based planning business and the separately managed account, all of which target high net worth markets. The hard reality is that, although many are enthralled by the convenience of the online advisory solutions especially in the 401(k) retirement market, the role of financial advisors is not quite clear. Unless the brokerage industry simply licenses the software to end users with brokerage commissions embedded in the license fees, the only viable alternative is to pursue the separately managed market.

For the online advisory business, the industry offers a variety of fund products. A single or multiple funds are offered as a part of advisory tools online. Separately managed accounts are different in that portfolios are particularly custom tailored according to the client's needs, which underlies the whole premise of the business. The separately managed account not only offers good theories but also makes sound business sense.

This paper has shown that, in principle, the best asset allocation model should be based on *ex ante* and not *ex post* efficient portfolio frontiers. Specific solutions to the portfolio selection problem are contingent upon the particular nature of variancecovariance matrix of securities returns. This results from particular pricing models used in the model. Desires to discover the sources of "alpha" can be easily accommodated by allowing portfolio managers to try out their own "factors" in the model. In other words, managers should be allowed to assess their own portfolio frontiers. That is, make all portfolios truly unique to all managers and to all investors.

	and the second	Example 1	Example 2	Example 3	Example 4	Example 5
1	ABC	12.43%	10.00%	12.16%	10.00%	2.82%
2	ACV	0.00%	0.00%	0.00%	-10.00%	-10.00%
3	BLS	0.00%	0.00%	0.00%	-10.00%	-5.14%
4	CFC	6.02%	10.00%	5.07%	10.00%	4.83%
5	DELL	0.00%	0.00%	10.00%	10.00%	-0.94%
6	EIX	0.00%	0.00%	0.00%	0.03%	0.04%
7	FBF	9.31%	10.00%	11.53%	10.00%	5.13%
8	FON	0.00%	0.00%	0.00%	-10.00%	-3.97%
9	GAS	8.75%	10.00%	9.63%	10.00%	1.61%
10	GDW	13.68%	10.00%	8.18%	10.00%	10.00%
11	HAS	14.90%	10.00%	14.46%	10.00%	4.16%
12	HMA	0.00%	0.00%	0.00%	-10.00%	-10.00%
13	IFF	0.00%	0.00%	0.00%	10.00%	0.32%
14	IGT	0.00%	10.00%	0.00%	10.00%	4.28%
15	JCI	0.00%	9.08%	0.00%	10.00%	1.91%
16	KSE	0.00%	0.00%	0.00%	10.00%	-2.52%
17	LSI	0.00%	0.00%	0.00%	-10.00%	-2.91%
18	MAR	0.00%	0.92%	0.00%	10.00%	1.26%
19	QTRN	0.00%	0.00%	0.00%	-1.13%	-2.80%
20	ROH	0.00%	0.00%	0.00%	2.62%	-3.44%
21	SDS	0.00%	0.00%	0.00%	-1.52%	-0.63%
22	UCL	0.00%	0.00%	0.00%	10.00%	-1.39%
23	VMC	11.81%	10.00%	11.47%	10.00%	6.56%
24	WWY	23.11%	10.00%	17.51%	10.00%	8.62%
25	XLNX	0.00%	0.00%	0.00%	-10.00%	-0.72%
26	ZION	0.00%	0.00%	0.00%	10.00%	-4.00%
		100.00%	100.00%	100.00%	100.00%	100.00%
Port Expe	folios ected Return	0.0918	0.0899	0.0896	0.1652	0.0799
Port Stan Devi	folios dard ation	0.2923	0.3038	0.3053	0.3025	0.0697
Max	imized Sharpe	0.2774	0.2607	0.2584	0.5107	0.9926

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Enhancing Management Education Using Hybrid Learning Nets: A Perspective From Working Adults

Owen P. Hall, Jr. Pepperdine University

Distance learning has come a long way since Sir Isaac Pitman initiated the first correspondence course in the early 1840's. Today the number of working adults who are returning to the classroom is growing rapidly as a result of globalization and technological developments. These dynamics call for new and innovative learning systems. One promising approach involves hybrid learning nets which combine both traditional classroom and Internet based content delivery. The purpose of this paper is twofold: 1) to highlight the design of a hybrid learning net (HLN) and 2) to present the results of a survey of working adults that utilized a HLN in a graduate level management course. The results show that two-thirds of the students surveyed found the HLN more effective than a traditional classroom format and that nearly 70% reported that the course fully met their expectations. The experience gained from this study suggests that implementation of HLN on a school wide basis will require a coordinated effort to a degree not seen in the past among faculty, IT technologists and administrative staff.

The demand for students who can compete in the expanding global marketplace and the number of working adults who are returning to the classroom is growing rapidly. The working business student is interested in a practical curriculum that focuses on results and convenience. To meet these demands, the traditional method of knowledge transfer that features the constraints of a fixed location, time, and learning is being replaced with more user friendly and customized learning nets (Smith, 2001). The Internet is the key ingredient in this new delivery stratagem. Many working adults who have been exposed to Internet supported instruction tend to favor this delivery approach over the traditional classroom-centric model (Lundgren, 2003).

The nature of modern business practice calls for students to have both an integrated as well as a results oriented learning experience (Schelfhaudt, 2005). This approach is particularly appropriate for working adults, since many already possess a rich work related experiential base that can contribute to the collective learning environment (Monks, 2001). In an integrated pedagogy, the focus is on understanding how basic management functions such as operations, finance, and marketing are linked. Furthermore, it has long been recognized that active, participatory learning is more effective than passive learning and that learners need feedback early and often (Smith, 2002). These principles provide the impetus for web based learning systems (Boticario, 2002). These systems provide content and know-how outside the walls of the traditional classroom at a time and place of the student's choosing (Jorgensen, 2002). One learning stratagem that supports this perspective is the Instructional Management System (IMS) cooperative initiative (Graves, 1999). This initiative is designed to promote systematic thinking regarding the delivery of higher education to improve learning outcomes and to increase return on instruction investments. Specific principles of the IMS initiative are as follows: 1) education involves more than a single course; 2) a course is more than content; 3) content is more important than lecture notes; 4) convenience is a priority and 5) quality assurance requires an integrated learning approach. One Internet based approach that embodies the IMS initiative are learning nets (LN). These systems are receiving increased attention because they offer students engaged in management education both a customized and an integrated learning experience (Kathawala, 2002).

Literature Review

Learning nets (LN) are Internet-based platforms that provide educational content on a 24/7 worldwide basis. Basically, there are two learning net formats: Hybrid and exclusively Internet (Harvey, 2003). The hybrid model features a combination of inclass and Internet based learning. A recent survey of Internet oriented MBA programs indicates that approximately 60% are hybrid (Ubon, 2002). Figure 1 illustrates the structural design of a hybrid learning net (HLN). In this context, the learning net serves as a conduit that connects students with the course content, peers, instructors and the external business environment.

Today, the general pedagogical direction in higher education is moving increasingly towards a learning-centric perspective (Driver, 2002). Constant feedback via on-line assessment is consequently a must for effective distance learning (Creaser, 2002). The roadmap to effective learning in a distance-learning environment is a customized lesson plan. Learning nets provide a 24/7 environment that supports interactive learning and delivers customized content. It has been recognized that working adults do not learn at the same pace (Kasworm, 2003). Therefore, providing self-paced "customized" instructional content, as part of the overall course design, can further enhance the learning experience. Generally, students tend to participate more in learning systems that are content rich and that feature extensive variety (Neo, 2004).

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In a learning net environment students can access course material through one convenient portal site. Thus, a working adult on travel status can remain current with the course material and team members via the Internet. Additionally, course assignments such as team examinations, homework, and term projects can be submitted electronically. This approach offers many advantages, including "real time" feedback and multiple archived copies of team assignments for subsequent use. Figure 2 illustrates the structural design of the management education learning net (LN) used in this study.





A central element of the LN design is the e-book. An e-book is a digitized learning resource that is both readable and downloadable from the Internet. One primary advantage of an e-book is that it can be customized to meet specific course requirements, thus avoiding the one size fits all approach of the past (Chen, 2003). A customized e-book was used through the hybrid course. Unlike print books (p-books), e-books are designed to support the feedback process through interactive student participation. For example, after reading a section on regression the student would be connected to an on-line regression simulation. Navigational enhancements are a key ingredient to increased e-book acceptance throughout academe (Shiratuddin, 2005).

Another important feature of learning nets are the availability of virtual facility tours (Pettijohn, 2000). The Internet offers a wide range of virtual sites that can be easily integrated into the lesson plan. These tours provide students with direct insight into the integrative nature of business management. In the near future, learners will be able to experience real time guided facility tours that feature the ability to interact directly with onsite management and staff. A key to effective distance learning is a customized lesson plan wherein the specific strengths and weaknesses of each student are identified, measured, and appropriate feedback is provided. On-line testing offers one approach for enhancing this assessment process (Erwin, 2002). Specifically, web-based exams not only expand the range for measuring students' skill levels, but they also provide a platform for real time, in-depth feedback. The development of a student performance database using on-line test results provides the opportunity to further improve the learning process through the delivery of customized content.

Business simulations have long been found particularly effective in developing both individual and team management skills (Aquino, 2005). Furthermore, evidence has shown that students engaged in simulations retain about 75% of the material compared to 5% for lectures, 20% for audio-visual presentations, and 50% for discussion groups (Johne, 2003). One specific simulation that has been used in the hybrid operations management course is the Internet based MIT Beer Game (Hong-Minh, 2000). This simulation is used to teach supply chain management principles in an interactive environment. The hybrid course also provides access to the digital library, Harvard business cases, and large databases such as the Bureau of Labor Statistics. Virtual computing applets were used extensively throughout the course. Virtual computing provides the student with direct access to a wide range of analytical models (e.g., regression) and is receiving increased usage throughout the industry (Vizard, 2002).

A number of surveys have been conducted on student perceptions of learning nets (LN) (Miller, 2003; Shih, 2003; Wang, 2003). The general consensus of these investigations, particularly for working adults, is summarized below:

- LN offer a high degree of interaction and collaboration that can be more effective than traditional classroom methods.
- LN represent a long sought solution to the ongoing challenges associated with adult education. Students can enjoy a dynamic, personal and scaleable experience for continuous learning in a flexible learning environment.

- LN provide the learner with a purposeful entry to Internet resources and thus to a new era of learning technologies.
- LN connect learners and instructors on a 24/7 basis.
- LN also underpin the development of new patterns of relationships between education and business through virtual arrangements such as faculty tours.

The following hypotheses were developed based on the foregoing literature review and the hypothesis testing of Internet learning systems by Changchit (2003).

- Hypothesis 1: Students reporting that a hybrid format course is more effective than a traditional format course is positively correlated with meeting student expectations.
- Hypothesis 2: Students reporting that a hybrid format course supports job demands is positively correlated with meeting student expectations.
- Hypothesis 3: Students reporting an interest in taking another hybrid course is positively correlated with meeting student expectations.
- Hypothesis 4: Students reporting a change in studying habits is positively correlated with meeting student expectations.

To test these hypotheses, a survey was conducted of working adults who had recently participated in a hybrid operations management course. The results of the survey are presented in the following section.

Student Response Survey

A 10-question instrument was developed to assess the student's overall response. The cohort group consisted of working managers enrolled in a 15-week graduate level operations management course. The course format consisted of both Internet as well as a number of in-class learning activities (Hybrid Learning Net). Some specific demographics of this cohort group are reported in Table 1. The data shows that nearly two-thirds of the students surveyed do not have an undergraduate business degree. The wide range of student academic backgrounds, coupled with students returning to the classroom after many years in the work place, provide a significant classroom challenge in terms of the appropriate level of content delivery. This is one area where Internet learning nets can help by providing customized and remedial content outside the classroom.

A pre-test of the instrument was conducted using a similar hybrid based class which was not included in the survey. Following the pre-test, the questionnaire was distributed via the Internet to 175 students that had taken the HLN based course over three trimesters (a total of seven classes). The number of respondents totaled 105 (60% response rate). An Excel database was developed from the questionnaire responses. Table 2 provides descriptive statistics for selected survey variables.

Table 1: Cohort Group Characteristics

Factor	Mean
Age	32
Years of Working Experience	7.8
International Students (%)	9
GMAT	566
Gender (% female)	34
Undergraduate Business Degree (%)	35
Annual Salary (\$)	64,200

Table 2: Selected Descriptive Survey Statistics

Variable Description	Percent
First time learning net user	80%
Gender (female)	34%
Hours studying/week	4.83
Numerical class grade	88.9
More effective than traditional course format	67%
Increase digital library usage	67%
Supportive of work schedule	93%
Interest in another hybrid course	89%
Interest in an "all" Internet course	13%
Changed study habits	35%

These statistics show that approximately 80% of the respondents indicate that this was their first hybrid based course and that they spent an average of 4.83 hours/week reviewing the course materials on-line. Additionally, 67% of the students found the hybrid course design more effective than traditional instructional methods. Furthermore, 93% of those responding to the survey indicated that they found this course design supported their work schedule. This positive response can be attributed to the fact that nearly 75% of the students missed one or more classes due to business activities, yet they were able to remain engaged in the course. Also, 69% of the students found that the HLN course fully met their expectations while only 5% indicated that it did not. Finally, only 13% of the students expressed interest in an all Internet based course.

The survey's open-ended question revealed the following general observations:

- Students were able to remain current with the assignments and content even while on extended travel status.
- Students found the linked facility tours helpful in understanding basic operational principles, e.g., how supply chain management is used in the automotive industry.

- Students enjoyed access to large-scale Internet-based databases, e.g., Bureau of Labor Statistics.
- Students valued the insights gained into the dynamics of business management via on-line business simulations.
- Students appreciated the availability of all course material at one accessible site.
- Students felt that real time practice testing increased their understanding of the subject material.

The correlation coefficient between actual midterm exam scores versus average practice Internet test scores was 0.78. Additionally, there was a very strong positive correlation between the number of times the student took the practice tests and their practice test scores. This data lead to the conclusion that consistent practice testing yields higher actual test scores. The demographics of the survey participants were consistent with the overall student population as measured by age and gender.

While one would expect similar results for in-class practice exams, the Internet provides a more efficient testing environment, e.g., Internet-based testing does not take up valuable class time. The testing system provided both weekly practice quizzes (10 questions per quiz) and timed 90-minute mid term and final exams (50 questions per exam). Students averaged approximately five hours in practice test taking over the trimester. Additionally, the testing system offered a layered response structure consisting of three feedback elements: 1) the correct answer, 2) a tutorial on the question's subject matter and 3) a web link to additional supportive material.

Results Analysis

Table 3 summarizes the hypothesis testing results. The first hypothesis suggests that a hybrid course that is found more effective than a traditional course is positively related to meeting student expectations. The results support this hypothesis (r = .43, p < .01). The second hypothesis, that a hybrid course that is supportive of job demands is positively related to meeting student expectations, was found to be statistically significant (r = .30, p < .01). Hypothesis 3 states that students who show an interest in taking another hybrid course is related to meeting student expectations. The results support this hypothesis (r = .57, p < .01). The final hypothesis states that a change in studying habits is related to meeting student expectations. The results do not support this hypothesis (r = .03, p = 0.73).

Hypothesis	p-value	r	Conclusion
1	0.00	.43	Supportive
2	0.00	.30	Supportive
3	0.00	.57	Supportive
4	0.73	03	Non-supportive

Table 3: Hypot	hesis Testing	Summary
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Variables	1	2	3	4	5	6	7	8	9	10	11
1. First	-	1.1		2		1	-			1.10	
2. Gender	04	-				1200		in the	1.1	1.1	
3. Hours	05	09						1.1	1.6		
4. Grade	05	19	.10	-				The second			
5. More	.06	19	.32*	.06							
6. Library	10	10	.16	06	.26*	-	1			4	
7. Supportive	13	13	.12	.03	.39*	.22*	1	1.1	1.1.1		1.1
8. Another	03	12	.25*	.25*	.26*	.26*	.50*	-	100		
9. All	08	.07	04	.07	.15	.03	.10	.14	-	1	
10. Habits	.20	.18	.12	23*	21*	.22*	20*	17	11	-	
11. Expectations	06	05	.22*	.04	.43*	.22*	.30*	.57*	.05	03	-

Table 4 presents zero-order correlation coefficients for the database.

 Table 4: Correlation Matrix (Pearson)

*Significant at 0.05

The correlation data revealed, among other things, that interest in taking another similar hybrid course is positively correlated with:

- The number of hours spent studying on the Internet (r=0.25, p < 0.01)
- The final numerical grade (r=0.25, p < 0.01)
- The view that a hybrid course is more effective than a traditional course (r=.46, p < 0.01)
- Increased digital library usage (r=0.26, p < 0.01)

The database was more fully explored using neural net analysis. A neural net predictor model was developed based on a "training" set of 75 observations randomly selected from the database where the target (dependent) variable was student expectations (Huang, 2002). The candidate predictor variables are listed in Table 2. Neural networks have seen increased use in educational applications (Choi, 2001). Specifically, neural nets appear as the analytical tool of choice when the underlying relationships between variables are somewhat ill defined as in the case of e-learning (Gonzalez, 2002). The resultant R² was 0.95. Table 5 presents the relative importance of the input factors. The variables "first Internet course" and "interest in taking another similar course" account for more than 50% of the relative importance of the factors considered.

Table 5: Relative Variable Importance

Variable	Importance
First HLN course	0.301
Interest in another hybrid course	0.275
Changed study habits	0.169
Higher grade	0.152
Increased library usage	0.047
Considered more effective	0.040
Interest in an all Internet course	0.014
Supportive of job demands	0.001
Hours studied	0.000
Gender	0.000

Figure 3 shows a plot of the actual versus predicted target variable values for the training database.

Figure 3: Comparison of Actual versus Predicted Values for Target Variable



The developed neural net model was then tested using a holdout dataset of 30 observations. The resultant R² was 0.14. This outcome can be attributed to the small sample size. Typically, a sample size on the order of 750 to1000 observations should yield improved performance results (Nguyen, 2001).

Neural nets can also be used for classification analysis wherein the target variable is characterized into two or more categories. Specifically, neural nets have been found to have superior performance relative to other classification methods over a wide range of situations (Kiang, 2003). An example of neural net classification application is college admissions in which the target variable categories could consist of accept, reject or hold for further consideration (Hoefer, 2000). The target (dependent) variable for the current classification study is defined as follows:

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- 1=Students found the course to be more effective than a traditional MBA course
- 0=Students found the course not to be more effective than a traditional
- MBA course

The neural net classification model was "trained" using 70 random observations from the database. This model correctly classified 100% of the observations. This model was then tested with the holdout group of 35 observations. The results of the holdout group classification analysis are reported in Table 6.

	Classified 0	Classified 1
Actual 0	60	8
Actual 1	40	92

Table 6: Classification Analysis of Target Variable (percent)

As can be seen from this data, the model was able to accurately identify those students from the holdout group that found the HLN course more effective (92%). However, the classification performance for the other group vielded a relative high level of type I errors (40%). A type I error in this case is defined as classifying a student who actually found the HLN more effective than a student who did not. The type I problem can be attributed to the relatively small sample size for the holdout group particularly with respect to the first category (sample size = 10). Enhancing the size of the database over time as additional students are exposed to the HLN course should lead to a more accurate classification model (Kiang, 2003). The overall accuracy rate of the neural net is 83%. This statistic is defined as the proportion of correct classifications across all categories (29/35). This performance result compares favorably with similar studies on preference classifications (Wong, 2000). The above classification model can be used to identify those students that may require additional preparation attention prior to and during the HLN course. Further, the model can be extended to pinpoint those instructor controlled tasks that are viewed as important by the students, e.g., e-mail feedback.

System Implementation Issues

A fundamental tenet of the HLN design is that one size does not fit all. That is, students do not learn at the same pace and they are impacted differently by the learning environment. While considerable attention is now being given to the development of e-learning content, there are a number of other structural components that need attention. These include system implementation and operation. Some specific administrative challenges in implementing an HLN are highlighted in the following:

- Training faculty for successful system deployment and usage
- · Providing worldwide access with the highest quality standards

- Setting specific performance goals and metrics for measuring student performance and expectations
- · Maintaining format consistency across departments and educational programs
- · Preparing students for entry and ongoing use of learning nets
- · Establishing the overall school culture that fosters learning net innovation

Successful system implementation requires a coordinated effort to a degree not seen in the past among faculty, IT technologists and administrative staff. One implementation strategy is first to deploy a prototype system using a specific cohort group such as an executive MBA program where the number of students is relatively small and the content is standardized. Based on the experience gained from the prototype, the HLN can then be expanded driven primarily on resource availability and content development. Student acceptance is also another significant factor (Martins, 2003). Arguably, the single most important operational issue is that the learning net must be available on a 24/7 basis. Anything less undercuts the basic notion of knowledge on demand. Developing the internal capability to deploy a learning net can be complex and expensive. Furthermore, an internalized approach may not take advantage of the ongoing developments in delivery technology, e.g., search engine technology. One emerging implementation strategy that is designed to help overcome the aforementioned issues consists of developing institutional partners with both content and application service capabilities (Sorel, 2001). This approach focuses specifically on the basic ideas behind supply chain management and is consistent with the increased use of suppliers in large volume operations such as those found in most business programs. Measuring ongoing system effectiveness and performance is required to help insure a viable and cost/effective learning net (Bersin, 2002).

Conclusions

Learning nets are on the rise in higher education (Coppola, 2002). The purpose of this paper was twofold: 1) to highlight the design of a hybrid learning net (HLN) for management education applications and 2) to present the results of a survey of working adults that utilized a HLN in a graduate level operations management course. The HLN combined both Internet-based content delivery with specific in-class learning exercises. The overall student response as measured by a number of survey dimensions was positive. The results revealed that nearly 70% reported that the course fully met their expectations. More specifically, the survey results indicated that the presentation of course content and assignments via the Internet were found to be more effective than traditional methods and that the HLN design was supportive of student job requirements. Furthermore, student usage of digital library assets increased. These results are consistent with the notion that HLN fosters new and robust learning patterns (Miller, 2003). HLN provides a vehicle for moving from a teaching-centric towards a learning-centric educational paradigm which is particularly attractive for graduate management education for working adults. The evidence suggests subject mastery is not eroded as a result of Internet based learning as long as students remain persistent (Mclaren, 2004).

The overall goal of HLN is to optimize the use of the Internet to provide effective distance learning while enhancing faculty and peer interactions. HLN provides an opportunity for collaborative learning that often yields a positive impact on the educational experience (Graham, 2001). Another essential feature of HLN is real time feedback. Real time feedback can be provided in a variety of ways, including testing and simulations. This capability presents both the instructor and student with insights into subject areas that require more attention. Providing the broadest range of tutorial instruction optimizes the opportunity for effective learning. Asynchronous real time feedback is particularly attractive for working adults who have difficulty maintaining an ongoing presence on the campus. The HLN stratagem outlined herein is designed to replace the three pillars of traditional instruction - fixed time, fixed location, and fixed learning pace – with a flexible and customized learning process. Specific benefits of HLN include the following:

- · Integrated perspective on the course/program
- 24-7 access to content including real time testing with feedback
- · Courses designed for specific learning applications with real time updating
- · Convenience which is particularly important for working adults
- Improved content linkage

Additionally, an HLN based curriculum permits more working adults access to the growing body of management know-how that will allow them to remain competitive in an ever-increasing global marketplace. There are a number of developmental tasks that need to be accomplished to further enhance the effectiveness of the HLN in business education. These include enhanced interactive simulations, real time videos and student performance diagnostics. One promising technology to support the latter are called artificial agents (Cheung, 2003). These Internet based systems can be used to design lesson plans and learning experiences based on student test performance and background characteristics. Similar systems are being used throughout industry to improve both productivity and effectiveness and could play a similar role in enhancing student learning (Casteluccio, 2001).

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Forecasting Occupancy Levels: A Problem for Management Forecasters

Jeffrey E. Jarrett Jeffrey S. Plouffe University of Rhode Island

Accurately forecasting occupancy levels is an essential planning ingredient in the process of developing a forecast of total annual revenue in managing an institution of higher education. Literature suggests that applied time series analysis is preferable to causal models for this application. The problem is that time series methods may not be optimal for forecasting total occupancy level due to the presence of measurement error in the historical occupancy data. Song and Chissom (1993b, 1994) developed a time series method based on Fuzzy Logic Set Theory (Zadeh, 1965), which they report to be robust in the presence of this type of uncertainty. We compare six general time series methods and the fuzzy method of Song and Chissom across two direct and two derived forecasting strategies. We also compare six time series methods and the "fuzzy" across direct and composite forecasting. We evaluate these combinations of method and strategy based on the criteria of accuracy and economy. The results indicate that the fuzzy time series method in conjunction with a direct forecasting strategy is preferable to all other combinations of method and strategy evaluated for forecasting each semesters total occupancy level.

Significant changes in the economic and demographic environments of public institutions of higher education increase the difficulty of forecasting of their total annual revenue (Zuniga, 1997). Rather than forecast total annual revenue directly, administrators combine the revenue forecasts for each of the revenue centers within

the institution to obtain the institution's total annual revenue forecast, (Caruthers and Wentworth, 1997). These revenue centers, in descending order of contribution, are Tuition and Fees (27.5%), Auxiliary Services (25.0%), State and Local Government (24.5%), Federal Government (11.0%), Endowments/gifts (8.5%) and Other (3.5%), (Hauptman, 1997). Recent data not discussed here indicate a continued decline in the public support of higher education.

Administrators facing the pressure to fulfill student demand for housing, have adopted sophisticated quantitative forecasting models to improve the accuracy of their forecasts (Layzell, 1997). To date, nearly all of the research in this area focused on developing methods for forecasting enrollment levels. These levels are necessary to calculate the revenue forecast for tuition and fees, which are the institution's largest revenue center (Brinkman,1997).

In contrast, research focusing on the development of methods for forecasting occupancy levels are nonexistent. These levels, however, are necessary to predict the revenue forecast for room and board. Revenue from room and board is 75.5% of the revenue from auxiliary services or 18.5% of an institution's total annual revenue (Hauptman, 1997). In light of an institution's objective to accurately forecast its total annual revenue, the need to accurately forecast each semester's residence hall occupancy level is clear and is similar to occupancy levels of for-profit enterprises.

The objective of this paper is to offer practical guidelines when followed by *budget planners* so they may obtain accurate forecasts of their institution's fall and spring semesters' total occupancy level. The relevant body of literature indicates that, for reasons of economy and accuracy, time series forecasting methods are preferable to other forecasting methods for this application. This will be investigated further in this paper.

Unfortunately, due to the manner in which *management* predicts and records occupancy levels, historical occupancy data contain considerable measurement error. In addition, general time series forecasting methods may not be robust enough to produce a sufficiently accurate forecast when this type of uncertainty is present (Song and Chissom, 1993). The authors propose to use "fuzzy set theory" (Zadeh, 1965) introduced by Song and Chissom (1993b), to produce better results for university management.

This paper studies and compares six general time series methods (Chan, 2002) and the Song and Chissom (1994) fuzzy time series methods across two direct and two derived forecasting strategies. The dynamic artificial neural network models for forecasting time series events (Zhang, 2003; Ghiassi et al., 2005) are ignored since dynamic modeling of this type presents a different architecture and is not directly comparable to the fuzzy method that is the focus of attention in this study. By directly modeling the direct strategies, the original total occupancy time-series to obtain the total occupancy forecast for the fall and spring semesters. In the derived strategies, freshmen, sophomores, junior and senior occupancy forecasts are combined to form the total occupancy forecast for each semester are evaluated. In total, we evaluate fiftysix combinations of method and strategy for forecasting total occupancy level for each semester for goodness-of-fit. The measures of fit used are *Mean Absolute Deviation* (MAD), *Mean Absolute Percentage Error* (MAPE) and *Root Mean Square Error* (RMSE) (Jarrett, 1991; Shumway and Stoffer, 2000). The authors hypothesize that due to the presence of measurement error, the fuzzy time series method, strategy aside, produces the most accurate forecast.

We organize the remainder of this paper as follows: The Background section highlights the similarity between occupancy and enrollment data, and reviews the quantitative and combination methods used to forecast the latter. The Methodology section discusses the data collection process; the four competing strategy alternatives for obtaining a total occupancy forecast for each semester; a review of the general time series methods use and a review of the measures used to assess goodness-of-fit. The Results section presents in two tables, evidence indicating that the fuzzy time series method in combination with a direct forecasting strategy provides the most accurate forecasts of each semester's total occupancy level. We include a subjective assessment of the economy of each combination. The Discussion section reviews the efficacy of the direct forecasting approach as well as an evaluation of the fuzzy time series method. We include some suggestions for future research.

The results section presents in two tables, evidence indicating that the fuzzy time series method in combination with a direct forecasting strategy provides the most accurate forecasts of each semester's total occupancy level. A subjective assessment of the economy of each combination is included. The discussion section reviews the efficacy of the direct forecasting approach as well as an evaluation of the fuzzy time series method. Suggestions for future research are also included in this section of the paper.

Background

There is significant similarity between the dynamics and characteristics of occupancy data and those of enrollment data within a given institution. Occupancy level, like enrollment level, fluctuates throughout a given semester. Often the department notified of changes in these levels is different than the one recording or the one reporting these levels. As such, it is likely that an institution's reported historical occupancy level and its enrollment level have measurement error. Due to these similarities between occupancy data and enrollment data, previous research on forecasting enrollment levels is used as the relevant body of literature for this study on forecasting occupancy level.

Methods

The methods examined fall into one of two groups: curve fitting techniques (time series methods) or causal (explanatory, structural and econometric) models. Curve fitting techniques rely on patterns in the behavior of enrollment itself to produce a forecast, whereas causal models rely on the relationship between the predictors of enrollment and enrollment itself to produce the forecast (Brinkman, 1997). Causal modeling by far dominates the research on forecasting enrollment within institutions of higher education.

Recent research covering the use of quantitative methods includes the following. Hoenack and Weiler (1979) developed a complex causal model for long-term enrollment forecasting. They focused on the examination of the relationship between demands for higher education, and price and labor market variables. Sally (1979) argued that short-term forecasts are more important for budgetary purposes than are long-term forecasts, and showed how to distinguish the influence of cyclical, seasonal and trend effects.

Gardener (1981) utilizing a double exponential smoothing model examined the effects which alternative weighting factors had on enrollment forecasts. Weiler (1984; 1987a) demonstrated how to design and use econometric enrollment demand models. Weiler (1987b) used an econometric technique for dealing with supply constrained graduate enrollments at public universities. Pope and Evans (1985), Chatman (1986), and Paulsen (1989) all showed how to provide regularly updated monthly forecasts of the next term's enrollment. Pfitsner (1987) explained how to use a Box-Jenkins procedure for producing a short-term enrollment forecast. Mixon (1993) and Mixon and Hsing (1994) use econometric techniques to forecast out-of-state enrollments. Bingham (1993) demonstrates how one predicts enrollment within the framework of marketing theory. Song and Chissom (1993b and 1994) introduced a time series method based on Fuzzy Set Theory (Zadeh, 1965) for forecasting enrollments. These authors proposed this model to address uncertainty in the form of "fuzziness" in the historical observations of enrollment data. These authors drew a distinction between uncertainties in the form of fuzziness and uncertainty because of white noise. In the latter case, they concluded that white noise results from random factors and can be handled by traditional stochastic models. In the former case, they concluded that fuzziness results from non-random factors such as measurement error and can only be handled by fuzzy models. In their study, they compared their fuzzy method to time series linear regression on a single series of enrollment data. They evaluated their method using the forecast error measures (MAD) and (MAPE).

Several results come from prior research on the use of quantitative forecasting methods. Specifically, curve fitting or time series methods appear to be more appropriate for short-term forecasts, particularly when one uses the forecast for budgetary purposes. In contrast, past research indicates that causal methods are more appropriate for long-term forecasts. Further, the curve fitting techniques are more economical then the causal techniques as they require only historical observations on enrollment itself to produce a forecast. Mahmoud (1984, pg. 139) has stated with respect to quantitative forecasting methods: "time series methods are almost always better than explanatory variable models'. The fuzzy time series method appears to offer the dual benefits of economy and robustness to measurement error.

Combination Methods

Research on the use of combination forecasting methods for enrollment forecasting is quite limited. Nunley (1981) discusses how to use a combination of quantitative forecasting techniques along with a qualitative consultative approach to predict enrollment. Weissman (1994) provides an example of a hybrid approach in which one uses regression routines to develop statistical relationships between services area populations and enrollments in various academic disciplines. These forecasts are adjusted by administrators in each discipline as they consider various factors, including supply, which may affect enrollment. Although the number of studies exploring the use of combination forecasting methods is small, in practice, these methods may be the most frequently used. As an example, at the University of Rhode Island, the institution serving as the subject of this study, administrators regularly adjust forecasts of enrollment level and occupancy level based on their intuition. On this point however, Makridakis (1979, pg. 97) concludes, "modifying the results of a quantitative forecast with a judgmental component tends to reduce the accuracy of the forecasts and adds to their costs".

Forecasting Strategies

The forecasting literature indicates one can use alternative strategies to obtain forecasted values when employing time series methods, specific forecasting method aside. One such strategy is to obtain forecasted values by directly modeling the time series of interest (Box, Jenkins and Reinsel, 1994). We used this direct strategy exclusively in the research on forecasting methods discussed above. A second strategy, when applicable, is to forecast the sub-aggregate series of the time series of interest. One combines these sub-aggregate forecasts to form a derived forecast for the series of interest (Wei and Abraham, 1981; Weatherby, 1984; Lütkepoh1, 1984). This second strategy, in principle, is the one used by administrators to obtain the total annual revenue forecast for four-year public higher education institutions. A third strategy is to directly model the time series of interest with several methods, and to use the mean of these forecasts as the final forecast for the time series (Bunn, 1979; Theil, 1954).

Method

Data Collection

We obtained the residence occupancy data from the Department of Housing, the Registrar's Office, and the Bursar's Office at the University of Rhode Island. As there is no single measure of occupancy level for an academic year, historical occupancy data was obtained and recorded separately for the fall and the spring semesters for the academic years 1986-1997. This was a sufficiently lengthy period to avoid problems associated with a spike or some other data intervention.

Data collection establishes October 16th as the occupancy level date for the fall semester and February 23rd for the spring semester. These dates are also suitable for calculating total revenue for each semester. However, due to inaccuracies in the occupancy records and the absence of a recording date for some observations, there is a substantial probability that measurement error is present.

The specific time series used in this study are total occupancy level, as well as freshman, sophomore, junior and senior occupancy levels for the fall and spring semesters for the years 1986-1997. This provided ten time series of occupancy data with twelve observations each. We created an additional five time series by combining each category's fall and spring semester occupancy time series into a single time series with twenty-four observations.

Forecasting Strategies

Both direct and derived forecasting strategies were examined. When these two strategies were implemented, two direct and two derived alternatives result for obtaining each semester's total occupancy forecast. These four possibilities are (1a) directly model the fall and spring semester total occupancy time series finding (t+1) for each semester. (1b) directly model the combined fall/spring semester total occupancy time series finding (t+l) and (t+2) for the fall and spring semesters respectively. (2a) directly model the fall and spring semesters freshman, sophomore, junior and senior occupancy time series' finding (t+l) for each semester. Then combine the class forecasts for each semester to obtain the derived total occupancy forecast for each semester; (2b) directly model the combined fall/spring semester freshman, sophomore, junior and senior occupancy time series' finding (t+l) and (t+2) for the fall and spring semester respectively. Then combine the class forecasts for each semester to find the derived total occupancy forecast for each semester. Alternative (la) implies that each semester's historical total occupancy level is the best predictor of its future total occupancy level. Alternative (1b) implies that each semester's historical total occupancy level plays a role in predicting the future total occupancy level of the other semester. Alternatives (2a) and (2b) suggest that the process of combining the class forecasts into a forecast of total occupancy level serves to minimize overall forecast error.

Data Analysis: General Time Series Methods

Six general time series forecasting methods were used. They are: Moving Average (MA), Single Exponential Smoothing (SES), Double Exponential Smoothing (DES), Brown's Method (BLE), Holt's Two-parameter Linear Exponential Smoothing (HLES) and Times Series Linear Regression (TSLR). The purpose is to find the benefits from the fuzzy method using the aforementioned benchmark methods to learn lessons for future forecasting activities (see Armstrong and Pagell, 2003) where they argue that one cannot evaluate all techniques under all principles). Time series methods were engaged because they represent methods ranging in sophistication from simple to complex and because they include both methods with and without trend adjustments. To ensure sufficient rigor, every parameter setting or combination of parameter settings for fit in each of the above methods was evaluated. Due to their limitations, we did not employ the first three general time series methods in the evaluation of approach (1b) and (2b) were not employed.

Data Analysis: Fuzzy Time Series Methods

Fuzzy time series methods to evaluate all four-strategy alternatives outlined above were examined¹.

Evaluation Methods

In this study, the recommendation of Krajewski and Ritzman (1994), regarding the magnitude of the weights used in time series methods were followed. Specifically, if

weights exceed (.5), an alternative method was employed. The magnitude of the model weights aside, the selection of the appropriate time series method was based on the fit of the method to the time series, with the fit being measured as forecast error. Decisions on goodness-of-fit were based on achieving the objectives of minimizing MAD and MAPE (as was the case in the Song and Chissom (1993b) study). RMSE was also included because of its wide use and statistical properties.

Results

The objective of this study was to identify the combination of a forecasting strategy and a time series method which provided the most accurate forecast of each semester's total occupancy level. Tables 1 and 2 present the forecast errors for the model of best fit within each of the four strategies alternatives evaluated in this study for the fall and spring semesters respectively. In each table, the forecasting strategy and method combination, are listed in descending order.

Table 1: Forecast errors for model	of best fit within each of four	r strategy alternatives evaluated
	(Fall Semester)	

Approach	<u> </u>	Method	ľ	Forecast Error	
		1	MAD	MAPE	RMSE
Direct Independent	(la)	Fuzzy	113.91	2.93%	161.95
Derived Independent	(2a)	TSIR	134.77	3.57%	167.05
Derived Combined	(2b)	TSIR	149.55	4.06%	184.23
Direct Combined	(1b)	TSIR	149.86	4.08%	183.3

Table 2: Forecast errors for mode	l of best fit within	each of four st	trategy alternatives	evaluated
	(Spring Sem	1ester)		

Approach	1	Method		Forecast Error	
	ĺ	`	MAD	MAPE	RMSE
Direct Independent	(la)	Fuzzy	87.73	2.42%	138.65
Derived Independent	(2a)	Fuzzy	115.27	3.38%	144.26
Derived Combined	(2b)	BlE	139.69	3.87%	171.31
Direct Combined	(1b)	TSLR	149.86	4.08%	183.3

These results suggest that alternative (la) in conjunction with the fuzzy time series method, provides the most accurate forecast of each semester's total occupancy level. In addition, while the fuzzy method is more time consuming to setup initially than are the general time series methods, the fuzzy method (la) combination is very economical to implement. The derived strategy (2a) in conjunction with TSLR for the fall semester, and fuzzy time series for the spring semester ranks second in accuracy.

However, due to the use of the derived strategy these combinations are not very economical. Alternative (2b) in combination with TSLR for the fall semester and BLE for the spring semester ranks third in accuracy. Due to the derived strategy, however, these combinations are not very economical. Alternative (1b) in combination with TSLR ranks

forth in accuracy for both semesters. This combination is, however, the most economical of the combinations evaluated^{2, 3}.

Discussion

The need to accurately forecast residence halls' occupancy levels in public institutions of higher education has become increasing important as budget planners strive to produce a more accurate forecast of their institution's total annual revenue. This study presents a comprehensive review of common forecasting strategies and time series forecasting methods which the literature suggests are appropriate for forecasting residence occupancy level. Included in this review is the relatively unknown fuzzy time series method of Song and Chissom (1993a), a method they proposed as a solution to the problem of measurement error in the historical observations of a time regardless of the source of the time series.

The results of this research indicate that directly modeling each semester's total occupancy time series with the fuzzy time series method provides a more accurate forecast of each semester's total occupancy level than do any of the alternative combinations evaluated. This combination of strategy alternative and method is relatively economical and all calculations can easily be performed in an Excel spreadsheet.

The success of the direct forecasting strategy (1a) in this application indicates that each semester's historical total occupancy level is the best predictor of each semester's future total occupancy level. Correctly identifying this relationship is an important step in obtaining an accurate forecast.

The accuracy of the fuzzy method is due to two factors. The first is the model's robustness, which is established in Step 4 of the fuzzy forecasting procedure. In this step, a probability is assigned to each fuzzy set representing the degree of membership of a given historical observation to that fuzzy set. In essence, this step creates an interval around the observed occupancy value which is likely to capture the true occupancy value in fuzzy teffils. As such, the influence of measurement error is muted. In the Song and Chissom (1993b) study, these authors observed that increasing or decreasing observed values by as much as 5% had no influence on the forecasted values.

The second factor contributing to the fuzzy method's accuracy is the Rfinal matrix calculated in Step 7. The Rfinal matrix summarizes the relationships between the historical observations of occupancy level, just as beta does in the TSLR method or the level or trend component does in the simpler time series methods. The difference, however, is that the Rfinal matrix appears to retain more unique information about the relationships between historical observations than do the single summary measures.

A shortcoming of the fuzzy time series method is the subjective nature of the decisions made in steps 1, 2 and 4 of the fuzzy forecasting procedure. Developing more objective criteria for steps 1, 2 and 4 in the procedure represents an excellent

²Charts presenting the observed vs. the Fuzzy forecast values of total occupancy level for each semester are available from the authors @DelCampo@mgt.unm.edu.

³Twenty four tables presenting the forecast error measures for all of the combinations and all of the time series evaluated in this study are available from the authors @DelCampo@mgt.unm.edu.

opportunity for additional research to advance the fuzzy time series method. There are also opportunities for additional research on forecasting occupancy level. Assuming continued use of qualitative or judgment forecasting methods by higher education budget planners to obtain each semester's total occupancy level, an experiment to compare methods and add to the relevant research in this area. Relative to quantitative methods, the addition of the results from more advanced time series methods and long memory modeling of occupancy data would serve to extend the results of this study. Most important, management and budget planners can relieve themselves of the burden of terribly inaccurate and confusing forecast information.

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A Touch of Class: Work and Family Balance in Professional and Working Class Hispanics

Robert G. DelCampo Andrew T. Hinrichs University of New Mexico

This article examines work-family conflict (a form of interrole conflict in which the role pressures from the work and family domains are mutually incompatible in some respect) among Hispanics at different levels of Socioeconomic Status (SES). Results did not support the hypothesis that Hispanics with a lower SES experience a higher level of WFC due to limited resources. However, because Hispanics are stereotypically considered loyal and family-oriented, these values may become weakened by upwardly-mobile career goals. Second, the maintenance of some level of Hispanic (or any ethnic) identity can improve the individual's ability to create family and work role separation.

The focus of the present study was to increase understanding of the challenges many individuals face in trying to achieve and maintain a balance between their work lives and their family lives. The most common type of household in American society today is the dual-earner home. As a result more individuals than ever are being confronted with the difficulties inherent of trying to be a good worker, as well as a good family member. This challenge may be especially salient for working-class individuals who may face more obstacles than their middle-class counterparts in embracing these challenges due to more limited resources.

The literature review completed for this study found that the increase in the number of individuals working outside the home has caused people to move between two realms on a daily basis, the home realm and the work realm, which are in many ways like two different countries or cultures. While both genders are affected by the challenge of balancing work and family, women report higher levels of difficulty and related stress (Higgins & Duxbury, 1992). The differences in class (professional versus working class) have yet to be examined. While women still do the majority of the housekeeping and emotional work at home, even if they are employed full-time outside the home. Hispanic women report higher levels of satisfaction than do Anglo-American women because they do not experience as much pressure to be "superwomen". There are a number of consequences associated with the challenge of maintaining work and family balance: problems at work spill over to home, and problems at home spill over to the workplace. At home, these problems are associated with decreased marital satisfaction, lower overall assessments of family relationships, and increased tension in the home for all involved. In the workplace, these problems can cause reduced performance, greater absenteeism, higher rates of turnover, and lack of job satisfaction and job commitment. Those individuals who are satisfied with their jobs are generally more committed to them, but job satisfaction has been found to be linked to satisfaction with one's life (Rice, Frone & McFarlin 1992). The challenge is therefore quite significant. Individuals who are trying to fulfill more roles than they are comfortably able to do, end up experiencing burnout in both their home and work environments; negatively affecting themselves and all with whom they are involved.

Literature Review

The United States Census Bureau defines persons of Hispanic origin as those who live in the United States and indicate their origin as Mexican, Puerto Rican, Cuban, Central, or South American. Of particular note is that persons of Hispanic origin may be of any race. Along these same lines, 'Latino' is defined as an individual living in the United States originating from or having heritage relating to Latin America (U.S. Census Bureau, 2000). While much debate exists as to how inclusive/exclusive these terms might be, for the purposes of the current study, the terms 'Hispanic' and 'Latino' will be used interchangeably. Hispanics are the largest and one of the fastest growing minority groups in the United States. Currently, there are approximately 33 million Hispanics, comprising approximately 12% of the U.S. population. It is projected that Hispanics will comprise a group of over 50 million by 2020 (U.S. Census Bureau, 2000). According to Census projections, Hispanics will comprise at least 25% of the total United States population by 2050. This group has accounted for 40% of the population growth in the United States in the past decade, growing at 60%, ten times the rate of non-Hispanics (Blancero & Blancero, 2001.) The U.S. Latino population has grown faster than predicted since 1990 and is now approximately the same size as the African-American population (U.S. Census Bureau, 2000). Clearly, Hispanics are a growing component of the workforce that corporations need to consider, especially if it can be demonstrated that they differ from other groups in the workforce.

Despite the explosive growth of the Hispanic population in the United States, there has been little research done on this group. The rise in the number of Hispanics poses great opportunity for researchers and practitioners and has important implications for organizations, especially considering the lack of scholarly work in this area. Moreover,

Hispanic business professionals have been largely under-investigated by business researchers. In the present study, business professionals were operationalized as those white-collar workers with a minimum of an undergraduate college degree.

The emergence of Hispanic business professionals has had effects on numerous levels. In addition to gaining strength as a larger portion of the workforce, Hispanics are becoming a more powerful consumer group. Increasing numbers of Hispanics are also beginning to make significant in-roads in their corporate presence. Learning more about this group and their perceptions about business practices, and more specifically their ability to cope with the strain created by multiple roles (work and family), is important not only to Corporate America, but to Hispanics themselves.

Work-Family Conflict

The literature on Work-Family Conflict (WFC) is well reflected in the work of Greenhaus & Beutell (1985). Their study examined the sources of conflict, between the work role and the family role. Their model predicted that family/work pressures are brought about by time-based conflict, strain-based conflict, and behavior-based conflict. The model hypothesized that role pressures (and hence WFC) are intensified when the work and family roles are central to the person's self-concept and when there are strong negative sanctions for non-compliance with role demands. The research findings were generally consistent with the notion of time-based conflict, meaning there is conflict when pressures of time are not compatible with the demands of their other role domain. The authors' findings on strain-based conflict show that strain, conflict, or the absence of support contribute to WFC.

Going further, researchers see that the interaction between work-nonwork conflict and the perceived quality of life are negatively related to overall quality of life (Rice, Frone & McFarlin 1992). These researchers concluded that the relationship between work-nonwork conflict and the perceived quality of life are not strengthened or weakened by membership in a sociodemographic subgroup. However, the specific impact of a more collectivist, traditionally family oriented group (such as Hispanics) was not evaluated. In an earlier study, Frone & Rice (1987) examined the effect of job and family involvement. Their study looked at whether family involvement moderates the relationship between job involvement and WFC. Two areas of family involvement and two areas of WFC were reviewed for evidence of inter-role conflict. The results showed that job-spouse conflict was positively related to job-involvement among people high in spouse involvement, but was unrelated to job-involvement among people low in spouse involvement. Contrary to the authors' predictions, parental involvement did not moderate the relationship between job involvement and jobparent conflict. Rather, job involvement was positively related to job-parent conflict regardless of the level of parental involvement. They concluded that most people are likely to be motivated to evaluate themselves favorably as parents, or demands as parents are more difficult to ignore or escape than other roles. Professional couples are often busier and constrained by time; this could advance WFC regardless of the resources available to them.

Similarly, it would seem that 'blue collar' or working class individuals may also

have time constraints that impact each of their roles. Future research is necessary in order to ascertain the differences between 'professional' and 'working-class' individuals and their unique pressures and strains. Research on professional women, reveals that women report more work-interfering-with-family (WIF) conflict than family-interfering-with-work (FIW) conflict (Gutek, Searle, & Klepa, 1991; Kinnumen & Mauno, 1998). A study by Noor (2004) found that in terms of each conflict's impact on well-being in professional women, FIW conflict is more significant than WIF conflict. The advent of dual-career families brings forth the idea that perhaps these issues are becoming more apparent in working class populations as well. However, the extent to which work and family overlap has not been evaluated in this population.

In terms of evaluating exclusively ethnic samples, Luk & Shaffer (2005) found significant support for interactions involving domain-specific support resources. They found that Chinese respondents reporting greater levels of family-friendly policies had higher levels of WIF conflict across all levels of work time commitment. Familyfriendly policies seem to operate as a stressor to Chinese employees, who view their relationship with their organization as harmonious. Because of this relationship, employees may respond to the family-friendly policies by working harder, which is in contrast with Western research. However, as Chinese culture places high value on family and the good of the group (collectivist), the Hispanic culture may also find that there is significant overlap and difficulty in balancing both work and home roles.

Perlow (1995) identified barriers at work that prevent current work-family policies (e.g. flex-place, flex-time, job sharing) from being effective. After identifying three barriers, the author addresses the assumptions about work which underlie those barriers. The first barrier is that one has to be present at work to succeed. The second barrier is having significant "face time", meaning being at work for extended periods of time. The final barrier is that work is always expected to be one's top priority. The underlying assumption is that one's presence at work is directly related to one's contribution.

Similarly, other researchers have found that job flexibility was related to reduced work-family conflict with a model that is transportable rather than gender or culturally specific (Hill, Yang, Hawkins & Ferris, 2004). The study, which included results from 48 countries, gave the authors reason to believe that international companies should invest in job flexibility policies to benefit employees and businesses operating in diverse cultures. The impact of specific policies or the specific needs of each population were not explicitly evaluated in the study.

Further, Lobel (1986) examined the values many people hold concerning behaviorbased conflict in regard to work life and family life balance, and how WFC occurs with these values in place. The author proposed that inconsistent expectations about correct behavior regarding work and family roles do not necessarily prevent people from satisfying those expectations or hinder their ability to do both roles. Specific conditions arise, or are in place, which enable values to conflict with work and family roles. The author also discussed strategies for organizations and individuals to manage WFC, such as changing one's own personal values to be more in line with the organization's or vice versa. This is important to individuals who hold family values in high regard and who also view their jobs in high regard. There is also evidence that a supportive work-family culture, which refers to an organization's supportiveness or responsiveness towards employees' family-related needs, is related both directly and indirectly to the well-being of employees (Mauno, Kinnunen & Pyykko, 2005). Their research finds this is accomplished through reduced work-family conflict. However, the view that individuals should 'change their opinions' seems rather short-sighted. In terms of determining the impact of WFC on specific populations, it seems that the specific needs, wants and values of a people must be evaluated before sweeping assumptions such as 'changing opinions' can be made.

Higgins & Duxbury (1992) evaluated dual-career and traditional – career men families. This study was of special interest as most Hispanic families follow the singleearner (more traditional) family structure (as reported in our survey). The authors explored the relationship WFC has on traditional career men (professionals with a housewife) compared to dual career men where the spouse is also a professional worker. They suggested that conflict will be stronger in dual-career men than in traditional-career men and that there will be a stronger negative relationship for dualcareer men in regard to conflict and quality of work life. The authors found that maternal career employment has a significant effect on dual-career men because of out-dated organizational policies, lack of flexibility in the workplace, and the notion that there are separate worlds for work and family with dual-career men lacking social support for their role in that environment.

Acculturation

Greenberg (2001), in his review of the cross-cultural organizational justice literature, discusses the pros and cons of addressing organizational justice concerns cross-culturally. He suggests that justice is norm based. His analysis contends that understanding people's perceptions of fairness in organizations requires considering the prevailing cultural standards in which the organization operates. The prevailing cultural standards within which employees operate will have significant impact on their perceptions of work/family balance as well. Greenberg (2001) also suggests that observed connections between culture and justice perceptions may be impacted by cultural diffusion and to this end it seems that many psychological variables should be impacted by such variables as level of acculturation and specific cultural values.

Corroborating these arguments, Blancero & Blancero (2001) found that almost one-third of individuals felt that they were treated differently at work as a result of being Hispanic. What is of concern here is the occupational group that was studied. This sample consisted of highly educated individuals in professional positions. In another finding of note, Blancero & DelCampo (2003) found that older Hispanics reported lower levels of fairness of the psychological contract. This finding may be based on the level of acculturation of the Hispanic worker. It seems plausible that younger Hispanics may be more acculturated to mainstream American culture. Similarly, it seems that socioeconomic status (SES) will also have an effect on the overall perceptions of Hispanic workers. In this case, the perception of work-family conflict may be impacted by level of Hispanic identity as well as SES.

Kray & Lind (2002), Ambrose (2002), Lamertz (2001) and Grienberger, Rutte and van Knippenberg (1997) all examine two-way interactions with reports of

organizational justice. These studies find that social influences have a significant effect on reports of organizational justice. They find that co-worker or social group member's reports of injustice have strong effects on individual reports of injustice. Severity and level of injustice were shown to have stronger and independent effects. This finding will also add to the acculturation/assimilation hypotheses as those individuals who more closely identify with their ethnic group are more susceptible to the reports of ethnically stereotypic views of family and culture and the balance of work and family roles.

Chrobot-Mason & Leslie (2003) attempted to explain the importance of multicultural competence for managers. They used 360-degree feedback (i.e., feedback from multiple sources in the organization both above and below the individual in the organizational hierarchy) in order to determine that multicultural competence is an important managerial skill. This resulted in many positive outcomes including increased job satisfaction, high managerial effectiveness ratings and high ratings of fairness and perceptions of discrimination. They conclude that, in today's workforce it is important for managers to understand the unique plight of workers from a myriad of cultures and to understand the specific challenges, feelings and past injustices of each group.

Hypothesis Development

In a closely related examination, Yang & Choi (2000) examined specific differences between ethnic (in this case Chinese) and American perceptions of work and family demands. Their research furthered the concept that ethnic groups have different perceptions of work and family and respond differently to these stressors. The authors surveyed American and Chinese enterprises to compare the extent to which different sources affected WFC. When exploring cross-national differences, the authors focused on time-based conflict and cited Greenhaus & Beutell (1985) as a major source for WFC time and strain based conflict information. The authors describe national differences in orientations to self and family as major differences that affect work-family relationships. They state that overwork is likely to be perceived as sacrificing family for one's own career in the US, but as sacrificing self for the family in China. American cultural norms put family before work, but Chinese norms put work before family. The results showed that "although work demand was significantly correlated with unpaid working hours in the United States, the relationship was not significant in China" (Yang & Choi, 2000, p. 122). Interestingly, the correlation between family demand and age was positive in China but negative in the United States.

Overall, Yang & Choi (2000) report that family demand is greater in the US than in China and the effect of family demand on WFC is greater than that of work demand in the US. Additionally, they report the effect of family demand on WFC is greater in the US than in China and the effect of work demand on WFC is greater in China than in the US. The authors found that WFC was indeed experienced by Chinese men and women working in organizations. WFC was an especially important factor for Chinese when it involved time for family and work obligations. They also found that American employees experienced greater family demand than did Chinese employees.
In sum, we find that as the Hispanic population grows, the specific issues associated with this group should be examined beyond that of the existing stereotypes. Research in the area of Work-Family Conflict has shown significant results in the level of conflict in differing family structures, designs and arrangements. The literature reviewed on the topic of acculturation leads us to believe that one's level of acculturation might also be a factor that explains differing outcomes and feelings in terms of work family conflict.

Overall, the current literature arrives at the conclusion that Hispanic career satisfaction is lower than racioethnic unspecific samples (DelCampo, 2004; Blancero & DelCampo, 2003; Foley, Kidder & Powell, 2002) and additionally, that racioethnic identity predicts the level of workplace satisfaction for Hispanic business professionals (DelCampo, 2004). Further, researchers report that status plays a large role in Hispanic acculturation, identity and job satisfaction (DelCampo, 2004; Tyler & Blader, 2002). Armed with this knowledge, it can be hypothesized that Hispanics at different levels of socioeconomic status will have different responses to work and family stressors.

Hypothesis 1a: WFC will be higher in Hispanic populations with lower SES than those with higher SES.

Hypothesis 1b: WFC will be lower in Hispanic populations with higher SES than those with lower SES.

Hypothesis 2: Socioeconomic status will moderate the relationship between racioethnic identification and WFC such that when SES is low the relationship between racioethnic identification and WFC will be strengthened.

Method

The present investigation was conducted through a survey of approximately 400 individuals employed at a major southwestern United States university and a survey of approximately 300 members of a large national Hispanic affinity association. The southwestern United States university workers were selected due to the high percentage of individuals in working-class occupations employed in the certain departments. The membership of the Hispanic affinity group was solicited at their annual meeting and represented a broad range of professional occupations. For the purpose of this study, 'Hispanic Professional' is operationalized as those individuals who self-identify themselves as Hispanic, have at least a 4-year college degree, and are employed full-time in the United States.

Instrument

The instrument used was a 96-item questionnaire on issues pertaining to work and family balance. Racioethnic identification was measured using Sanchez & Brock's (1996) approach of measuring not only level of acculturation but also Hispanic identity. Hence, an individual can closely identify with their Hispanic heritage, e.g. speak Spanish, yet still be highly 'acculturated' as well. Work-Family Conflict was

evaluated via Reitzes & Mutran's (1994) scale that evaluates employment identity as well as identities in a variety of intimate relationships. Data was analyzed using ANOVA and regression analysis.

Results

Results of the analyses are reported in Table 1 and indicate that Hypotheses 1a and 1b (predicting that lower socio-economic status will indicate higher levels of work-family conflict) were not supported. In fact, it appears the opposite is true: those individuals with lower socio-economic status actually report lower levels of work-family conflict.

Hypothesis 2 predicts that socio-economic status moderates the relationship between the level of racioethnic identification and work-family conflict. The hypothesis predicts that the relationship will be such that when socio-economic status is low, the relationship between racioethnic identification and work-family conflict will be strengthened. The analyses presented show that socio-economic status has no relationship with these variables. However, anecdotally, there is a strong (inverse) relationship between Hispanic identity and Work-Family Conflict which has some interesting ramifications which are discussed below.

Discussion

While none of the hypotheses presented showed significance, several interesting conclusions are presented. Hypotheses 1a and 1b show exactly the opposite of the proposed relationship. Individuals in the lower socio-economic status group actually have lower-levels of work-family conflict than those in the high socioeconomic group. While one might think that Hispanics in low-paying jobs may not have the education or capacity to compartmentalize their work and family relationships, we find that they are able to do so. Stereotypically, Hispanics are considered loyal and family-oriented. It seems that perhaps these values are somewhat diluted by an upwardly-mobile career. Taken in concert with the Hypothesis 2 finding that those individuals with high levels of Hispanic identity are also more prone to presenting low levels of work-family conflict, perhaps the perceived 'white-washing' of high level minority employees is a measurable negative outcome. While this is in no way a blanket statement that upwardly mobile Hispanic (or other minority) individuals lose elements of their identity, the maintenance of some level of Hispanic identity can have positive outcomes for one's family and work separation.

Further research in this area is needed, as most previous studies have focused primarily on middle-class Anglo-Americans. This study comparing professional and working-class Hispanics found some differences in level of WFC due to level of acculturation, indicating that different ethnicities may have differing views on the challenge of balancing work and family. Other ethnicities should be studied to increase understanding of the impact of this challenge, and different levels of socioeconomic status within ethnicities could provide still more information. Finally, studying different types of families from all walks of life can provide a much broader understanding of the implications of this important area of family studies and organizational research.

Interestingly, those Hispanics who most closely identify with their heritage have the lowest levels of WFC; this is in contrast to conventional knowledge which would dictate that those with ambiguous identity might have increased difficulty with many issues including work-family conflict. For example, past research (Michener & Delamater, 1999; Kroska, 1997) shows that identity is an important factor in linking individuals to larger society and reducing role ambiguity. In this vein, Hispanics who closely identify with their heritage might enjoy the cultural benefits such as more social support from their intimate relationships. In contrast, those Hispanics who do not identify closely with their heritage and perhaps are more acculturated might have higher levels of WFC due do this disidentification.

While the findings that WFC and socioeconomic status are related and compelling, future research should further investigate the correlates of Hispanic identity, levels of acculturation, and other forms of identification (work groups, workplace demography, professional associations, etc.). In this initial examination, the authors posit that while working class Hispanics and Hispanic professionals have varied levels of WFC, the role of Hispanic identity in this relationship has yet to be determined. With further examination through longitudinal evaluation, the authors hope to show the influence of racioethnic identity, level of acculturation, and other variables on work-family conflict.

Table 1: ANOVA

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	104.161	1	104.161	81.580	.000
Within Groups	443.047	293	1.277		
Total	547.208	294			

Class of Individual

Table 2: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.436(a)	.190	.188	1.12995

a Predictors: (Constant), Class

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
2	.096(a)	.009	.000	1.42328

a Predictors: (Constant), iden_sca, Class

*R Square decreases indicating no moderation

Variables	Ν	Mean	Std. Dev.	1	2	3
1. Class	294	.590	.492	1	436**	418**
Identity	294	2.69	1.25 4	436**	1	.221**
3. WFC	294	2.54	1.324	418**	.221**	1

Table 3: Means, Standard Deviations and Intercorrelations

** correlation is significant at the .01 level (2-tailed)

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