# CHANGES IN THE INTERINDUSTRY WAGE STRUCTURE IN CALITORNIA MANUFACTURING INDUSTRIES By <br> Sidney Morris Blummer <br> A Dissertation Submitiod to the taculty of the DEPARTMENT OF ECONOMICS <br> In Partial Fulfillment of the Requirements For the Defree of DOCTOR OF PHILOSOPRY <br> In the Gradmate College <br> THE UNIVERSITY OT ARIZONA 

I hereby recommend that this dissertation prepared under my direction by Sidney Morris Blumner entitled Changes in the Interindustry Wage Structure in California Manufacturing Industries
be accepted as fulfilling the dissertation requirement of the degree of Doctor of Philosophy



After inspection of the final copy of the dissertation, the following members of the Final Examination Committee concur in its approval and recommend its acceptance: \%

*
This approval and acceptance is contingent on the candidate's adequate performance and defense of this dissertation at the final oral examination. The inclusion of this sheet bound into the library copy of the dissertation is evidence of satisfactory performance at the final examination.

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## PREHACE

The purpose of this research is to attempt to determ mine whether the interindustry wage structure in a small geographic area erhibits the same characteristics as does the interindustry wage structure at the national level。

In order to make this study compatible with previous work done at the national level，it was necessary to use the same basic techniques that were used by researchers analyz－ ing interindustry wage structures at both the national and regional level。

The material presented in this work is divided into rive sections．The first section reviews the work done by previous investigators in the area of interindustry wage structures．The second section is devoted to the method－ ological techniques and definitions used in this research． The third and fourth portions of the paper present the findings and the analysis of the authox ${ }^{\circ}$ s research involving the California manufacturing interindustry wage structure。 The last portion of this paper presents a summary of what this research accomplished and also suggested areas for further research．

I wish to thank my family and especially my wife for encouraging me in this endeavor．

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#### Abstract

A great deal of research has taken place both at the national and regional level in the area of interindustry wage structures．The purpose of this research was to inves－ tigate whether the characteristics that were associated with national and regional interindustry wage structures were also associated with interindustry wage structures within a small geographic area。 The geographic area chosen for this investigation was the state of California。 The invesm tigation of the California manufacturing interindustry wage structure was concerned with the period 1954－1963．

The stability of the California manufacturing inter－ industry wage structure was tested by rank order correlation to determine whether the structure exhibited the same degree of stability as the national interindustry wage structure。 The rank order correlation coefficient indicated that the California manufacturing interindustry wage structure during the period under investigation exhibited a high degree of stability which was similar to the stability exhibited by the national interindustry wage structure。

The various factors that influenced wages were also investigated as part of this research．Multiple regression


analysis was used to determine the degree of association between several independent variables and wages. The independent variables were value added per worker, earnings as a percentage of value added, percentage of remales in the industry work force, cumalative percentage increases in employment and production workers as a portion of total employment. The dependent variable was wages. It was found that those independent variables explained a large percentage of the variation in wages during the period under investigation。

The partial correlation coefficients derived from the multiple regression analysis indicated those variables that were associated with industries that paid high wages and those variables that were associated with industries that paid low wages. The major conclusion reached in this study was that the California industries that paid high wages during the period under investigation were characterized relative to other manufacturing industries by a higher amount of value added per worker, by earnings being a smaller portion of value added, by a smaller percentage of production workers in relation to the total work force, by a larger cumulative percentage increase in employment, and by a lower percentage of female workers in their total labor force. Low wage paying industries in the California
manuracturing interindustry wage structure were conversely characterized by a lower amount of value added per workerg by a larger percentage of production workers in relation to total employment, by smaller cumulative percentage increases in employment and by a larger percentage of remales in their labor roree.

CHAETER I。 THE PROBLEM AND THE BACKGROUND

## Purpose of This Study

The purpose of this stady is to determine whether some of the major ractors that have been found by previous researchers to arfoct wages and wage structures in industry generally, are valid in a particular geographic area which has experienced oxceptiomally rapid growth since World War II。 $N$ o attempt is made to test empirically all of the mamy wage theories and their variants. Rather, this researeh is confined to ascertaining and analyming the salient characteristics of the interindustry wage structure in the area studied and to determining the major factors which appear to have influenced that structure in the recent past. The interindustry wage structure is derined as a ranking or zudestries on the basis or wages paid. Those industries that remk highest in the structure pay the highest wages.

Accordingly, in order to ferify the already existing knowledge on this subject derived riom studies done $2 t$ the national level, specific mpirical research project was undertaken to analyme the charactorg the stabilityg and the chicr ractors inflomeing the jutorindustry wage structure (1) the manuracturing sindustries located within the state or

Califormia．The basic data collecion and factor analysis wore conductuch such way as to make any conclusions dram reasomably comparable to the rindimgs of provious matronar studies．Some deviatuons from the methodology or certain national stwdies were found necessaryo Details，of scope，methodologys and termimology are given in Chapter II。 The next section or this paper rewiews other relem Fant work that has been come in the area of interindustry wage structures．

## Roviow of the Researeh Relewant to the Purpose or This stwdy

In recont years research in the field of interm industry wage structures has benm quite estemsive。 Some Of the major research on this subject at the national Ievel has been done by Abbotty Culleng Donty，Maher，and Ostryol

1．E Abyott，Mhe Wages or Unskilled labor in the United States， $1850-1900^{\circ}$ Journal of Political Ecomomys Junc 1905．ppo 321－327．

Do Cullemg verne Imterindustry Wage structure． 1899－1950，Anerican Economic Review，June 1956，ppo 353－ 359。

H．M．Doviry，＂Umion Impact on Vage Structure，＂ Industrial Relations Research Association，Proceedings or FiPth Meetings December 1953．ppo61－76。

Jo．E．Manero vUnion，Nomunor Mage Difrereno tials ${ }^{\circ}$ American Ecomomic Reviews Jume 1956，ppo 336m352。

Fo Myers and $R_{0}$ Bowldy．＂The Interindustry Vage Structure and Productivity，Imdustrizl Labor Relations Revicw October 1953，ppo 92c102。

SoW。 Ostry MImberimdustry Eamings Direarerm tials im Camada 194501956 ＂Industrial Labor Relations Review April 1959，po．335－352．

The general conclusions reached by these researchers are very similar．Such differences as do exist in the findings of these previous studies are primarily the result of the different research techniques utilized．The general con－ clusions derived from many of the studies of interindustry wage structures indicate，however，that there are several characteristics of industries that pay high wages，and thus have a high ranking in the interindustry wage structure。

Factors Which Previous Studies Have Found to Cause Differ－ ences in the Nage Rate Between Industries

Labor costs in relation to total costs．The first characteristic of these high ranking industries is that their labor cost usually represents a small percentage of the value of the total output． 2

Productivity of labor．A second characteristic of industries that pay high wages and rank high in the inter－ industry wage structure is that labor productivity is usually high。3

2。 D．G。 Brown，＂Expected Ability to Pay and Interindustry Wage Structure in Manuracturingg＂Industrial and Labor Relations Review，October 1962，po．47。

3。 Jo To Dunlop，＂Productivity and the Wage Structures＂in Wage Determination，Market or Power Forces？ ed．by Ro Perlman（Boston：D．Co Heath and Coog 1964）g p．69．

Capitar investment per worker. Another characterm istic of industries that pay migh wages and have a high ranking in the imtexirdustry wage structure is that they have a large amoumt of invested capital per worker.

Proportion of romale worlcers. Arouth charactarm intic of these hifg ramking industrios is that the percentm 2ge of remale production workexs mployed in them is small. 5

Skitl mixo Industries that rank in the bighest portion or the interimdustry wage structure and pay high wages tend to heve more skilled workers employed in them than those industries that do not have as high a ramkingo 6

Comotitive comaitionso The sixth characteristie at incustries that pay high wages and have a migh ramking in the interimdustry wage structure is that they tend to be located in impersect product marketsof

Rate of emplowment groutho one or the characterm istucs ortom associated with industries that have high

Ho Browng opo ditog po 47
5.... S. H. Slichter, ONOtes on the Stresture of Wages ${ }^{\circ}$ The Reviow of Economics and Statistics, February 1950 po84。
6. Dumlop, opo citog po 73.
7. JoGarbarino, of Theory or Intexindustry Wage Structure Variationg Quarterly Journal of Economics. May 1950. po 299.
ramkings in the interindustry wage structure is the rela tionship between wages and growth in employmemto It has bon suggested rrom some previous research done in this thold that those industries that have had the greatest moreases in mployment pay the highest wageso 8 Howevers Sifchter ${ }^{\circ}$ research has determined that the relationship betwoen wages and employment growth is a negative one; those industries that pay the highest wages and rank higho est'in the interindustry wage structure haye the smallest increases in employment。9 Both of the above studies were conducted in manufacturing industries and involved produco tion workerso At present, therefore, this chaxacteristicos relationship to wages paid to production workers in a menuraturing indestry is a matter on which there is substantial disagreoment mong researchers who have investio gated this subject.

Degres or unionjugtiomo The next characteristic that meeds to have its sigmificamee clarified is that of the relationshi between the degree of unionitation in an andustry and the wages that the industry payso It has beem suggested by some studios that those indostries that have

[^0]a high degree of unionization tend to pay higher wages than those industries that do not have the same degree of unionization．${ }^{10}$ However，it is possible that the degree of unionization in an industry has little effect on wages paid by the industry。11 Again，this is a point concerning which previous research is not in agreement．

Relative Importance of Selected Wage－Influencing Factors as Shown by Previous Studies

Much debate has occurred as to which of the above mentioned factors has the highest degree of association with wages．This section presents a brief evaluation of the principal factors concerning which previous researchers have been in substantial agreement，as well as certain factors in which there have been wide differences of opinion。

Major importance of labor productivity．Several economists suggest that large increases in productivity， when measured in physical terms as well as in money terms， is the characteristic most highly coxrelated with high wages．Dunlop reached this conclusion in his studyo 12

10。 Garbarino，opo citos po 305。
Ross and Goldnerg opo citos p．256。
11．D。Eisenmann，＂Interindustry Wage Changes 1939－1947，Review of Economics and Statistics，November 1956，po447。

12．Dunlop，opo citos p．69．

He determimed that those industries that had the greatest frereases in physical outpar per manhour over a giwen period or time and those industries which had the greatest imcreases in wages were closely associated. He measured this relationship by rank correlation and obtained $r=.650^{13}$ Duniop concluded from mis study that production ity was not; however, the only ractor related to wages, because the correlation between productivity and wases was less than one He suggested in his article that three Other ractors axo ringhy correlatec with wages. These ractors are labor cost as a percemiage or the falue os the total outpaty comperitire conditions in the product market. and the skill miss esinting in the industryolt Dunlop does not indicate that those factors play a more prominemt role in wage determination than does productivity: but he does swgesst that they are presont and important in wage determ mination ard camot be zgnored. 15

Dulop ${ }^{\circ}$ technique of determinimg the association between productivity ancl wages imwalwes the use or percentm age changes in physical output per manhour ame percontage Ghanges in wages over a spocitied period or time By the
13. Ibidos P. 640

140 ITbige9 P.73。
15. ITIC
use of ramk order correlation technique, he determined the degree of associatiom betweon these two variableso 16 Perlman in research in the same area wanted to discover whether he could measure productivity by using the walme added statistic amd also if with the use of this statistic, he cowll reach the same conclusions as Duralop.

Perlman tested by rank order correlation the relae cionship between changes in physical output por manhour and wages and the relationship botween value added per worker and wageso He then comeluded that both statistics have a high degree of association with wagesol7 It is significant, houever, that his analysis showed that the relationship botweem value adied and wages was a stronger ome than the rolationship betwoom changes in physical oute put per manhour and wages. The correlation coorficient that Perlman obtained for value added and wages was also higher tham the one Dunlop obtained by using physicall chamges in outpurt per mamhour. 18

Perlmanos value added measure reflects what the busimessman acturilly may base hils decisions upor. The
16. Ibidos po66。
17. RoPerlman, walue Productivity and the Intera industry Wage structure, on Irdustrial and Labor Relations Review October 1956, po 32。
18. Ibid.
bwsinessman is awere of money chmees in prices and costs. He may not be aware or, or even especially comeermed with, changes in physical productivity per se, iooos 2part from income yiclded by additionall units of output. Im short, The is primarily imterestod im the mollaz productivityo of labor and wlimately, of comrse, im prorits for the firm rather than in mere physicall productive officioncy per mahouro Consequenty, im the presemt writer ${ }^{\circ}$ siaw, the busimessmam will make wage or outpus adjustments whem his ${ }^{\text {wnarginal reweme producto curve shixts, thens intersectimg }}$ his marginal labor cost curve at a different point than rosmerly. Swch a change and the rosulting wage or output adjustments obriously could be caused by changes in product prices or changes im physicall productivity or bothobut the "dollar test would appear to be the decisive ractor. This gerernll view will be summarized in theoretical form below in the section entitled mMargimal Productivity Theory or Wages:"

Like Durilop and Perlman, Garbarino also has done research on interindustry wage structuresol9 Garbarime concluded rrou his rosearch that physical productivity is an important ractor in the determination of waseso 20 In
19. Garberinos ow。 cito po 282.
20. Tbido. Po 298。
additiong howoverg he suggests that there is a strong Telationship metmean the concontration or fixms xim an indusiry mathe wages paid am also indrcates that thore as a positime relatonship metween wages paid in an induso
 Garbarimo rurther denoted that a righ degree or correlation existed between the concentration or firns in 2n inmustry and union mombershipo 22 Using this selathom
 in an industry and the wages that an industry paid were positively relatea． 23 This particular conclusion can be shasply criticiued on the basis or the research techniave used。

Firsty Garbarimo correlated the degree or mionitac tion with the concentration or firms in am industryo This
 Hated the relatronship betuen the degree of comeentration fra an industry and the imdustry ${ }^{0}$ wageso Againg he used the 叫促 tost。 Botm or the above correlations indicated a high association botweon the variables tested．

Based on these Dove results，Garbarimo concluded that there was m high association betmeen the degre or

21．Tbidos P0 305．
22．Ibiden Po 302。
23．Ibido．305．
quionitation in an industry and the industry ${ }^{\circ}$ wageso ${ }^{2} 4$ The above conclusion is subject to criticism because the infereme was reached without a direct test or the relao tionship between the degree or maioniuation in mindestry 2mewages. 25 Garbarino simply inferred that simee there was a migh association betwem the degree or mmiomazation in am industry anc the concentration of inms in an indusm try and a high association between the degree or concentram tion of firms in am industry and the industryos wages there must also be a high association between the degree - unionization in am industry and the industryos mages. 26 Garbarino s conelusions or the relationship betweon productivity and wages and Dunlopis and Parlman ${ }^{\circ}$ s are quite similar. Also, his conclusions concerning concentration or firms in an industry and Dunlop s conclusions conceming competitive markets are quite similar. Howover, Garbarino s implied relationship of the correlation between wages and the degree of maionization in an industry which was not statistically proven is a sexious limitation on this studyo

Eisemman, who also did research in the area of interindustry wage structure, reached quite disterent
24. Ibid. P. 302
25. Tbid.
26. ITid.
results rrom those obinimed by Dumiom and Garburlmos although the statistical ditn were similaro 27 Her method Of malysis indicated that there was no reletronship betwem productwity mo vageso 28 The reason $x$ or this differing comelusion is that tisenman measured changes in physical owtput per manhomr as a percentage or bl baso sears while the other researchers usce percamtage changes in physical ourpur pre manhour rrom year to yearo

E边 semman also fownd that trere was no relationm ship between the degree or minomyation in an industry and wages． 29 However，she did Pind that there was a high degree of association befween value adeed per worker and wages am also between propits and wages． 30

The reason for the above dirferimg conclusions an productifrty is the method or approzch to the problem under investigationo Perlmen and Eisenmam round a migh degree of comelation betwean walue added per worker and waseso Dunco and Garbarino rown lower cormelations ror produco tivity whon measured by changes in actual output per mano howr amd wages．In this case，fowover，the difierence in 27．Eisommamag opocitospokn5o 28．Ibido po 4n6。 29．Ibido po khy。 30．Ibiolo po 4，6．
the correlation figmres is not due to the method of measurem ment, but to the character or the data used. Dunlop and Garbarim are measurimg physical charess im output per manhours, while Porman and Eilsemman are measuring both physical charges in output por manhous amo price changes by the wse of the Falme added statistic。

Efsemmanm conclusions on productivity and Dumlop ${ }^{\circ}$ no Garbarimo s comelusioms dircer becamse or neasmrement techmone diryerences, although the data wsed were derimed in the sane way. Dunlor and Gambarimo msed percemtage changes in physical output per manhour and percemtage chamges in wages per mambours Eisemuanmos techaique or measwramert ras silghtiy dirnaremis fer technique involved percertage changes in wages based on base yearo The reswits of these two dixxerent mothocs 0 computimg perm contage changes lead to tho differimg resultso.

Grouth in employment. Ross mo Goldmer in their resensch on the interimolutry wage structure did not spend 3 great deal or arfort studyimg the relationship botwoen productituty 2nc waceso Instead, their study centered on the relationship betmen aspansion in mployment in an industry and wages and the degree of wnionimation in an industry and qages. 31 The rirst portion or Ross and
31. ROSS and GOIdmers opocitog ppo 256 ard 267.

Goldmeris research was devoted to determinimg the relation ship botween expansion in an indmstryos employment and the wages that the industry paid. They comeluded that those industries that had the greatest expmason in moloyment also mad the greatest imereases im wases paido 32

It seems apparemt to this wirter that there appears to be contradiction between the resurts soum by Ross amd Goldmer and those cound by sifchter in the analysis or the efrect or changes in mployment and wages. Slichters wnike Ross and Goldmer, found a megatime corselation betweem employment and wages, although both sturies utilited the same statistical testrig techmiqueso 3 It is possible that the dirfercme may berelated to the time perod umder investigationo Ross and Goldmeris research was concerned with the $1930^{\circ} \mathrm{s}$ and early $1940^{\circ} \mathrm{S}_{\mathrm{m}}$ while Slichter s research was involwed with the $1940^{\circ} 5_{0} 3^{h}$ This dirference in the time period used may furmsh a partial explamation por dixferent resultso On the whole, howerer, there is still much conc jecture about the errect or chamges in mployment on wageso Degree or unionizatiorn Boss and Goldmero like Garbarino conclude trat a positive correllation exists
32. Tbiddo P. 267
33. Silchters opo citos po 89.
34. Ross and Goldner, opo citos ppo 25ko281。 Slichter, Opo cito 9 Ppo 80-91。
betwem the degre of umionimation in am imdustry and the wayes that the industry pays．Hownver．Ross and Goumer suggest that this relathonship omly exists for umions winich grew rapialy in the $1930^{\circ} \mathrm{s}_{0} 35$ The tochmique that they used to arrife at this comclusion has boen criticimed considerm aly by Garbarino and need be memenomed oniy briculy here． 36

Ross ma Goldmer divided the industries that thoy Were studying into three catogoriesmbigh kage payimg indwso bifes，middle wage payimg indugtries，mad low wage payinm industries． 37 They mest determined the degree of mnionitao tion existimg in an industry by examinimg the number of firms in the industry that were undar union contract durimg the period under investigation（1930 s through 1940 s）。 The researchers mext correlated the degree or mmionimation in an industry with wages paid by that industry． 38 Each Hadustry grouping was analywed soparatelyo From this malysis they reached the conclusion that wages and the －mpansion in mmion memberhip had a positive correlationo The above study las been criticined estensimely by Garbarino because or the method of determining the

35．ROSS and GOIdmer．Opo cito ppo 256 and 267 ． 36．G2rbarinog opocitoo po 287。

3\％．Ross and Goldmer，opo citon po 258。 38．Ioidoo po 267。
relationship between the degree of manomization and the method of weighting employmemt in the industrieso 39 The researchers railed to explain thoir method of weightimg industries in the three categorios mad did not prove that this increase in wages and monomembership was not due to rapid increase in employmento 40 At present, there is still mach dobate as to the relationship betwoen wages paid in an inoustry and the degree or unionizationo
"Ability to payo Brown in his research in the fileld of intorindestry wages exmmined the factors thet inm Pluenced the interindustry wage structure rrom a dirferent approach than was used in the other previously mentioned studieso Instead of attemptimg to deal with just one or two ractors that might arrect wages, Brom chose several dirferent ractors to analywe together as anno He called these factors the waility to payon ${ }^{41}$ Brown suggested that these ractors as a group ineluenced mages that an industry could payo In order to obtain a relationship between all the ractors fre the obility to pay and wages, Brown used multiple corselationo Brown rolt that the ability to pay Wes arrected by the rollowing: (I) the percentage of
39. Garbarino, opocitos p. 287。
40. Ross and Goldmer, Doportos ppo 254m281。
41. Brown opo citospo 450
labor costs to value of the total output, (2) the produco tivity or the industry when measured by changes in physical output per manhour, and (3) the degree or concentration in the industryo 4,2

Brown ancountered several problems im the measereo ment of these above mentioned ractorso since he had to use approsimatiomo yot, even with these approximationss Broma Found that the results of his research mere statistically sigmiricanto 4

Brown used approximate measures for all of his ractorso The ratio of labor costs to walue of the total output was approximated by using total average hourly earnings as a percentage of value added. 4 this was dome becamse data on wages per hour, wages per weekg and value of the torall output were not available. 45

Brom measured concemtration by takirg the outpue or the four largest rimm in an industry and measurimg thoir output as a percemage of total output for the entire industryo 4
42. Ibidog ppo 46-47.

44, IBidog P4 4
45. Ibid.
46. Ibid. po 51.

He wtilized multiple regressiom amalysis to detero mun ther relationship betwern these above mentioned ractors and wages. The mutiple correlation coorferont that was Obtainea was $r=0860^{147}$

Comelmsions as to rindines or orovious studies. In most studies, productivity, measured exther in dollars or by actmal changes im physical output por manhour, appears to be the ractor whth the highest correlatom with wageso Nevero theless several otmer ractors, as discussed previousiys hate mocn shown by researchers im this riteld to have some posithwo correlatiom with wages. Turther research needs to be done, however, to establish and earfirm more precisely the relative importance of all of these commonly recognized wasemdetermining factors.

The roregoing summary of the ersisting relevant lito erature also indicaces the persistemt and troublesome probo Lems or certain techmiqus. One sueh problem is whether to wse the meastre of percontage changes from one year to the next or peremtage changes based on single yearo Although these two techniques may give similar results, they do not mecessarily do so, as has been indicated in the studies or Garbarino and Eisenmann presented above。48

47 Tbidog po 58。
48. Eisenmanm, opo cition pobso Garbarimo, opo eiteg po 298.

Another problem that occurs is that studies made during periods of depression or rapic inflation may load to conclusions that are only applicable under the particular Or similar conditions oxisting at the time tine studios were conducted. In short, comelusions derived rimen research dome during one period or time may contradict those derivod from similar research conducted in other periodso

In final commentg it is perhaps well to emphasize again that despite the mumerous dirierences in scope, the approach; the techniques, and the conclusions exhibited by the various studies surveyed above, one reasonably unirorms if broad, conclemsion seems to mave been reached by nearly 211 the researchers in this rield. This common denominator, so to speak, is that the productivity or labor, however measured, is the most important sirgle ractor arfecting the level or wages him most industries and accordm frgly, is the most prominent detorminame of tho character of the interindustry wage structure。

As shown above, some or the studies surveyed ased the statistics of physical output per manhour as the measo ure of labor productivity, whille others used the value added concept. It will be recalled that, while both these measures of productivity generally yielded a higher correlation with the wages being paid than did amy other single Variable, labor productivity expressed in terms of value
added showed a higher correlation than productivity measured in terms of physical output alone。

Indeed, both common sense and obsermable business practice suggest that the employing firm is primarily imterested in the mallar productivityl or its labor rorce (techrically, 0, at tho maxging) wather tham in mere physical ereiciency in terms of maits or output per mamhour alone。 Or course, given a satisfactory product price, and one that will not decline appreciably as the individual rirmº outo prit ard sales are increased. the physical productivity of labor may well be the key to the firmog innancial success and be largely determinative of the wage rate the rirm is able and willing to payo

But in product price ralls swbstantially with increased output, or if for any reasom, the demand (schedm ule) itself changes so that tower and fewer units are demanded at any and all prices, then high physical producm tivity per manhour loses its importance and cannot, by itselp, onable arim to pay high wages or (porhaps) any wages.

The formal theoretical upression of this ompira ically observed rimding is of course elaborated in considerable detail in what is known as the marginal productivity theory or wages. Accordingly, the followimg section is devoted to a brier summary of that general
theorys indicating the main variants of the theoretical model usually found in theoretical exposition, insofar as they are substantially pertinent to the purpose of the present study.

The Marginal Productivity Theory of Wages
The marginal productivity theory of wages explains the general level of employment for a firm and the general level of wages for an industryo 49 As indicated above, this study is concerned primarily with the general level of wages in an industry.

Wage Determination in a Purely Competitive Factor and Product Market

The model of wage determination involving pure competition in both the product market and labor market is one in which the supply and demand for labor determines the wage rate in the industry and the level of employment for the firm. In this model, the rollowing assumptions are made:

1. Tull employment exists
2. Pure competition exists in both the product and labor market
3. Employers attempt to maximize profits
4. Employees attempt to maximize wages
5. A. Mo Cartter, Theory of Wages and Employments (Homewood, I11.8 Richard D. Irwing Incog 1959), po 45
6. There is complete mobility im the ractor market
7. All decisions are made on the basis of money changes in prices and costs

In this particular model, the incersection of the supply and demand curve for labor determines the level of wages in agimen imdustry. The demand curve ror labor is the margimal revenue product curve of labor (MRP)。 This curve slopes dommard to the right becawse the marginal physical product of labor decreases as the mumber of workers mployed increases. This is due to the law of diminishimg returns. The marginal revenue product of labor is computed by taking the marginal physical product or each worker atilited in the production of a product and multiplying that rigure times the marginal revenue derived rsom the sale of the product that the rorker produced. Under condm tions or perfect and pure competition in the product marketg the marginal revenue product of labor is equal to the palue of the margimal product of labor (VMP), because in these models the prife or the product oquals the marginal revente or the product.

Figure 1 illustrates the decreasing marginal revenue product curve of labor (MRP) based on the assumption of pure comperition.


Figure 1. Illustration of Marginal Revenue
Product Curve of Labor for Firm
The above graph indicates that as additional workers are employed by the firm, the marginal revenue product of labor decreases. To obtain the industry marginal revenue product curve, one sums the marginal revenue product curves for the firms in an industry. This summation yields the industry marginal revenue product curve of labor.

In order to determine the level of wages, the supply curve of labor for the industry must be derived. For any given industry, the supply curve in a competitive labor market slopes upward to the right. The supply curve of labor for the firm under conditions of pure competition in the labor market is perfectly elastic. The slope of the supply curve of labor upward to the right indicates that for firms in a given industry to attract new workers into that industry, wages must increase. This is due to the assumption of full employment. This type of supply curve is illustrated below in Figure 2.


Figure 2. Supply Curve of Labor for Industry Equilibrium is determined at point A in Figure 3
in this model at the intersection of the marginal revenue product curve of labor for the industry and the supply curve of labor for the industry. At this intersection, the marginal revenue product derived from the hiring of the last worker in the industry is equal to the wage paid. This is illustrated in Figure 3. In this graph, when equilibrium is at $A$, the industry wage is $W_{1}$ and the units of 1 abor hired are $Q_{1}$.


Figure 3. Determination of Level of Wage in Purely Competitive Labor and Product Market

Figure 3 illustrates that the wage rate is detero minea when the supply curve or labor intersects the demand curve of labor. In this case, tho purely competitive market mechanism in the product and labor markets determine the wage rate paid in ar industryo However, this only occurs when there is pure or perfect competition in both the product and labor markets.

There are many other market models for wage determination that aid in the explanation or interindustry wage structures. Because the derivation or marginal revenue product curves of labor and supply curves or labor in a purely competitive labor market are similar for all models, they will mot be discussed in the following models. (The case oi the monopsonistic buyer and the supply curye or 1abor that he races will be discussed laterol

Wage Dotermination in a Purely Competitive Labor Market and Monopoly in the product Marleet

The model os wage determination involving a purely competitive labor market and a monopolistic product market results in the worker being paid less than the value of the marginal product that he produces. This is due to the nature of the model The assumptions of the model that lead to this conclusion are:

1. Fall employment exists
2. Pure competition exists in the labor market
3. Monopoly exists in the product market
4. Employers attempt to maximize profits
5. Employees attempt to maximize wages
6. All decisions are made on the basis of changes in money prices and costs

In this particular model, the marginal revenue product of labor is less than the value of the marginal product of labor. This is because under the condition of monopoly, the marginal revenue derived from the sale of a product is less than the average selling price. The relationship between the marginal revenue product curve of labor and the value of the marginal product of labor under conditions of monopoly are illustrated in Figure 4.


Figure 4. Relation of Marginal Revenue Product of Labor and Value of Marginal Product of Labor Under Conditions of Monopoly

The intersection of the purely competitive labor market's upward sloping supply curve and the marginal
revenue product curve for the monopoly determines where equilibrium will occur in this model. This is illustrated in Figure 5 at point A.


Figure 5. Wage Determination in a Purely Competitive Labor Market and a Monopolistic Product Market

The wage rate in this market model is $W_{1}$ and the quantity of labor hired is $Q_{1}$. In this particular market model, the wage rate and number of units of labor hired are less than would occur in the purely competitive product and labor markets. Equilibrium in a purely competitive labor and product market would be determined where the purely competitive supply curve of labor intersects the value of the marginal product curve of labor for the monopoly. This would result in a new equilibrium at $B$ with a wage of $W_{2}$ and the number of units of labor hired being $Q_{2}$.

The model of pure compotition in the labor market and $\mathbf{n}$ merrect competition in the product market, as well as the model of pure competition in the labor market and Oligopoly in the product market lead to conclusions similar to those of the preceding paragraph; thererore, they need not be expowraded here.

Wage Determination in a Monopsonistic labor Market and a Purely Competitive Product Market

The model of wage detomination in a monopomistic labor market and a purely competitive product market again results in the worker being paid less than the vale of his margimal product. Once againg this is due to the nature or the model. The assumptions of the model that lead to this type or conclusion are:

1. Full exployment exists
2. Pure competition exists in the product market
3. Monopsony comditions essist in the labor market
4. Employers attempt to maximize prosits
5. Employees attempt to maximite wages
6. All decisions are made on the basis of chamges in money prites and costs
7. There are mo mions

The condition of momopony in the labor market is illmstrated in Figure 6。


Figure 6. Supply Curve of Labor Under Monopsony The frequent case cited as an example of monopsony in the labor market is the so called "company town." In this type of situation only one firm in town hires units of labor. To attract additional workers, the firm must constantly increase its wages. Thus, in this type of model, the marginal cost of hiring the last worker always exceeds the average cost of labor. This type of situation causes the marginal cost curve of labor to lie above the supply curve of labor which is the average cost of labor. This is illustrated in Figure 6.

In the case of the purely competitive product market and the monopsonistic labor market, the number of labor units hired is determined by the point at which the marginal cost curve of labor intersects the marginal revenue product curve of labor. In the purely competitive firm, this is point $A$ on Figure 7. Although this is opposite the wage $W_{2}$, only the wage $W_{1}$ is paid. Thus in this model, the last worker hired is paid a wage of $W_{1}$
while producing a value of $W_{2}$. The number of units of labor hired is $Q_{1}$.


Figure 7. Determination of Wages in a Competitive Product Market and a Monopsonistic Labor Market

The distance between $W_{1}$ and $W_{2}$ is commonly called the area of "exploitation." The distance between $W_{1}$ and $W_{2}$ is the amount of value that the worker produces, but does not receive. Under pure competition in both the product market and labor market, more workers would be hired and the wage that they would receive would be greater than $W_{1}$. The purely competitive factor market incorporated into the above model would result in a wage of $W_{3}$ being paid. The number of units of labor hired would be $Q_{2}$. Thus in this case, because the marginal cost of the labor equals the average cost, the exploitation is eliminated.

## Wage Determination Under Monopsomy in the Labor Market and Monopolv in the Prodenct Marleet

In the market structure or monopoly in the product market and monopsony in the labor market, exploitation also occurso. This conclusion is due to the assumptions or the model These assumptions ares
I. Full employment exists
2. Momopsony exists in the labor market
3. Monopoly exists in the product market
4. Employers attempt to maximize profits
5. Employees attempt to maximize wages
6. All decisions are made on the basis of changes in money prices and costs
7. There are no unions

In this particular model, the buyer of labor is a monopolist in both the product market and labor market. Figure 8 indicates wage determination under this type of model.

In this model, equilibrim occurs where the marginal cost curve of labor intersects the monopolistic rirmos margimal. revemu product curve of labor. This occurs at point A. In this model, the wage paid is Wil and the number or mits of labor hired is Q $Q_{1}$


Figure 8. Wage Determination Under Monopsony in the Labor Market and Monopoly in the Product Market

In the above model, the worker produces value of $W_{2}$ and is paid $W_{1}$. The area of exploitation is the distance between $W_{2}$ and $W_{1}$. If this model was converted to allow a purely competitive labor market as was discussed earlier, the exploitation would be eliminated.

The model of monopsony in the labor market and oligopoly in the product market and monopsony in the labor market and imperfect competition in the product market lead to similar conclusions as those of the preceding paragraph, and accordingly, are not discussed in this brief summary of the marginal theory.

Wage Determination Under Monopoly in Both the Product and Labor Market

The model of wage determination involving monopoly in the product market and monopoly in the labor market
involves a model in which there are many possible solutions to the level of wages and employment. Only a few of these solutions will be discussed in this paper. Assumptions of this model are:

1. Full employment exists
2. There is a single seller of labor (union)
3. There is monopoly in the product market
4. Employers attempt to maximize profits
5. Seller of labor attempts to maximize wages and/or employment
6. All decisions are made on the basis of changes in money prices and costs


Figure 9. Wage Determination Under Monopoly in the Product Market and Labor Market

One method of beginning a discussion of wage and employment determination involving this type of model is to use as a starting point the previous model of monopsony in the labor market and monopoly in the product market.

Figure 9 is the same as pigure 8 except for some addi tional lettering。

Imitially in this model with the single seller of 1abor still excluded, the wage rate will be $W_{1}$ and the number of labor umits hirea will be $Q_{1}$. Equilibrium will occmr at point A. At this point, the marginal cost or hiring the last unit of labor is oqual to the marginal revence product that that unit or labor produces. Now, allow the assumption or mo simgle seller in the labor market to be relaxed, and assume that there is 2 single seller in the Form of a union Furthermore, assume that this union is interested in maximiming employm ment without increasimg or decreasing wageso If this is the case, the wage will remain at $W_{1}$, but the anownt or Habor hirced will increase to $Q_{3}$ o This is because the single soller orfers all mints of labor to the rirm at a price of Wio Thus the supply curve becomes perfectly Qlastic and the exploitation is eliminatedo Under certain assumptions, it is possible for the number of units of Iabor hired at $W_{\text {I }}$ to be Quo

In the next case, assume that the union does not attempt to maximize employment, but instead wishes to masso imiqe wages. $I n$ this example, the wage will increase from $W_{1}$ to $W_{3}$ and the level of employment will remain at Q1. In this case, as in the provious one, the supply of labor
is now perfectly elastic at wage $W_{3}$ (due to the union) and the employer can hire all of the labor he wishes to at that wage rate, which is $W_{3}$ Equilibrium is still at point $A$. As in the previous example, the monopsony is once again eliminated.

The last variation to be discussed is the case of the seller who wishes to maximize wages and employment. This can be done if the wage rate is set somewhere between $W_{1}$ and $W_{3}$ A wage rate set in the range of $W_{1}$ and $W_{3}$ will increase employment and wages. At $W_{2}$ employment expands to $Q_{2}$ illustrating this case。

The above market model has many other solutions depending upon what is assumed. The analysis of all the variations of the above model goes beyond the scope of this paper.

The above discussed market models have all indim cated that the level of wages in an industry is a function of the demand for labor (marginal revenue product curve of labor-in short, its "dollar productivity" at the margin) and the supply of labor. Firms are assumed to adjust to changes that occur in either the supply curve or demand curve and to changes that occur when both the supply curve and demand curve change position. There has been a great amount of debate as to whether this theory is actually used by businessmen. It is advisable to discuss the issues
involved with this debate to indicate the problems involved with a study of this type。

The Debate Over the Marginal Productivity Theory
The critics of the marginal productivity theory of wages can be divided into two groups．These groups are the economists who contend that businessmen do not behave as the marginal productivity theory suggests and those economists who believe that the businessman cannot behave as the marginal productivity theory of wages suggests． 50

Richard Lester，Melvin Reder，and Herber Simon all suggest that employers do not utilize the marginal concepts in their decisions． 51 These researchers contend that the employer does not make adjustments in employment to every single change in wages．Their contention is based on the assumption that the businessman does not have knowledge of

50．S．Cohen Labor in the United Statess（2nd editiong Columbus，Ohio：C．E。Merrill Books，1966）．

51．Ro Lester，＂Shortcomings of Marginal Analysis For Wage Employment Problems，${ }^{\circ}$ American Economic Review， March 1946，pp．62－82．

M．Wo Reder，＂A Reconsideration of the Mar－ ginal Productivity Theory，＂The Journal of Political Economy，October 1947，pp． $450-458$ 。

Ho＇Simon，wTheories of Decisionmaking in Economics and Behavioral Science，＂American Economic Review， June 1959，ppo 262－264。
his marginal relationships nor does he know anything about the concept of marginalism。 52

Other economists，such as Belfer and Bloom，argue that the businessman cannot behave as marginalism dic－ tates． 53 One reason advanced for this theory is that the firm is not a simple organism，but is highly complex，and therefore has many product lines and cannot actually separate out each marginal value。 These same economists also argue that the businessman is hemmed in by institum tional arrangements that do not allow him to adjust employ－ ment and output freely。54

The economists supporting the marginal productivity theory of wages approach to the problem of wage determina－ tion use the marginal tool in a different context than do the critics of the theory．The supporters of marginalism contend that as long as the businessman is assumed to attempt to maximize profits，the tools of marginalism are

52．Lesterg opo cit． Reder，opo cit． Simong opo cit．

53．No Belfer and G。Blooms MUnonism and the Marginal Productivity Theory，in Insights in Labor Issuess ed。 by R。Lester and Jo Shister（New York：Macmillan Coog 1948）。

54．Wo Jo Eiteman，＂The Equilibrium of the Firm in MultimProcess Industries，＂The Quarterly Journal of Economics，February 1945，ppo 280－289。
applicable。55 The businessmang in attempting to maximite prorits，will not pursue a program which comsistently leads to costs which eaceed revenueso Thus，the narginal concept is an aid to the businessman even in he is not arare that he is wtilitzing thils tool．

The derenders of margimalism in answer to eritics of the marginal productivity theory of wages suggest that the marginal concepts are used to explain long run relam tionships． 56 Thus，the businessman need not respond to every change he experiences．The changes that the busimesso man undertakes may all be major and may be over long periods of time Yet，as long as the businessman is attempting to maximize profits，all of his decisions are being made with the aid of marginalism。

The literature devoted to the applicability of marginalism is quite estensive。 For purposes of this study， the marginal productivity theory or wages will be used as the underlying explamation for dirferences between wages． However，there are，obviously，several possible variables that are closely associated with interindustry wage differm emtials。 These variables are not directly incorporated in the marginal productivity theory of wages，but some operates

55．To Machlups Margimal Amalysis and Empirical Researeh，American Economic Review，September 1946， PP。 $519-554$ 。

56．Ibid．
directly or indirectyg to influmee the character or the marginal revenue product curve of labor or the marginal labor cost curve or the supply curye for labor．These possible spectric variables are，in facts those that have been summarized previously to have been demonstrably influential to some degree im wage determinationo

The productivity variable，whether in physical or dollar terms or both，is most direct in the influence it would have on the marginal calculation Significantly enowgh it was primarily this variable which nearly all provious ompirical studios have shom to have the highest correlation with wages paid。 This paper is not a test of the marginal productivity theory of wages，but rather a test of the estent of the influence of those other variables mentioned earlier on the interindustry wage structure in a particolar selected settings namely manaractaring induso tries in Calirormia。

The mext chapter presents the hypotheses to be tested，the geographic area under investigationg and the statistical tools that will be used in this study。

## CHAPTER II. METHODOLOGY

Structure of This Study
As pointed out earlier, this study does not presume to answer all of the perplexing questions and unsolved problems of wage structure analysis. The subject matter of this study is divided into two parts. The rimst is devoted simply to determining the degree or stability in the Califormia manuracturing interindustry wage structure during the period 1954-1962. Both Slichter and Cullen suggest the national interindustry wage structure has exhibited great stability through time。 part of this study is to determine whether the Califormia manuracturing interindustry wage structure has exhibited the same degree - 5 stability as the mational structure.

The second part of this study is to determine the factors that have influenced the wages paid by industries in this structure and in the process, ascertain whether the manufacturing industries in California exhibited an essenm tially similar or a significantiy different pattern in

1. D. E. Cullen; "The Interindustry Wage Structure, 1899-1950, American Economic Review, Jthe 1956, po 352. S. H. Sipchter, Motes on the Structure of Wages, The Review of Economics and Statistics, February 1950. p . 88 。
comparison with the previously discussed studies of this subject in other industries and areas. The ractors investigated in their relationship to wages in this research during the period $1954-1962$ are:
2. Valle added per worker as a measure or changes in physical output per manhour and prices
3. Percentage increases in employment based on a singlo year
4. Percentage of mion members in the work rorce in an industry
5. Percentage of females in the work force in an industry
6. Wages as a portion of walue added used to measure labor costs to value of total output
7. Percentage of production workers to total labor work force in an industry as a measure of skill mis

To aid in the investigation of tho relationship between these ractors and wages, the following hypotheses have been formelated.

Hypotheses

## Hypothesis I

The California manuracturing interindustry wage structure from 1954 m 1962 had a high degree of stability.

## Hypothesis II

California manuracturing industries that have the greatest amount of value added per worker have the highest average hourly earnings: thus, these California manfacturing industries rank hyghest in the California manuracturing interindustry wage structure。

## Hypothesis III

The California manuracturing industries that have had the greatest percemtage increase in umployment since 1954 have the highest average hourly earnimgs；thess these Califormia manufacturing industries rank laighest in the Califormia manumacturing interindustry wage structure。

## Hypothesis IV

The Califorma manufacturing industries that have the targest percentage of females in their work force pay the lowest average hourly earmings；thusg these Califormia manufacturimg industries rank lowest in the Califoraia manufacturing interindustry wage structure．

## Hypothesis V

The California manuracturing industries that have the largest percentage of union members in their work Corce pay the highest average hourly earmings thus，these Califorma manuracturing industries rank highest in the Califormia manuracturimg internmustry wage structure。

## Hypothesis VI

The Califormia manufacturing industries that have the lowest percentage of wages as a portion of total value added pay the highest average hourly earmingsi thus，these Califormia manufacturimg industries rank highest in the California manuacturing interindustry wage structure。

## Hypothesis VII

The Calliormia manuracturing industries that have the largest percentage or production workers in their total worls force pay the lowest average hourly earningsi thus． these California manfacturim industries rank lowest in the Califormia manufacturing interimdustry wage structure．

Due to the possible interaction of the above
independent variables，it is necessamy to formulate an
eighth hypothesis．This hypothesis is as follows：

## Hypothests VIII

The California manuacturing industries that hare the greatest amount of Falue added per worker, the greatest increases in employment since 1954 , the smallest percentage of f emales in their work force, the lowest percentage of wases as a portion of value added. and the smallest perm centage of production workers in their total work roree have the highest average hourly earmings; thus these Califormia manufacturing industries rank highest im the California manuracturing intarindustry wage structura.

## Definitions

The following terms will be repeatedly employed in the discussion and analysis to rollowo

## Average Hourly Eamming

For purposes of this research, an average hourly earning is derined as the payment to a production worker for an hour worked. ${ }^{2}$

## Manufacturing Indestry

The definition of manuracturing industry for purposes of this research is the same as that used by the Standard Industrial Classinication Manual of Industries. The Standard Industrial Classification Manual of Industries
defines mamuracturing as the mechanical or chemical transformation of inorganic or organic substances into new products. The assembly of component
2. J. A. Mark, Mechical Note: Industry Indexes of Output Per Manmorr, Momthly Labor Review, November 1962. po 1272.
parts or intermediate products is also considered to be mamuracturing in the resulting product is neither a structure nor other fixed improvement．： 3

These types of activities when performed by simillar types of firms constitute a manufacturing industry。 4

The following types or activities are derined as being nommanufacturing activitiess
（a）Processing on farm wher the raw materials are grown on the farm and manufacturing activities （poultry dressing，milk and butter production， logging）are on a small scale without extensive use of paid labor．Also excluded as manuracturing are custom milling，cotton ginming，and similar activities．
（b）Mineral preparation swch as crushing，screenc ing and concentrating of ores．However，mining performed as a secondary activity in conjunction with manuracturing is included in manufacturing： for examples stone and clay mining at cement， lime，and clay product plants．
（c）Custom work to the individual order or housem hold consumers．Examples are custom tailoring， woodworicing，lettering on monumentsg setting of diamonds and the making of orthopedic appliances． （d）Repair and other service activities，except specified services performed far the trade。 ${ }^{\circ}$ Repair shops for railroads are also exeluded．but machine shop jobbing and repair and boat repair were included in manufacturimg．
（e）Production of coke for own use by establishm ments owned by public utility companies． 5

Several other types of economic activities are also defined as nonmanufacturing，namely，retail stores engaged in the selling of their products directiy to households：

3．U．S．Department of Commerce，Annual Survey of Manufactures． 1962 p．2。

4o Ibid．
5．Ibid．
construction contractors who sell at the place of construca tion; certain educational, elemosynary, and penal instim tutions; and govermment omed and operated racilities. 6

## Production Workers

The torm production workers is dorined as
Workers (up through the working foreman) engaged in fabricating, processing, assembling, inspection, receiving, storage, handing, packing, warehousing, shipping (but not delivering), maintenance, repair, janitorial, watchman services, product development, auxiliary production for plants ${ }^{\circ}$ own use (e.gog power plamtl, record keeping, and other services closely associated with these production operam tions at the establishment covered by the report are included. Supervisory employees above the working toreman level are excluded from this category. 7

## Value Added

Value added is cefined as the value of shipments Of manufacturing goods, plus revenue from service rendered, plus the addition to value added by merchandising operations, plus the net changes in inventories less "o.othe cost of materials, supplies, containers, fuels purchased, electricity, and contract work. 8
6. Ibid.
7. Ibidog p. 5.
8. Ibid., p. 7.

Sources and Justification of Data Utilized

## Average Hourly Earnings

Rather than using data based on average hourly wage rates，previous studies in the field of interindustry wage structures have used average hourly earnings． 9 Average hourly earnings are a less accurate indicator of what a worker earns per hour than are average hourly wage rates because they include such items as incentive pay，shift differentials，and overtime premium pay。10 By the omission of the above items，average hourly wage rates furnish a more accurate estimate of what a worker is paid per hour of work．Yet，although average hourly wage rates are statistically a more manageable indicator，in recent years they have been collected only on an occupational basis．

At present，the only measure of an average indusm trial wage is the average hourly earning statistic。 Regardm less of the above mentioned limitations which the average hourly earning statistic imposes，researchers in the field

[^1]of interindustry wage structures have used this statistic as an indicator of the average hourly wage rate that a worker is paid in a specific industry.

Recently, data on average hourly earnings have been made available by both the Bureau of Labor Statistics and the Department of Comerce. To compute the average hourly earnings, both these agencies use the total payroll receipts for a given industry divided by the number of employee hours worked in that industry. ${ }^{11}$ This technique will be the one employed in this study. Since overtime premium pay, incentive pay, and shift differentials differ from firm to firm, mo adjustment for these ractors is made when the data are collected. 12

The Department of Commerceis data were selected for the computation of average hourly earnings in this study for the following two reasons. The first reason is the Department of Commerce's data cover a greater time span than those of the Bureau of labor Statistics. The Bureau of Labor Statistics ${ }^{\circ}$ data for some industries were not compiled before 1958, while the Department of

> 11. Mark, opocito, po 1212.
> 12. Ibid.

Commerces data began prior to the base year of this studym 1954． 13

The second reason for the choice of the Department of Commerces data involves the definition of what consti－ tutes manhours．The Commerce Departmentis data include all hours that are actually worked at a given plant and exclude vacation pay，holidays，and sick leave．${ }^{14}$ The data gathered by the Bureau of Labor statistics include all of the above mentioned items． 15 The Bureau of Labor Statis－ tics ${ }^{\circ}$ data cannot be used without the exclusion of these above mentioned items，for their inclusion would result in an overestimation of the oooactual return to the worker for a stated period of time．0．ot 16

## Manufacturing Industry

The trends in the manuracturing interindustry wage structure would be determined best by a very narrow industry

13．U．S．Department of Labor，opo cito，ppo 34－44． U．S．Department of Commerce，Annual Survey of Manuractures．1949－1953，1955－1957，1959－1962，passimo

U．S．Department of Commerce，Census of Manufactures．1954，1958，passim．

Department of Commerce data have been compiled on a yearly basis since 1949 。

14．Mark，opo citos po 1212。
15．U．S．Department of Laborg opo citos p．650．
16．Mark，opo citos po 1212。
classification (The narrowest of these classirications is the rour digit levelo) while some data are collected at the three and Pour digit levels of the Stamdard Indusm trial Classification of Manufacturing Industries by the Department of Commerce for the nation as a whole, the material for individual states is comparatively sparse。 17

Because of the indicated limitations of state datag the two digit classirication system of the standard Induso trial Classification of Manufacturing Industries has been selected for this study. Data at the two digit classification level of industries encompass all or the industries included at the three and rour digit classirication levels, and have been collected by the Department of commerce in the following areas: total number of employees, payroll for all employees, number of production worker manhours, total number of production workers, payroll for production workers, value added by manuracturing by industry, and new capital expenditures by industry. 18

1\%. U.S. Department of Commerce, ndivisions and States, Annual Survey or Manuractures, 1949-1953. 1955-1957, 1959-1962, passimo
U.S. Department of Commerce, upivisions and States, Census of Manufactures, 1954, 1958 passim.
18. U.S. Department of Commerce, Anmual Survey of Manuractures, op. cit passim.

> U.S. Department of Commerce, Census of Manuractures, op.cit. passimo

## Production Workers

The Bureau of Labor Statistics ${ }^{0}$ classification system of employees furnishes a more nearly accurate description of the number of workers in each area of an industry's production process than does the present classification system of employees of the Department of Commerce. This is because the Bureau of Labor Statistics data on employees are collected at regular intervals throughout the year, while the Department of Commerce's data are collected only once a year. However, since the more accurate data of the Bureau of Labor Statistics were not available for some industries at the two digit level until 1958, the employee data from the Department of Commerce are used in this investigation。19

## Physical Productivity and Prices

The only indicator at present that can be used at the state level to measure physical output per manhour (productivity) is the value added statistic. It does, however, also reflect price changes。 20 If prices remain constant and value added per worker increases, this rise in value added can be attributed to increases in
19. U.S. Department of Labor, opo citog ppo 34-440
20. Ro Perlman, "Value Productivity and the Interindustry Wage Structure, "Industrial and Labor Relations Review, October 1956, po 32
productivity。 If productivity remains constant and value added per worker increases，the increase in value added can be attributed to rising priceso Since value added per worker can reflect either or both of the above conditions， it can be used as an approximate measure for changes in the firm ${ }^{0}$ s marginal revenue curve。 As discussed previously， this curve can shift due to changes in physical output per manhour or changes in prices．The value added per worker in each industry is computed by dividing the value added by manufacture for each industry by the total number of production workers employed in that industry．

## Stability

The definition of stability was derived from a table of rank order correlation coefficients based on a sample of sixteen industries．From a standard chart of confidence limits for rank order correlation coefficients， using a sample size of sixteen and level of significance of 1 per cent，the confidence range for $R_{s}$ ，denoting stability，is $666-1.000$ ；while for the 5 per cent levels it is ．507－1．000． 21

## Temale Vorkers

The data on female workers utilized in this
research were derived from the State of California ${ }^{\circ}$

21．So Siege1，Nonparametric Statistics， （New York：McGrawmill Book Company，Incog 1956），p．284。

Califormia Statistical Abstract. 22 These data include both wage and salaried female workers. Information was not available on just the number of remale workers employed in the classification of production workers.

## Union Membership

The data on union membership were derived from the State of Californias Calirormia Statistical Abstract. 23 These figures include mion members employed in industries Within the state of California. Due to the combination of several indestries into one industry group on the basis of union membership, only ten industry groups were examined. Also, becamse of this combining of industries into one group, the degree of unionimation will be deleted from the analysis based on multiple regression.

## Labor Costs as a Portion of Value of Total Output

The analysis of labor costs as a portion of total value of the output will be based on approximate data. Data on labor costs are not available in the form of weekly, annual, or hourly wages. The only data on labor
22. State of Califormia, Department of Industrial Relations, Califormia Statistical Abstract 1957. 1963. passim.
23. State of Califormia, Department of Industrial Relations, Union Labor in Califormia 1960, 1962, passim.
costs available are armings paid to workerso Thereroreg eamings will be used in place of wages. Also, total vaiue of an industry ${ }^{\circ}$ s outputin California is not available. Because of this, value added will be used to appromimate the value of the output. The use of these slightly different statistics does not result in severe limitation on the validity of this study as earnings are a very close approximation to wages in any one year and value added is the additional value that each industry produces in a given year. 24

Skill Mix
The measurement of the skill mix in this study has been done by computation of the percentage of the labor force that is mployed in the classirication of production workers as a portion of the total labor roree employed in the industry, 25 It will be assumed that those industries that have the greatest percentage of production workers have the lowest average level of skill in the labor mix. This measure is only a rough approximation of the skill mix as one cannot obtain the number of workers employed in each occupation in an industry at the state level.
24. D. G. Brown ${ }^{\text {PI Expected Ability to Pay and }}$ Interindustry Wage Structure in Manufacturing, Industrial and Labor Relations Review, October 1962, p. 24.
25. Ibid.

Concentration of Firms in an Industry
The factor of concentration will not be measured in relation to wages as it has been too costly to gather data in this area at the state level．

## Geographic Area

The geographic area investigated in this study is the state of California．California was selected because it has one of the most rapidly expanding economies in the United states．Four different economic indicators are used to denote this expansion during the period 1954 m 1963 ． These four indices are：

1．Index of employment on manufacturing payrolls
2．Gross weekly earnings
3．Absolute number of workers employed in manufacturing

4．Value added by manufacturing
On the basis of the index of employment on manu－ facturing payrolls for states from 1954－1963，California was third highest．Only Utah and Arizona showed greater increases in employment． 26 According to the second index， gross weekly earnings，California was one of the highest wage paying states during the period 1954－1963．27．In

26．U．S．Department of Labor，opo cito，po xii。
27．Ibid。 ppo xxxviii－xxxix。
terms of the absolute number of workers employed in manum facturing, the third index, California ranked consistently in the top three states. 28 on the basis of the last index used, value added by manufacturing, California was found to be in the top four states during the time period under study。 29

A second reason for the selection of California is that, of the two-digit manuracturing industry groups found in the United States, nineteen of the twenty groups are located in California. 30 The only manuracturing industry not located in Califormia is the tobacco industry. 31 Since such a large number of these two-digit manuracturing industry groups are located within Californiag trends in wages at this time may give an indication of future wage trends in other states as they undergo similar economic expansion in manufacturing.

Califormia was selected also because of the large amount of data available on a contimuous yearly basis for
28. Ibide ppo xuvimxuvi io
29. U.S. Department of Commerce, ${ }^{\text {Divisions and }}$ States, Annual Survey of Manufactures, 1949-1953, 19551957, 1959-1962, passim。
U.S. Department of Commerce, "Divisions and States, " Census of Mameractures, 1954,1958 , passim.
30. Ibid.
31. Ibid.
the industry groups in the state. The only industry groups included in this study were those having continuous data for the period under investigationg 1954m1962. Three Califormia industry groups have gaps in the data for the period under consideration: leather and Ieather products, petroleun and coal products, and instruments and related products. Gaps appear in the data in these industries for the following years: leather and leather products, 1959. 1960:32 petroleum and coal products. 1954m-1956;33 and instruments and related products, 1954-1957。34 These industry groups have consequently been omitted from this survey because of the inability to estimate the missing data with any degree or accuracy.

## Industry Groups

The manuracturing groups that are included in this research represent sixteen of the nineteen manuracturing industry groups located in California. The industry groups used are those having the twomdigit classirication system established by the standard Industrial Classification
32. U.S. Department of Commerce, "Divisions and Statess Annual Survey of Manuractures, 1959-1962.
33. Ibid 1955-1956.
34. U.S. Department of Commerce, "Divisions and States, Annual Survey of Manuractures, 1955-195\%.
U.S. Department or Commerce, "Divisions and States, ${ }^{\circ}$ Census of Manuractures, $1954{ }^{\circ}$
Manual of Manufacturing Industries. 35 The included manufacturing industries are as follows:

| Industry | SIC Number* |
| :--- | :---: |
| Food and kindred products |  |
| Textile mill products | 20 |
| Apparel and related products | 22 |
| Lumber and wood products | 23 |
| Furniture and fixtures | 24 |
| Paper and allied products | 25 |
| Printing and publishing | 26 |
| Chemicals and allied products | 27 |
| Rubber and plastic products | 28 |
| Stone, clay and glass products | 30 |
| Primary metal products | 32 |
| Fabricated metal products | 33 |
| Machinery, exceptelectrical | 34 |
| Electrical machinery | 35 |
| Transportation equipment | 36 |
| Miscellaneous manufacturing | 37 |
|  | 39 |

* Standard Industrial Classification Number

Under the Standard Industrial Classification System, these industries represent approximately 80 per cent of the value added by the manufacturing industries that are located in California。36

Time Span
The time span of this detailed statistical investim gation is that of the years 1954-1962. The year 1954 was chosen as the base year because of the lack of continuous
35. U.S. Department of Commerce, Annual Survey of Manufactures. 1959-1960. p. 5.
36. U.S. Department of Commerce, Annual Survey of Manufactures, 1956, p.60.
annual data before that year． 37 The terminal year was chosen because of the data collection problems for any period after the year 1962．To use the only available data for the year 1963 or later would involve preliminary estimates to which no satisfactory degree of accuracy could be attached． 38

Statistical Tools

## Spearman ${ }^{\circ}$ s Rank Order Correlation Coefricient

In order to determine whether the findings of Cullen can be applied to a small geographic areas it is necessary to use his statistical techniques，namely Spearman ${ }^{\circ}$ s rank order correlation，at the state level。 39 This same technique will be used here to erramine the stability of the interindustry wage structure at the state level． 40

37．The Department of Commerce did not collect data on value added on the basis of states before 1954． See U．S．Department of Commerce，Annual Survey of Manufactures．1949－1953．

38．The Bureau of Labor Statistics has data for this period on average hourly earnings，but as discussed earlier in this chapter，this material is not comparable． with the data being used in this research．

39．Cullen，opocitog p．355．
40．The formula used in this portion of the investigation is found in $H$ 。 Mo Walker and Jo Lev， Statistical Inference，（New Yorks Holt，Rinehart and Winston Coog 1963），po 280。

However，before any inferences can be made concern－ ing the reasons for the changes which may have occurred in the interindustry wage structure，the stability of the structure must be determined．Industries therefore will be ranked on the basis of average hourly earnings paid per industry during each year under observation。 Rank order correlation will then be applied to the data with the base year of the study（1954）being the control year．

Perlman and Dunlop used rank order correlation in their studies of interindustry wage structure relationships to determine the degree of association between some estimate of the marginal revenue product of labor and wages． 41 This study will also use rank order correlation to determine the relationship between wages and the previously mentioned factors that may affect wages．In this study，these factors will be the independent variables，and wages will be the dependent variable．The degree of association between each of these factors and wages will be computed for each year under investigation。

This technique of measurement of the degree of association will be used to test each of the above relam tionships because no assumptions need be made concerning

[^2]the distribution of the data。 42 The only criterion that must be met if this test is to be used is that the data be ranked on an ordinal level and the data under observation meet this requirement。 43

Spearman＇s rank order correlation technique has one limitation。 This technique does not indicate changes in individual variables．All the technique shows is actual changes in the ranking of entire groups of independent variables and dependent variables．Therefore，a table will be used to show changes that have occurred in the relative position of each industry in the interindustry wage structure during the period under investigation。

The rank order correlation coefficient derived will show the degree of association between an independent var－ iable and the dependent variable。 A tom test of signifm icance for rank order correlation coefficients will be used to determine whether the association between each independ－ ent variable and the dependent variable is due to chance or not． 44

42．D．C．Adkins，Statistics，（Columbus，Ohio： C．E．Merrill Books，1964），po 282。

43．Ibid．
44．Siegel，opocit．s po 212。

## Multiple Regression Analysis

Both Perlman and Dunlop in their articles on the interindustry wage structure indicate that other factors besides productivity influence this type of structure． 45 Dunlop noted in this study that when employment was also included along with physical changes in output per manhour as independent variables，the correlation coefficient increased in value over the one that was computed on the basis of physical changes in output per manhour． 46

The objective of this portion of the analysis is to determine the relationship between all the independent variables and the dependent variable through multiple regressiono 47 The multiple correlation coefficient will be computed across all data used in this study，except union membership，for all sixteen industries．The degree of association between the independent variables and the dependent variable will be obtained for each year from the multiple correlation coefficient．In addition，the degree of association between all variables will be computed for the entire period under investigation by the same technique．

45．Dunlop，opo citog po．72。 Perlman，opo cito，po 39。

46．Ibid．p．64。
47．The formula used in this portion of the investigation is found in J。Neter and W。Wasserman， Fundamental Statistics，（Boston：Allyn and Bacon，1961）， p． 378 。

## Partial Correlation

Partial correlation coefficients are often used together with multiple regression analysis to determine the relative degree of association of each of the independent variables with the dependent variable. This type of correlation will be used in this study to learn the degree of association between each of the independent variables used in this research and the dependent variable。 48
48. H. M. Blalock, Jrog Social Statistics; (New York: McGraw-Hill Book Company, Incog 1960)g p. 331。

## CHAPTER IIX。 FINDINGS

This chapter will record the results of the investi－ gation of the California manufacturing interindustry wage structure。

## Test of Hypotheses

Test of the stability of the California Manufacturing Interindustry Wage Structure 1954－1962

The first objective of this research was to test the stability of the California manufacturing interindustry wage structure during the years $1954-1962$ in order to ascertain whether an interindustry wage structure within a small geographic area exhibits the same degree of stabil－ ity as does the interindustry wage structure determined by both Cullen and Slichter for the entire United Statesol

The following hypothesis was tested to measure the stability of the interindustry wage structure in California during the years 1954－1962．

Hypothesis I．The California manufacturing intero industry wage structure during the period $1954-1962$ had a high degree of stability．

I。 D．E．Cullen，${ }^{\text {If }}$ The Interindustry Wage Structure 1899－1950，American Economic Review，June 1956，ppo 353－359。

S．H．Slichter，MNotes on the Structure of Wages，Review of Economics and Statistics，February 1950， ppo 80－91．

AREAY OT STXTE EN CAUTTORNIA MAHUF GOTURING THDUSTRIESO
AVERACE HOURLY EARHTNGS FOR YEARS $1954 \sim 1962$

|  | 2954 |  | 1255 |  |  |  | 1957 |  |  |  | 1959 |  |  |  | 2961 |  | 2962 |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| RANR | STC | GAGE | $5 \pi \mathrm{C}$ | MACE | SIC | WAGE | STC | WAGE | STC | WAGE | STC | VAGE | SIC | WAGE | STC | WgGE | SIC | WAGE |
| 1 | 27 | 2.54 | 27 | 2.56 | 27 | 2.84 | 27 | 2.96 | 27 | 2.99 | 27 | 2.99 | 39 | 3010 | 27 | 3.19 | 27 | 3.36 |
| 2 | 37 | 2.20 | 30 | 2.32 | 37 | 2.40 | 33 | 2.54 | 39 | 2.977 | 39 | 2.96 | 27 | 3.04 | 39 | 3014 | 39 | 3.22 |
| 3 | 30 | 2:16 | 37 | 2.30 | 33 | 2.36 | 37 | 2.52 | 33 | 2.72 | 33 | 2.80 | 37 | 2.87 | 37 | 2.99 | 37 | 3.12 |
| \% | 33 | 2014 | 33 | 2.27 | 30 | 2.31 | 30 | 2.39 | 37 | 2.68 | 37 | 2.78 | 33 | 2.82 | 33 | 2.94 | 33 | 3.05 |
| 5 | 24 | 2012 | 35 | 2.22 | 35 | 2.30 | 35 | 2.38 | 35 | 2.59 | 35 | 2. 66 | 35 | 2.75 | 35 | 2.77 | 34 | 2.84 |
| 6 | 34 | 2.07 | 2 B | 2.17 | 34 | 2.25 | 36 | 2.31 | 34 | 2.53 | 28 | 2.61 | 34 | 2.64 | 34 | 2.76 | 35 | 2.84 |
| 7 | 35 | 2.05 | 34 | 2.12 | 23 | 2.24 | 24 | 2.30 | 28 | 2.51 | 34 | 2.59 | 28 | 2.63 | 32 | 2.68 | 32 | 2.80 |
| 8 | 28 | 2.02 | 28 | 2.11 | 32 | 2.20 | 32 | 2.30 | 32 | 2. 45 | 32 | 2.52 | 32 | 2.54 | 28 | 2.67 | 28 | 2.74 |
| 9 | 26 | 2.00 | 26 | 2.08 | 36 | 2.18 | 34 | 2.29 | 30 | 2.36 | 36 | 2.46 | 36 | 2.52 | 36 | 2.63 | 36 | 2.69 |
| 10 | 39 | 2.00 | 32 | 2.05 | 26 | 2.17 | 28 | 2.28 | 26 | 2.35 | 30 | 2.41 | 26 | 2.51 | 26 | 2.60 | 26 | 2.67 |
| 11 | 32 | 1.97 | 25 | 1.95 | 28 | 2.15 | 26 | 2.24 | 24 | 2.33 | 26 | 2.39 | 30 | 2.4.7 | 20 | 2.51 | 20 | 2.63 |
| 12 | 36 | 11.94 | 39 | 1.95 | 25 | 2.02 | 39 | 2.18 | 36 | 2.33 | 24 | 2.34 | 20 | 2.432 | 30 | 2.46 | 25 | 2.53 |
| 13 | 25 | 1.89 | 36 | 2.94 | 20 | 2.01 | 20 | 2011 | 25 | 2.27 | 20 | 2.31 | 25 | 2.39 | 25 | 2.45 | 30 | 2.4, 4 |
| 14 | 20 | 1.85 | 20 | 1.93 | 39 | 2.00 | 25 | 2.03 | 20 | 2.23 | 25 | 2.30 | 24 | 2.38 | 24 | 2.40 | 24 | 2. 2,6 |
| 15 | 22 | 1.66 | 22 | 1.66 | 22 | 1.72 | 22 | 1.70 | 22 | 1.81 | 22 | 1.91 | 22 | 1.97 | 22 | 2.03 | 22 | 2.15 |
| 16 | 23 | 1047 | 23 | 1.50 | 23 | 1.55 | 23 | 1.57 | 23 | 1.63 | 23 | 1.63 | 23 | 1.73 | 23 | 1.76 | 23 | 1.80 |
| Erplamation of SIC Numbers |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| STC |  | Industry Group |  |  |  | 5. | Tindustry Grouse |  |  |  |  |  | STC |  | Imdustrsy Grouse |  |  |  |
| 20 | Food and krndred products |  |  |  |  |  | Princimg and publushimg |  |  |  |  |  | 34 Fabricated metal products |  |  |  |  |  |
| 22 | Testile mill products |  |  |  |  |  | Chamical and allied products |  |  |  |  |  | $35 \quad \mathrm{Ma}$ |  | mers | rscepr | lect | deal |
| 23 | Apparel and related prouscis |  |  |  |  |  | Rubore and plastic products |  |  |  |  |  | 36 E10 |  | mica | machi | z\% |  |
| 24 | Lumber and wood products |  |  |  |  |  | Stone, clay min flass products |  |  |  |  |  | 37 Tr |  | por | ior |  |  |
| 25 | Fermiture and fimtures |  |  |  |  |  | Primary metal indurtrios |  |  |  |  |  | 39 Min |  | 11a | (0s ${ }^{\text {ama }}$ | T20 | ¢ำg |
| 26 | gaper amd allied products |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

[^3]
## TABLE II

CORRELATION OF STRUCTURE OF AVERAGE HOURLY EARNINGS IN SIXTEEN CALIFORNIA MANUTACTURING INDUSTRIES IN YEARS 1955-1962

| Years Compared <br> 1954 Base | Coefficient of Rank <br> Order Correlation |
| :---: | :---: |
| $: 1955$ | .978 |
| $\therefore 1956$ | .913 |
| $\therefore 1957$ | .871 |
| $\therefore 1958$ | .774 |
| $\therefore 1959$ | .720 |
| $\therefore 1960$ | .638 |
| $\therefore 1961$ | .620 |

Source of Data: U.S. Department of Commerce, Anmual Survey of Manufactures. 1955-1957, 1959-1962 and UOS. Department of Commerce, Census of Manufactures. 1954 , 1958 。

Using the earnings data presented in Table $I_{9}$ Hypothesis I was tested by rank order correlation The base year in this statistical test was 1954 ，and the results of the rank order correlation are presented in Table II。

In order for this hypothesis to be acceptable for the California manufacturing interindustry wage structure with a population of sixteen industries at the 1 per cent level of significance，the rank order correlation coeffi－ cient（ $R_{S}$ ）had to lie in the confidence interval of $.666-1.000{ }^{2}$ At the 5 per cent level of significance， the rank order correlation coefficient $\left(R_{S}\right)$ had to lie in the confidence interval of $.507-1.0000^{3}$ As can be seen from Table II，all of the rank order correlation coeffi－ cients fall within the 1 per cent confidence interval except those for the years 1960－1962，and these years fall within the 5 per cent confidence interval．Thus it can be concluded that when tested by the techniques of Cullen and Slichter，the California manufacturing interindustry wage structure exhibited a high degree of stability during the period 1954－1962．4．Therefore，Hypothesis I tends to have substantial support．

2．So Siegel，Nonparametric Statistics（New York： McGraw－Hill Book Company，Incog 1956），po 284。

3．Ibid．
4．Cullen，opocitos po 358． Slichters opocitos p。83．

In order to accomplish the second goal of this research, the determination of the factors that influence wages and thus the interindustry wage structure, it is neco essary to test the other previously mentioned hypotheses.

Test of the Relationship Between Value Added Per Worker and Average Hourly Earmings

The relationship between value added per worker and average hourly earnings was tested by the following hypothesis.

> Hypothesis II. The California manufacturing induso tries that have the greatest amount of value added per worker have the highest average hourly earno ings: thus, these California manufacturing industries rank highest in the California manuracturing interindustry wage structure。

This hypothesis was tested by using rank order correlation for the years 1954-1962. The dependent varm iable for each year in the correlation was average hourly earnings; while the independent variable was value added per worker. The results of this test are presented in Table III。

In order for one to accept this hypothesis for the California manufacturing interindustry wage structure during the years 1954 m 1962 , the rank order correlation coefficients had to be evaluated in order to determine whether the suggested relationship between value added per worker and average hourly earnings was due to chance.

TABLE III
CORRELATION OF VALUE ADDED PER WORKER AND AVERAGE HOUREX EARNTNGS FOR SIXTEEN CALIFORNIA MANUTACTURING INDUSTRIES IN THE YEARS $1954-1962$

| Years | Coefficient of Rank Order Correlation | ```Observed t Value``` | $\begin{gathered} 60 \% \\ L e v e 1 \\ t=0.258 \end{gathered}$ | $\begin{gathered} 75 \% \\ \mathrm{Level} \\ t=0692 \end{gathered}$ | $\begin{gathered} 90 \% \\ \text { Leve1 } \\ t=1.345 \end{gathered}$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 1954 | .346 | 1.381 | 5 | 5 | 5 |
| 1955 | - 517 | 2.295 | $s$ | S | 5 |
| 1956 | . 456 | 1.915 | $s$ | S | 5 |
| 1957 | . 404 | 1.652 | 5 | 5 | 5 |
| 1958 | .615 | 2.921 | 5 | 5 | 5 |
| 1959 | . 574 | 2.617 | 5 | 5 | 5 |
| 1960 | .612 | 2.895 | 5 | $s$ | 5 |
| 1961 | .602 | 2.805 | 5 | 5 | 5 |
| 1962 | .639 | 3.106 | $s$ | $s$ | S |

$S=$ Sigmificant value of t at selected level
Source of Data: U.S. Department of Commerce, Annual Survey of Manufactures, 1955-1957, 1959-1962; and U.S. Department of Commerces Census of Manufactures, 195421958.

This evaluation was accomplished by a test of significance for rank order correlation coefficientso 5 The rejection ranges for the association between the two variables to have occurred by chance were drawn at the 60,75 and 90 per cent probability level. The results of these tests are also presented in Table III。 The 60 per cent probability level for the t test of significance for sixteen items is o258, at the 70 per cent probability level it is -692, while at the 90 per cent probability level it is 1.345 .6 The meaning of the 60 per cent probability level is that there is a 40 per cent chance that the $t$ value of the rank order correlation of the observation is greater than 0258 , when in truth the population has a rank order correlation of zero. The meaning of the 75 per cent probm ability level is that there is a 25 per cent chance that the $t$ value of the rank order correlation coefficient of the observation is greater than 0692 , when in trath the population has a rank order correlation of zero. The meaning of the 90 per cent probability level is that there is a 10 per cent chance that the t value of the rank order correm lation coefficient of the observation is greater than 1.345, When in truth the population has a rank order correlation of
5. Siegel, opo citog po 212.
6. R. Fisher and Fo Yates, Statistical Tables For Biological, Agricultural and Medical Research, (Edinburgh: Oliver and Boyd, 1953), Table III。
zero．（This explanation is applicable to the remainder of this paper．）All of the correlation coefficients when tested by the $t$ tests were above the minimum figureso Therefore，the second hypothesis tends to have substantial support．

Test of the Relationship Between Percentage Increases in Employment in an Industry and Averase Hourly Earnings

The relationship between percentage increases in employment in an industry and average hourly earnings was tested by the following hypothesis：

Hypothesis III。 The California manufacturing indus－
tries that have had the greatest cumulative percentage
increases in employment since l95h pay the highest
average hourly earnings；thus，these California
manufacturing industries rank highest in the
California manufacturing interindustry wage structure。
The above hypothesis was tested for the years 1955 1962，again using the rank oxder correlation technique。 The percentage increase in employment was computed with the base year being 1954．Earnings were designated as the dependent variable；and the percentage increase in employment was used as the independent variable in this analysiso The rank order correlation coefficients are presented in Table IV．

In order for one to accept this hypothesis for the California manufacturing interindustry wage structure for the years $1955-1962$ ，the rank order correlation coefficients had to be evaluated to determine whether the suggested relationship between earnings and employment was due to

## TABLE IV

CORRELATION OF PERCENTAGE INCREASES IN EMPLOMMENT IN AN INDUSTRY AND AVERAGE HOURLY EARNINGS FOR SIXTEEN CALIFORNIA MANUFACTURING INDUSTRIES IN THE YEARS 1955-1962

| Years | Coerricient of Rank Order Correlation | $\begin{gathered} \text { Observed } \\ t \\ \text { Value } \end{gathered}$ | $\begin{gathered} 60 \% \\ L e v e 1 \\ t=.258 \end{gathered}$ |
| :---: | :---: | :---: | :---: |
| 1955 | -. 2221 | -. 846 | N |
| 1956 | .099 | - 380 | 5 |
| 1957 | . 352 | 1.404 | S |
| 1958 | .023 | . 086 | W |
| 1959 | . 265 | 1.028 | $s$ |
| 1960 | -297 | 1.164 | S |
| 1961 | -248 | . 957 | 5 |
| 1962 | . 293 | 1.486 | 5 |

$N=$ Nonsignificant value of $t$ at selected level
$S=$ Sigmificant value or $t$ at selected level
Source of Data: U.S. Department of Commerce, Annual Survey of Manuractures, 1955-1957, 19591962; and U.S. Department of Commerce, Census of Manufactures, 195421958.

## TABLE V

CORRELATION OF PERCENTAGE OF FEMALE WORKERS EMPLOYED
IN AN INDUSTRY AND AVERAGE HOURLY EARNINGS TOR SIXTEEN CALITORNIA MANUFACTURING INDUSTRIES IN THE YEARS 1954-1962

|  | Coefficient <br> of Rank Order <br> Correlation | Observed <br> Value | $60 \%$ <br> Level <br> $t=0258$ | $75 \%$ <br> Level <br> $t=.692$ | $90 \%$ <br> Leve1 <br> $t=1.345$ |
| :--- | :---: | :---: | :---: | :---: | :---: |
| 1954 | .517 | 2.270 | S | S | S |
| 1955 | .480 | 2.045 | S | S | S |
| 1956 | .379 | 1.531 | S | S | S |
| 1957 | .230 | .886 | S | S | N |
| 1958 | .502 | 2.169 | S | S | S |
| 1959 | .350 | 1.397 | S | S | S |
| 1960 | .309 | 1.214 | S | S | N |
| 1961 | .324 | 1.283 | S | S | N |
| 1962 | .339 | 1.349 | S | S | S |

$S=$ Significant value of $t$ at selected level
$N=$ Nonsignificant value of $t$ at selected level
Source of Data: State of California, California Statistical Abstract, 1958, 1965: U.S. Department of Commerce, Annual Survey of Manufactures, 1955-1957,
1959-1962; and UoSo Department of Commerce, Census of Manufactures, 1954, 1958.
chance．This was done by subjecting the rank order correm 1ation coerricients to the t test or signiricamee for rank order correlation coefficients．The rejection range for the association to have occurred by chance was again set at the 60 per cent probability level．The results of this test are $2 l$ so presented in Table IV．The test of signife icance for a 60 pex cent probability level for sixteen items is ． 258.7 since two of the rank order correlation coeffi cients when tested by the test fell outside of the 60 per cent probability level，judgment on this hypothesis is withheldo（When judgment is withheld，no testing will be done at higher probability levelso）

Test of the Relationship Between the Percentage of Females Employed in the Industry and Average Hourly Earnings

The relationship between the number of females employed in an industry and average hourly earnings was tested by the rollowing hypothesis：

Hypothesis IV。 The California manufacturing indus－ tries that have the largest percentage or remales in their work force pay the lowest average hourly earnings；thus，these Califormia manuracturing industries rank lowest in the Califormia manufacm turing interindustry wage structure。

The above hypothesis was tested for the years 1954 1962 by rank order correlationo Average hourly earnings

> 7. Ibid。
were designated as the dependent variable; and the percentm age of remale workers in the industry was used as the indopendent variable。 The rank order correlation coefrim cients are presented in Table V。

To accept this hypothesis ${ }_{9}$ the rank order correlam tion coefricients had to be evaluated in ordex to determine whether the suggested degree of association between the percentage of female workers in an industry and average hourly earnings was due to chance. This was done by again subjecting the rank order correlation coeficients to the $t$ tests of sigminicance for rank order cosrelation coefrim cients. The results of these tests are also presented in Table V. The 60 per cent probability level for the test of significance of sixteen items is 0258 , at the 75 per cent probability level it is 069 , while at the 90 per cent probability level it is $1.3450^{8}$ All of the correlation coefficients when subjected to the t tests were greater than 0258 and -692. Therefore, the rourth hypothesis tends to have substantial support when tested at the 60 and 75 per cent levels of probabilityo Judgment is withheld at the 90 per cent levels as some of the $t$ values were less than 10345.

## TABLE VI

CORRELATION OF PERCENTAGE OF UNION MEMBERS IN AN INDUSTRY AND AVERAGE HOURLY EARNINGS FOR TEN CALIFORNIA MANUFACTURING INDUSTRIES IN THE YEARS $1954 \times 1962$

| Years | Coefricient of Rank Order Correlation | $\begin{gathered} \text { Observed } \\ t \\ \text { Value } \end{gathered}$ | $\begin{gathered} 60 \% \\ \mathbb{L e v e l} \\ t=.250 \end{gathered}$ | $\begin{gathered} 60 \% \\ L e v e 1 \\ t=0263 \end{gathered}$ |
| :---: | :---: | :---: | :---: | :---: |
| 1954 | -152 | - 590 | S |  |
| 1955* | .067 | . 178 |  | N |
| 1956* | -. 033 | -. 087 |  | N |
| 1957 | -.030 | $=079$ | NT |  |
| 1958 | - 127 | . 362 | S |  |
| 1959 | . 164 | - 469 | S |  |
| 1960 | . 079 | . 224 | NT |  |
| 1961 | -. 067 | -. 189 | $\mathbb{N}$ |  |
| 1962 | -.067 | -0189 | NT |  |

* Denotes when only nine industries were used.
 $N=N \begin{aligned} & \text { Nonsignificant value of } t \text { at selected level }\end{aligned}$

Source of Data: State of Californiag Union Labor in Califormia, 1960-1962; U.S. Department or Commerce, Annual Survey of Manuractures, 1955-1957, 1959-1962; and U.S. Department of Commerce, Census of Manuractures, 1954, 1958.

Test of the Relationship Between Union Membershio in an Industry and Average Hourly Earnings

The relationship between the number of union members in an industry and average hourly earnings in an industry was tested by the following hypothesis：

Hyeothesis $V$ ．The California manufacturing indusm tries that have the largest percentage of union members in their work force pay the highest average hourly earnings；thus，these California manufactur－ ing industries rank highest in the interindustry wage structure。

This hypothesis also was tested for the years under investigation by rank order correlation。 Once againg aver－ age hourly earnings were designated as the dependent varo iable；and the percentage of union members in an industry was the independent variable．The rank order correlation coefficients are presented in Table VI。

To accept the above hypothesis，the rank order correlation coefficients had to be evaluated in order to determine if the degree of association between the percento age of union members in an industry and average hourly earnings was a matter of chance．Once again this determ mination was done by the use of the t test of significance． Because the population was reduced to ten industry groups for some years and nine for others，the 60 per cent probability level was also changed．9 For nine industries．
the level of acceptance was o263 and for ten industries，it was ．250． 10

The results of the above test of significance are presented in Table VI。 As can be denoted from this table， only three of the correlation coerficients when tested by the $t$ test $f a l l$ within the 60 per cent probability level． Therefore，the rixth hypothesis appears to lack support． Test of the Relationship Between Earnings as a Percentage
of Value Added and Average Hourly Earnings

The relationship between average hourly earnings and earnings as a percentage of value added were tested by the following hypothesis：

> Hyoothesis VI．The California manuracturing induse tries that have the lowest percantage of earmings as a percentage of value added pay the highest average hourly earningsi thus，these Califormia manufacture ing industries rank highest in the California manuracturing intexindustry wage structure。

This hypothesis was tested using rank order corre－ lation for the years 1954－1962．The dependent variable for each year in the correlation was earningsi while the independent variable was average hourly earmings as a percentage of value added．The results of this test are presented in Table VII。

In order to accept this hypothesis for the
Califormia manuracturimg interindustry wage structure

10．Ibid。

## TABLE VII

CORRELATION OF PERCENTAGE OT EARNINGS TO VALUE ADDED AND AVERAGE HOURLY EARNINGS FOR SIXTEEN CALIGORNIA. MANUFACTURTNG INDUSTRIES IN THE YEARS 195401962

| Years | Coefricient of Rank Order Correlation | ```Observed t Value``` | $\begin{gathered} 60 \% \\ L e v e 1 \\ t=0258 \end{gathered}$ |
| :---: | :---: | :---: | :---: |
| 1954 | -0007 | -. 009 | N |
| 1955 | -.135 | -. 509 | N |
| 1956 | . 126 | . 475 | S |
| 1957 | . 195 | . 743 | S |
| 1958 | . 057 | .213 | $\mathbb{N}$ |
| 1959 | . 268 | 1.043 | S |
| 1960 | . 282 | 1.091 | S |
| 1961 | . 221 | . 846 | 5 |
| 1962 | . 229 | . 879 | S |

[^4]Source of Data: U.S. Department of Commerce, Anmual Survey or Manuractures, 1955-1957, 19591962; and U.S. Department of Comerce, Census of Manuractures, $1954,1958$.
during the period under investigation，the rank order correw lation coefricients had to be evaluated to determine whether the swggested relationship was due to chance。 This evalua－ tion was done by means of the t test of significance for rank order correlation coefficients．The rejection point for the above suggested association to have occurred by chance was dram at the 60 per cent probability level。 The 60 per cent probability level for the test of significance for sixteen items is o258． 11 only five of the correlation coefricients，when tested by the t test，fell within this 1evel therefore judgment is witheld on the sixth hypothesis．

Test of the Relationship Between the Percentage of Produc fion Workers in an Industry＇s Work Force and Average Hourly Earnings

The relationship between the percentage of produc－ tion workers in an industry ${ }^{\circ}$ s work force and average hourly earnings was tested by the following hypothesis：

Hypothesis VII．The Califormia manufacturing indusm tries that have the largest percentage of production workers in their total work force pay the lowest average hourly earningsi thws，these Califormia manuracturing industries rank lowest in the California manufacturing interindustry wage structure。

The above hypothesis was tested for the years 1954m 1962 by rank ordex correlationo Average hourly earnings was once again desigmated as the dependent variable；while

11．Ibid。

## TABLE VIII

CORRELATION OT PERCENTAGE OF PRODUCTTON WORKERS IN AN INDUSTRY AND AVERAGE HOURLY EARNINGS FOR SIXTEEN CALITORNIA MANURACTURING INDUSTRIES IN THE YEARS 1954-1962

| Years | Coerricient of Rank Order Correlation | $\begin{gathered} \text { Observed } \\ t \\ \text { Value } \end{gathered}$ | $\begin{gathered} 60 \% \\ t e v e l \\ t=0258 \end{gathered}$ | $\begin{gathered} 75 \% \\ t e v e 1 \\ t=.692 \end{gathered}$ | $\begin{gathered} 90 \% \\ t e v e l \\ t=1.345 \end{gathered}$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 1954 | . 270 | 1.048 | S | 5 | $\mathbb{N}$ |
| 1955 | . 290 | 1.134 | 5 | 5 | N |
| 1956 | - 329 | 1.313 | $s$ | $s$ | N |
| 1957 | .430 | 1.780 | 5 | 5 | S |
| 1958 | .693 | 3.597 | 5 | 5 | $s$ |
| 1959 | . 729 | 3.980 | $s$ | $s$ | $s$ |
| 1960 | -757 | 4.317 | 5 | $s$ | 5 |
| 1961 | . 685 | 3.514 | S | 5 | $s$ |
| 1962 | . 740 | 4.114 | 5 | 5 | 5 |

$S=$ Signinicant value of $t$ at selected level
$N=$ Monsignificant value of $t$ at selected level
Source of Data: U.S. Department of Commerce, Annual Survey of Manufactures, 1955-1957, 1959-1962; and U.S. Department of Commerce, Cemsus or Manuractures, 1954, 1958.
the percentage of production workers was the independent variable．The rank order correlation coefficients are presented in Table VIII。

In order to accept the above hypothesis，the rank order correlation coefficients once again had to be eval－ uated in order to determine whether the suggested degree of association between the percentage of production workers in an industry and average hourly earnings was due to chance。 This was done once again by subjecting the rank order correa Iation coefficients to the testso The $60^{\circ}$ per cent prob－ ability level for the test of significance for sixteen items is o258，while the 75 per cent probability level is .692 and the 90 per cent probability level is 1.345 .12 At the 60 and 75 per cent probability level，the seventh hypothesis tends to have substantial support as all of the correlation coefricients are significant。 Judgment is withheld at the 90 per cent probability level on the seventh hypothesis．

Test of the Relationship Between Value Added Per Worker， Cumulative Percentage Increases in Employment Since 1954， Percemtage of Females in Industry Work Force，Earnings as a Percentage of Value Added，Production Vorkers as a Per－ centage of Total Work Foxce and Average Hourly Earrings

To analyze the relationship between value added per worker，the cumulative percentage increases in employment 12．Ibid．
since 1954，the percentage of remales in an industry ${ }^{\circ}$ s work force，eamings as a percentage of value added，production workers as a percentage of the total work force and average hourly earnings，the following hypothesis was formulated。

Hypothesis VIII．The California manufacturing indus－ tries that have the greatest amount of value added per worker，the largest cumulative percentage increases in employment since 1954 ，the smallest percentage of females in their work force，the lowest percentage of earnings as a portion of value added，and the smallest percentage of production workers in their work force have the highest average hourly earnings； thus，these California manuracturing industries rank highest in the California manufacturing interindustry wage structure。

This hypothesis was tested for the years 1955－1962。 Because of the large number of independent variables（value added per workerg cumulative percentage increases in employ－ ment since 1954 ，percentage of remales in work force，earn－ ings as a percentage of value added，and production workers as a percentage of the work force）that were used in this area of the analysis，it was necessary to utilize multiple regression analysis．The year 1954 was excluded because it was the base year from which the percentage increases in employment were computed． 13 The multiple regression anal－ ysis was computed for the entire period of 1955－1962，as

13．To include the 1954 data would create a statis－ tical fallacy since all employment figures in this year were given a base of 100 for computation of the cumulative per－ centage increases in employment．

## TABLE IX

CORRELATION OF VALUE ADDED PER WORKER, PERCENTAGE INCREASES IN EMPLOYMENT SINCE 1954, PERCENTAGE OF FEMALES IN INDUSTRY WORK FORCE, EARNINGS AS A PERCENTAGE OF VALUE ADDED, PRODUCTION HORKERS AS A PERCENTAGE OF TOTAL WORK FORCE AND AVERAGE HOURLY EARNINGS FOR SIXTEEN CALIFORNIA MANUFACTURING INDUSTRIES IN THE YEARS 1955-1962

## Years

## Multiple Correlation Coefficient

1955
1956
1957
1958
1959
1960
.883
1961
.895
1962
. 883
$1955-1962$

Source of Data: UoS. Department of Commerce, Annual Survey of Manuractures, 1955-1957, 1959-1962, and U.So Department of Commerce, Census of Manuractures, 1954,1958 , state of Californiag Califormia Statistical Abstractr I958, 1965.

## TABLE $X$

PARTIAL CORRELATION COEEICIENTS BETHEEN VALUE ADDED PER WORISER, CUMULATIVE PERCENTAGE INCREASES IN EMPLOYMENT, TEMALES AS A PERCENTAGE OF THE TOTAL WORK FORCE EARNINGS AS A PORTION OF VAXUE ADDED, SKILL LEVEL AND AVERAGE HOURLY EARNINGS FOR STXTEEN CALIFORNIA MANUFACTURING INDUSTRIES FOR YEARS 1955-1962

| Years | Partial Correlation Coerficients |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | Value Added | Employment | Females | Earnings As \% or Value Added | Skill <br> Measure |
| 1955 | 0454 | 0.114 | 0.649 | -0.071 | -. 4880 |
| 1956 | 04.42 | -197 | -. 560 | -0.194 | -. 257 |
| 1957 | -469 | - 280 | -. 518 | -. 192 | -. 565 |
| 1958 | -4,43 | . 298 | -.618 | -0.152 | -0.640 |
| 1959 | -4.58 | . 300 | -. 588 | -. 212 | 0.682 |
| 1960 | 0441 | . 223 | -. 589 | -.177 | -. 667 |
| 1961 | -410 | . 164 | -0.55 | -0.142 | -0.674 |
| 1962 | . 455 | - 182 | 0.576 | -. 186 | -. 660 |
| 1955-1962 | . 546 | . 301 | $-4.470$ | -. 223 | 0.490 |

Source of Data: UoSo Department of Commerce, Ammal

Department of Commerce, Census of Manufactures 1958 ; State of Califormia, Califormia Statistical Abstract, 1958 , 1965.
well as for each of the years under observation．The results of these correlations are presented in Table IX Table $X$ presents the partial correlations for each of the years under observation．（The results of the partial correlations will be analyzed in the next section。）

Table IX denotes that the multiple correlation coefficients for each year are above $R$ ．78．The multiple regression correlation coefficient for the entire period 1955－1962 was $R$ 。836。 For the entire period under investio gation，the coefficient of determination indicates that approximately 70 per cent of the variation in earnings （and thus，the interindustry wage structure）can be explained by the mount of value added per workerg cumula－ tive percentage increases in employment，percentage of females in the work force，earnings as a percentage of Value added，and the percentage of production workers in the work Sorce．Thus based on the data derived from the multiple regression analysis，the eighth hypothesis tends to have substantial support。

## CHAPTER IV。 ANALYSIS OF FINDINGS

At present there does not appear to be a wage theory that completely explains interindustry wage structuresol The theory of bilateral monopoly provides the labor economist with a theory of wage determination which is applicable in situations involving economic power. In this type of a market structure, the buyer of labor is a monopolist or powerful oligopolist in the product market. The buyer of labor deals with a seller of labor who is a monopolist in the labor market.

The determination of the wage rate and the level of employment is a function of the desires of the buyer and seller of labor. The various possible solutions to wage and employment determination under this model and similar models have been discussed previously. These models can be applied in a limited form to all of the industries that constitute the California manufacturing interindustry wage structure。

In the competitive product and labor market models the purely competitive product market and monopsonistic

1. Jo To Dunlop, "The Task of Contemporary Wage Theory, ${ }^{\prime \prime}$ in The Theory of Wage Determination, ed. by J. To Dunlop (London: Macmillan and Coog Ltdos 1957), p. 13.
labor market model, the bilateral monopoly model, and the other models discussed in Chapter $I_{,}$the supply of labor affects the wages paid. In the competitive product and labor market model, the wage rate is set by competitive Porces which interact upon the supply curve and demand curve of labor. Failure by the firm or industry to pay the market determined wage rate results in a loss of the firm ${ }^{0}$ s or industryos labor supply in this type of model。

In all models in which the competitive labor mare ket is lacking and there is no union, it is assumed that the supply curve of labor slopes upward to the right with the marginal cost curve of labor IFing above the supply curve of labor. The upward slope of the supply curve of labor allows for the possibility of various wage and employment decisions to be made by the buyer of labor and the seller of labor. These various employment and wage decisiors have been discussed earlier.

Labor economists at present essentially have only the above suggested relationships derived rrom the various theories of wage determination to aid them in analyzing interindustry wage structureso Although not providing a complete answer, these theories furnish guidelines for the labor economist in his oxplamation of interindastry wage structures.

The models dealing with imperfectly competitive situations in the product and／or factor market furnish a form of ability to pay concept as a possible guideline for the analysis of interindustry wage structures．${ }^{2}$ Much of the research that is being undertaken at present is an attempt to quantiny the suggested factors that arfect ino dustries ${ }^{\circ}$ wages；and thus，affect the interindustry wage structure。 3

Due to the lack of an explanatory model，this study attempted to find the degree of association between certain variables and wages in order to increase the body of data available on interindustry wage structures and thereby help to formulate a more complete theory of wage differences between industries．

Time Period and Data Collection Problems
As indicated earlier，much of this research was hampered by data collection problems．One problem was the lack of available data on a continuous basis before the year 1954． 4 The Annual Survey of Manuractures and the Census of Manufactures were not published before 1969．The 1949

2．D。G。Brown，Expected Ability to Pay and Interindustry Wage Structure in Manufacturing，Industrial and Labor Relations Review，October 1962，ppo $45-46$ ．

3．Ibidos p．62。
4．U．S．Depariment of Commerce，Anmual Survey of Manuractures，1949－1953，passim。
edition of the Annual Survey of Manufactures furnished sparse and inadequate data at the state level． 5

Although data collection improved after 1954，data in the time period under investigation were still so sparse that the two－digit classification level of manufacturing industries was the only one that could be used．The use of the two－digit classification level of industries resulted in a population of only sixteen industries．Although the population is limited，these manufacturing industries produce over 80 per cent of the value added within the state。 6

## Value Added Per Worker as a Measure of Physical Productivity and Prices

Most wage theories indicate that there is a close association between wages and productivity．Productivity is usually defined as changes in physical output per man－ hour．These statistics are not available at the state level and many times，as in this study，value added is used to approximate productivity and price changes together． 7

5．Data on value added were not available for most industry groups in this first volume。

6．U．S．Department of Commerce；Annual Survey of Manuractures．1956，p．60．

7．For a complete discussion of the use of this measure see：R．Perlman，＂Value Productivity and the Interindustry Wage Structure，＂Industrial and Labor Relations Review，October 1956，ppo 26－39。

## Female Workers

One of the characteristics that is associated with low wage paying industries is the involvement of a large number of female workers in the production processo 8 Data． on the number of females employed in the production process in individual industries are not available for the state of California。 The only California data available on females employed in manufacturing industries are total female employment in an industry．9．Therefore，the only relation－ ship in this area that could be tested was the degree or association between average hourly earnings and the total number of females employed in the industry．

## Union Membership

The relationship between the degree of unionization in an industry and an industry＇s average hourly earnings is a complex one。10 In California，data on union membership are not available for all of the two digit industries that were used in this research project．The data collected by

8．Brown opo cit．po 53：
9．State of California，California Statistical Abstract 1956 and 1965.

10．For a full discussion of the types of problems involved in this type of research，see：Jo Wo Garbarino， ＂A Theory of Interindustry Wage Structure Variation， Quarterly Journal of Economics，May 1950，ppo 285－290，and A．Mo Ross and Wo Goldner VForces Affecting the Inter industry Wage Structure，＂Quarterly Journal of Economics， May 1950，passim。
the state Department of Industrial Relations combine several of the two digit industriesoll In order to determine the relationship between average hourly earnings in an industry and the degree of union membership, some of the earnings data of the two digit industries had to be combined. The result of this combination was that the population analyzed in this portion of the research was reduced from sixteen industries to nime for the years 1955 and 1956, and to ten industries for the rest of the years under study.

Analysis done on such a small sample may lead to misleading results and must be carefully qualiried. Also, due to the combination of industries which resulted in a smaller population, data on union membership were not included in the multiple regression analysiso

## Wages and Their Relation to Total Cost

Data on total cost of an industry ${ }^{0}$ s output are not available at the state level for the two digit classificam tion of manufacturing industries. Therefore, earnings and value added were utilized to measure the relationship between wages and total cost. The use or earnings and value added to measure the relationship between wages and total cost is logically consistent, as has been demonstrated
11. State of Califormia, Union Labor in Califormia, 1960-1962。
by D. G. Brow in his article, "Expected Ability to Pay and Interindustry Wage Structure in Manuracturing, 12 and thus offers a measure of this relationship.

Ski11 Mix
Occupational data are not available ror each indusm try at the state level. The only data that are available are on production workers employed in the industry and on the total number of employees employed in the industry. 13 The assumption was made earlier in this study that the industries that employ the greatest percentage of production workers have the lowest level of skill mix.

Analysis of findings of Hypotheses

## Measurement of stability

The rirst objective of this research was to replim cate the type of research done by Slichter and Culien on a national scale in the field of interindustry wage
12. Brown, opo citog po 55.
13. U.S. Department of Commerce, mivisions and States, ${ }^{\text {P Annal Survey of Manuractures, } 1949-1953 \text {, 1955 }}$ 1957 , 1959-1962, passimo
U.S. Department of Commerce, Mivisions and States, Census of Manuractures 1954 . 1958 , passim.
wage structures． 14 In accomplishing this task，the rollow－ ing hypothesis was tested．

Hypothesis I．The California manufacturing interm industry wage structure during the period 195401962 had a high degree of stability．

The rank order correlation coefficients presented in Table II indicate that industry rankings within the Califormia manufacturing interindustry wage structure for the years under investigation were highly stable．According to the data in Table $I I_{\text {，this degree of stability would have }}$ occurred by chance only five times out of one hundred．This observation is similar to those denoted by Slichter and Cullen．However，there are several qualifications that need to be made concerning the stability of the Califormia manum facturing interindustry wage structure。

The rirst qualirication is that the time span in which this research was conducted was very narrow due to the lack of available data for all the industries under investigation．The base year of this study was 1954。 This year was chosen because data of the nature used in

14。 D。E。Cullen，＂The Interindustry Wage Struco ture，1899－1950，American Economic Reviews June 1956， p．358．

So H．Slichter，＂Notes on the structure of Wages，The Review of Economics and Statistics．February 1950，po 88。
this research were not available for any period prior to 1954 at the state levelo 15

The significance of this lack of data can be observed from Table II。 From this table, it can be seen that over time there is a decrease in the values of the rank order correlation coefficients. It is possible that if this research could have covered a longer period of time, the structure might have exhibited a different degree of stability than it does。

It also must be noted that the use of average hourly earnings to approximate average hourly wage rates probably caused an upward bias in the relationship between some of the industries $\begin{gathered}\text { wage data and the variables that were corm }\end{gathered}$ related with the industries ${ }^{\circ}$ wages. Thus in some cases in which this bias occurred, the correlation between an industry ${ }^{\circ}$ s wages and the independent variable was higher than would have appeared had actual wage rates been available: 16 This type of bias may have occurred because it is impossible to adjust the data used in this research to many of the factors that are discussed in the previous chapters, factors which tend to overestimate the worker ${ }^{0}$ s

[^5]pay for a period of time, égog vacation pay, in some industries. (Industries that have few fringe benefits will have average hourly earnings closely approximating average hourly wage rates. Those industries that have many fringe benefits will have average hourly earnings exceeding average hourly wage rates.)

Test of the Relationship Between Value Added Per Worker and Average Hourly Earnings

The relationship between value added per worker and average houriy earnings was tested by the following hypothesis:

> Hyoothesis II $\quad$ The California manufacturing indusm tries that have the sreatest amount of value added per worker have the highest average hourly earno ings thus, these California manuracturing industries rank highest in the California manufacturing intero industry wage structure.

The rank order correlation coefficients derived from the testing of the above hypothesis were presented in Table III。 It appears that for all years investigated, the rank order correlation coefricients, when subjected to the $t$ tests of significance at the probability level of 90 per cent indicated that the relationship stated in the above hypothesis had a great probability of not having been caused by chance。 (The hypothesis will always be accepted at the highest level possible, therefore, there is no need to discuss accoptance at lower levels of probabilityo) If the results of Table III had been evaluated at the 95
per cent probability level，judgment on this hypothesis－ would have been withheld as two of the correlation coeffim cients would have been less than the minimum value of 1．761。

If one is willing to accept the 90 per cent probm ability levels then the conclusions drawn concerning the relationship between value added per worker and average hourly earnings is similar to the conclusions reached by Perlman，Slichter，and Eisenmanno 17

The rank order correlation coefficients in Table III are very misleading when judged without qualificationo The use of average hourly earnings，as mentioned previously， overestimates the average hourly wage rates．In additiong when value added is used to measure productivitys an upward bias occurs in the degree of association unless prices are stable during the period under investigation．The strongest conclusion that can be drawn from this hypothesis is that there is a high degree of association between value added per worker and average hourly earningso

Since value added per worker reflects changes in output per manhour and price changes， 18 it can be inferred

[^6]from the previously stated relationship that there is a positive degree of association between productivity and price changes and wages.

This inference is not anique one. Wage and employment theory suggests that for firms and industries, the purchasing of units of labor is partially related to productivity. An increase in productivity will cause an increase in wages in almost all market models but the purely competitive one。 If the models are analymed under periods in which money prices are allowed to change, then increases In prices will shint the marginal revenue product curve of labor to the right。 In all market structures, this shift will tend to cause the firms or industries to pay higher wages in the long run. Thus, the above suggested relationship between value added per worker and average hourly earnings has validity within the realm of economic theory.

Test of the Relationship Between Cumulative Percentage Increases in Employment and Average Hourly Earnings

The third hypothesis was tested to determine the relationship between cumulative percentage increases in employment and average hourly earnings. The hypothesis used to test chis relationship is as follows:

Hypothesis III. The California manufacturing industries that have had the greatest cumulative percentage increases in employment since 1954 pay the highest average hourly earnings; thus, these California manufacturing industries rank
highest in the Califormia manufacturing inter－ industry wage structure。

The rank order correlation coerficients derived from the test of the above hypothesis were presented in Table IV。 It appears that for all but two of the years investigated， the rank order correlation coefficients，when subjected to the $t$ test of significance at the 60 per cent probability level，indicated some degree of association．However， because two of the $t$ values fell outside of the acceptable level，judgment was withheld on this hypothesis．If one is willing to accept the results at the 60 per cent probw ability level，then these results are similar to those of Dunlop and Ross and Goldner． 19

Although not supported by the results of the hypo－ thesis involving employment and average hourly earnings，the expected association between cumulative percentage increases in employment and average hourly earnings is derived from the framework of wage and employment theory．Assume that the industry or firm faces an upward sloping supply curve of labor．This supply curve indicates that additional units of labor to be attracted to the industry must be paid a higher wage rate than the previous units．This type of

[^7]supply curve can occur during periods in which the economy is at full or near full employment. The "tight labor market" causes all industries to pay higher wages to attract additional units of labor. Those industries that have the greatest desire for additional units of labor will have to pay the higher wages. Thus, the relationship between increases in empleyment and average hourly earnings that is suggested by the above hypothesis appears to have validity within the realm of economic theory, although this research did not support the hypothesis.

Test of the Relationship Between the Percentage of Females in an Industry and Average Hourly Earnings

The degree of association between the number of
females in an industry and average hourly earnings was tested by the following hypothesis:

Hypothesis TV. The California manufacturing industries that have the largest percentage of females in their work force pay the lowest average houriy earnings; thus, these California manufacturing industries rank lowest in the California manfacm turing interindustry wage structure。

The rank order correlation coefricients derived from the test of the above hypothesis were presented in Table $V$. When subjected to the tests of significance, all of the rank order correlation coefficients indicated that the relationship stated in the above hypothesis has a probability of not having been caused by chance when evaluated at the 75 per cent probability level. Judgment in regard
to this hypothesis at the 90 per cent probability level is withheld as three of the $t$ values were less than the minimum acceptable value (1.345) at this level. If one is willing to accept the results of the evaluation of the rank order correlation coefficients at the 75 per cent probability level, one can conclude from this analysis that there is a high degree of association between the percentage of female workers in an industry and average hourly earnings. The results of this test are similar to those arrived at by Brown in his research。 20

If one accepts the hypothesis at the 75 per cent probability level, the reswlts of this test must be qualified in that the relationship derived rrom this hypothesis is only applicable to total remale employment in the industry and average hourly earmings and is not related to the relationship between percentage of females in the production classification of workers and average hourly earnings. It is possible that this latter relationship may not exhibit the same type of association as the former.

Economic analysis suggests that industries which employ large numbers of remales may pay lower wages than industries that do not. There are three possible reasons for this phenomenon。 The first is that historically women
20. Brown, opo cito, po 56.
have been paid less than men. This precedent then may explain why wages are lower in industries that employ large numbers of women.

The second possible reason is the high turnover rate among female employees as opposed to male employees. Industries tend to pay women lower wages because it is assumed due to the high turnover rate that they have no long term goals in the industry and thus will work por lower wages than men。

The third suggested reason why women receive lower wages than men is the assumption that women cannot do the same work as men and therefore, should be paid accordingly.

Due to these above suggested reasonss it is possible that industries that employ large numbers of women will tend to pay lower wages than industries that do not have as large a number of women employed in them. Thus, the above mentioned hypothesis when accepted at the 75 per cent probability level tends to have validity in economic analysiso

Test of the Relationship Between Union Membershio in an
Industry and Average Hourly Earnings
The relationship between union membership in an industry and average hourly earnings was tested by the rollowing hypothesis:

Hypothesis $V$ The California manuracturing induso tries that have the largest percentage of union members in their work rorce pay the highest average hourly earningsi thus, these California
manuracturing industries rank highest in the Califormia manuracturing interindustry wage structure。

The rank order correlation coefricients derived rrom the testing of the above hypothesis were presented in Table VI。 When subjected to the t test of significance，only three of the yearly correlation coerficients indicated that the relationship stated in the above hypothesis has a great probability of not having been caused by chance。 Because the other rank order correlation coefficients did not indim cate such，the relationship between the degree of union membership and average hourly earnings over the whole period was deemed to be caused by chance．

The results of this test differ from Garbarino ${ }^{\circ}$ research in this area． 21 Garbarino reached the conclusiong as mas discussed previouslyp that there was some degree or association between the above mentioned variableso However． this degree of association was inferredo The results of the investigation or the two variables for the Califormia manuracturing industries are also different rrom the results obtained by Ross and Goldnero 22

The conclusions that Ross and Goldnex reached after studying the relationship between the degree or union membership in an industry and vages was that the industries

21．Garbarino，opo citos ppo 305－306。
22．Ross and Goldner，opocito，ppo 278－282．
whose labor force had experienced rapid increases in union membership in the $1930^{\circ}$ s also experienced rapid increases in employment and wages．They inferred that unions estabm lished before the $1930^{\circ}$ s did not grow as rapidly as those established in the $1930^{\circ}$ s and did not experience the same increase in wages． 23

Based on the statistical evidence presented in this paper，no conclusions can be drawn concerning the relation－ ship between union membership and wages for the California manufacturing interindustry wage structure．The data are much too sparse and fragmented．

The above suggested relationship between union membership and wages cannot be verified in this study。 However，this suggested relationship is based on one of the models of wage determination The bilateral monopoly theory of wage determination suggests that the single seller of labor and the single buyer of labor may bargain for wages within a previously discussed zone。 The single seller of labor to the firm or industry in this case could be aniono If the union is stronger than the buyer of laborg wages would tend to be higher than in a firm or industry in which the buyer of labor is stronger than the seller．This particular relationship needs mach further research which cannot be undertaken in a paper of this size。

23．Ibid．

Test of the Relationship Between Earnings as a Percentage of Value Added and Average Hourly Earnings

To test the relationship between earnings as a percentage of value added and average hourly earnings，the following hypothesis was formulated：

Hypothesis VI．The California manufacturing indus－ tries that have the lowest percentage of earnings as a portion of value added pay the highest average hourly earnings；thus，these California manuracturm ing industries rank highest in the California manufacturing interindustry wage structure。

The rank order correlation coefficients derived from the test of the above hypothesis are presented in Table VII。 AIl but three of the rank order correlation coefficients when subjected to the $t$ test of significance indicated that the relationship stated in the above hypothesis had some probability of not having been caused by chance at the 60 per cent level of probability．However，because three of the $t$ values were below the minimum $t$ values judgment is withheld on this hypothesis．If one is willing to accept this hypothesis at the 60 per cent probability levelg one can conclude that there is some degree of association between earnings as a percentage of value added and average hourly earnings．If one accepts this hypothesis at this level；the conclusions reached are similar to those derived by Brown in his work。 24

24．Brown，opo citos po 56．

AIthough Hypothesis VI involving the association between earnings as a percentage of value added and average hourly earnings did not have substantial support, the association between the two variables can be derived from economic theory. If as presented in Chapter II, earnings can be used to approximate labor costs and value added can be used to approximate value of the outputg then the following analysis is applicable. If the demand for a particular resource is a small portion of the industryos value of the output produced, increases in the cost of the resource will not result in a large decrease in its purchase。 Thuss it is possible that if earnings are a small portion of value added, increases in average hourly earnings will not result in a larger decrease in the number of units of labor purchased.

Test of the Relationship Between Percentage of Production Workers in an Industry and Average Hourly Earnings

The relationship between the percentage of produce. tion workers in an industry and average hourly earnings was tested by the rollowing hypothesis:

Hypothesis VII. The California manufacturing industries that have the largest percentage of production workers in their total labor force pay the lowest average hourly earnings; thus, these California manufacturing industries rank lowest in the California manuracturing interindustry wage structure。

The rank order correlation coefficients derived from the test of the above hypothesis were presented in Table VIII. All of the rank order correlation coefricients when subjected to the $t$ test of significance indicated that the relationship stated in the above hypothesis had some probo ability of not having been caused by chance when evaluated at the 75 per cent probability level。 Judgment in regard to this hypothesis at the 90 per cent probability level is withheld as three of the $t$ values were less than the mine imum acceptable value (1.345) at this level。 If one is willing to accept the results of the evaluation of the rank order correlation coefficients at the 75 per cent probability level, one can conclude that there is a high degree of association between the percentage of production workers in the work force of an industry and average hourly earnings.

Wage and employment theory indicates that skilled workers receive higher wages than unskilled workerso In industries that have large amounts of low skilled production workers, labor cost as a percentage of total cost should be high. These industries in which the marginal revenue product of labor is lower than industries employing large amounts of skilled workers will pay low wages because the marginal revenue product per worker is lower. Thus, the previously established association between earnings as a percentage of value added and average hourly earnings can
be explained by economic theory, when evaluated at the 75 per cent probability level.

If the above is not valid, it may be possible that another portion of economic theory can be used to explain this relationship。 If a particular type of labor involved in the production of a commodity is a small percentage of the total cost of the commodity, then the demand for labor to this firm or industry is highly inelastic, such that increases in average hourly earnings will have little effect on the units of labor purchased.

Test of the Relationship Between Value Added Per Worker, Cumulative Percentage Increases in Employment, Percentage of Female Workers in an Industry, Earnings as a Percentage of Value Added, Percentage of Production Workers in an Industry and Average Hourly Earnings

In order to analyze the relationship between value added per worker, the cumulative percentage increase in employment since 1954, the percentage of females in an industry ${ }^{0}$ s work force, earnings as a percentage of value added, production workers as a percentage of an industry ${ }^{0}$ s work force and average hourly earnings, the following hypothesis was formulated:

Hypothesis VIII. The Califormia manufacturing industries that have the greatest amount of value added per worker, the largest cumulative percentage increases in employment since 1954, the smallest percentage of females in their total work forces the lowest percentage of earnings as a portion of value added, and smallest percentage of production
workers in their work force have the highest average hourly earnings; thus, these California manufacturing industries rank highest in the California manufacturing interindustry wage structure.

The multiple correlation coefficients presented in Table IX establish the degree of association between the independent variables, value added per workerg cumulative percentage increases in employment since 1954, percentage of females in an industry ${ }^{0}$ s total labor force, earnings as a percentage of value added, and production workers as a percentage of the total work force in an industry and the dependent variable, average hourly earningso for the entire period under investigation, about 70 per cent of the variation in average hourly earnings can be explained by the independent variables. These results are similar to those derived by Brown from the multiple regression utilized in his study。 25

The time span used in this research was the main factor 1 imiting the regression analysis which determined the degree of association between the independent variables and the dependent variable. The time period used in this research is too short to draw definite conclusions concerning the relationship between the independent variableso

As in other portions of this study, the research in this section concerning the degree of association between

> 25. Ibid.s po 58.
the independent variables stated above and the dependent variable was hampered by the lack of continuous data over a long period of time。 However, several tentative conclusions can be derived concerning the California manufacturing interindustry wage structure which, in turn, can be evolved into a simple economic theory. This theory is presented below.

> Theory of the Structure of the California Manuracturing Interindustry Wage Structure

Statistical Evidence of Relationships
The multiple regression analysis that was used to determine the degree of association between the independent variables and the dependent variable (average hourly earno ings) also furnished partial correlation coefficientso These partial correlation coefficients are presented in Table XI. Each of the independent variables degree of association with average hourly earnings, as formulated in Hypothesis VIII, is indicated by the partial correlation coefficientso Since Hypothesis VIII concerns the relationship of the independent variables with industries that pay high average hourly earnings; the negative partial correlation coefficients indicate the variables that may tend to depress wages. Thus, these variables have a low degree of association with industries that pay high average hourly

TABLE XI
PARTIAL CORRELATION COEFFICIENTS BETUEEN VALUE ADDED PER WORKER, EARNINGS AS A PERCENTAGE OF VALUE ADDED, FEMALES AS A PERCENTAGE OF THE TOTAL WORK TORCE SKILL LEVEL, CUMULATIVE PERCENTAGE INCREASES IN EMPLOYMENT AND AVERAGE HOURLY EARNINGS FOR SIXTEEN CALIFORNIA MANUFACTURING INDUSTRIES FOR YEARS 1955-1962

Partial Correlation Coefficients
Earnings
Value As $\%$ of
Skill
Years Added Value Added Females Measure Employment

| 1955 | . 454 | 0.071 | -..649 | -. 480 | -. 114 |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 1956 | . 442 | -. 194 | -. 560 | -. 257 | . 197 |
| 1957 | .469 | . 192 | -. 518 | -. 565 | - 280 |
| 1958 | -4.43 | -. 152 | -. 618 | -. 640 | - 298 |
| 1959 | .458 | -. 212 | -. 588 | -. 682 | .300 |
| 1960 | -4,41 | 0.177 | -. 0589 | -. 667 | . 223 |
| 1961 | .410 | $-.142$ | -. 554 | -. 674 | . 164 |
| 1962 | . 455 | -. 186 | -. 576 | -. 660 | . 182 |
| 1955-1962 | . 546 | -. 223 | $-.470$ | -. 490 | . 301 |

Source of Data: U.So Department of Commerce, Anmual Survey of Manufactures, $1955-1957,1959-1962$, and U.S. Department of Commerce, Census of Manufactures. 1954 . 1958: State of California, California Statistical Abstract, 1958. 1965.
earnings and a high degree of association with industries that pay low average hourly earnings.

Thus it appears that California industries that paid high average hourly earnings during the period under investigation, relative to other industries in the structure, had larger amounts of value added per worker, earnings as a smaller percentage of value added, smaller numbers of females in their total labor force, higher skill levels, and larger cumulative percentage increases in employmento The above conclusion was used to formulate a theory explaining industry rankings in the California manufacturing interindustry wage structure during the period under study.

The Supply Curve of Labor for Industries in the California Manufacturing Interindustiy Wage Structure

It is assumed that in this explanation the supply curves of labor for the industries of the structure are upward sloping to the right. The $y$ intercept of the supply curve for any given industry in the structure is determined by the number of females employed in the given industry.

This assumption concerning the supply curves of labor for the industries in the structure is based on the theory that during the period under investigation, the California manufacturing industries ${ }^{\circ}$ labor market was one that could be classified as a "tight labor market。" This
"tight labor market" might be accounted for by a combination of the following three variables.

The first variable that may account for this upward sloping supply curve of labor for California manafacturing industries is that potential entrants into the state"s labor market tended to stay in school longer than potential entrants into manufacturing labor markets in other sectors of the economy. The effect of this delayed entrance was to Corce industries desiring additional units of labor to pay high average hourly earnings to these potential employees in order to induce them to discontinue their education. The second variable that might cause the supply curve of labor for an industry to slope upward to the right is a decrease in the industry ${ }^{0}$ s mandatory retirement age。 Thus, workers leave the industry and possibly create a shortage of workers during periods in which the "tight labor marketu is in efrect. Many of these workers will not be rehired by other manufacturing industries due to their age。 If they are hired by other industries, it is possible that they will enter the industry only at an average hourly earnings which is higher than the one paid to them by the previous industry.

The third factor which might cause this upward sloping supply curve of labor for a manuracturing industry is the decrease of potential entrants due to increased draft
quotaso: Industries experiencing an increase in the demand for labor are raced with a shortage of possible employees due to increased draft calls. In order to attract potential employees away from other industries, they must pay higher average hourly earmings.

None of these variables by themselves provides a complete esplanation of the upward sloping supply curve of labor in a California manufacturing industry。 However, all three may constitute an explanation for the direction of the curve。

The Demand for Labor in the Industries that Constitute the California Manuracturing Interindustry Wage Structure

Traditional wage and employment theory suggests that units of labor are hired up to the point where the marginal cost of the last unit of labor employed is equal to the marginal revenue product of the last unit of labor employed.

Assume that a marginal revenue product curve for labor can be estimated for each California manufacturing industry. The exact slope and location of this curve will then be affected by two factors. If the marginal revenue product of labor is high per worker, the curve will lie far out in the fourth quadrant. If the marginal revenue product of labor is lows the curve will lie nearer the origin of the fourth quadrant.

The actual slope of the marginal revenue product curve of labor is partially a function of the demand for labor by the industry．If the units of labor are a small portion of total cost，increases in average hourly earnings will not result in a large decrease in the quantity or labor．Thus，the marginal revenue product curve of labor will be highly inelastico

## Application of Supply and Demand Analysis

The interaction of the supply curve and demand curve of labor（marginal revenue product curve of labor） provides a partial explanation of wage determination in the California manufacturing industries and thus indirectiy relates an explanation of the state ${ }^{0}$ s manufacturing inter－ industry wage structure。

This explanation is based on the following assumpo tions for a given period of time．

1．Industry $A^{0}$ s marginal revenue product for units of labor is higher than for any other industry in the structure。

2．Industry $A{ }^{\circ}$ s marginal revenue product curve of labor is more inelastic than any other industry ${ }^{0}$ s marginal revenue product curve of labor in the structure。

3．Industry $A^{\circ}$ s supply curve of labor is more inelastic than any other industry ${ }^{\circ}$ s supply curve of labor in the structure。

4．Industry $A^{\circ}$ s supply curve of labor has a higher $y$ intercept than any other industry ${ }^{0}$ s supply curve of labor in the structare。
5. There are no unions.

Due to the above assumptions, Industry A will pay higher wages than any other industry. Economic theory then suggests that interindustry wage structures may partially be explained by the interaction of the supply curve of labor for a given industry and the demand curve of labor for that industry。 Industries exhibiting the four above characterm istics will pay higher wages relative to those industries that do not.

The above theory may also partially explain the California manufacturing interindustry wage structure。 However, approximate values must be used to estimate the conditions stated in the above assumptions.

In order to determine the validity of this theory for the California manuracturing interindustry wage strucm ture, the following estimates were made:

> 1. Marginal revenue product of labor-value added per worker
> 2. Elasticity of marginal revenue product curve of labor earnings as a portion of value added and production workers as a portion of total labor force
3. Supply curve of labor cumulative percentage increases in employment
4. Supply curve of labor ${ }^{0}$ s $y$ intercept on the $y$ axismpercentage of remales employed in the industry

Using the above estimates, the following statement can be made to determine whether the previously discussed wage and employment theory can explain wage determination in an industry and thas the industry ${ }^{0}$ s ranking in the interindustry wage structure。

California industries that pay high average hourly earnings are characterized relative to other manuracturing industries by a higher amount of value added per worker, by earnings being a smaller portion of value added, by a smaller percentage of production workers in relation to the total labor force, by a larger cumulative percentage increase in employment, and by fewer female workers in their total labor force Low wage paying industries in the California manufacturing interindustry wage structure are conversely characterized by a lower amount of value added per worker, by earnings being a larger portion of value added, by a larger percentage of production workers in relation to total employment, by smaller cumulative percentage increases in employment, and by a larger percentage of females in the labor force.

The above statements can be verified by observing the top and bottom quartiles of the California manuractur ing interindustry wage structure during the years 1955 1962. The following industries constituted the top quare tile for most of the period under investigation:

TABLE XII
1955 DATA ON SUGGESTED TACTORS AFTECTING AVERAGE MOURUY EARNINGS AND AVERACE KOURUY EARNTNGS FOR INDUSTRTES IN TKYF TOP AND BOTTOM QUARTILES OF OALITORNIA MANTEAGTURTHG INDUSTRIES BASED ON 1955 RENRTNGE

|  | AWerege Hodrey Exmnims | Cumulatrife \% Therease <br>  | $V 2 y$ An Aded per Horker | Expmingsl Valme Added | Eemales/ Total Kabor FOTCB | Productron <br>  Total Forkers |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Incustrix six Top Muxstire |  |  |  |  |  |  |
| Prex mixng amo publish | 2.56 | 105081 | 1301351 | -3291 | - 42608 | . 56485 |
| Rublor and plastic procucts | 2.32 | 108.90 | 12.6691 | -4192 | - 32845 | . 81152 |
| Transportatiom | 2.30 | 103.81 | 11.2694 | - 42.27 | -23896 | 071041 |
| Primery motal incustrics | 2.29 | 120.25 | 11.9224 | $\text { - } 3824$ | $.10010$ | $.83990$ |
| Imowstries im Bottom ounsitile |  |  |  |  |  |  |
|  | 1093 | 109.499 | 10.795 | - 3718 | 061840 | 01331 |
| \%(1) Mnd krmurec products | 2.33 | 106.09 | 140.284 | $02620$ | - 39231 | $-71929$ |
| Texityle mirll producciss | 1.66 | 121001 | 8.9691 | $-3709$ | -61864 | -84602 |
| Apomser mme relatec procucts | 1.50 | 108.19 | 6.1537 | - 4,408 | . 85651 | . 87368 |

## TABLE XIII

1956 DRTA ON SUGGESTED FACTORS ATRECTING AVERAGE KOURLY EARNIGGS AND AVERAGE HOURLY PARNTNGS TOR TNDUSTRIES IN THE TOR AND BOTTOM QUARTILES OF CALTEORAXA MANUTACTURING TADUSTRIES BASED ON 1956 RANKTHES

|  | Avorece Howsily <br>  | Cumy Increase in Employment | VaIme Adced per Horker | Earmings Value Added | Temales! Total Rabor Force | Producciom Workers/ Total Workers |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Imdustries im Tow Quartile |  |  |  |  |  |  |
| Primitimg and puorishimg | 2.70 | 117.55 | 1401351 | - 33150 | -4,3595 | . 59098 |
| Tramsportatiom | 2.40 | 206.58 | $13.236 \%$ | - 3846 | -25228 | . 68045 |
| Primary metal industrios | 2.36 | 12 th . 77 | 12.5752 | - 3783 | -10142 | . 82898 |
| Rubber and plastic products | 2.31 | 108.99 | 11.1901 | -4079 | . 33200 | .79309 |
| Indestrics im Bottom Qumitile |  |  |  |  |  |  |
| Food and kindre products | 2.01 | 110.37 | 140.6420 | - 2662 | -40919 | - 22310 |
| Miscellaneous manuracturimg | 2.00 | 116.25 | 10.3309 | - 3748 | . 26908 | -72375 |
| Testinc mill products | 1.72 | 108. 14 | 8.3111 | -4135 | . 55510 | . 85184 |
| Apparel ame related products | 1.55 | 109.39 | 6.1892 | . 4.538 | . 85272 | - 67360 | Calisomma Statistreal Abstract 1958.

TABLE XIV
1957 DATA ON SUGGESTED RACTORS AFTECTING AYRRAGE HOURLY RARNTNGS AND AVERAGE HOURLY EARNINGS FOR INDUSTRXES IN TRE TOP AN BOTTOM QUARTILES OF CALITORNIA MANURAGXURING INDUSTRIES BASED ON 1957 RANKINGS

|  | AWerase <br> Yourly Watinitg s |  Jmarease in Emioyment | VaI以 Adx per korker | (2smumgs Valu Added | Temedes! Total Iabor Tosee | Production Woricers TOEAL WOrkers |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Industries in Top Qunitill |  |  |  |  |  |  |
|  | 2085 | 121.83 | 15.0560 | - 3236 | -42332 | . 58394 |
| Primary metal fncustrics | 2.54 | 121.013 | 12.7387 | - 3940 | -10380 | - 01130 |
| Transportatiom | 2.52 | 110.61 | 140407 | -3629 | -2k988 | . 65960 |
| Rutiocr ano plastre products | 2.39 | 308.45 | 111.9058 | - 3968 | -34075 | -79334 |
| Industries in Botuom Ouxirtill |  |  |  |  |  |  |
| Food a w rimered products | 2.11 | 104,89 | 16.154, | 02507 | - 0338 | .66689 |
| Formiture and fixsures | 2.03 | 119.52 | 9.21104 | - 4188 | -21540 | -81656 |
| Textill mixl products | 12.70 | 106. 10 | 8.3600 | -3974 | - 50146 | - 84365 |
| Apparel and related products | 1.57 | 104.06 | 6.6729 | -6256 | .8637 | .85831 | Califormia Statistical Alostract, 1958.

TABLE XV
1958 DATA OR SUGGESTED RACTORS MFRECTING AVERAGE KOURY TARNINGS AND
 QUARTILES OR CALIFORNEA MANUTACTURTNG INDUSTRIES BASED ON 1958 RANKTHES


1959 DATA ON SUGGESTED RACTORS AFECTING AVERAGE KOURY EARNTNGS AND AVERAGE KOURLY EAROENGS FOR INDUSTRIES IN TEE TOP AND BOTTOM
QUARTLLES OF CALTEORNIA MANUTACTURING INDUSTRIES BASED ON 1959 RANTINGS

|  | Ayerage Bourly Emrnimgs | Cumratise \% <br> Increase in Employment | Varue Aded per Workes | Earmings Value Aded | Females/ Total Rabor Foree | Prometion Workers <br> Total Uorkers |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Industries in Top Quartile |  |  |  |  |  |  |
| Printimg and publishing | 2.99 | 132.32 | 16.4232 | - 3259 | -42160 | . 62128 |
| Miscollancous mamuractenrimg | 2.96 | 170.20 | 18.1688 | - 3302 | - 14.460 | . 536435 |
| Primary metal industries | 2.80 | 133.59 | 1 $\mathrm{H}, 0283$ | - 3891 | -11736 | . 79452 |
| Tramsportation | 2.78 | 89.49 | 1407631 | . 3851 | . 24.946 | . 65357 |
|  |  |  | 1 |  |  |  |
| Industries in Bottom Qunrtile |  |  |  |  |  |  |
| Food and kindred products | 2.31 | 107.31 | 18. 5889 | -24381 | - 21628 | . 694448 |
| Furmiture and xixtures | 2.30 | 131.29 | 10.6012 | -4291 | -21653 | -82116 |
| Testile mill proumets | 1.91 | 103.67 | 21.3905 | -3349 | - 45035 | .78581 |
| Apparel and related products | 1.67 | 102.52 | 7.2250 | - 4158 | - 9198 | . 87186 |

TABLE XVIT
1960 DATA ON SUGGESTED FACTORS AFFECTTEG ANERAGE EOURUY EARNITGS AND AVERAGE EOTRUY EARNTNGS TOR TNDUSTRIES ITN TES TOP AND BOTTOM QUARTIRES OT CALIMORNIA MANURACTURING INDUSTRTES BASED ON 1960 RANAINGS

|  | Aberage HOB5Iy槵2rming s | Cumulatio \% Increase in Eraployment | Varue Acded per Worker | Karmingsl Valw Added | Females/ Total labor Forec. | Production Woriers/ Total Worlers |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Trumstries in Tom ewartill |  |  |  |  |  |  |
| Miscellameous mamuracturimg | 3.10 | 170.63 | 19.1633 | - 3256 | -14351 | -50374 |
| Printing and publis shimg | 3.04 | 133.79 | 16.7892 | - 3250 | -44123 | -62236 |
| Transportation | 2.87 | 79.30 | 17.0132 | - 3522 | . 25081 | . 63582 |
| Primary metal imdustries | 2.82 | 124.21 | 13.9313 | - 40004 | - IIS30 | . 78298 |
| Iralustries in Bottom eumitile |  |  |  |  |  |  |
| Tus riture ancl fixtwres | 2.39 | 120.63 | 10.9258 | - 4391 | . 22676 | .79994 |
| Lumber and rood procucts | 2.38 | 91. 543 | 9.2102 | . 5339 | $\bigcirc 07233$ | -87502 |
| Testile mill producis | 1.98 | 11209 | 12.0676 | - 3326 | .07233 | -78548 |
| Apparel amd related products | 1.73 | 97.69 | 7.8593 | . 3906 | . 97785 | $\bigcirc 87282$ |

TABKE XVITI
1961 DATA OM SUGGESTE FAGTORS ATYECTING AVERAGE HOURIY EARNINGS AND AVERAGE HOURIY EARATNGS FOR INDUSTRES IM THE TOP AND BOTTOM QUARIXLES OF CALIFORNTA MANYFACSURIAG INDUSTRIES EASED ON 1961 RANKIMGS

|  |  Howrly Earmincs | Cumintivo \% Inerease in Fmoloyment | Valre Added per Worker | Earmings/ Varue Added | Temares! Total labor rorec | Production Norkers/ Totel Workers |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Industrics in Top Quartilo |  |  |  |  |  |  |
| Primeing and publichaing | 3.19 | 136.79 | 17. 3152 | - 3340 | -43154 | . 617843 |
| Miscellancous mamuracturimg | 3.14 | 166.64 | 17.7043 | - 3562 | -15579 | - 56776 |
| Transportation | 2.99 | 71.15 | 18.3878 | - 3362 | -24332 | . 58164 |
| Primary metal imdustries | 2.94 | 122.12 | 13.9271 | -4122 | -11120 | . 79856 |
| Industries in Botcom eumitile |  |  |  |  |  |  |
| Turaniture and fiscores | 20, 2,5 | 124.91 | 11.232k | -4377 | . 22329 | . 80540 |
| Lumber and rood products | 2.40 | 84.13 | 9.4 .956 | - 5255 | -07394 | -87598 |
| Textile rill products | 2.03 | 115.61 | 12.2125 | - 3411 | -44231 | . 77519 |
| Apparel way rolated procucts | 1.76 | 102.78 | 8.0704 | - 3862 | -92334 | . 87263 |

TABRE XIX


|  | Arrease Howrly <br>  | Cumernative \% Trarease 品 Wmploymer | Vales Acted per forker | W2rmimes Valw Added | Twales/ Total Labor FOICE | Proderejom WOrkers Total Worters |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Tmemstries im Top Ouarcirle |  |  |  |  |  |  |
|  | 3.36 | 141028 | 18.1312 | . 3354 | -43422 | . 62219 |
| Miscellameovs namuracturine | 3.22 | 198.78 | 19.8744 | - 3331 | - 14989 | - 57624 |
| Tramsportation | 3.12 | 65.59 | 21.3140 | - 3038 | -25006 | - 53829 |
| Primary metal jodustrios | 3.05 | 129.22 | 14.654,2 | -4070 | - 10748 | -800ls7 |
|  |  |  | + |  |  |  |
| Industries in Botuom Mxastrie |  |  |  |  |  |  |
| Rutuer and plastre products | 20.4.0 | 161.32 | 140453 |  |  |  |
| Lunber mme wood procucts | 20, 06 | 80.56 | 10.2691 | $.5055$ | $-0782$ | - 87491 |
| Textile mill products | 2.15 | 12.50 .94 | 14.2825 | - 3068 | - 47938 | - $7705 \%$ |
| Apparel mmerelated products | 1.80 | 102.08 | 882566 | - 3948 | -97181 | - 86478 |

1。 Printing and publishing
2. Miscellaneous manufactaring

3o. Transportation
4. Primary metal industries

The bottom quartile for most of the period under investigation was structured as rollows:

1. Tood and kindred products
2. Furmiture and Pixtures
3. Textile mill products
4. Apparel and related products

One can deduce from Tables XII to XIX that the industries in the top and bottom quartiles of the California manuracturing interindustry wage structure on the whole exhibited the characteristics discussed earlier, namely those that are associated with these quartileso However because of the changing value of characteristics, the quartiles are not completely stable.

It appears then that the economic theory presented earlier in this chapter partially explains the California manuracturing interindustry vage structure when examined by the use of estimated values However, some variables are still not accounted for, and these may aid in a better formulation of an economic modelo These are presented in Chapter Vo

## Economic Significance of This Research

Although it does not furnish a new theory of interm industry wage struetureg this study does further reinforce
the statistical evidence on variables that influence wageso It also indicates that the interindustry wage structure within a state may exhibit the same degree of stability as that at the national level.

This analysis, along with the others that have preceded, it, may be useful to labor economists trying to explain industry wage differenceso It may also be useful to management and union personnel who engage in the colleco tive bargaining process by furnishing some insight into the factors that influence high wageso

## CHAPTER V．CONCLUSIONS

This research has furnished the following general conclusions that expand the area of economic knowledge．

1．The California manufacturing interindustry wage structure appears to exhibit the same high degree of stability as does the national interindustry wage structure。

2．The same independent variables（value added per worker，cumulative percentage increases in employment，earnings as a percentage of value added，production workers as a portion of total employment，and percentage of females in an industry）that appear to influ－ ence average hourly earnings in the national manufacturing interindustry wage structure also appear to influence the California manufacturing interindustry wage structure。

Duplication of the Studies Done of the National Interindus－ try Vage Structure

This study indicates that the concept of the existm ence of a high degree of stability in interindustry wage structures，which up to the present has been acknowledged only at the national level，may also apply to a small geographic area（Califormia）。

Furthermore，several previous studies in the area of the factors that affect wages have been given further strength。 The use of value added to approximate produc－ tivity and price changes has been given further strength by this study．The rank order correlation coefficients between
value added and average hourly earnings indicate a high degree of association between these two variables when calculated from California manufacturing industrieso data。

The theory of the high degree of association between rapid increases in employment in an industry and high average hourly earnings is an area in which research should be continued. It is possible that the positive relationship between employment and average hourly earnings may be supported by the leading or lagging of the independent variable. Unfortunately, this type of analysis was beyond the scope of this paper.

The use of earnings and value added to approximate labor cost and total cost in this study has not produced substantial results. This is due to data problems that most likely can only be solved when data which are a closer approximation to labor cost and total cost are made available by industry group.

The suggested hypothesis that industries that employ a large percentage of females pay low average hourly earnm ings appears to have some support in the California manum racturing interindustry wage structure. There appears to be a positive degree of association between the number of remales in an industry and low average hourly earnings.

The relationship between union membership and averm age hourly earnings appears to be a relationship in which
much further research must be conducted. The research presented here indicates that for any investigation of the degree of association between union membership and average hourly earnings, the time period utilized should be longer than ten years and that more accurate data are needed than are now available。

The concept that several independent variables arfect wages has been given further reinforcement by the multiple regression analysis used in this researcho The research indicates that the independent variables lamount of value added per worker, cumulative percentage increases in employment, earnings as a percentage of value added, production workers as a portion of total employment, and the percentage of females in an industry) explain approximately 70 per cent of the variation in average hourly earnings during the period 1955-1962。

Areas of Further Research
All of the results and conclusions of the study must be considered as only tentative due to the lack of available data over a long period of time. To strengthen the findings concerning the interindustry wage structure within a small geographic area, research should be con ducted in other small geographic areas.

More research should be conducted in the area of the relationship between employment and wages and labor
cost as a portion of total cost and wageso Further research in this area might enable one to investigate in greater detail the relationship of these two factors and wages so that some positive conclusions in this area can be reached.

Another area of investigation which might be helpful would be in the area of intrastate comparisons. This might determine whether the interindustry wage structure within a state has the same degree of stability as do the state interindustry wage structures and the national interindustry wage structure.

Much work is yet to be done in the area of the construction of conversion factors in order that data collected by the Bureau of Labor Statistics will be comparable with those of the Department of Commerce. The use of both these agencies statistics in the same study might enable researchers to gain more knowledge concerning the interm industry wage structure。

Currently, data collection appears to be the most pressing problem in this fielde Very little data are available over a long period of time on factors that might affect the interindustry wage structure. Research should be done in the collection of data at both the state and national level in order to obtain more knowledge of additional variables that affect wages.

TABLE XX
CALTFORNIA GENERAL STATISTICS BY INDUSTRY GROUR: 1954



| Industry | 1 mployees | Productuon workers |  |  | Value added my mamracture (\$1,000) |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | Total (mumbor) | Total (number) | $\begin{gathered} \text { Manmhours } \\ (1,000) \end{gathered}$ | $\begin{gathered} \text { Wages } \\ \left(\$ \$_{5} \mathbf{S}_{2000)}\right. \end{gathered}$ |  |
| Food and kimdrod products | 1498902 | 107,823 | 206,429 | 399.059 | $1.522,972$ |
| Textele mill products | 5.923 | 5,011 | 10,029 | 16,668 | 4,4.4.944, |
| Apparal and related products | 60,670 | 53.006 | 96,003 | 143.783 | 326.184 |
| Lumber and wood products | 58,920 | 52,586 | 105,242 | 228885 | 500.278 |
| Furnemere and xistures | 25.485 | 21, 145 | 41.053 | 80,256 | 182, 524 |
| Paper and allited products | 21.789 | 17.5469 | 36.4 .53 | 75.695 | 196,3x |
| Printxmg and perbi shimg | 57.755 | 32.623 | 59,350 | 151.763 | 461.129 |
| Chomicals mel zilied procucts | 33,610 | 21.795 | 42.848 | 90,211 | 468.896 |
| Rubber and plastic products | 17.800 | 14.4845 | 30.292 | 70,206 | 168,271 |
| Stone, clay and glass products | - 340.777 | 28,605 | 55,583 | 113.714 | 335.653 |
| Prenmery metal industries | 46,389 | 38,962 | 78.416 | 177.643 | 4643,582 |
| Tabricatea metal proutcts | 75.781 | 60.429 | 118,655 | 251.764 | 631.108 |
| Machinerys escept electrical | 74, 4,40 | 55.523 | 114, 128 | 253.064 | $633 . \operatorname{lng} 76$ |
| Electrical machimery | 57,582 | 429074 | 84.887 | 164,968 | 4.43 .410 |
| Transportation equipment | 288,644 | 205,057 | 428,934 | 987.345 | 2,310,862 |
| Miscelameous mameracturimg | - 50.935 | 36,696 | 70.191 | 136.767 | - 367.232 |

[^8]TABRE RXII
CAZITORNIA GENERAR STATISTICS BY INDUSTRY GROUP: 1956

| Industisy | employees | Production workers |  |  | $\begin{gathered} \text { Value } \\ \text { added by } \\ \text { mampacturs } \\ (\$ 1,000) \\ \hline \end{gathered}$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\begin{gathered} \text { Total } \\ \text { ( } \mathrm{mamber}) \\ \hline \end{gathered}$ | $\begin{gathered} \text { Total } \\ \text { (mumber) } \end{gathered}$ | $\begin{gathered} \text { inamonours } \\ (1,000) \end{gathered}$ | $\begin{aligned} & \text { Wages } \\ & (\$ 4000) \\ & \hline \end{aligned}$ |  |
| Food amd kindred products | 155,229 | 112, 276 | 217.656 | 437.202 | 106492052 |
| Testrile mill products | 5.710 | $44^{8} 86$ | 9.712 | 16,717 | 40.1225 |
| Apparel me roluted products | 61.344 | 53, 593 | 97,103 | 150,535 | 331.698 |
| Lamber anc wood products | 58,580 | 51.994 | 103.411 | 231,316 | 483.655 |
| Furmiture and fixstures | 27.4245 | 22,625 | 4, 砍, 280 | 89,574 | 208, 167 |
| Paper and allice producty | 23.258 | 18.785 | 38.659 | 83.956 | 225,106 |
| Preatcime mad pentishnimg | 61.327 | 36.248 | $64_{3} 088$ | 172.905 | 517. 654 |
| chmicals and allied products | 35,464 | 23.013 | 48.012 | 103,010 | 522,811 |
| Rubser and plastic products | 18,230 | 14.9,58 | 28.603 | 65.986 | 161,787 |
| Stome clay amolylass products | 35,24,9 | 28.725 | 55,580 | 122,000 | 400.944 |
| Primary metal indestriss | 48.767 | 40.4227 | 81.332 | 192,297 | 508,377 |
| Fabricated metal products | 80.788 | 64,131 | 124, 473 | 279,589 | 7179671 |
| Machumery, meapt electrical | 81. 197 | 60,269 | 1240, 137 | 285, 115 | 692,051 |
| Elcotrical machinery | 67.134 | 49.926 | 94, 470 | 205, 977 | 517. ${ }^{\text {年875 }}$ |
| Tremsportation equr memt | 309, 405 | 210,535 | 4,47229 | 1,071,666 | 2, 286,718 |
| Miscellaneous manuracturimg | 54, 4,497 | 39,406 | 76,045 | 152,301 | 407.099 |



TABKI $\mathbb{E X T I}$
CARTFORNIA GENRRAR STATKSTICS BY INDUSTRY GROUR8 1957

| Trabustyy | 11 maloyess | Production workers |  |  | $\begin{gathered} \text { Value } \\ \text { sded } \\ \text { many } \\ (\$ 1,000) \\ \hline \end{gathered}$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\begin{gathered} \text { Total } \\ (\text { mesmber }) \\ \hline \end{gathered}$ | $\begin{gathered} \text { Toral } \\ \text { (mumber) } \end{gathered}$ | $\begin{gathered} M a m m o w s s \\ (1,000) \end{gathered}$ | $\begin{array}{r} W 2 g e 5 \\ (\$ 8,000) \\ \hline \end{array}$ |  |
| Food and kindred products | 159.850 | 106,599 | $20{ }^{2} 9648$ | 431.660 | 1,722,048 |
| Textrile maill products | 5.673 | 4.588 | 9,361 | 15,899 | 40,021 |
| Apparel and related products | 58,94,6 | 50, 594 | 91,992 | $1{ }^{1+34} 2785$ | 340,212 |
| Lumber and wood products | 54,978 | 48.162 | 92,620 | 213,315 | 432021 |
| Furmaiture and risstures | 27.290 | 22,284 | 42,378 | 85,963 | 205,24.5 |
| Paper me alited products | 23.822 | 19,219 | 39.203 | 87.991 | 253.011 |
| Primtrmg and perbij shimg | 64,322 | 37,560 | 64.4.58 | 182, 974 | 565,505 |
| Chmicals amd mided products | 36,292 | 23.220 | 48.065 | 109,370 | 564.837 |
| Rubber and plastic products | 18.126 | 145380 | 28.382 | 67.940 | 1719205 |
| Stone, clay and glass products | - 35,721 | 28,829 | 55.598 | 127.655 | 4502161 |
| Primery motal jndustries | 48.687 | 39.500 | 78,088 | 198,228 | 503,178 |
| Fabricated metal products | 85, 429 | 66, 431 | 129.561 | 296,392 | 8043619 |
| Machimery, ercept olectrical | 88,016 | 62,718 | 127.403 | 303, 136 | 7340158 |
| Electrical machimery | 76, 334 | 53.309 | 103.941 | 239.834 | 655,796 |
| Transportedtion equipment | 331.264 | 218,502 | $4,58,844$ | 2.139.101 | 3,147.982 |
| Mrscellameows manux | 66.354 | 4078.848 | 879816 | 190.2 等9 | 511,502 |



TABLE XXIV
CALIFORNIA GENERAL STATISTICS BY INDUSTRY GROUP: 1958

| Indestery | 11 employees | Production workers |  |  | Value <br> added by <br> manectare <br> $(\$ 1,000)$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\begin{gathered} \text { Total } \\ \text { (number) } \end{gathered}$ | $\begin{gathered} \text { Total } \\ \text { (number) } \end{gathered}$ | $\begin{gathered} \text { Mamehouss } \\ -(1,000) \\ \hline \end{gathered}$ | $\begin{array}{r} \text { Mases } \\ (\$ 1,000) \\ \hline \end{array}$ |  |
| Food and kindred products | 1578.709 | 110,4,99 | 209.486 | 467.966 | $1,906,895$ |
| Textile mill products | 5.401 | 4,302 | 8,554 | 15, 4.94 | 4,6, 162 |
| Apparel and relluad products | 56,934 | 48,388 | 87.160 | 1428806 | 331, 118 |
| lember and wood products | 51.569 | $4,4,876$ | 89,178 | 207,663 | 400,992 |
| Wumbiture and risutures | 27.489 | 22,264 | 42.761 | 96,978 | 215,143 |
| Paper and allied procucts | 24,469 | 19.873 | 40,298 | 94,823 | 263.460 |
| Prating and publishing | 64, 197 | 38.291 | 69,127 | 20\%,813 | 596.651 |
| Cnemicals and allied products | 32,588 | 19,569 | 39.264 | 98,588 | 596.735 |
| Rubber and plastic products | 23,810 | 118,287 | 36.076 | 85.120 | 248.361 |
| stones clay and glass products | s 41,283 | 32,338 | 63,938 | 156.371 | 484.311 |
| Primary metal imdustrites | 468.444 | 36,870 | 72.448 | 1979123 | 505.561 |
| Fabricated metal products | 85,023 | 64,876 | 127,851 | 323.780 | 856.353 |
| Machumy, escert eloctrical | 78,665 | 53.265 | 106,243 | 275,275 | 767.748 |
| Electrical machimery | 85,548 | 59.856 | 120.538 | 280,584 | 808,190 |
| Transportation equipment | 264,550 | 175,110 | 360,377 | 965,750 | 2,525,462 |
| Miscellameous manuacturing | 91.429 | 57.363 | 118.589 | 328.608 | 958,4074 |



| Industry | employees | Production workers |  |  | Value added by manufacture $(\$ 1,000)$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | Total (number) | $\begin{gathered} \text { Total } \\ \text { (number) } \\ \hline \end{gathered}$ | $\begin{gathered} \text { Man-hours } \\ (1,000) \\ \hline \end{gathered}$ | $\begin{gathered} \text { Wages } \\ (\$ 1,000) \end{gathered}$ |  |
| Food and kindred products | 157,040 | 109,061 | 213.566 | 494,857 | 2,027,328 |
| Textile mill products | 5,934 | 4,663 | 9,336 | 17,788 | 53,114 |
| Apparel and related products | 57,608 | 50,226 | 90,416 | 150.905 | 362,884 |
| Lumber and wood products | 55,487 | 48,920 | 101,622 | 238,275 | 4949243 |
| Furniture and fixtures | 29,808 | 24,477 | 48,386 | 111,350 | 259.486 |
| Paper and allied products | 26,306 | 20,633 | 43.922 | 104,923 | 311.031 |
| Printing and publishing | 65,666 | 40.797 | 72,953 | 218,392 | 670, 017 |
| Chemicals and allied products | 33,930 | 20,466 | 40.784 | 106,593 | 681,287 |
| Rubber and plastic products | 26,169 | 20,278 | 39,906 | 96,196 | 281,557 |
| Stone, clay and glass products | 45,174 | 35,942 | 70,678 | 177,962 | 561,654 |
| Primary metal industries | 50,404 | 40,047 | 78,046 | 218,602 | 561,792 |
| Fabricated metal products | 86,643 | 66,846 | 135,364 | 350,283 | 967,242 |
| Machinery, except electrical | 86,770 | 60,384 | 118,961 | 316,067 | 913.472 |
| Electrical machinery | 103,315 | 69,705 | 140,607 | 345,587 | 1,035.475 |
| Transportation equipment | 270,483 | 176,779 | 361,949 | 1,005,143 | 2,609,811 |
| Miscellaneous manufacturing | 107,548 | 57,694 | 117,102 | 346,086 | 1,048,231 |

[^9]TABEE XXVI
CAZIEORNIA GENERAL STATISTICS BY INDESTRY GROUP: 2960

| Industry | 11 molowees | Production workers |  |  | Value |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | Total (nembers) | $\begin{gathered} \text { Total } \\ (\text { mumbers) } \\ \hline \end{gathered}$ | $\begin{gathered} M \operatorname{manowrs} \\ (1,000) \end{gathered}$ | $\begin{gathered} \text { Wases } \\ \left(x_{2} 000\right) \end{gathered}$ | manuracture $(\$ 1,000)$ |
| Food and krndred products | 159,858 | 110,566 | 218,037 | 526.625 | $2,132,457$ |
| Textill mill produncts | 6.418 | 5.042 | 10.287 | 20.345 | 60.8135 |
| Apparcl and related products | 54.834 | -47,860 | 85,156 | 146.934 | 376, 146 |
| Lumbers and wood products | 52,1138 | 14,5,622 | 9408081 | 224,346 | 4202188 |
| Fermiture and frimtures | 28,116 | 22,491 | 4,5,226 | 107889 | $24^{4} 5738$ |
| Paper and allifed prouncts | 25.884 | 20,309 | 42.738 | 107,350 | 295,593 |
| Primutmg and publin shing | 66.298 | 41.248 | 73.977 | 225,065 | 692.319 |
| Chmmicas amd allied products | 33.521 | 20,155 | 418098 | 108,283 | 689,968 |
| Rubber and plastro products | 26.747 | 20.587 | 40.929 | 101.076 | 293,518 |
| Stone, olay and glass products | 5 4, ${ }^{2} 923$ | 34.906 | 68,560 | 173.852 | 560.735 |
| Primary metal imdenstries | 51,400 | 140,245 | 79.561 | 224, 4,95 | 560.664 |
| Tubricated metal products | 88,305 | 66,934 | 135.329 | 357,613 | 941.691 |
| Machimery, ercept ellectrical | 82.806 | 55,743 | 112.764 | 310,375 | 853.660 |
| Electrical mackimery | 134.581 | 83.120 | 169.543 | 427.760 | 1.300 .743 |
| Tramsportation equipmemt | 240.172 | 152,704 | 318,810 | 914.939 | 2.597 .981 |
| Miscellaneous manuracturirag | 1148816 | 57.837 | 116.389 | 360,880 | 1.108 .346 |



TABLE XXYIT
CADTEORNIA GENERAL STATISTICS BY INDUSTRY GROUP: I961

| Imadestry | 11 employees | Production workers |  |  | $\begin{gathered} \text { Valde } \\ \text { added by } \\ \text { manractur } \\ \left(\frac{1}{12000} 0\right. \end{gathered}$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | Total (numbes) | $\begin{gathered} \text { Total } \\ \text { (numbers) } \end{gathered}$ | $\begin{gathered} \text { Marabours } \\ (1,000) \end{gathered}$ | $\begin{gathered} \text { Wages } \\ (\$ 1,000) \end{gathered}$ |  |
| Food and kindred products | 161.776 | 111.522 | 218,007 | 546,969 | 2,276,015 |
| Testide mill produces | 6.708 | 5.200 | 10,645 | 21.660 | 63,505 |
| Apparel and related products | 57.705 | 50,355 | 89.137 | 156.937 | 406.386 |
| Lember and wood procucts | $44^{4} 863$ | 41.927 | 87.054 | 209,198 | 3989124 |
| Fusmiture and rixtures | 28.915 | 23,288 | 46.788 | 114,505 | 261.580 |
| Paper amd allited products | 26.497 | 20.729 | 43.283 | 112,522 | 323,921 |
| Primitmg ma publix shimg | 68,307 | 428.175 | 76,427 | 243.907 | 730,269 |
| Chnuicals and allied products | 34, 214 | 20.227 | 42,380 | 113.057 | 707.4048 |
| Rebber and plastio products | 27.235 | 20.863 | 41.792 | 101,888 | 3048123 |
| Stomes clay and glass products | - 44, 293 | 35,002 | 68,307 | 182,784 | 593.529 |
| Primary metal imdustiriss | 49.552 | 39.570 | 77.305 | 227, 137 | 551,097 |
| Fabricated metal products | 89.706 | 67.953 | 135.895 | 375,331 | 980,526 |
| Machinery oxcept electrical | 86,650 | 58.365 | 121,386 | 335.992 | 962, 4,78 |
| Electrical machimery | 1450, 034 | 87.336 | 1778185 | 466,508 | 11.4630463 |
| Transportation equipment | 241, 653 | 14005540 | 289,009 | 865,463 | 2,584, 479 |
| Miscellanoous manuracturing | 99, 4981 | 56.487 | 113,508 | 356,224 | $10_{9} 000062$ |

[^10]TABCE XXVITI
CALITORNXA GENERAL STATISTICS BY INDUSTRY GROUP: 1962

| Indestry | 12 emplorees | Production workers |  |  | $\begin{gathered} \text { Value } \\ \text { 2dded by } \\ \text { mandactars } \\ (\$ 1,000) \end{gathered}$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | Total (number) | Total (number) | $\begin{gathered} \text { Manwhouss } \\ (1,000) \end{gathered}$ | $\begin{array}{r} \text { W2ges } \\ (\$ 1000) \\ \hline \end{array}$ |  |
| Food and krmared products | 160.4457 | 109.977 | 216,745 | 569.617 | 2,291,989 |
| Testille mill products | 6,768 | 5.215 | 10,605 | 22,853 | 74,483 |
| Apparel and related products | 57,830 | 50,010 | 90.723 | 163,017 | 412,915 |
| Lumber and wood products | 45.888 | 40,148 | 84.735 | 208,393 | 4129284 |
| Fumbiture and cistures | 29.226 | 23.485 | 49.330 | 1248586 | 278,501 |
| Paper and allied products | 28,268 | 22,392 | 466,499 | 123,949 | 363,772 |
| Primtemg and publitshimg | 69,956 | 43.526 | 78,817 | 264, 670 | 789.178 |
| Chemicals and arlied products | 34.753 | 20.915 | $4,2,840$ | 117.239 | 724.560 |
| Rublor 2nd plastic procucts | 27.828 | 21,398 | $4,3.64,3$ | 107.962 | 309.315 |
| Stone, clay and glass products | s 43,558 | 34.101 | 66,397 | 185,580 | 6128889 |
| Primary metal industries | 52,308 | 41.871 | 82,005 | 249.727 | 613.584 |
| Fabricated metal products | 90.174 | 68,679 | 140.257 | 397.767 | 1.037 .563 |
| Machumery ercept electrical | 98.658 | 65,392 | 139.748 | 396,959 | 121350404 |
| Eloctrical machinery | 159.179 | 99.315 | 206, 172 | 555,359 | 1,846, 357 |
| Transportstion equipment | 240.709 | 129.571 | 268,540 | 839.002 | 2,7610.680 |
| Miscellaneous manueatursmg | 116,934 | 67,382 | 138, ${ }^{3} 52$ | 4466.042 | 1.339 .175 |



TABCE XXTK
CALTFORNIA GENERAL STATISTICS BY TNDUSTRY GROUP: 1963

| Industry | cmoloyees | Production woxters |  |  | Vallo acdec by mannecture (象 1000 ) |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | Total (mumber) | TOXDI (mumber) | $\begin{gathered} \text { Mancmours } \\ (1,000) \end{gathered}$ | $\begin{array}{r} 19808 \\ \left(5 \$_{0} 000\right) \\ \hline \end{array}$ |  |
| rood and kimered products | 155.731 | 109, 654 | 566,87\% | 216,773 | 2,452,211 |
| Textil maill prodmets | 6.805 | 5.678 | $2{ }^{4} 213$ | 11.480 | 79.18 |
| Apparel and related products | 63.559 | 55.081 | 182,972 | 1100.275 | 428.337 |
| maber and wood products | 51.906 | 4.5,902 | 24,4, 579 | 100.239 | 511.509 |
| Fusritimre 2nd wood produrts | 32.125 | 26,368 | 1349491 | 51.491 | 316.032 |
| paper and alli poroducts | 28.865 | 22,761 | 128,682 | 46,510 | 367.727 |
| Printing and poblil shing | 74.407 | 45.367 | 287,203 | 83.465 | 819.511 |
| Chomicals and allied products | 35.703 | 21, 4,81 | 126.761 | 43.257 | 813.948 |
| Rubber and plastic products | 29,275 | 22,972 | 117.785 | 46,363 | 337.006 |
| stones clay and glass products | 45.645 | 34.771 | 202,658 | 70.648 | 658, 67 |
| Pramary metal industrios | 48.469 | 38.840 | 242,929 | 77.519 | 592.451 |
| Fabricated metal products | 88,535 | 69,085 | 393,903 | 141.758 | 1,059,871 |
| Machinery escept electrical | 93,308 | 61, 548 | 373.592 | 125,354 | 11,078,390 |
| Electrical machimery | 187,965 | 110,507 | 629.671 | 225,300 | 2,162,756 |
| Transportation equxpment | 202,090 | 125,861 | 868,209 | 261,991 | 2,742,346 |
| Miscellanoous mawracturing | 24.650 | 75.844 | 486.728 | 14.8 .855 | $12.935,2.95$ |
| UoS. Department of Commerce, Census or Mamuracuses, Ereliminars Estrmater 1963, ppo 5011 = 5-15. |  |  |  |  |  |

## APPENDIX B

TABLE XXX
WOWEN WAGE AND SALARY WORKERS ${ }^{\text {a }}$ IN CALTFORNIA MANUTACTURING INDUSTRIES, 1954.1962
(In thousands)

| Industry | 1954 | 1955 | 1956 | 1957 | 1958 | 1959 | 1960. | 1961 |
| :--- | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: |
|  |  |  |  |  |  |  |  |  |

anIncludes administrative, supervisory, sales, technicals and office persomel as well as production and related workers. Does not include employer, ommaccount workers, and unpaid family workers. Detail may not add to total because of rounding.

Source of Data: State of California, California Statistical Abstract, 1958, 1965.


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[^4]:    $N=$ Nonsignificant value of t at selected level
    $S=$ Significant value of $t$ at selected level

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