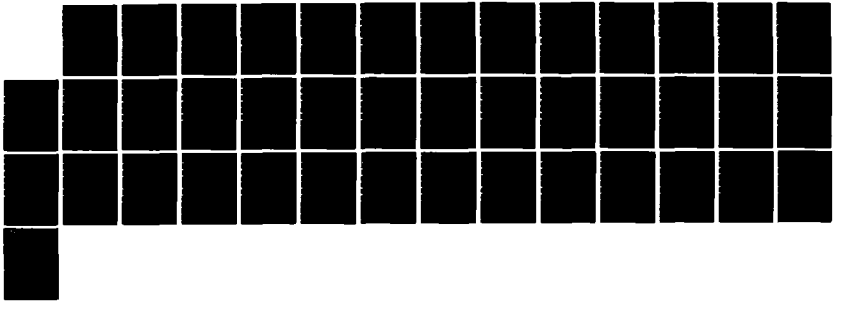
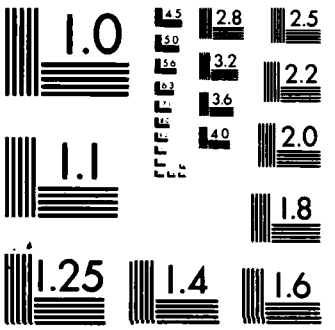
AD-A139 761 ETTIMATING DIFFERENCES IN AREA-LEVEL IMPACTS OF VARIOUS 1/1
RECRUITING RESOUR..(U) DUKE UNIV DURHAM NC CENTER FOR
APPLIED BUSINESS RESEARCH R C MOREY AUG 83 ONR-200-10
UNCLASSIFIED N00014-80-C-0200 F/G 5/1 NL





MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS 1963-A

AD A139761

(12)

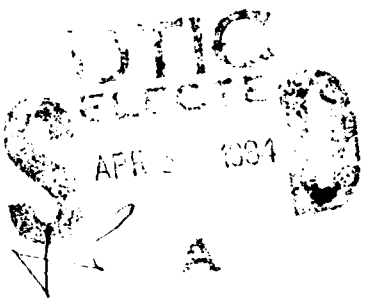
ESTIMATING DIFFERENCES IN AREA-LEVEL IMPACTS OF VARIOUS RECRUITING RESOURCES:

Can Different Recruiting Areas and Years by Pooled?

Final Rpt

Contract N00014-80-C-0200

Report ONR-200-10



Principal Investigator: Richard C. Morey, Ph.D.

August, 1983

DTIC FILE COPY

This document has been approved for public release and sale; its distribution is unlimited.

TABLE OF CONTENTS

	Page Number
1.0 BACKGROUND	1
1.1 Background on "Pooling"	1
1.2 Thrust of This Effort	2
2.0 OVERVIEW OF POOLING TESTS	3
2.1 Hypotheses to be Tested	3
2.2 The Two Types of Pooling Tests Utilized	4
3.0 CONTEXTS OF POOLING TESTS	5
3.1 Overview of Six Navy Recruiting Areas as of September, 1982	5
3.2 Comparison of Outcomes Over Fiscal Years 80, 81, and 82	5
4.0 RESULTS OF POOLINT TESTS	6
4.1 Male, Non-Prior Service, Upper Mental, HSDG Contracts	6
4.2 Results of Pooling Analyses for Local Leads	11
4.3 Results of Area Pooling For Navy-Sourced NOIC Leads for FY80	12
4.4 Results of Pooling Analysis for JADOR-Sourced NOIC Leads for FY80	14
4.5 Results of Pooling Analysis for Total NOIC Leads (Regardless of Source)	15
5.0 CONCLUSIONS	17
APPENDIX	18

DTIC COPY INSPECTED

TABLES

Table 1 - Overview of Six Navy Recruiting Areas (as of 9/82)

Table 2 - Comparison of Key Outcomes and Resources for Navy for FY80, FY81, and FY82

Table 3 - Comparison of Nation-Wide Elasticities from FY81 Data (From 2 Different Regression Approaches)

Table 4 - Area Level Elasticities for FY81

Table 5 - Area Level Recruiter Elasticities for Using FY81 and FY82 Data

Table 6 - National and Area Level Effects Related to Production of Male Local Leads (Qualified and Interested) from LAMS Advertising (Based on FY82 Experience)

Table 7 - Long Term Elasticities for Navy-Sourced NOIC Leads (Based on FY80)

Table 8 - Long Term National and Area Level Elasticities for JADOR-Sourced NOIC Leads (Based on FY80)

Table 9 - Long Term National and Area Level Elasticities for Total NOIC Leads (Regardless of Source of Advertising) for FY79, FY80 (FY80: 146,465)

Appendix - Table 1a - Comparison of Results from Different Data Bases Related to Contracts (HSG's, Non-HSG's, UMHSDG's)

Table 2a - Comparison of Results from Different Data Bases Related to Production of Local Leads (Male, Qualified and Interested)

1.0 INTRODUCTION

1.1 Background on "Pooling"

A substantial amount of manpower supply modeling has been performed over the past several years with the goal of being better able to predict and explain the diverse factors, resources and environmental considerations that impact on Department of Defense enlistments. Regression models have been developed for the numbers of male, non-prior service, quality (e.g., High School Degree Graduate (HSDG's) and/or Mental Category I-III U) enlistments, as well as for various types of national leads (e.g., NOIC leads from a Navy source or from Joint DOD advertising (JADOR) sources), and for local leads. An Appendix summarizes the findings of this investigator over the past five years.

Manpower models have utilized cross-sectional data, time series data, and so called "pooled" cross-sectional, time-series observations which afford the modeler both types of variation to gain insights. This investigator's efforts have generally been of the last pooled type where the observations (cells) are typically at the district, monthly level, sometimes over several fiscal years. The thrust of these models have been to estimate the impacts that various demographics (e.g., the local unemployment rate, size of male High School senior population, etc.) in a district and its resources (e.g., number of production recruiters in district, dollars of various types of advertising) have on obtaining certain types of supply limited recruits. One of the key outputs of these models are elasticities of various types, i.e., the marginal percent change in the dependent variable (e.g., male, Upper Mental, HSDG, non-prior service, enlistment contracts) that results from a 1% change in the independent variable (e.g., the number of production recruiters located in a district). The key implicit assumption has been that there is a single elasticity for each factor that applies for all districts. In addition, if several years of data are combined, it has also been assumed that the

elasticity of interest would be invariant over the different years.

It is important to appreciate that past analyses have not assumed, e.g., that the impact of additional recruiters in different districts would be identical in any absolute sense, but rather that the marginal proportional impacts would be the same. Indeed some of the models developed explicitly allowed the impacts, within a given district, over and above any adjustments for a district's unique demographics and propensities, to be different. This was modeled by allowing each district to have its own separate intercept. However, it must be recognized that in the past there has been a strong assumption made regarding the commonality of the slopes (i.e., elasticities) across districts, across areas and usually across different fiscal years.

The results of the above models have generally yielded intuitively palatable results and have also been shown to predict quite well at the national level. For example, when the model developed from monthly-district data over the period FY76-FY78 was applied to forecast the numbers of quality enlistments for FY79 and FY80, the predictors were within 2-3% of the actuals, when viewed at the national level. However it must be admitted that the predictors did not fare nearly as well at the area or district level, where discrepancies of 15-20% were sometimes observed.

1.2 Thrust of This Effort

The thrust of the efforts reported herein have been to systematically subject the data to rigorous "pooling" tests to determine if the data from different districts and areas or years possess the homogenity needed to be combined. If the pooling tests are rejected, then the interpretation is the following: even after adjustments for population, unemployment rate, propensity, etc have been taken into account, the structure or processes underlying the enlistment behavior and management style in the various districts or over different years is sufficiently different so that separate elasticities must be estimated for different areas and/or

different years. Knowledge of such differences, if they are present, should enable better area level forecasts to be developed and hence should facilitate improved resource allocation and goaling among the areas.

Pooling analyses and area level estimations were carried out for five key outcome measures, namely for: i) HSDG, Upper Mental, male, non-prior service enlistment contracts; 2) local leads; 3) total NOIC (Navy national) leads from a Navy source[1] of advertising; and 4) NOIC leads from a JADOR source of advertising; 5) NOIC leads, regardless of source of advertising. For each of the outcomes we shall address:

i) Is pooling permissible across the six recruiting areas (which is the level at which goaling and budget allocation is performed)?

ii) Is pooling permissible across recent fiscal years?

iia) If not, what are the differences in elasticities across the six major recruiting areas and across different years when the "slopes" are allowed to vary?

iii) Do the area level and yearly changes imply a different cost-effectiveness for the resources than was implied by the pooled models which assumed a single elasticity?

2.0 OVERVIEW OF POOLING TESTS

2.1 Hypotheses to be Tested

The principal hypothesis to be addressed is: "Are the elasticities (slopes) invariant across the six recruiting areas and/or across different fiscal years or do they vary by recruiting area or by year?" Observe that we have not posed this question at the district level (there are 41 districts) since not enough quality information is available to separate out district level effects. However since the budget allocation and the quota setting process is done at the area level, the prime need is to be able to distinguish any varying effects at this level.

---

[1] A NOIC lead is termed a Navy sourced lead or a JADOR sourced lead based on which type of media it responded to. If it responded to both, the first response is the one that was used.

The basic idea is to analyze the amount of reduction in the sum of squared residuals obtained by allowing different slopes to occur in the regression models for different areas and different years. If the reduction is large (compared to the regresssion model where the elasticities are forced to be the same), then the pooling tests will be rejected and separate area level or year dependent elasticites will need to be estimated. On the other hand, if the reduction in the sum of squared residuals is rather small, then the homogenity test cannot be rejected and so one set of national elasticities can be used for all areas.

2.2 The Two Types of Pooling Tests Utilized

Two separate tests were tried. The first is the classical F-test (e.g., see Econometric Methods by Johnston (1972), pp. 198) where the test statistic for the hypothesis test is the ratio of: a) the difference in the sum of squares (between two regression models where in one, all of the elasticities are forced to be the same versus the second where the elasticities can vary) divided by the difference in the degrees of freedom between the two models and b) the sum of squares for the model where the elasticities can vary, divided by the degrees of freedom. The ratio of (a) to (b) is compared to a F-statistic with the parameters being the degrees of freedom for (a) and (b). Only if this test statistic exceeds the prestated percentile for the F distribution (at a presepcified level of significance) can the homogenity test be rejected.

The second and weaker test is due to Wallace (see "Weaker Criteria and Tests for Linear Restrictions in Regression," Econometrica, Vol. 40, No. 4 (July, 1972) and is to be used when the above F test is rejected. It asks the question of whether or not pooling is still advantageous in reducing the variance of the estimators, even though the estimator is known to be biased since the F-test was rejected. The tradeoff is one of accepting a small bias while reducing the range of uncertainty. This test utilizes exactly the same test statistic as before but in

this test compares it to the percentile of a non-central F with known parameters. If this second test cannot be rejected at the prespecified level of significance, the conclusion is that pooling is still an attractive way to reduce the variance of the estimators of the elasticities.

3.0 CONTEXTS OF POOLING TESTS

3.1 Overview of Six Navy Recruiting Areas as of September, 1982

Before addressing the questions as to whether the elasticities are different over the six areas, it may be useful to have a rough profile on each of the areas to help discern how homogenous they appear.

Table 1 shows vast differences in the scale of operation for each of the areas. For example, as of September, 1982, Area 700 (the Southwest) had only 375 recruiters compared to the populous Northeast (Area 100) with 633 recruiters. Notice also the large differences in each area's fair market share (i.e., 12.03% vs. 19.63% for Area 700 vs. Area 100). Notice also the large differences in the size of the Delayed Entry pool per recruiter for each of the Areas. Hence it appears plausible that the areas may well be quite different in the techniques used, management style, history, etc. even after adjustments for differences in population, propensity, racial mix, education, and unemployment rate.

3.2 Comparison Of Outcomes Over Fiscal Years 80, 81, and 82

We shall be concerned with pooling tests, not only over areas but over different fiscal years. For example, we shall ask, "Is the recruiter elasticity for Area 100 (or for the nation) the same in FY81 as in FY82 or are separate elasticity estimates needed for different years?" To better appreciate this issue, Table 2 is presented which compares some of the key raw national outcomes for the last 3 fiscal years. The following substantial differences are apparent which suggest e.g., that Fiscal Years 81 and 82 may be quite non-homogenous:

TABLE 1

OVERVIEW OF SIX NAVY RECRUITING AREAS (AS OF 9/82)

		Area 100	Area 300	Area 400	Area 500	Area 700	Area 800	Total
1.	Designator	Northeast	Southeast	Midwest	Chicago based	Southwest	Far West	-
2.	Number of Districts	7	8	8	8	7	5	41
3.	"Fair" Percent of National Goal	19.63%	17.6%	19.76%	13.26%	12.03%	17.72%	100%
4.	Number of recruiters in Place	633 (20.8%)	561 (18.4%)	575 (18.9%)	413 (13.6%)	375 (12.3%)	484 (15.9%)	3,041 (100%)
5.	DEP Position (Size of Delayed Entry Pool)	7,835	7,331	8,309	5,225	4,053	6,436	39,189
6.	DEP/Recruiter	12.37	13.06	14.45	12.65	10.81	13.30	12.89

TABLE 2

COMPARISON OF KEY OUTCOMES AND RESOURCES FOR NAVY

FOR FY80, FY81, AND FY82

		FY80	FY81	FY82
1.	Average Local Unemployment Rate	6.35%	6.98%	8.8%
2.	Local Advertising Placement Cost	$1.207M	$1.404M	$1.325M
3.	Number of Male, Qualified and "Interested"* Local Leads	55,645	61,477	90,624
4.	Average Cost per Qualified and Interested, Male (Placement Cost Only)	$21.69	$22.84	$14.62
5.	General National Advertising Campaign's TV/Radio Placement Cost	$3.388M	$5.491M	$5.434M
6.	General National Advertising Campaign's Magazine Expenditures (Placement Cost Only)	$38K	$110K	$1,148K
7.	General National Advertising Campaign's Direct Mail Expenditures (Placement Cost Only)	$430K	$258K	$856K
8.	Total General National Advertising Campaign (Includes Minority and General Campaign)	$3.856M	$5,859M	$7.438M
9.	Number of Navy National Leads Originating from Navy Advertising	69,709	135,832	141,753
10.	Average Cost per Navy Lead	$53.32	$43.13	$52.47
11.	Joint DOD TV/Radio Campaign (Placement Costs)	$4.291M	$5.280M	$5.272M
12.	Joint DOD Magazine Campaign (Placement Costs)	$2.526M	$.481M	$1.910M
13.	Joint DOD Direct Mail Campaign (Placement Costs)	$967K	$631K	$215K
14.	Joint DOD Supplements Campaign (Placement Costs)	$359K	$1,607K	-0-
15.	Total of Joint DOD Campaign (Placement Costs)	$8.143M	$7.999M	$7.397M
16.	Number of Joint/Navy Leads (Joint Leads Where Information on Navy Requested)	76,756	85,911	71,499

17.	Average Cost per Joint/Navy Lead	$106.09	$93.11	$103.46
18.	Number of Navy Recruiter Man-Years	3,752.1	3,793.4	3,691.4
19.	Number of Upper Mental, HSDG Male Contracts	36,680	37,928	43,861
20.	Number of Upper Mental Contracts per Recruiter Man-Year	9.78	10.00	11.88
21.	Number of Male UMHSDG per NOIC Lead (Regardless of Source)	.250	.171	.206

*The potential recruit desired more information.

i) FY82 had more Upper Mental, HSDG (UMHSDG) contracts with fewer recruiters. (The number of UMHSDG contracts/recruiter actually rose by 20%.)

II) The average unemployment rate was 26% higher in FY82 than in FY81.

III) There were 50% more local leads in FY82 than in FY81.

iv) There was a 10 fold increase in Navy magazine advertising in FY82 over FY81.

v) There was a 4 fold increase in Navy direct mail advertising in FY82 over FY81.

vi) There was a 4 fold increase in JADOR magazine advertising in FY82 over FY81.

vii) There was a $1.6M drop in JADOR supplements in FY82 over FY81.

viii) There was a drop of about 14,000 JADOR-sourced NOIC leads in FY82, compared to FY81.

4.0 RESULTS OF POOLING TESTS

4.1 Male, Non-Prior Service, Upper Mental, HSDG Contracts

The dependent variable in these monthly-district analyses were the prime quality male contracts, i.e., HSDG's with an ASFAB score in the category of I-III Upper. The independent variables were: number of production recruiters; number of male, upper mental High School seniors; local unemployment rate; percent of male 17-21 year olds residing in an SMSA for the district in question (this variable is referred to as the "urban-rural mix"); propensity; the total number of NOIC-Navy sourced leads (lagged two months); the total number of NOIC-JADOR sourced leads (lagged 2 months); and the total number of male, qualified and interested leads (lagged 1 month). The pooling analysis consisted of making two Ordinary Least Squares (OLS) runs and comparing the sum of the squared residuals and the degrees of freedom present.

Consider first the issue of whether or not a single set of national elasticities was appropriate for FY81,* i.e., for FY81, are six separate sets of elasticities needed or is there a single set of elasticities that can be operational for all six

*FY81 is of special interest since the state of the economy in FY81 is felt to perhaps be more typical of the economy in the remainder of the decade than was FY82.

areas of the country? We first observe that for FY81, there is a total of 12 x 41 = 492 monthly, district cells available. In the first run, the elasticities (slopes) for all of the districts within the six areas were forced to be the same. In the comparison case, a second OLS run (denoted run 2) was performed using the same monthly-district data but where the slopes were forced to be the same only for districts within a given area i.e., the elasticities for districts in different areas could vary. The monthly adjustments (seasonal factors) were constrained to be the same for all areas. The sum of the squared residuals in run (1) (with 472 degrees of freedom, i.e., 492 - 11 monthly dummies - 8 estimated elasticities - intercept) was 21.603. Note that run (1) produces a national vector of eight elasticities, one for each of the resources and demographics that were used as independent variables. The second run estimated 48 elasticities, i.e., the 8 elasticities for each of the six areas. Hence there were 40 degrees of freedom less in the second run than in the first. This second run had a sum of squared residuals equal to 12.441. The F-test consists of forming the statistic deonted F where

$$F = \frac{\text{"difference in sum of squared residuals between Run 1 and Run 2"}}{\text{differences in degrees of freedom between Run 1 and Run 2}} \Bigg/ \frac{\text{sum of squared residuals from Run 2}}{\text{degrees of freedom from Run 2}}$$

$$= \frac{\frac{21.603 - 12.441}{472 - 432}}{\frac{12.441}{432}} = 7.9 \qquad (1)$$

This number is then compared to the 95^{th} or 99^{th} percentile (depending on whether a 5% or 1% level of significance is desired) for the central F distribution with

numerator - 40 (i.e., the difference in the degrees of freedom) and the denominator equal to 432, i.e., the degrees of freedom from run (2). This is about 1.39 (for 5%) and 1.59 (for 1%). The hypothesis test regarding the homogenity of elasticities over the six areas is clearly rejected for any reasonable level of significance since the calculated statistic in (1) exceeds the given percentiles. Hence for fiscal year 81, the test verifies our intuitive notion that there is no one set of elasticities that is really operational over the six areas.

A second test was then performed using the Wallace criteria which is a weaker test in that sometimes pooling is acceptable under the second criteria, even though it failed the first test; the criteria for the second test is to reduce the variance of the estimators of the elasticities. However, even the weaker Wallace pooling tests was rejected*, signifying that no statistical rationale exists for pooling of the six areas in FY81.

The next step was to see if any subsets of the six areas could be pooled, even though we had determined that the six areas could not be. After several combinations were tried, it was determined that areas 700 and 800 (i.e., Southwest and Far West) could be pooled (via the Wallace criteria) at the 5% level of significance.

The results of these analyses and the area estimation process are the following:

1) Suppose pooled national estimates of the various resource elasticities are needed. Table 3 presents such estimates, using two regression techniques. Both types of regression models show the number of NOIC-Navy sourced leads to have a substantially higher elasticity than is the

---

*The 95th percentile of the non-central F with parameters equal to 40,432 and 20 (i.e., one half of the first parameter for the preceeding central F test) is about 2.74 which is still substantially less than the 7.9 in (1). Hence pooling across the six areas is once again rejected.

TABLE 3

COMPARISON OF NATION-WIDE ELASTICITIES FROM FY81 DATA

(From 2 Different Regression Approaches)

	Elasticities From Ordinary Least Squares (R^2=.76) and t values	Elasticities From Park's* Model
1. Production Recruiters	.54 (11.59)	.553 (11.77)
2. NOIC-Navy Sourced Leads	.102 (4.26)	.063 (5.35)
3. NOIC-JADOR Sourced Leads	.081 (3.09)	.041 (2.45)
4. Local Leads	Not sig.(.31)	Not sig.(.56)
5. Unemployment Rate	.198 (4.27)	.283 (6.70)
6. Number of Upper Mental, Male Seniors	.298 (7.99)	.373 (10.58)
7. Percent Urban	-.109 (-2.98)	-.31 (-2.61)
8. Propensity	Not sig.(1.42)	Not sig.(.086)

*Parks is a much more robust and discriminating model than OLS which relaxes many of the strongest assumptions needed for OLS. It allows for and corrects for unequal variances of error terms, autocorrelations and pairwise correlations. The reader is referred to "Confidence Intervals and Validation of a Forecaster of Quality Naval Enlistments," ONR-200-6, by Richard C. Morey and John M. McCann, July, 1982 for more details.

**T values must exceed 1.95 in absolute value for the elasticity estimate to be statistically significant at the 5% level of significance; i.e., if the t value exceeds 1.95 in absolute value there is less than a 5% chance, e.g., that the elasticity estimate for recruiters would turn out to be .54, when indeed it was truly 0.

case for NOIC-JADOR sourced leads, the difference being about 25% for the OLS run and 50% for the more credible Parks model. This same type of result holds as well using area-pooled FY82 data. Hence we can conclude either that: a) NOIC-Navy sourced leads have a larger percent of male, HSDG qualified individuals than is the case for the NOIC-JADOR sourced leads; and/or b) the percent of male, HSDG qualified NOIC-Navy sourced leads (who are also in the upper mental categories) which convert to a contract is at a higher rate than is the case for the matching group from the NOIC-JADOR sourced group. This second possibility is fairly intuitive since a NOIC-Navy sourced lead may not be recruited and followed up by the other Services to the same extent as is the case for a JADOR-sourced lead. This investigator will soon have available more detailed breakdown on the composition of each of the two types of NOIC leads which should shed more insight as to the relative attractiveness of more leads of various types in terms of their ulitimate yield of male, non-prior service, HSDG, Upper Mental enlistments. We also observe that local leads appeared to have no impact on the yield of UMHSDG contracts.*

2) Consider now the results which adhere to the statistical principle that the six recruiting areas cannot be pooled and that there is indeed no single set of elasticities which applies for all areas. The results shown in Table 4 are from the run (2) with a R^2 of .86. Note that local leads were once again never significant in terms of improving the yield of male, HSDG, Upper Mental contracts. Note that, as with the single national set of estimates, the NOIC Navy sourced leads tend to dominate the NOIC-JADOR sourced leads in terms of their elasticities.

3) Next consider the question of whether or not FY81 and FY82 can be combined, when we permit separate elasticities to operate for different areas. This pooling test is performed by running two OLS analyses, one where separate area

*Earlier work has shown local leads to be an important factor, however, for HSG contracts, presumably for the GED's and lower mental, HSDG's.

TABLE 4

AREA LEVEL ELASTICITIES FOR FY81

Area	Elasticity of Production Recruiters	Elasticity of Navy Sourced - NOIC Leads	Elasticity of JADOR Sourced - NOIC Leads
100 (NE)	.40	.041	.032
300 (SE)	.23	.055	.055
400 (MW)	.36	.075	.026
500 (Chicago Based)	.31	.056	.063
700 (SW)	insig.	.033	.058
800 (FW)	.88	.070	.008
Area 700 & 800 Pooled*	.472	.128	.024

*The weak Wallace test just accepted (at the 5% level of significance) pooling for Areas 700 and 800 in terms of the criterion of reducing the variance of the estimators of the elasticity, at the possible expense of bias.

elasticities must apply for both years, versus one whose separate elasticities apply for different years. The monthly adjustments and intercept are assumed to be the same for both years and for all areas.

The result of this exercise is that the pooling test for FY81 and FY82 is rejected, with the area level elasticities for FY82 being typically a little higher than those for FY81. The separate area level elasticities, for recruiters, are shown when the years are pooled (Column 1) and when the years are not pooled (Columns 2 and 3). Note that there were 37,928 UMHSDG contracts in FY81 and 43,361 in FY82. We note that the FY81 area level recruiter elasticities obtained from using the joint 81, 82 data (with common monthly dummies and intercept) are somewhat higher than those obtained earlier from just using FY81 data. Also note, when the area level elasticities are allowed to vary over the years, that 4 of the 6 recruiter elasticities in FY82 are larger than those in FY81.

Finally, to have a comparison with the single year results of Table 4, the data for FY82 was run by itself in an OLS mode. Again area level pooling was rejected. The results for FY82 for recruiters are shown in the last column of Table 5.

Hence, in summary, the key insights from various ways of looking at FY81 and FY82 data for UMHSDG, male contracts seem to be:

i) FY81 and FY92 cannot be combined.

ii) For FY81 or FY82 separately, areas cannot be combined.

iii) Local leads were never significant, regardless of the approach used, relative to the yield of UMHSDG contracts. However, based on earlier analysis, they do play a vital role for GED's and lower mental HSDG's.

iv) Navy sourced-NOIC leads have 25-50% higher elasticities than do NOIC-JADOR sourced leads.

v) Recruiters are consistently the most important resource variable, particularly for UMHSDG contracts, and FY82 seemed to yield generally higher

TABLE 5

AREA LEVEL RECRUITER ELASTICITIES FOR USING FY81 AND FY82 DATA

Area	Same Elasticity for Both Years Using 81, 82 Data R^2 = .85	Different Elasticities for Different Years Using 81, 82 Data R^2 = .87		OLS Using FY82 Data Only
		FY81	FY82	82 Alone
100	.801	.588	.619	.80
300	.620	.411	.604	.736
400	.652	.570	.33	.501
500	.591	.418	.528	.727
700	.517	.07	.491	.641
800	.669	1.00	.772	.92

recruiter elasticities than was the case for FY81. (This may have been due in part to efforts of the Recruiting Command to make recruiters more productive by equalizing the size of the Delayed Entry Pool per recruiter across the areas and by holding recruiters more accountable. [See the PUMP program in "Comparions of the Armed Services' Management of the Delayed Entry Program," January, 1983, ONR-200-8, Richard C. Morey (prepared for the Office of the Assistant Secretary of Defense)]

vi) Recruiters appear particularly effective in Area 800, the Far West.

vii) The other important independent variables are:

a) The number of male, upper mental, HS seniors in district;

b) The local unemployment rate, and;

c) Propensity.

4.2 Results of Pooling Analyses for Local Leads

The local lead data base is a new one, having begun in FY80. It consists of responses to local advertising (referred to as LAMS) in classified ads and in high school newspapers. Expectedly, there were problems with incomplete reporting for FY80 and FY81. For this reason the pooling analysis concentrated on FY82 only. As with the analysis of UMHSDG contracts, 2 OLS runs were made, using district-monthly data, one where all of the elasticities were forced to be the same and one where area level elasticities were allowed to differ. The key conclusions, relative to the generation of local leads, are:

1) Areas cannot be pooled.

2) LAMS seems consistently important, especially in Area 400.

3) The impact of LAMS seems to be entirely felt in the month of the advertising.

4) The important demographics were the number of male, high school seniors, percent black, percent urban, and the unemployment rate.

5) No discernible impact on production of UMHSDG contracts from local leads but significant impacts on those contracts in the lower mental categories and those possessing a GED.

The varying area level effects of LAMS advertising on male, qualified and interested local leads is shown in Table 6.

4.3 Results of Area Pooling for Navy-Sourced NOIC Leads for FY80

The only years for which total NOIC leads had been broken down by the source of the leads (i.e., a Navy source versus a JADOR source) at the monthly, district level were for FY80, FY81, and FY82. In addition, the detailed monthly breakdowns of advertising expenditures (by source) is available from FY76-FY80. (The tapes for FY81 and FY82 are about to be analyzed.) Hence for a pooling analysis, relative to the generation of Navy-sourced NOIC leads, we had to rely on FY80. The pooling analysis examined whether or not a common set of elasticities applied for all six areas of the country. The dependent variable in the monthly-district analysis was the total number of NOIC leads from a Navy source. This includes both male and female, and non-HSG and HSG's. This national number was 69,709 for FY80; 135,832 for FY81; and 141,753 for FY82. The dependent variables included monthly dummy variables, seven different types of advertising (placement dollars), and five demographic variables. In addition, to capture the suspected long term effect of advertising relative to the generation of leads, a so-called Koyck model was used to estimate the elapsed time over which advertising effects were felt.

The seven types of advertising (each at the monthly-district level) were:

i) Dollars of placement cost in the Navy's General Enlisted Program (GEP) for TV and radio expenditures. (This was $1.267M for TV and $2.12M for radio for FY80.)

ii) Dollars of placement cost in the Navy's GEP program for magazine expenditures. (This was $37,500 for FY80, a very low number which was not typical of the magazine expenditures in past or recent years. When data for

TABLE 6

NATIONAL AND AREA LEVEL EFFECTS RELATED TO
PRODUCTION OF MALE LOCAL LEADS
(Qualified and Interested)
FROM LAMS ADVERTISING
(Based on FY82 Experience)

National OLS Estimate (R^2 = .58)	.554
Area 100	.294
Area 300	.342
Area 400	.568
Area 500	.423
Area 700	.079*
Area 800	.479

*Not significant at 10% level of significance.

FY81 and FY82 is analyzed, this shortcoming will be eliminated.)

iii) Dollars of placement costs for Navy's GEP direct mail campaign. (This was about $431,000 for FY80.)

iv) Dollars of placement cost for the Navy's Minority Program for enlisted personnel. (This totaled $562,000 for FY80.)

v) Total placement cost for the Joint DOD (JADOR) campaigns related to TV and radio. (This was $3.364M for TV, and $926,000 for JADOR radio.)

vi) Total placement cost for JADOR magazine campaign and supplements. (This was $2.167M for magazines and $359,000 for JADOR supplements.)

vii) Total placement costs for JADOR direct mail. (This totaled $976,000 for FY80.)

The five demographics variables included were: the district's percent urban (i.e., the percent of the male, 17-21 year olds living in a SMSA in the district); the percent of the male; 17-21 year olds that are non-white; the number of male; HS seniors in district; the local unemployment rate; and the district's propensity. A total of three runs were made for FY80. The first run utilized the Park's regression model where all of the area elasticities were forced to be the same. This same analysis was repeated using the Ordinary Least Squares (OLS) regression technique. Finally another OLS run was made where the area level elasticities were allowed to differ. The results of the area pooling tests was that the weak Wallace test passed (at the 3% level of significance), signifying the merging of the areas, to arrive at a single set of elasticities, was an attractive mechanism to reduce the variance of the estimators.

The key conclusions for <u>Navy-sourced NOIC leads are</u>:

1) It takes from 2.9 to 3.75 months for 95% of the effect of advertising to make itself felt on Navy-sourced NOIC leads. In this regard, the "stock of goodwill" effect from Navy unique advertising seems to last longer than the carryover effect for JADOR advertising.

2) The six recruiting areas passed the weak pooling test for Navy-sourced NOIC leads and hence the areas could be merged.

3) There is an intuitive marked "substitution" effect where JADOR advertising has a large deletorious effect on the production of Navy-sourced NOIC leads. (Note the JADOR magazines has a positive effect on JADOR sourced-NOIC leads and hence overall NOIC production is enhanced by JADOR magazines advertising. However, JADOR direct mail does not produce a corresponding increase in JADOR-sourced NOIC leads so that the net impact of JADOR direct mail on total NOIC production is negative and significant. (This is discussed more in Section 4.5.)

4) Navy direct mail appears to be extremely effective in the production of Navy-sourced NOIC leads.

5) The reason for Navy magazine not appearing important is due to the extremely low level of magazine advertising in 1980. Other results from earlier years related to total NOIC production show strong effects for Navy magazine advertising.

6) The important demographics were number of male High School seniors, percent black, percent urban and unemployment rate.

The comparison, for the merged areas, of the results from the OLS model and the more discriminating Park's model follow in Table 7. Note that Navy TV/radio was significant in both models with Navy direct mail as the big winner. The substitution effect is very noticable for JADOR magazines and JADOR direct mail, especially in the Park's model, where the negative elasticities are strongly significant. The prime months for generation of Navy sourced leads seemed to be January, March, June, August and November.

4.4 Results of Pooling Analysis for JADOR-Sourced NOIC Leads for FY80

Exactly the same three types of runs, as were just described for NOIC-Navy sourced leads, were performed for the JADOR-sourced NOIC leads for FY80. This total was 76,756 in FY80; 85,911 in FY81; and 71,499 in FY82. The same set of independent variables, as were used in the pooling analysis for Navy-sourced leads,

TABLE 7

LONG TERM ELASTICITIES FOR NAVY-SOURCED NOIC LEADS

(Based on FY80)

	National "Parks" Estimate	National OLS Estimate (R^2=.77)
Navy TV/Radio	.016	.041
Navy Magazines	insignificant	insignificant
Navy Direct Mail	.305	.317
Navy Minority Advertising	insignificant	insignificant
JADOR TV/Radio	insignificant	-.15*
JADOR Magazines	-.112	-.14*
JADOR Direct Mail	-.239	-.12*
Number of Male, HS Seniors	.98	1.32
Unemployment Rate	.18	insignificant
Percent Non-White	-.078*	.137
Propensity	1.81	insignificant
Percent Urban	1.01	-.45

*Not significant at 10% level.

were also utilized for NOIC-JADOR sourced leads. Recall that the classification of a NOIC lead as either JADOR sourced or Navy sourced is based on which types of ad the individual responded to first. Also, it is important to stress that the JADOR sourced NOIC leads include both men and women, and no distinction is made regarding education. (The same was true for NOIC-Navy sourced leads. Data is being collected to allow us to concentrate on only male NOIC leads of each type who are or will be (presumably) HSDG graduates.) The key conclusions were:

1) Recruiting areas cannot be pooled, even under the Wallace criteria. (This is in contrast to the Navy-sourced NOIC leads.) However, one year does not provide sufficient variation for some of the resources to be significant and stable across the areas.
2) It takes about 2.09 months for 95% of the JADOR advertising to make itself felt on JADOR NOIC leads. This is in contrast to 3 months for the Navy sourced leads.
3) In general JADOR magazines are very effective for creating JADOR sourced NOIC leads.
4) Navy unique advertising does not appear to substantially effect production of JADOR sourced-NOIC leads, except possibly for Navy magazine (which was at too low a level in FY80 to be detected) and possible Navy direct mail (which appeared in national Park's model.)
5) Important demographics are propensity, percent urban, number of male, HS seniors, and unemployment rate.

The detailed results follow in Table 8, both for the pooled national results (i.e., one set of elasticities for all areas) and six sets of area elasticities.

4.5 Results of Pooling Analysis for Total NOIC Leads (Regardless of Source)

This section considers a separate pooling analysis, relative to the generation of all NOIC leads, regardless of the source. (There was a total of 146,465 NOIC leads in FY80; 221,743 in FY81; and 213,252 in FY82.) It should be stressed at the outset that it is felt the more valuable information pertains to the earlier analyses where each type of lead is analyzed separately. The reasons for this

TABLE 8

LONG TERM NATIONAL AND AREA LEVEL ELASTICITIES FOR JADOR-SOURCED NOIC LEADS

(Based on FY80)

	National OLS Est. (R2=.93)	National Parks Estimate	Area 100	Area 300	Area 400	Area 500	Area 700	Area 800
JADOR TV/Radio	.075*	.067	.107	.073	.09	.05*	.106	.073
JADOR Magazine	.246	.192	.131	.181	.145	.204	.157	.176
JADOR Direct Mail	.009*	.071*	.126	.116	.125	.116	.113	.108*
Navy TV/Radio	insig.	.00002*	insig.	insig.	insig.	.019	insig.	insig.
Navy Magazines	.010*	.063*	insig.	insig.	.034	insig.	insig.	insig.
Navy Direct Mail	.0027*	.029	insig.	insig.	insig.	insig.	insig.	insig.
Navy Minority	insig.	insig.	insig.	insig.	insig.	insig.	insig.	insig.
Male, HS Seniors	.62	.44	.7	.76	.205	.66	.763	insig.
Unemployment Rate	.13	.13	.36	insig.	.44	.16	insig.	insig.
Propensity	.14	.74	insig.	insig.	insig.	insig.	insig.	insig.
Percent Non-White	.19	.047*	.94	.31	1.76	.14	.06	insig.
Percent White	.34	.66	insig.	.65	insig.	.50	insig.	.66

*Not significant at the 10% level.

include:

i) Each type of lead has quite a different impact, in terms of its yield, for quality contracts;

ii) The proportion of the leads of each type that are (or will be) male and HSDG qualified may well differ;

iii) These are complex substitution mechanisms operating with more JADOR advertising being associated with more JADOR sourced NOIC eads, but at the expense of less NOIC Navy source leads.

One of the appeals of rerunning the analysis on total NOIC leads is that we can now include data from FY79 where there were significant NAVY magazine expenditures (but where NOIC JADOR sourced and NOIC Navy sourced leads have not been broken out). The key conclusions relative to total NOIC lead production are:

1) Areas could not be pooled, but FY79 and FY80 could be. (This agrees with the finding that JADOR NOIC leads could not be pooled for FY80.)

2) It takes 3.05 months for 95% of the advertising effect to be felt. (This is about the result obtained for NOIC-Navy sourced leads which constitutes the majority of total NOIC leads.)

3) Negative and/or at best, insignificant effects of JADOR TV/radio and JADOR direct mail on total NOIC production are found, regardless of the regression model, or area of the country. Apparently, while JADOR mail certainly creates some NOIC-JADOR leads, JADOR's presence may cause some individuals, who otherwise might have become a NOIC Navy sourced lead, to become, e.g., an Army-JADOR sourced lead. This tentative conclusion needs to be further explored, with the data from FY81 and FY82.

4) Navy magazine advertising is about twice as effective as JADOR magazine.

5) Navy mail is at .17, compared to negative effect for JADOR mail.

6) Navy magazine advertising is about 4 times as effective as Navy's TV/ radio, but only one half as effective as Navy mail in creating NOIC leads.

7) The only positive measurable impact of JADOR advertising on total NOIC leads is through JADOR magazine advertising.

The detailed results follow in Table 9.

5.0 CONCLUSIONS

The analyses of the preceeding sections strongly suggest that in most cases there is not simply one set of elasticities that applies for all regions of the country and for different fiscal years when it comes to relating the marginal impacts of various recruiting resources and demographics to leads and enlistments. In contrast, separate area level and year dependent elasticities typically need to be estimated since the data, even after adjustments for differences in demographics and the level of resources involved, are not sufficiently homogenous so that one set of "national" elasticities applies. This finding is really quite intuitive when one examines the wide differences in the scale of operations between the various recruiting areas (e.g., Area 700 (the Southwest) with 375 recruiters and a fair market share of 12.3% of goal with Area 100 (the Northeast) with 633 recruiters and 20.8% of the goal). Also there are huge differences in the operations of different fiscal years based on variations in quotas, management innovations (such as the Navy's PUMP program which improved the equity and effectiveness of the Navy's Delayed Entry Pool), mixes of advertising, the economic scenario, etc. that argue for not pooling different fiscal years. To balance these comments, it is noteworthy that the general types of insights and relative cost-effectiveness findings obtained when the areas and years had been pooled were for the most part unchanged even when areas were allowed to have different marginal impacts. In summary, it appears that area level prediction and resource allocation can be improved through the use of area level elasticities, not to mention the increased credibility and defensibility of any findings.

TABLE 9

LONG TERM NATIONAL AND AREA LEVEL ELASTICITIES FOR TOTAL NOIC LEADS

(Regardless of Source of Advertising) for FY79, FY80

(FY80: 146,465)

	National OLS Est. (R2=.83)	National Parks Estimate	Area 100	Area 300	Area 400	Area 500	Area 700	Area 800
Navy TV/Radio	.019	.024	.014	insig.	.032	.02	insig.	insig.
Navy Magazines	.082	.084	.06	.079	.052	.039	.081	.044
Navy Direct Mail	.174	.175	.047	.083	.054	.092	.078	.123
Navy Minority Advertising	insig.	insig.	insig.	insig.	insig.	insig.	insig.	insig.
JADOR TV/Radio	insig.	-.009	insig.	insig.	insig.	insig.	insig.	insig.
JADOR Magazines	.038	.041	.017	insig.	.026	.012	.014	.033
JADOR Mail	-.039	-.035	-.028	insig.	insig.	insig.	insig.	-.029
Male, HS Seniors	.71	.63	.28	.96	1.05	.62	1.0	insig.
Unemployment Rate	.20	.18	.22	insig.	.05*	.52	.36	.63
Propensity	.51	.52	insig.	1.63	.86	insig.	.73	insig.
Percent Urban	.27	.19	.53	.18	.15	insig.	.24	.80
Percent Non-White	.17	.15	.15	.28	.44	.05	.09	insig.

*Not significant at the 10% level.

Table 1 a

Data Base	Measure of Interest	Report for Additional Details	Methodology	Key Results	Comments
1) Jan. 76 - Dec. 78 (District-monthly) 1,548 cells	HSG contracts (male, non-prior service) (included GED;s and no mental category distinction)	"Confidence Intervals and Validation of a Forecaster of Quality Navy Enlistments " (July 82)	Pooled cross-sectional, time series data (same elasticities for all areas and districts). Parks regression technique which allows unequal variances, autocorrelation, cross correlation between districts	Recruiter elasticity of .69. Unemployment rate of .17. LAMS advertising elasticity of .04. Military propensity elasticity of .63. NOIC leads elasticity of .009	The model, in an independent validation effort, predicted within 3.7% of actual national totals for FY79 and within 2.5% of actual national totals for FY80; it did best in Area 300, 400, 500 and 700; a confidence interval was developed which stated that, with 80% confidence, the actual national results should fall within ± 6.3% of the predicted result.
2) Jan. 76 - Dec. 78 (A 2 year model with a year's lag for HSG contracts and leads)	HSG contracts and non HSG contracts as a function of size of Delayed Entry Pool, quotas, allocation, philosophy of recruiters, timing decisions related to advertising "pulses," etc.	"Impacts of Various Types of Advertising Media, Demographics and Recruiters on Quality Enlistments: Results from Simultaneous and Heteroscedastic Models " (July, 80)	Simultaneious equations approach using 2-staged least square geared to the following "chicken and egg" types of questions: "To what extent is the geographical mix of HSG contracts obtained due to a market or allocation effects? That is, are the outcomes due to recruiters being allocated there or is it the case that recruiters were allocated there because in the past HSG contracts were obtained from that district?	Elasticity of recruiters of .9. Elasticity for national leads of .039. Elasticity for military pay relative to civilian pay of 1.37. Negative substitution effect between HSG contracts and non HSG contracts.	Intermingling in single stage studies of market and allocation effect may underestimate impact of recruiters. Significant allocation effects between distribution of HSG contracts this past year and geographical allocation of recruiters in present year is observed. Significant allocation effect between pulsing of advertising this year and last year's monthly distribution of leads observed.

Data Base	Measure of Interest	Report for Additional Details	Methodology	Key Results	Comments
3) FY80 (Monthly district level)	HSG contracts and Upper Mental, HSDG contracts as a function of local leads, NOIC leads, demographics and recruiters	"Comparison of the Marginal Cost-Effectiveness of Various Recruiting Resources for HSG Enlistments: Analysis of National Local and Walk-in Leads" (Nov. 82)	Parks regression, geard to answering question, "Does advertising impact production of contracts over and above its effect in generating leads?, i.e., are there many recruits who enlist without ever being a lead of any type? These were called "walk-in's."	Elasticity of total NOIC leads of .052. Elasticity of local leads of .0133. Elasticity of recruiters at .33	Higher recruiter elasticities observed for UMHSDG contracts than for HSG contracts. JADOR magazines advertising may contribute to Navy HSG contracts production over and above its effect on NOIC production.
4) FY81 (Monthly district data, pooled over nation)	UMHSDG contracts	Pooling Analysis (June 83)	i) Parks regression on pooled model (all elasticities same) ii) OLS regression on pooled model (all elasticities same)	Recruiter elasticity at .553 (from Parks) and .563 (OLS). Navy sourced NOIC leads at .063 (Parks) vs. .102 (OLS). JADOR sourced NOIC leads at .041 (Parks) vs. .081 (OLS). Local leads insignificant. Upper Mental High School seniors at .37 (Parks) vs. .25 (OLS). Unemployment rate at .28 (Parks) vs. .08 (OLS)	Regardless of the regression technique, the yield rate from Navy sourced leads was 25-50% larger than that for JADOR sourced NOIC leads. No impact of local leads on UMHSDG contract production.

Data Base	Measure of Interest	Additional Details	Methodology	Key Results	Comments
5) FY81 (Monthly district data but pooled only o-er areas)	UMHSDG contracts	Pooling Analysis (June 83)	OLS but each area allowed to have separate elasticities (intercept and monthly effects forced to be the same)		Pooling over nation generally not allowed. Area 700 (SW) and Area 800 (FW) could be pooled.

Area	Elasticity of Recruiters	Elasticity of Navy Sourced Leads	Elasticity of JADOR Sourced NOIC Leads
100 (NE)	.4	.041	.032
300 (SE)	.23	.055	.055
400 (MW)	.36	.075	.026
500 (Chicago)	.31	.056	.063
700 (SW)	.472	.128	.024
800 (Far West)	.472	.128	.024

6) FY82 (Monthly district pooled over nation)	UMHSDG contracts	Pooling Analysis (June 83)	OLS but pooled over nation	Elasticity for Navy sourced NOIC leads is at .048 compared to elasticity for JADOR sourced leads at .033. The elasticity for Recruiters is .744. Pooling of FY81 and FY82 is not permissible.	FY82 appears quite different from FY81 due to 26% higher unemployment rate, 50% more local leads, 10 fold increase in Navy magazine advertising, etc.

Data Base	Measure of Interest	Additional Details	Methodology	Key Results	Comments
7) FY82 (Monthly district data pooled by area)	UMHSDG contracts	Pooling Analysis (June 83)	OLS but different elasticities allowed for different areas	JADOR and Navy sourced NOIC effects could not be detailed at area level in FY82.	Recruiters played significantly more of a role in FY82 than in FY81 in terms of UMHSDG contract production. In FY81 there were detectable differences in yield rate (for JADOR NOIC leads vs. Navy NOIC leads) relative to UMHSDG contract production. In FY82, the key explanatory variable was recruiters.

Elasticity for Recruiters by Area for FY82

Area 100	.802
Area 300	.737
Area 400	.501
Area 500	insig.
Area 700	.642
Area 800	.92

COMPARISON OF RESULTS FROM DIFFERENT DATA BASES RELATED TO PRODUCTION OF LOCAL LEADS

(Male, Qualified and Intersted)

Table 2a

	Data Base	Measure of Interest	Report for Additional Details	Methodology	Key Results	Comments
1)	FY80 (quarterly-district) 172 cells = 43 x 4	Local leads as a function of LAMS	"Comparison of Marginal Cost-Effectiveness, etc." (Nov. 82)	Park's model on pooled time series, cross-sectional	LAMS elasticity of .889	Yield rates from local leads to HSG contracts of about 1.53%. Each additional local lead costs about $34 (including overhead).
2)	FY82 (monthly-district) 41 x 12 = 492 cells (grouped over nation)	Local leads as a function of LAMS and demographics	Pooling Analysis (June, 1983)	OLS pooled cross sectional monthly district (same elasticity for all areas)	.55 elasticity. Pooling across 6 recruiting areas not permissible.	R^2 of .55. No impact of local leads on productivity of UMHSDG contract production.
3)	FY82 (monthly-district grouped by area)	Local leads as a function of LAMS and demographics	Pooling Analysis (June, 1983)	OLS but different elasticities permitted for different areas (same monthly dummies, and intercept used in all areas)	LAMS consistently important with most impacts in Area 400 and 800 LAMS Elasticity by Area Area 100, .294 Area 300, .342 Area 400, .568 Area 500, .423 Area 700, .079 Area 800, .479	No lagged effect of advertising. Important demographics are male, HS seniors, percent black, percent urban and the unemployment rate.

COMPARISON OF RESULTS FOR DIFFERENT TYPES OF NOIC LEADS

(Total, Navy-sourced and JADOR sourced)

	Data Base	Measure of Interest	Report for Additional Details	Methodology	Key Results	Comments
1)	FY79, 80 (Monthly-district data - 118 cells - pooled at national level	Total NOIC Leads, regardless of source	"Comparison of Marginal Cost-Effectiveness, etc." (Nov. 82)	i) Parks regression (pooled over nation) ii) OLS	Elasticities: Navy TV/Radio at .024 (Parks) vs. .019 (OLS) Navy Magazine at .084 (Parks) vs. .082 (OLS) Navy Mail at .175 (Parks) vs. .174 (OLS) JADOR TV/Radio at -.009 and significant (Parks) vs. insignificant (OLS) JADOR Magazine at .041 and significant (Parks) vs. .038 and significant (OLS) JADOR Mail at -.035 and significant (Parks) vs. -.039 and significant (OLS)	JADOR magazines aids production of total NOIC leads but Navy magazines twice as effective. JADOR TV/radio and JADOR mail has no detectible positive effect on production of NOIC leads. The R^2 = .83.

	Data Base	Measure of Interest	Additional Details	Methodology	Key Results	Comments
2)	FY79, 80 (Monthly-district, but pooled only at area level)	Total NOIC leads, regardless of source	Pooling Analysis (June 83	OLS (pooled only at area level)	The areas cannot be pooled but the years FY79 and FY80 can be. The negative or insignificant impact of JADOR mail & JADOR TV/radio continues at the area level. JADOR magazines continues to be positive at the area level.	Navy advertising is much more effective in creating NOIC leads than the JADOR sources. A three month lag effect is observed. Navy mail is most effective in Far West.

Elasticities

Area	Navy TV/Radio	Navy Magazine	Navy Direct Mail
100	.014	.06	.047
300	insig.	.079	.083
400	.032	.052	.054
500	.02	.039	.092
700	insig.	.081	.078
800	insig.	044	.123

3)	FY80 (Monthly district, pooled over nation)	Navy sourced NOIC leads	"Comparison of Marginal Cost-Effectiveness, etc" (Nov. 82) and Pooling Analysis (June 83)	i) Park's regression ii) OLS at national pooled level	Pooling is permissible at area level. Navy TV/radio at .016 (Parks) vs. .041 (OLS). Navy magazine insignificant. Navy direct mail at .305 (Parks) vs. .317 (OLS). JADOR TV/radio was insignificant in both models, JADOR magazines at -.112 (Parks) vs. insignificant (OLS). JADOR direct mail at -.239 (Parks) vs. insignificant (OLS)	R^2 = .77. Navy magazine advertising's effect was miniscule in FY80 and hence its effect cannot be measure There is a marked substitution effect where more JADOR advertising tends to produce JADOR sourced NOIC leads and reduce the number of Navy sourced NOIC leads.

Data Base	Measure of Interest	Report for Additional Details	Methodology	Key Results	Comments
4) FY80 (Monthly district pooled over nation)	JADOR sourced NOIC leads	"Comparison of Marginal Cost-Effectiveness, etc." (Nov. 82) and Pooling Analysis (June 83)	Parks regression and OLS, both pooled at the national level	JADOR TV/radio at .067 (Parks) vs. insignificant (OLS). JADOR magazine at .192 (Parks) vs. .246 (OLS). JADOR direct mail insignificant under both models. The Navy advertising is insignificant with the exception of Navy mail at .029 in the Parks model.	R^2 = .93. JADOR magazine very powerful in creating JADOR NOIC leads; Navy sources have little effect on JADOR sourced leads.
5) FY80 (Monthly district, but pooled at area level)	JADOR sourced NOIC leads	Pooling Analysis (June 83)	OLS but elasticities allowed to differ between areas.		Pooling rejected at area level but same types of results observed as at national level.

Elasticities

Area	Navy TV/Radio	Navy Magazine	Navy Direct Mail
100	.107	.131	.126
300	.073	.181	.116
400	.09	.145	.125
500	insig.	.204	.116
700	.106	.157	.113
800	.073	.176	insig.

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER: ONR-200-10	2. GOVT ACCESSION NO.
3. RECIPIENT'S CATALOG NUMBER	
4. TITLE *(and Subtitle)*: ESTIMATING DIFFERENCES IN AREA-LEVEL IMPACTS OF VARIOUS RECRUITING RESOURCES: Can Different Recruiting Areas and Years be Pooled?	5. TYPE OF REPORT & PERIOD COVERED
	6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s): Richard C. Morey	8. CONTRACT OR GRANT NUMBER(s): N00014-80-C-0200
9. PERFORMING ORGANIZATION NAME AND ADDRESS: Center for Applied Business Research, Fuqua School of Business, Duke University, Durham, NC 27706	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS: NR 170-903, 62763N, RF 55521002
11. CONTROLLING OFFICE NAME AND ADDRESS: Office of Naval Research, Code 452, 800 N. Quincy Street, Arlington, VA 22217	12. REPORT DATE: August, 1983
	13. NUMBER OF PAGES
14. MONITORING AGENCY NAME & ADDRESS*(if different from Controlling Office)*	15. SECURITY CLASS. *(of this report)*
	15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT *(of this Report)*

Distribution of this document is unlimited. Reproduction in whole or in part is permitted for any purpose of the U.S. Government.

17. DISTRIBUTION STATEMENT *(of the abstract entered in Block 20, if different from Report)*

18. SUPPLEMENTARY NOTES

Supported by the Naval Research Manpower R&D Program.

19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*

Pooling, Upper-Mental, High School Degree, enlistment contracts, hypothesis testing, national leads, local leads, Joint DOD advertising.

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

Rigorous statistical pooling tests were performed for five separate outcome measures to determine if one set of elasticities applies for each of the six Navy recruiting areas and for different fiscal years. When it was determined that this was not the case, area level and year dependent elasticities were estimated for various recruiting resources and demographics. The five key outcome (dependent) variables related to: male, Upper Mental, HSDG enlistment contracts, and various types of leads. In general, the findings were that areas and fiscal years are sufficiently different in scale and (continued)

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

S/N 0102-LF-014-6601

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE *(and Subtitle)*		5. TYPE OF REPORT & PERIOD COVERED
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR*(s)*		8. CONTRACT OR GRANT NUMBER*(s)*
9. PERFORMING ORGANIZATION NAME AND ADDRESS		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS		12. REPORT DATE
		13. NUMBER OF PAGES
14. MONITORING AGENCY NAME & ADDRESS*(if different from Controlling Office)*		15. SECURITY CLASS. *(of this report)*
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT *(of this Report)*		
17. DISTRIBUTION STATEMENT *(of the abstract entered in Block 20, if different from Report)*		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*		

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

management style that, even after adjustments for differences in demographics, that one set of elasticities cannot apply for every region of the country.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

S/N 0102-LF-014-6601

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

END

FILMED

5-81

DTIC