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OPTIMAL SALARY POLICIES FOR GRADUATE INSTITUTIONS  
IN DEVELOPING NATIONS WITH REFERENCE  
TO THE PHILIPPINES

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# OPTIMAL SALARY POLICIES FOR GRADUATE INSTITUTIONS

## IN DEVELOPING NATIONS WITH REFERENCE

### TO THE PHILIPPINES

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Roberto M. Bernardo and Dean A. Worcester, Jr.\*

Higher education in the best universities in the developing nations, and their graduate instruction in particular, is moving into a new phase which carries great opportunities provided that unavoidable risks, the most notable of which is the loss of faculty to the advanced countries, are run successfully. Although this is already an important problem, little effort has been made to anticipate and cope with these risks. The following analysis is stated in terms of the course of events in the Philippines but it is thought to be relevant to other developing nations particularly to countries in South Asia and South America where similar levels of university development are being achieved.

#### Current Successes: The First Phase and the Challenge

The first phase of graduate education in developing nations is characterized by heavy dependence upon foreign universities for faculty training especially those expected to man graduate instruction. During this phase many of the most talented students are chosen and sent abroad with expenses paid but with a commitment to return to specified schools and positions for a period of time specifically related to time invested in their foreign training.

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During this phase, which is continuing in such places as the Philippines, many scholars have demonstrated their excellence by winning the highest degrees offered by the best universities in Europe and the United States. Energetic and forward looking administrators and trustees of Philippine universities have taken advantage of the opportunities offered to build institutions of higher learning more adequate to the needs of their societies. While criticisms of detail can be made, no one can deny the fact that this first phase is making noteworthy progress. Perhaps the best evidence of this is the fact that again and again objective scholar-administrators primarily from foundations have appraised these universities favorably. They concluded that the training of the students and staff, their capacity to grow, the needs of their society and the standing of education in the community are such that quite short-term and rather intensive programs of university development stretching over periods as short as five to ten years, (although sometimes longer) will suffice to make certain Schools or Divisions of various universities in the developing nations outstanding regional centers for graduate instruction and research capable of high quality work by anyone's standards.<sup>1</sup>

The rise of such centers represent a coming of age which would be particularly valuable to the developing nations because of their location and natural interest in regional problems and potentials.

It is a simple fact that the first phase of these programs is going well. An outstanding example exists in the Philippines at Los Baños where 67 Filipino Ph.D.'s presently at work are to be joined <sup>by</sup> 56 more in 1972.<sup>2</sup> Moreover,

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<sup>1</sup>For an extensive but incomplete list of these university development programs abroad, see the Annual Reports of Rockefeller and Ford Foundations.

<sup>2</sup>See Annual Report, Fiscal Year 1966-1967, Office of Faculty, Research and Extension Services, Table II and Faculty Members Sent Abroad On Study Program, as of December 31, 1967, pp. 1-19.

a total of 128 faculty members have been sent by other colleges of the University of the Philippines to leading foreign universities for advanced study. Forty-eight are on Ph.D. programs, 33 on Master's programs, 45 on special studies and 2 on post doctoral research.<sup>3</sup> All of these except those who take their post-doctoral during their sabbatical year are committed to return to labor in specific divisions of the university for twice as long as they have been supported abroad (the so-called indenture system). Those scholars will have achieved their degrees in competition with the best of the world's students in the best of the institutions devoted to their specialties.

The first phase is still running strong, but the ~~second~~<sup>second</sup> phase has already begun in the Philippines and with it different strains and stresses are becoming evident that will almost surely impede and could even abort the fruition promised by the achievements thus far.

The second phase of university development in Southeast Asian countries is characterized by a growing recognition of the achievement of their academic staffs not as advanced students but as mature scholars. As a consequence, the best known of these scholars will find their services in demand abroad often at high salaries. This is inevitable and some must be expected to go. Losses must be held to moderate levels if the growth to excellence is to be maintained. In the following pages we attempt to assess the strength of the centripetal forces and to sketch the major outlines of a salary and personnel policy which will best utilize the universities' resources to achieve excellence -- a goal influenced by the need to forestall the drain of high-level faculty and non-faculty

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<sup>3</sup>See Annual Report, Fiscal Year 1967-1968, p. 2.

personnel to the advanced countries.

An indication of the strength of foreign competition for qualified staff can be inferred from **Table I**.

These comparisons are very rough. One can argue, for example, that the exchange rate used, P3.9 = \$1, makes Philippine salaries appear low since the low cost of such luxuries as servants tends to be excluded. Moreover, the U. S. A. data are averages of many institutions of diverse quality for the academic year 1966-67 and include fringe benefits. Philippine data are for the 1967-68 year, only some of which include fringe benefits. The direct comparison of proposed U.P. salaries for 1968 (without fringe benefits) with 1966-67 salaries for all U. S. universities and all U. S. junior colleges (with fringe benefits) is deemed reasonable because a 11.2% salary increase occurred in the U.P. scale for the latter year. This is probably more than the cost of U. P. fringe benefits. U.P. salaries are also overstated since the top U.P. salary at each rank is used rather than an average figure. The net effect is probably to understate the salary discrepancy thereby minimizing the problem under discussion. Nevertheless, the general nature of the relationship is clear; the average salary paid by an American university exceeds by at least  $3\frac{1}{2}$  to  $4\frac{1}{2}$  times the top salaries of the University of the Philippines. More surprising, the average U. S. junior college pays 3 to 4 times the U.P. salary scale. The margin over Ateneo de Manila University is somewhat less in the higher ranks. Individual cases known to the authors involve larger differences than any shown in the table.

The Philippines pays academics well in terms of its total output. The average full professor in the U.S. received less than twice the average family income of \$9,400 in 1966, while the U.P. full professor receives about 6.5

TABLE I

ACADEMIC COMPENSATION: THE PHILIPPINES AND THE UNITED STATES  
(P3.9 = \$1)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	U.P.1 1967	U.P.2 1968	Ateneo 1967	De La Salle 1967	USA1 (Ave. All univ.) 1966-67	USA2 (Ave. Jr. Coll.) 1966-67	U.S.A.1 U.P.2	U.S.A.1 Ateneo	U.S.A.2 U.P.2
(Top of Scale, except as indicated)									
Professor	P14,880	P16,740	P18,000 (Base)	P14,400	\$17,080	\$12,873	4.0	3.7	3.0
Assoc. Professor	11,400	12,780	18,000	13,200	12,400	11,257	3.8	2.7	3.4
Asst. Professor	9,120	10,260	9,000 (Ph.D.)	11,904	10,142	9,411	3.9	4.4	3.6
Instructor	6,660	7,500	6,750	10,056	7,789	7,812	4.1	4.5	4.1

Sources: University of the Philippines: Memorandum Circular dated June 21, 1967. 1968 data are proposed.

Ateneo University: Mimeographed data supplied by the President's office.

De La Salle College: Mimeographed data supplied by the President's office. There is a single salary at each rank.

U.S. A. data: American Association of University Professors Bulletin, Vol. 53, (June, 1967), pp. 136-195.

times the Philippine average of about P2,541, and 2.5 times the average for Manila. But the fact remains, to the extent that Philippine universities achieve respected places in the intellectual world they also enter a world market and the university becomes exposed to the danger that those members of the academic staff who bring respect to the university will be lost. Such losses need to be limited, and offset, if the status of the few graduate and research universities and institutions in the developing nations which seek excellence are to continue to improve.

One of the principal advantages enjoyed by countries such as the Philippines during the first phase, the use of English as the principal language of instruction, becomes a mixed blessing in the second phase. It gives ready access to most of the world's scientific literature, but the advantage that command of English gives in graduate study abroad also makes it easier to send students to the U.S. for training and greater fluency makes the Philippine Ph.D. more attractive to universities in the U.S., Canada, the U.K. and elsewhere where English is spoken. However desirable this may be for individuals, the threatened loss of talent is costly from a national viewpoint. From that point of view, manpower controls, even of the types imposed by communist nations may be justified by some. They feel that nations or governments "own" the people, since they have been reared there at some expense and they should be able to control the former students so as to reap the maximum national return on the national investment.

#### Present Controls That Limit Loss of Staff

The dangers of loss of staff in non-totalitarian developing countries are presently minimized by administrative controls which supplement salary



increases. On one hand, the United States cooperates with foreign governments by issuing visas which are good only as long as the scholar remains in student status or as an exchange visitor (J-visa). On the other, those graduate students who receive aid from a developing university are committed to return to the university granting the aid for a period equal (in some cases at least) to twice the period spent abroad. Since four years or more is usually required to earn a Ph.D. degree, at least eight years service is usually assured, although it is possible for the student to buy up his contract. Much more often the returnee will go abroad for additional years of post-doctoral study, adding additional years of indentured service to the university.

At present most of the 192 faculty members with Ph.D.'s at the University of the Philippines are indentured. Moreover, as of June 30, 1967, 58 of the 255 fellows abroad returned, 15 having completed their Ph.D. and 23 either an M.A. or an M. S.<sup>4</sup> While this reduces the immediate threat of loss of the best-trained faculty, this bulwark is being eroded as the international prestige of Philippine universities grows; as able Philippine staff reach the end of their periods of indenture, as they are able to buy up their contracts; as the foundation assisted faculty development programs reach their terminal dates; and particularly as the logical next steps into the second phase are taken.

#### Responses to the Challenge are Inadequate

One natural next step, which seemingly reduces the risk of faculty loss, is to limit contacts with foreign universities in the advanced countries by introducing graduate work through the Ph.D. level in the leading graduate

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<sup>4</sup>Annual Report, Fiscal Year 1966-67, p. 2



institutions of the developing nations. This was for example the main reason cited by the proponents of the five centers for research and graduate studies in Taiwan in engineering, mathematics, physics, chemistry and biology. They estimate that only 100 return out of the 2,000 top graduate students who go abroad for advanced education in a normal year.<sup>5</sup> The same problem faces many other developing countries but in a lesser degree since the political problems are less acute.<sup>6</sup> This method of reducing the drain of high-level technical and faculty talent to the advanced countries also partly motivates foundation programs of university development,<sup>7</sup> and the founding of the Asian Institute of Management's MBA program in Manila. Thus the most able students will be encouraged to take their degrees at home. Quality will suffer in some respects, but may improve overall in that more of the most able staff will be retained, less time should be required for the degree, and the applied work done is more likely to be relevant to national needs. Continuation of programs for post-doctoral study and innovations such as a chair for a succession of visiting

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<sup>5</sup>See J. B. Platt, "Emigration of Scholars and the Development of Taiwan" reprinted in Development Digest, Vol. IV, No. 1, April, 1966, p. 43.

<sup>6</sup>For example, India and Greece. See S. P. Awasthi, "An Experiment in Voluntary Repatriation of High-Level Technical Manpower -- The Scientists' Pool"; G. V. Haniotis. "An Exercise in Voluntary Preparation in Greece," reprinted in Development Digest, Vol. IV, No. 1, April, 1966.

<sup>7</sup>"One long-range purpose of university development efforts is to enable nations to offer advanced-degree programs for their own most gifted scholars, so that they will not have to rely on foreign training for their future professional, government, and business leaders. Great concern has been expressed over the so-called "brain drain" in the developing countries, which is in part traceable to the fact that students who go abroad for advanced training often decide not to return home, where their talents are critically needed."

Source: The President's Review & Annual Report 1967, The Rockefeller Foundation, New York, p. 76.

foreign professors can repair part of the loss with perhaps less risk of emigration.<sup>8</sup>

Such policy may tend to reduce the prestige of the university at least for a time because its faculty may do less work of a fundamental nature and will not be so well-known abroad. There are also dangers of inbreeding. But with good fortune, abler staffs can probably be retained and the reputation of the developing nations' universities established in the usual scholarly ways, especially if the universities continue to do ~~their~~ work in one of the recognized major languages. At any rate the decision to develop graduate university instruction has been decided in the affirmative in many developing nations.

The goal of achieving excellence in each field of inquiry in the immediate future, as sought by some multiversities in the advanced countries, is beyond the capabilities of low income countries. It is possible for them to develop high quality advanced degree programs in a few areas of specialization in a modest number of institutions of higher learning. A case in point is the University of the Philippines which has a comparative advantage in Southeast Asia in the field of agricultural education and research and its regional reputation in this field is unquestioned.

The Asian Institute of Management (AIM) which is now moving out of

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The last is an offsetting measure practised for instance by the Asian Institute of Technology and planned by the Asian Institute of Management. See Asian Institute of Technology, (Bangkok: Catalog for 1968-69) and Asian Institute of Management, (Manila: Sycip, Gorres, Velayo & Co., February, 1968).

the planning stage<sup>9</sup> is an example of <sup>primarily</sup> domestically financed creative response to the pressures discussed above. It can serve as a useful model for the developing nations. AIM's goal is professional excellence in one specific area of graduate study of particular relevance to developing nations -- business management. Excellence in this context consists not only in maximizing the institution's academic and professional image in the home country but in the region as well.

Formed by Ateneo University and De La Salle College as a joint effort with major initial faculty development assistance from the Ford Foundation, it will supersede the Master's of Business Management programs at both institutions. AIM will establish 18 professorial chairs by 1971 about 16 of which will be fully endowed by the largest local corporations and two partially with the aid of the Ford Foundation matching funds. The cost of land and buildings is also similarly financed by a local corporation. The separation of this institute from its mother institutions into an independent foundation was partly determined by the need to free the new institute from the strong intra-institutional egalitarianism of faculty and administrators which made it extremely difficult to justify the new and enormously higher salary scales for professors of graduate business management. Conscious of the fact that it competes for high-level indigenous and foreign faculty on domestic and world markets, AIM has moved a long way toward adjusting its salary policy to reflect its aims

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<sup>9</sup> It will start operations in July, 1969 with a faculty of eleven and at somewhat lower salaries than are given here. The larger magnitudes will be reached in the third year. The Asian Institute of Technology in Bangkok does not qualify in this category since it is an internationally managed and financed institution. Taiwan's five new graduate studies and research centers referred to earlier pay high enough salaries as to eliminate the need for second jobs at night but not enough to compete with overseas academic markets (J.B. Platt, op. cit., p. 45).

We are grateful to Fr. Donelan, President of Ateneo University, and to Brother Paul, Dean of Graduate Studies, De La Salle College, for generously supplying the authors with information pertaining to A.I.M.



under conditions confronting an open economy. Hence AIM's "salaries are believed to be adequate to attract faculty members of high quality..."<sup>10</sup> They are more than twice the average salaries in the leading Philippine university (U.P.) when the programmed income from consulting is included, and compare favorably with world faculty salaries in comparable institutions minus the cost of moving. The programmed basic monthly salary scale ranges from P1,800 to P2,250 monthly for local faculty in 1969 rising progressively to P2,000 to P2,400 in 1971-1973 for a teaching load equivalent to about one-and-a-half courses per semester or 40% of faculty time. In addition, faculty are expected to spend about 30% of their time in research and another 30% in research-related consulting cleared through the dean which is expected to add an additional P1,000 to each faculty member's income. Such activities as these, relevant to the professor's work, should be welcomed by other universities provided that the staff member involved continues to perform his academic duties diligently. Safeguards to ensure this are discussed later. Fringe benefits add another 8 1/3% of the basic salary. In order to get the best dean to head the Institute, an annual salary of P75,000 will be offered for the first year and this is scheduled to rise to P100,000 in 1971-1973. A foreign visiting professorial chair carries a salary of P100,000.

AIM's salary policy, however, as it is described in its founding five year plan does not make the best use of its salary budget because it still retains the traditional type of salary structure that largely ignores the academic market. In having its wage structure uniformly shifted upwards, AIM's salary scale exhibits sensitivity to market forces. But the mere uniform raising of salary scales as noted later is wasteful of the salary budget; and the new

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<sup>10</sup>Asian Institute of Management, p. 14

structure could conceivably ossify into the traditional and administrative pattern so widespread in Southeast Asian institutions of higher learning. The somewhat rigid salary structure does not allow the largest room for maneuver on the part of administrators in dealing with each unique faculty member singly as will be made more clear shortly. Finally no salary distinction between indentured and non-indentured staff is made. The development of indigenous programs is not sufficient to overcome the risks of the second phase. If Asian universities succeed in achieving international standing, their outstanding people will find themselves on the world markets. Serious thought must be given to the ways and means whereby losses of the best-trained and most able staff from the developing nation's universities can be minimized. A wise salary policy is a necessary part of an intelligent program unless university staff can be subjected to severe manpower controls without harming their creativity. This point of view has often been challenged.

Traditionally, universities, like governments and religious institutions have prided themselves as being above the market which has meant, among other things, that professors, government administrators, clerics and other practitioners of the true professions have chosen to devote themselves to the service of their fellow men with minimal regard to their monetary compensation. Churchmen are said to renounce the "world" and embrace genteel poverty, statesmen and soldiers are called to respond to "duty" and professors to a love of learning. Such motivations have set these professionals apart from and above the rest who, presumably, act out of self-interest and for material rewards. This status is recognized and highly valued by non-professionals, for many occupations seek "professional status" via legislative enactment and trade association activity. The short motto of the most far-flung of the business

and professional men's clubs is "Service Above Self" (although a skeptic might stress the less frequently displayed second statement in the motto, "He profits most who serves best" by assuming that monetary profits are referred to, and that this tarnishes the selflessness of service). A similar skepticism has arisen in some quarters with respect to the clergy, doctors, lawyers, government officials and professors.

#### Acute Problems in the Second Phase: Interdepartmental Differences

Traditionally the professions have been filled either by people of independent income or by people of such devotion to their calling as to find their chief reward in its intrinsic satisfactions. In certain of the learned professions, notably medicine and law, the economic opportunities are so great and of such a nature as to permit the establishment of fees on a crude ability to pay principle. This makes it possible for the professional to prosper although many who are in need are served without compensation.

It has been otherwise in higher education. Much of the reward has indeed been in the work itself. The small staffs required in the past could be supplied by men dominated by a love of learning and teaching. But as incomes rise, the proportion of younger people seeking higher education rises dramatically. Moreover, education has become recognized as economically valuable by the decision makers in business and government, swelling the proportion of college-age youth to whom higher education makes an appeal. The same development presents many of the university staff with attractive non-academic opportunities. As a result, the numbers of faculty required to staff higher education can no longer be supplied from the ranks of those who are motivated primarily by a love of academia, but must include many whose career interests are more diverse.

Many must choose an academic career in spite of the substantial attractions of other careers if the universities' needs are to be met.

The situation can be shown diagrammatically as in Figure 1 where the number of people attracted to academic life is shown on the horizontal axis and the money income necessary to attract a particular number of the required ability and training is shown on the vertical axis. It is virtually impossible to define the exact position of such a curve. Moreover, the curve shifts for reasons discussed below. It can, nonetheless, help clarify the alternatives open to a university administration and their relative costs. More importantly, the analysis of the facts that cause shifts in this curve can inform the administration of the kinds of adjustments necessary to meet changing conditions.

If we assume that the curve labelled  $S_1$  shows the number of professors that will be attracted and held by different salary scales under the conditions for say 1960, and that  $P_1$  gives the required number of professors for that year we may conclude that an annual compensation of about ten was necessary at that time.

We have argued that modern conditions have greatly increased the number of academic personnel required as well as the demand for highly educated people for the professions, business and government, and will continue to do so in the future.

The increased requirement for academic personnel by, for example, 1970, can be illustrated by the difference between the two vertical lines above  $P_1$  and above  $P_2$ . If that were all that changed it would appear that a 50% increase of compensation to 15 would suffice to attract the desired number into academia without a sacrifice of quality standards. But the demand for well-trained high quality personnel is also increasing in non-academic vocations with the result



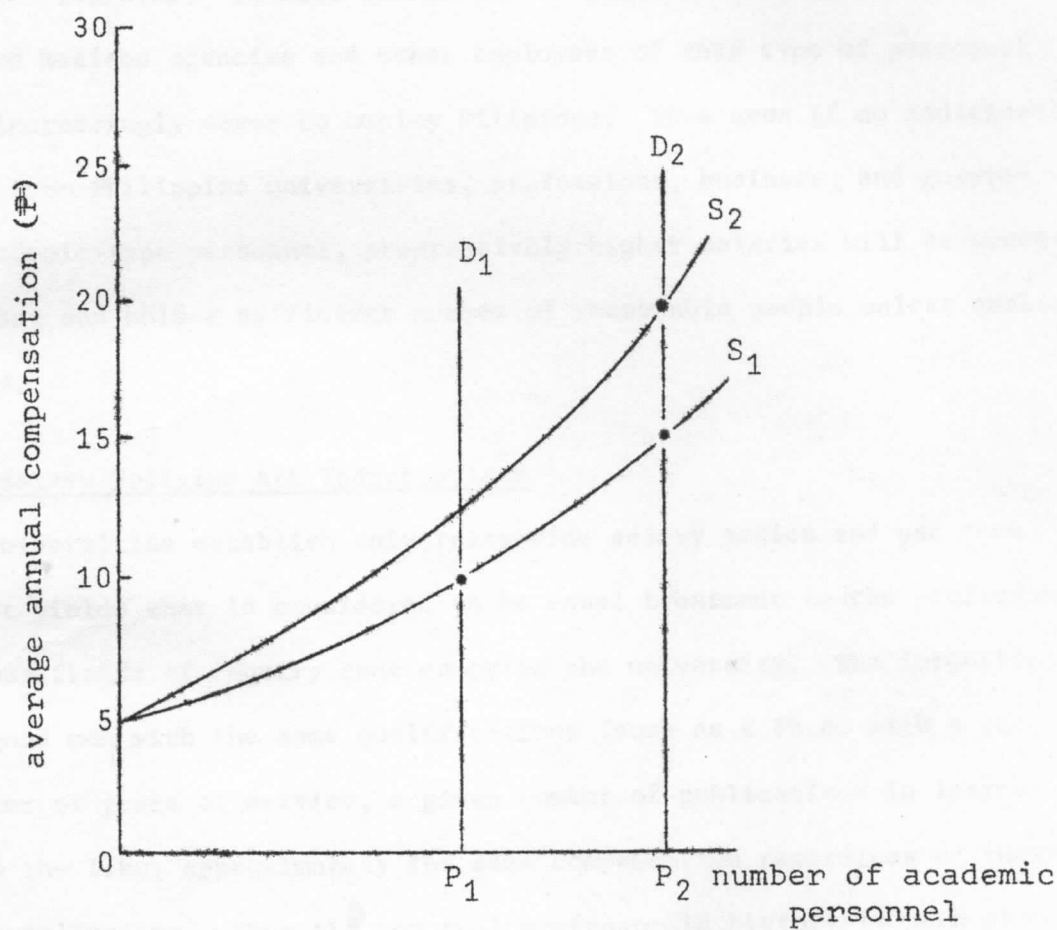


FIGURE 1

that the supply curve facing universities,  $S_1$ , shifts upwards as illustrated by  $S_2$ . Thus a doubling of the salary scales to P20,000 is indicated as necessary in this hypothetical but nevertheless relevant illustration.

This process is bound to continue and will become increasingly serious if the Philippine universities achieve high status among the world's institutions of higher learning. It will become more serious because foreign universities, United Nations agencies and other employers of this type of personnel will become increasingly eager to employ Filipinos. Thus even if no additional demand comes from Philippine universities, professions, business, and governments for academic-type personnel, progressively higher salaries will be necessary to attract and hold a sufficient number of these able people unless quality is sacrificed.

#### Traditional Salary Policies Are Inappropriate

Most universities establish university-wide salary scales and use them in a way that yields what is considered to be equal treatment to the professors in the various fields of inquiry that comprise the university. The intention is to give good men with the same qualifications (such as a Ph.D. with a particular number of years of service, a given number of publications in learned journals and the like) approximately the same compensation regardless of their field of specialization. Thus the top full professor in history is paid about the same as the top man in physics, the top man in education and the top man in law. This time-honored procedure has undesirable consequences which will become far more costly to Southeast Asian universities as they achieve fuller recognition among the universities of the world.

The consequences of this type of salary scale are largely offset during phase 1 because the departments achieving international recognition are often

aided by special programs, usually foreign financed, which have in fact made certain disciplines on the campus much more attractive than others, and because a large portion of the staff are in indentured status. As these special programs fade away, their initial mission largely accomplished, rapid erosion of the gains will occur if the traditional policy remains dominant. This is a certainty because the staff that benefits from such programs is particularly likely to be well-known in other universities at home and abroad, and, where relevant, in business and government. Thus the supply curve for some disciplines will shift upward much more rapidly in some fields than in others. The result is that a salary level which attracts and holds a sufficient number of professors of a satisfactory quality in certain departments will not be enough to hold enough good men in others.

#### Alternative Policies

Two major courses of action are possible if a university-wide salary structure is used: 1. Raise the general scale of salaries to a level that will suffice to retain the able men who enjoy excellent opportunities in foreign universities, business and government and pay out substantial surpluses to professors in other fields of inquiry although they do not have comparable alternatives, or 2. Stick to lower scales and lose many of the internationally known men. The second alternative accepts a decline in the quality of personnel in the departments which seem presently to be the ones in the forefront of building the prestige of the university and which are frequently those where excellence of graduates is most needed in the modern world.

The first alternative is not only costly and productive of "bonuses" to personnel who do not contribute greatly to the growth of the university in the world's intellectual circles, but it also tends to attract more of the able

staff into the fields of lesser academic interest. A graduate student who has some interest in several academic disciplines will not be so clearly told that his rewards will be higher in the academic departments in need of expansion because of the exceptional demand for specialists in those fields, although it is true that employment will be easier to find there since market pressures cannot be fully eliminated. This means that the departments which are "overpaid" will be able to raise their quality standards, picking and choosing among a larger number attracted to the field. It also means that the departments that have achieved international recognition will be less able to attract students so that quality will tend to suffer even if university wide salary scales are raised in proportion to the apparent needs of the department facing the strongest competition for its staff. In a word, uniform salary scales strongly tend to produce higher quality in the departments working on problems of the least interest to the academic world and society, and lower quality in the departments working on the problems of the greatest interest.

#### Differences in Compensation Among Disciplines

Some clues to the effects of differing market pressures by department can be found in the American experience where more than 2,000 universities and junior colleges compete with the professions, business and government (to say nothing of Canadian universities, the United Nations and other institutions) for highly educated more or less academically-minded personnel. The National Science Foundation has compiled a National Register of Scientific and Technical Personnel for several years and some of the more important of its results have been analyzed by a special committee of the American Economic Association.<sup>11</sup>

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<sup>11</sup>N. A. Tolles, "The Structure of Economists' Employment and Salaries", The American Economic Review, (55) Part 2, Supplement, December, 1965.



The study shows substantial differences in the salaries paid by universities to professors in different departments. In general, these parallel, but at a lower level, the salaries paid by the federal government, and business. Table II presents the findings for 1964.

Table II

Annual Salaries by Type of Employer in Twelve Professions, 1964

Field of Specialization	Median Salaries - Thousands of Dollars		
	<u>Educational Institution</u>	<u>Federal Gov't.</u>	<u>Industry and Business</u>
All fields	9.6	11.0	12.0
Social Sciences			
Economics	10.1	13.7	14.4
Statistics	10.4	13.0	12.0
Psychology	9.7	12.0	14.1
Sociology	10.0	12.9	14.0
Linguistics	9.0	10.7	12.0
Physical Sciences			
Physics	9.6	12.0	13.5
Chemistry	9.3	10.8	11.7
Mathematics	8.7	12.1	13.0
Biology	10.1	11.0	12.5
Meteorology	10.5	10.6	11.0
Earth Sciences	8.8	11.0	11.0
Agriculture	10.2	9.3	9.0
Other Fields	8.3	12.1	12.0

Source: Tolles, pp. 28-29.

It is evident that median salaries differ substantially by field, regardless of type of employer. It also seems clear, that except in agriculture, the universities pay less. This suggests that there are certain attractions in the university life for which the typical professor is willing to sacrifice some income. Finally, these figures suggest that if all university professors were paid at a rate high enough to hold the present numbers of meteorologists (the