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THE IMPACTS OF VARIOUS TYPES OF ADVERTISING MEDIA, DEMOGRAPHICS--ETC(U)
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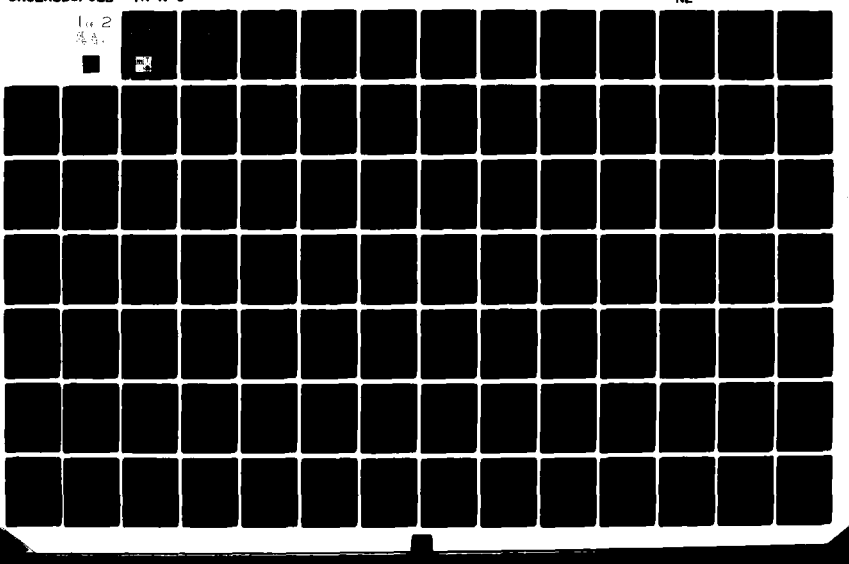

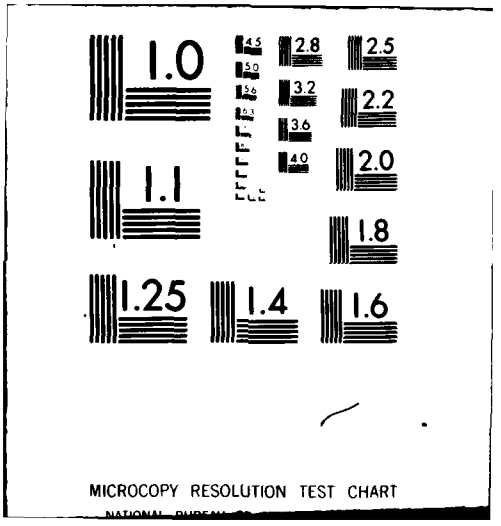
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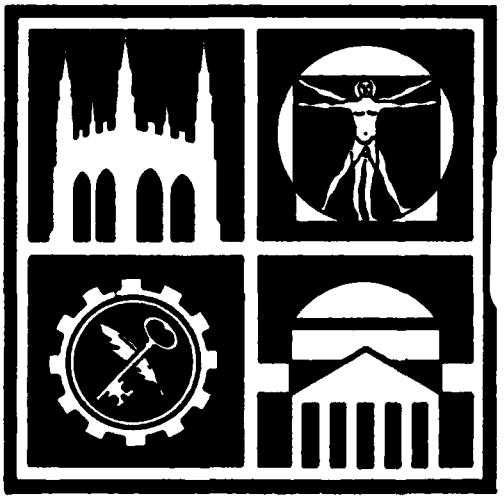

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A Technical Report

Prepared for the Naval Recruiting Command and the Office of Naval Research

(9)

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THE IMPACTS OF VARIOUS TYPES OF ADVERTISING MEDIA, DEMOGRAPHICS, AND RECRUITERS ON QUALITY ENLISTMENTS:

Results from Simultaneous and Heteroscedastic Models.

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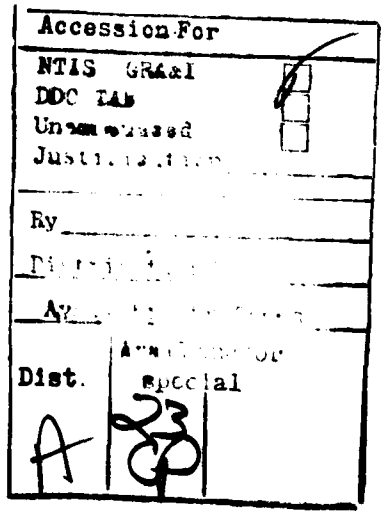


EXHIBITS AND FIGURES

1.0 SUMMARY

1.1 Background

This report deals with the efforts performed since the beginning of the year (as part of a continuing effort from the year before) to obtain a more effective balance between advertising and recruiter expenditures. With recruiting costs for the services running at about $700 Million per year, it behooves the country to determine the proper media mix, and timing of advertising, together with the numbers and locations for recruiters to maximize the efficiency of recruiting expenditures. The reader is referred to two previous reports by this Investigator in this area in 1979, namely, "Budget Allocation and Enlistment Prediction Models for the Navy's Recruiting Command: the Proper Balance Between Recruiter and Advertising Efforts", (Technical Report of Center for Applied Business Research, Duke University) May 1979, and "Budget Allocation and Enlistment Prediction Models for the Navy's Recruiting Command: Testing and Validation", October 79, dealing with the estimation and optimization of expenditures geared toward the male, non prior service, High school graduate, enlisted recruit. Both reports utilize a monthly-district level data base covering the period January 1976-December 1978. A summary of the data base utilized, in addition to the results of the validation efforts, is included in Section 2.1. In addition the model developed over the past year was exercised in December for the FY 1982 - FY 1986 period to help build the POM budget request for enlisted recruiting and to show the impacts of changing demographics and different scenarios related to the unemployment rates and accession quotas. These results are summarized in Appendix D.

1.2 Key Thrust

This current effort differs from that performed in 1979 by attempting to get additional insights as to the proper mix of media types. To be

more exact, the earlier efforts aggregrated the available advertising data for enlisted personnel into one variable; this included such diverse media as LAMS (classified ads), TV/radio, direct mail, magazines, RAD (materials, etc. In contrast this effort disaggregates these media types, and also adds the Minority advertising and JADOR/Joint Military) expenditures. In addition, many more demographic variables have been added to help increase the explanatory and predictive ability of the model. These variables include the district's urban-rural mix, the percent of Blacks in the district population, the district's "propensity" (based on responses to a questionairre administered to the general male youth population), the relative compensation between the military and private sectors, and the size of the Delayed Entry Program. The detailed data elements are given in Section 2.

The key thrust of this effort has been to explore the differences in results arrived at by using a variety of regression techniques on the same data base, one incidentally that now includes over 1500 monthly-district observations covering the 43 recruiting districts over the period January 76 - December 78 by month. The key predictive equations developed are for HSG contracts, for the upper Mental category HSG contracts, and for NOIC Leads.

While some of the runs made and presented used the conventional, single-stage ordinary least squares approach used in the previous year (and the one used by the great majority of investigators over the past several years*), the emphasis in this report has been to compare the supply estimates derived from the two most credible approaches, and to examine in terms of the cost-effectiveness, the consequences for each type of recruiting activity of any marginal expenditures.

* See Appendix A for a comprehensive overview and summary of studies and results obtained over the past several years dealing with first term supply.

The two key approaches are:

i) the use of a simultaneous equations (utilizing two stage, least squares) approach which deals with separating out the convoluted "market" and "allocation" effects, and obtaining consistent estimates of the various elasticities involved. The key issues being addressed are: "To what extent are HSG contracts from certain districts the result of the fact that recruiters have been allocated there, or is it the case that in fact recruiters were allocated there because in the past HSG contracts were obtained from those districts?" The "market" effect has to do with the intrinsic recruit potential for the district, independent of the number of recruiters present, whereas the "allocation" effect has to do with the recruit potential due to adding more recruiters there. Hence it is sort of a "chicken and egg" phenomenon as to which is really the cause and effect. The same issue applies for the timing of the advertising, i.e. do contracts result in given months because the advertising was pulsed in certain months or is the advertising pulsed in certain months because the seasonal distribution of past contracts or leads followed a certain pattern?

The model explored utilized 3 years of monthly-district data to build a two year model with a year's lag of the distribution of HSG contracts and leads. The past year's HSG contracts and NOIC Leads were of interest to help possibly explain, respectively, the assignment of recruiters for the present year, and the timing of the advertising expenditures. The system utilized had eight endogenous variables (which are assumed to effect and be affected by each other) and a number of exogenous* variables (which only affect endogenous variables, but are not effected by the levels of activity of the other variables). The eight endogenous variables included the various levels of advertising and recruiter expenditures, leads, HSG enlistment con-

* Appendix C is included to show the types of factors and considerations other investigators have considered.

tracts, and non HSG enlistment contracts. Many interesting and intuitively reasonable interrelations were found and are presented in Section 3.

As examples, we find that the current timing of GEP's General TV/radio advertising appears to be strongly affected by the previous year's monthly distribution of NOIC Leads, and that the past year's geographical distribution of HSG contracts has a strong impact than the current year's distribution of recruiters.

ii) the use of a single-stage regression which relaxes many of the stringent and unrealistic assumptions associated with ordinary least squares (OLS) approaches. In particular, unlike OLS methods, this approach can accommodate so-called heteroscedascity, i.e. unequal variances of the error terms; further it allows and estimates correlations of the error terms between districts and over time. The results of exercising this much more powerful and credible method, which is well suited to a pooled time series/cross-sectional analysis* of the type we wish to perform, should be more realistic estimates of the elasticities sought for. These results are presented in Section 4 which also includes comparisons of the results obtained from OLS.

Finally Section 5 is presented which estimates changes in elasticities occurring when one is concerned with the upper mental category, HSG enlistments, in contrast to HSG enlistments in general. We shall see that most of the elasticities in this case are lower than for the case of HSG contracts in general.

1.3 Key Results

Exhibits 1A, B and C summarize the initial conditions, resources expended and outputs achieved for each of the three calendar years. Notice for example the significant reduction for the numbers in the Delayed Entry Program from January 1978 to December 1978 where overall dep dropped about forty-four hundred recruits (26%) and HSG dep dropped about thirty-eight hundred (24%). It is also of interest to see the progression in costs per contract and cost per accession from 1976 to 1978.

Exhibits 2A, B and C were included to help provide some overall

*Appendix B is included to discuss the advantages and disadvantages of pooled methods compared to either longitudinal or cross-sectional analysis alone.

EXHIBIT 1A

ACTUAL CY 78 PERFORMANCE

FOR NAVAL RECRUITING COMMAND

Initial Conditions	1)	Average Annual Unemployment Rate	5.86%
	2)	No. of High School Seniors	1.628 M
	3)	Relative Average Ratio of Military Pay to Civilian Pay	.738
	4)	Total Annual Quota (Accessions)	79,289
	5)	Starting Depth Position at Beginning of January 78 (Includes)	16,621
		I) No. of HSG in Depth Position at Beginning of January 78	15,520
Resources	6)	Recruiter Man Years	3,320
	7)	Total Annual Recruiter Cost @ $21,190 *	$72.931 M
	8)	Advertising Expenditures (Includes)	$ 9.344 M
		I) Lams	$ 1.317 M
		II) GEP General (Includes)	$ 5.811 M
		i) Media 1	$ 4.824 M
		ii) Media 2	$ .987 M
		III) GEP Minority	$ .754 M
		IV) Joint General	$ 1.404 M
		V) Joint Minority	$ .058 M
	9)	Sum of 7) and 8)	$82.275 M
	10)	Percent on Advertising	11.36%
Outputs	11)	NOIC Leads	154,336
	12)	No. of All Enlistments	68,631
	13)	No. of HSG Enlistments	55,012
	14)	Percent of All Enlistments that are HSG	80.16%
	15)	No. of Upper Mental Category HSG Contracts	36,557
	16)	Total Number of Accessions	72,241
	17)	Total Number of Accessions in CY 78 Due to Expenditures in CY 78 16) - 5)	55,620
	18)	Ending Depth Position at End of December 78 (Includes)	12,244
		I) No. of HSG in Depth Position at End of December 78	11,695
Performance Summary	19)	Average Cost Per Contract 9) ÷ 12)	$1,199
	20)	Average Cost Per HSG Contract 9) ÷ 13)	$1,496
	21)	Average Cost Per Accession 9) ÷ 16)	$1,139

* Includes $2.58 M RAD Expenditure

EXHIBIT 1B

ACTUAL CY 77 PERFORMANCE

FOR NAVAL RECRUITING COMMAND

Initial Conditions	1)	Average Annual Unemployment Rate	6.36%
	2)	No. of High School Seniors	1.623 M
	3)	Relative Average Ratio of Military Pay to Civilian Pay	.747
	4)	Total Annual Quota (Accessions)	97,227
	5)	Starting Depth Position at Beginning of January 77 (Includes)	25,059
		I) No. of HSG in Depth Position at Beginning of January 77	23,540
esources	6)	Recruiter Man Years	3,357
	7)	Total Annual Recruiter Cost @ $21,190	$71.135 M
	8)	Advertising Expenditures* (Includes)	$ 7.607 M
		I) Lams	$ 1.357 M
		II) GEP General (Includes)	$ 5.766 M
		i) Media 1	$ 4.677 M
		ii) Media 2	$ 1.089 M
		III) GEP Minority	$ .484 M
		IV) Joint General	0
		V) Joint Minority	0
	9)	Sum of 7) and 8)	$78.742 M
	10)	Percent on Advertising	9.66%
Outputs	11)	NOIC Leads	140,548
	12)	No. of All Enlistments	82,848
	13)	No. of HSG Enlistments	64,002
	14)	Percent of All Enlistments that are HSG	77.25%
	15)	No. of Upper Mental Category HSG Contracts	42,765
	16)	Total Number of Accessions	91,667
	17)	Total Number of Accessions in CY 77 Due to Expenditures in CY 77 16) - 5)	66,608
	18)	Ending Depth Position at End of December 77 (Includes)	16,621
		I) No. of HSG in Depth Position at End of December 77	15,520
erfor- ance Summary	19)	Average Cost Per Contract 9) ÷ 12)	$ 950
	20)	Average Cost Per HSG Contract 9) ÷ 13)	$1,230
	21)	Average Cost Per Accession 9) ÷ 16)	$ 859

* Does Not Include RAD Expenditures

EXHIBIT 1C

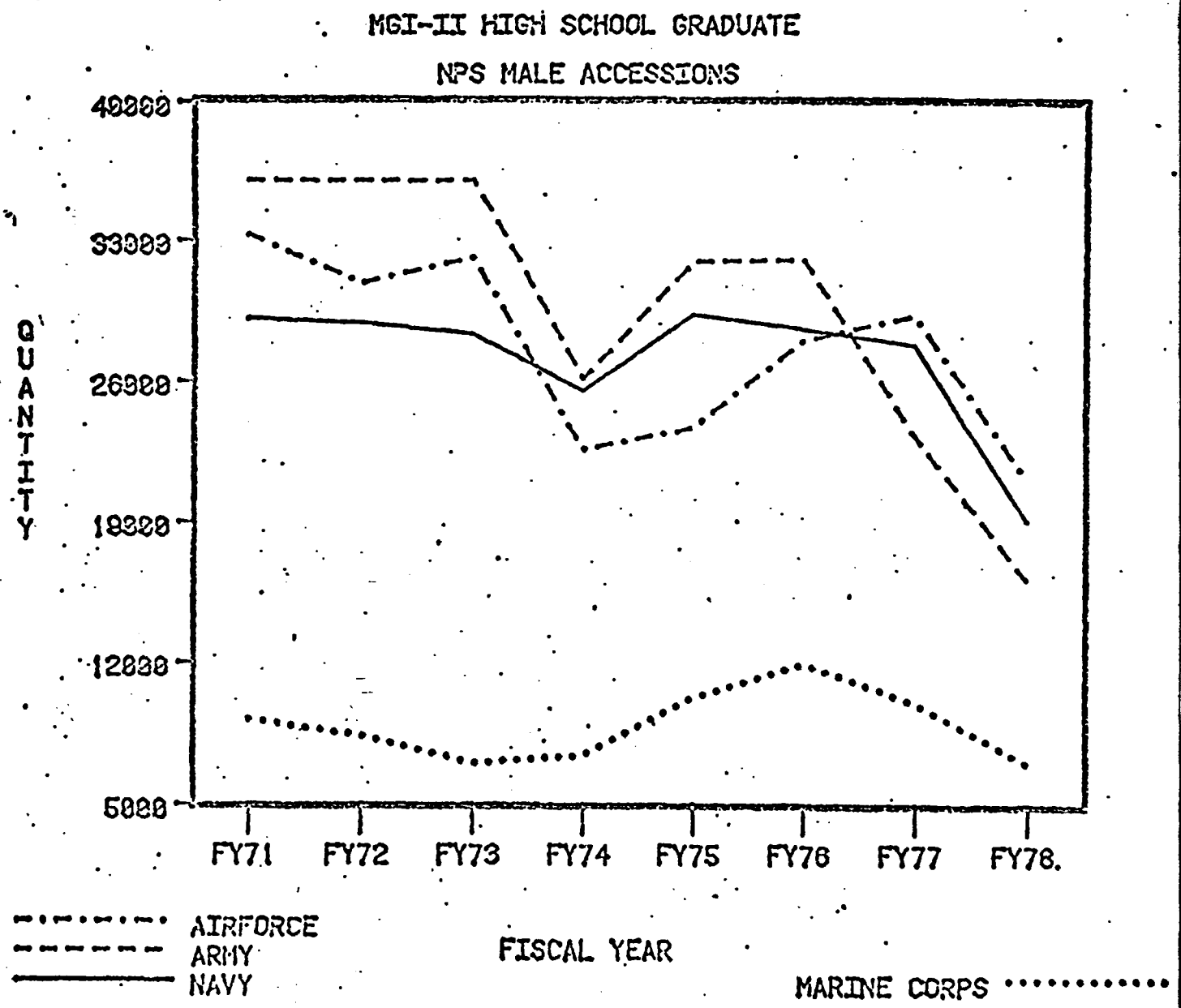
ACTUAL CY 76 PERFORMANCE

FOR NAVAL RECRUITING COMMAND

Initial Conditions	1)	Average Annual Unemployment Rate	7.51%
	2)	No. of High School Seniors	1.621 M
	3)	Relative Average Ratio of Military Pay to Civilian Pay	.765
	4)	Total Annual Quota (Accessions)	94,318
	5)	Starting Depth Position at Beginning of January 76 (Includes)	14,519
		I) No. of HSG in Depth Position at Beginning of January 76	13,464
Resources	6)	Recruiter Man Years	3,212
	7)	Total Annual Recruiter Cost @ $21,190	$68.062 M
	8)	Advertising Expenditures* (Includes)	$ 5.637 M
		I) Lams	$ 1.243 M
		II) GEP General (Includes)	
		i) Media 1	$ 1.373 M
		ii) Media 2	$ 2.694 M
		III) GEP Minority	$ .327 M
		IV) Joint General	0
		V) Joint Minority	0
	9)	Sum of 7) and 8)	$73.699 M
	10)	Percent on Advertising	7.65%
Outputs	11)	NOIC Leads	152,891
	12)	No. of All Enlistments	103,466
	13)	No. of HSG Enlistments	83,259
	14)	Percent of All Enlistments that are HSG	80.49%
	15)	No. of Upper Mental Category HSG Contracts	59,686
	16)	Total Number of Accessions	90,997
	17)	Total Number of Accessions in CY 76 Due to Expenditures in CY 76 16) - 5)	76,478
	18)	Ending Depth Position at End of December 76 (Includes)	25,059
		I) No. of HSG in Depth Position at End of December 76	23,540
Performance Summary	19)	Average Cost Per Contract 9) ÷ 12)	$ 712
	20)	Average Cost Per HSG Contract 9) ÷ 13)	$ 885
	21)	Average Cost Per Accession 9) ÷ 16)	$ 810

* Does Not Include RAD Expenditures

EXHIBIT 2A


MGI-II HIGH SCHOOL GRADUATE
NPS MALE ACCESSIONS
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33000
26000
19000
12000
5000
QUANTITY
FY71
FY72
FY73
FY74
FY75
FY76
FY77
FY78
AIRFORCE
ARMY
NAVY
MARINE CORPS
FISCAL YEAR

EXHIBIT 2B

MG-IIIA MALE NPS HSG ACCESSIONS

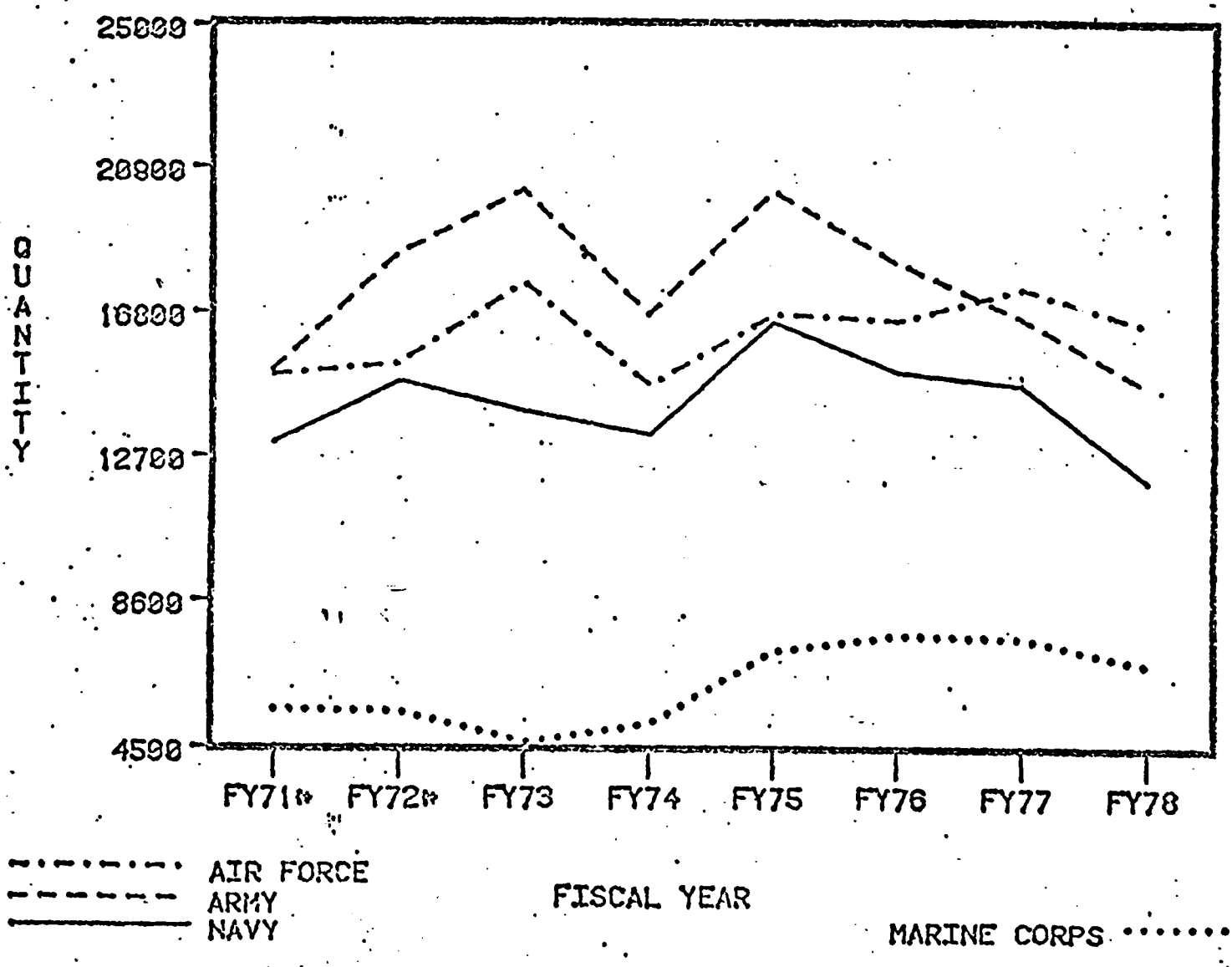
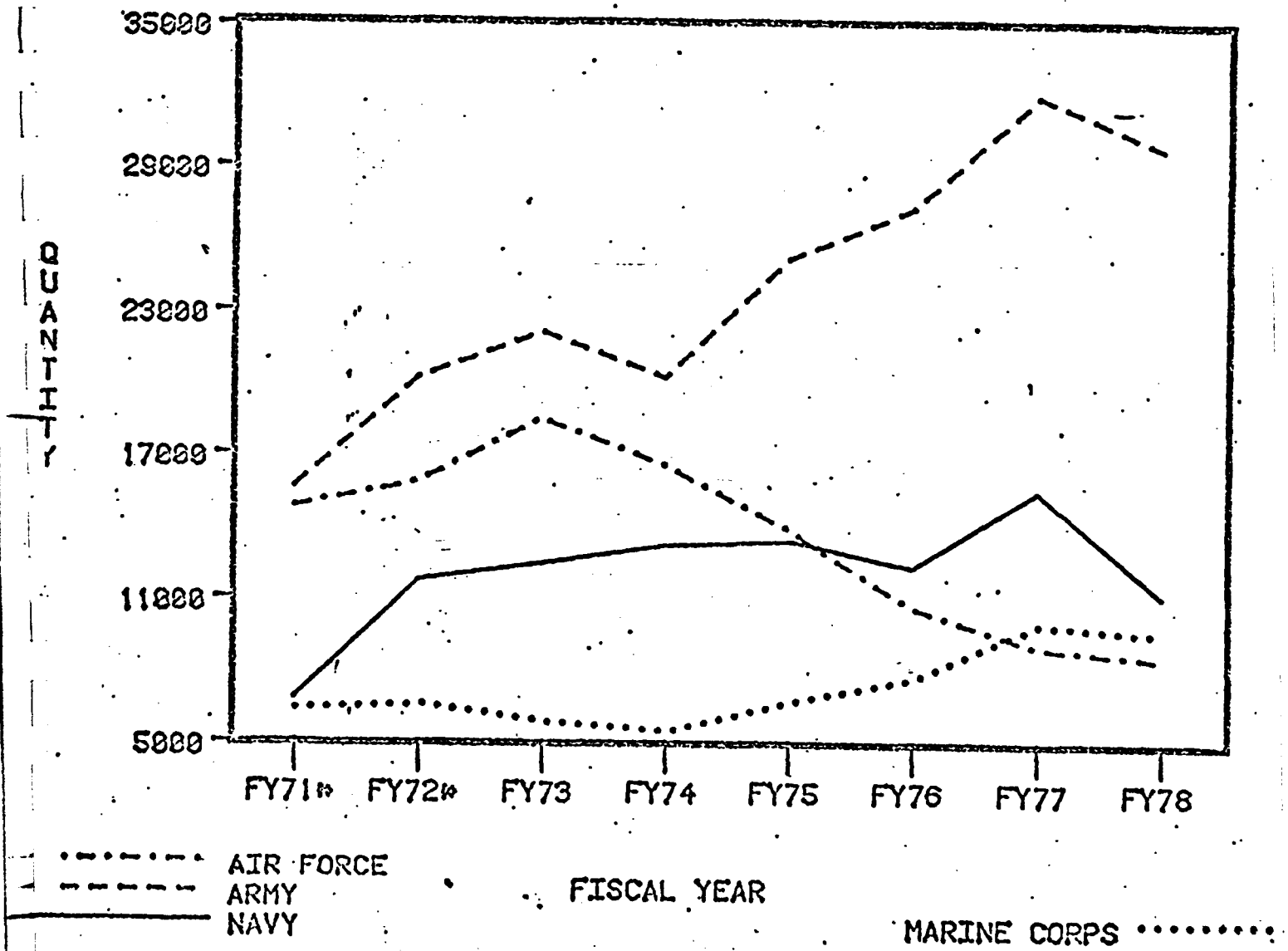


EXHIBIT 2C

MG-IIIB MALE NPS HSG ACCESSIONS



perspective on recruiting since the All-Volunteer Force and how the 3 year period 1976-78 fits in with the general scheme. Exhibit 3A shows district-level breakdowns of the total recruiter related costs from a national, yearly perspective and for 1978,comparisons of the percent expenditures with the percent of HSG contracts obtained. Note for example that for Area 500 each of its districts, in terms of HSG contracts,is not meeting its pro-rata share of recruiter related expenditures, whereas practically every district in Area 100 is exceeding its pro-rata expenditures. We also quickly add that these results are not adjusted for differences in demographics or advertising expenditures. Exhibit 3B shows the huge variation in the pulsing of advertising for the General Enlisted Program. It shows for 1978 the biggest months were February and October,with essentially nothing in December and very little in January, June and August.

Next we present a chart, Exhibit 4, showing, for the two main regression approaches, the impact any additional dollars spent in CY78 would have had on NOIC Leads. The cost shown is the media cost* for one additional NOIC lead if all the additional money was spent on the particular type of advertising shown. Note the actual number of Leads was 154,336 and the total cost for the 5 media was $9.344M. Hence the average actual cost was $60.54.

Hence it is very clear that, if more NOIC Leads were desired in CY78 and if additional dollars were to have become available then, their impact would have been maximized by putting them into GEP-General's printed budget. As is shown subsequently,the results of the model indicate that the great bulk of GEP's advertising should be for printed materials, in contrast to the present TV/radio dominance.

* Does not include overhead and profit of advertising agency and assumes no additional labor involved.

EXHIBIT 3A

PERCENT OF YEARLY NATIONAL EXPENDITURES FOR RECRUITERS, LAMS & RAD BY DISTRICT BY YEAR

Recruiting District	Percent Expend 1976	Percent Expend 1977	Percent Expend 1978	Percent Area Total Expend 1978	% HSG 1978	Area Totals % HSG 1978
Albany	.0322	.0304	.0303		.0301	
Boston	.0314	.0321	.0345		.0420	
Buffalo	.0317	.0309	.0308		.0321	
New York	.0300	.0304	.0324		.0374	
Harrisburg	.0159	.0182	.0185		.0203	
Philadelphia	.0249	.0286	.0312	Area 100	.0315	Area 100
Newark	.0251	.0250	.0243	.2020	.0281	.2215
Montgomery	.0162	.0161	.0190		.0222	
Columbia	.0139	.0147	.0160		.0172	
Jacksonville	.0160	.0189	.0255		.0282	
Atlanta	.0177	.0170	.0224		.0240	
Nashville	.0147	.0171	.0203		.0166	
Raleigh	.0173	.0173	.0206		.0245	
Memphis	.0138	.0143	.0182	Area 300	.0186	Area 300
Miami	.0168	.0188	.0251	.1671	.0306	.1819
Louisville	.0175	.0180	.0167		.0141	
Richmond	.0158	.0163	.0155		.0145	
Washington	.0247	.0249	.0217		.0309	
Cleveland	.0306	.0291	.0268		.0205	
Columbus	.0275	.0278	.0271		.0259	
Pittsburgh	.0219	.0217	.0206		.0239	
Detroit	.0402	.0428	.0416	Area 400	.0484	Area 400
Indianapolis	.0196	.0194	.0183	.1883	.0131	.1913
Chicago	.0383	.0302	.0280		.0212	
St. Louis	.0239	.0246	.0231		.0189	
Kansas City	.0186	.0221	.0218		.0165	
Minneapolis	.0286	.0249	.0211		.0161	
Omaha	.0187	.0180	.0159		.0120	
Des Moines	.0168	.0198	.0204	Area 500	.0141	Area 500
Milwaukee	.0217	.0191	.0161	.1464	.0130	.1118
Denver	.0193	.0197	.0188		.0147	
Albuquerque	.0149	.0153	.0146		.0182	
Dallas	.0252	.0228	.0211		.0198	
Houston	.0163	.0160	.0164		.0181	
Little Rock	.0148	.0147	.0131		.0150	
New Orleans	.0131	.0105	.0096		.0113	
Oklahoma City	.0144	.0140	.0133	Area 700	.0086	Area 700
San Antonio	.0167	.0168	.0163	.1393	.0144	.1201
Los Angeles	.0446	.0451	.0421		.0422	
Portland	.0249	.0244	.0282		.0234	
San Francisco	.0547	.0541	.0465		.0528	
Seattle	.0307	.0297	.0215	Area 800	.0211	Area 800
San Diego	.0282	.0280	.0285	.1728	.0338	.1733

EXHIBIT 3B

CY78 GEP NATIONAL EXPENDITURES BY MONTH

FOR GEP-MINORITY, GEP-GENERAL & TOTAL

	GEP MINORITY	PERCENT	GEP GENERAL	PERCENT	GEP TOTAL	PERCENT
JANUARY	41,828.7	5.55	262,355	4.51	304,183.7	4.63
FEBRUARY	83,319.2	11.05	841,796	14.48	925,115.2	14.09
MARCH	93,612.6	12.41	672,181	11.57	765,793.6	11.66
APRIL	72,906	9.67	494,165	8.50	567,071	8.64
MAY	93,247.5	12.36	756,417	13.02	849,691.5	12.94
JUNE	44,790	5.94	116,982	2.01	161,772	2.46
JULY	60,286.8	7.99	277,307	4.77	337,593.8	5.14
AUGUST	52,884.5	7.01	274,886	4.73	327,770	4.99
SEPTEMBER	47,116.9	6.25	408,196	7.02	455,312.9	6.93
OCTOBER	94,002.2	12.46	982,471	16.91	1,076,473.2	16.40
NOVEMBER	70,185.1	9.31	716,159	12.32	786,344.1	11.98
DECEMBER	0	0	8,597	0.15	8,597	0.13
TOTAL	754,179.5	100.0	5,811,512	100.0	6,565,691.5	100.0

Observe that about a third of the advertising is being pulsed presently in the two months of February and October, about 37% in the three months of November, May and March, and only about 22% in the five months of January, June, July, August, September, and December.

Consider the case now for HSG contracts and for Upper Mental category HSG contracts. We note that the actual average cost per HSG contract in CY78 (using $21,190 per year as the cost of a recruiter) $1,496 and for the Upper Mental, HSG contract, it was $2,251, where 55,012 HSG contracts and 36,557 Upper Mental, HSG contracts were actually obtained. Hence it is very clear from Exhibit 5 that, if the estimates are at all correct, LAMS has been underfunded and that the TV/radio portion of GEP-General has been overfunded. The same directions of recommendations comes from the simultaneous model where LAMS had large elasticities. Also note that, with the exception of LAMS, the cost of one additional upper mental category, HSG is about 50% more than that of a HSG contract (with the mix of Upper Mentals and Lower Mentals resulting in 78).

Finally in Exhibit 6 we present a ranking of districts in terms of their adjusted performance in obtaining HSG contracts. This ranking can be used to provide an "early warning system" to detect exceptional districts for which field audits and on-site assessments would appear warranted. The rankings are given in terms of a predicted "enlistment rate" for each district after one has adjusted or taken into account favorable or unfavorable circumstances for the district such as its population, unemployment rate, numbers of recruiters, etc.. The interpretation of this adjusted enlistment rate for district i is the estimated ratio of male, non prior service HSG contracts to the number of male high school seniors that would be obtained if district i's demographics, and resources (for the 3 year period) were suddenly changed to those of the "average" district; the average district is one which has the average value (over all districts in the country) for each demographic , and resource . The methods for accomplishing this are presented in Section 4.6. We note that a district such as San Antonio, which is in the top 11 in terms of its unadjusted performance, falls to the 35th position when adjustments are made for favorable demographics.* On the other

*This result and the worst position for Oklahoma City were also confirmed by the size and level of significance of the district dummy variables used in the simultaneous model (see Section 3.3.3 for more details).

EXHIBIT 4

MARGINAL COST PER ADDITIONAL NOIC LEAD *
(Based on CY1978 experience and estimated elasticities)

MEDIA TYPE	Actual media experience in CY1978	Estimate of marginal cost from single stage heteroscedastic model for 1 more lead	Estimate of marginal cost from simultaneous two stage model for 1 more lead
GEP-General's National TV/Radio/ Billboards	$4.824M	91.36	223.18
GEP-General's National Printed Materials	$ .987M	6.48	2.78
GEP-Minority	$ .754M	70.81	no impact found
LAMS (classified ads, locally managed)	$1.317M	no impact found	no impact found
Joint Advertising	$1.458M	no impact found	no impact found

* THE AVERAGE COST PER LEAD WAS $60.54 FOR CY 78.

EXHIBIT 5

MARGINAL COST PER ADDITIONAL CONTRACT OF TYPE SPECIFIED

(Based on CY78 experience and
estimated elasticities from heteroscedastic model)

	Actual CY1978 Costs	Estimate of Marginal cost for 1 additional HSG contract*	Estimate of Marginal cost for 1 additional Upper Mental, HSG contract
Recruiter and RAD materials @ $21,190 per recruiter	$72.931M (3,320 recruiters & and 2.58M in RAD)	1,761	2,625
GEP-General's TV/Radio/Billboard	$ 4.824M	28,353	39,843
GEP-General's Printed materials	$ .987M	2,005	3,212
GEP-Minority	$ .754M	22,176	29,453
LAMS	$ 1.317M	521	554
JADOR	$ 1.458M	no impact found	no impact found

*Based on mix of 66% Upper Mental category & 34% of Lower Mental category.

EXHIBIT 6

PREDICTED HSG ENLISTMENT RATE* ADJUSTED FOR DIFFERENCES IN DEMOGRAPHICS AND RESOURCES (CY76-CY78)**
(Predicted Enlistment Rate if District's Demographic and Resources at Average Level)

	RANK	DISTRICT	REGION	ACTUAL HSG ENLISTMENT RATE	PREDICTED HSG ENLISTMENT RATE
(Best)	1	San Francisco	800	4.31%	6.31%
	2	Detroit	400	3.69%	5.88%
	3	Boston	100	3.34%	5.07%
	4	Los Angeles	800	3.99%	5.05%
	5	New York	100	2.95%	4.60%
	6	San Diego	800	4.43%	4.34%
	7	Buffalo	100	4.53%	4.08%
	8	Washington	400	3.32%	4.01%
	9	Philadelphia	100	3.57%	3.98%
	10	Miami	300	4.80%	3.88%
	11	Albany	100	3.98%	3.82%
	12	Newark	100	3.27%	3.65%
	13	Jacksonville	300	5.41%	3.61%
	14	Columbus	400	3.58%	3.37%
	15	Raleigh	300	3.29%	3.31%
	16	Pittsburgh	400	3.09%	3.21%
	17	Atlanta	300	4.66%	3.15%
	18	Portland	800	4.44%	3.07%
	19	Montgomery	300	4.51%	3.05%
	20	Harrisburg	100	3.37%	2.80%
	21	Chicago	500	2.27%	2.77%
	22	Seattle	800	3.59%	2.76%
	23	Dallas	700	3.89%	2.67%
	24	Cleveland	400	2.69%	2.66%
	25	Albuquerque	700	4.37%	2.65%
	26	Memphis	300	3.37%	2.59%
	27	St. Louis	500	3.00%	2.55%
	28	Houston	700	4.13%	2.54%
	29	Columbia	300	3.53%	2.37%
	30	Kansas City	500	2.76%	2.32%
	31	Little Rock	700	3.54%	2.24%
	32	Nashville	300	3.62%	2.23%
	33	Minneapolis	500	2.73%	2.21%
	34	Richmond	400	2.74%	2.07%
	35	San Antonio	700	4.02%	2.04%
	36	Louisville	400	2.36%	2.03%
	37	Denver	700	3.40%	2.03%
	38	Des Moines	500	2.23%	1.99%
	39	Milwaukee	500	2.43%	1.91%
	40	Indianapolis	400	3.02%	1.86%
	41	Omaha	500	2.23%	1.79%
	42	New Orleans	700	2.93%	1.77%
(Worst)	43	Oklahoma City	700	2.43%	1.31%

*Ratio of high school graduate contracts to size of high school male senior population
**By way of a benchmark, the overall national ratio of HSG contracts to male HS seniors was 3.647% (i.e., 55,012 ÷ 1,508,425) for CY 1978. As an illustration, Oklahoma City's predicted enlistment rate, if its demographics and resources were suddenly changed to those of an "average" district, would be 1.31%.

hand a district such as Chicago, which is third from the bottom in terms of its unadjusted performance, rises to a respectable 22nd from the bottom (or 21st from the top) when unfavorable demographics and resources are accounted for.

It should be restressed that the rankings are qualified in the sense that they disregard measurement problems, and that there may well be demographic factors, other than those included in the model, that "explain" the exceptional status. However, this caveat notwithstanding, it is felt this tentative indicator of relative performance might be of use in objectively highlighting those districts with recruiting practices that should perhaps be tried in other districts, as well as those districts where some deterioration has potentially occurred. Eventually it may be possible to periodically recompute the adjustments to reflect the dynamic character of quality constraints, quotas, and individual operating environments.

2.0 DATA INCLUDED IN ANALYSIS OF MONTHLY QUALITY ENLISTMENT CONTRACTS BY RECRUITING DISTRICT OVER PERIOD JANUARY 1976 - DECEMBER 1978

2.1 Summary of Data Base Utilized and Results from Earlier Analysis

2.1.1 Data and Analysis Considerations

The analyses performed over the calendar year 1979 by this Investigator was limited to the following variables which were then readily available:

1) number of High School graduate contracts by month by district (both Regular Navy and Active Mariners);

2) number of "on board" recruiters by month by district;

3) dollars of advertising for the so-called General Enlistment Program-General. This is the major portion of the advertising expenditures (see the breakdowns included), and refers to advertising aimed at the general public (in contrast to the minority advertising). The other types of enlisted advertising not addressed in the earlier work are General Enlisted Program - Minority, and Joint Military Advertising (both General and Minority). In addition, in the earlier efforts the GEP-General was combined with the LAMS (classified ads) and RAD (Recruiter Aid) expenditures to create one overall advertising variable;

4) the total civilian labor force for each district by month;

5) the number of unemployed in the civilian labor force (by district by month);

6) the number of high school seniors by district by year;

7) the accession quotas (for combined Regular Navy and Active Mariners);

8) the number of NOIC (national leads) by district by month;

The earlier effort's response function analysis consisted of applying a single stage, ordinary least squares, log-linear model with a distributed lag. This utilized a pooled time series cross sectional data, applied first to the CY 1976-1977 period. This effort utilized monthly and district indicator (dummy) variables to capture the many demographic and policy variables, such as pay, not included. The model was then applied to the CY 1978 in a validation effort. This yielded forecasts which were somewhat overly optimistic* (by about 6-8% on the average). However it demonstrated the basic appeal of the pooled time series - cross sectional approach (see Appendix B for more discussion on this issue) as well as the advantage of analyzing enlistment contracts, in contrast to the past approaches of concentrating on accessions. (The reader is referred to Appendix A for a summary of past recruit supply studies and their findings.)

The main advantage of studying enlistment contracts, rather than accessions, is that with the widespread use of the Delayed Entry Program (71% of the Navy accession in FY 1977 utilized the DEP mechanism) one can estimate the lagged effect of advertising, unemployment, recruiter efforts, etc. much more accurately. Also, the pooled approach, in contrast to performing only cross-sectional regressions or longitudinal regression analyses separately, has the ability to account for variations in enlistment patterns across both dimensions simultaneously. Hence factors which may be difficult to separate out using a time series method only, such as relative military/civilian pay and recruiters, become amenable by adding the geographical variation. In addition, in contrast to only

*One reason for this overestimate is that the CETA (Comprehensive Employment and Training Act) Program, designed to provide employment opportunities for youth, began in this year. The Program, with outlays of 5-6 Billion dollars, employed some 360,000 youths.

using cross-sectional analyses, one can discern from a pooled approach the impact of changes in policy variables such as the advertising mix, as well as determine seasonal and lag patterns.

2.1.2 Findings from the Earlier 1979 Analysis

Ater the above tasks had been accomplished to help establish a degree of credibility in the approach (both in terms of its forecasts as well as the use of "reasonableness" checks on the elasticities produced), the data for CY78 was included and the regressions redone for the entire 3 year period 1976 - 1978. These results were then used to help prepare forecasts of the budgets needed in the POM process for various quotas, demographic and economic scenarios for the periods 1982 - 1986. A summary of these results is included in Appendix D. The key econometric results were that the long term elasticity for recruiters and the aggregated advertising variable (GEP-General, LAMS, RAD) for HSG contracts were .55 and .08, respectively; the other key elasticities were .36 for the number of high school seniors, and .10 for the overall unemployment rate. This implies an optimal mix of media* expenditures (relative to the total of media and recruiter expenditures) of 12.7%.

2.2 New Data Analyzed

The efforts performed under the present contract have included many more demographic variables, much more detail and breadth in the advertising area, the key policy of relative pay, and the impacts of the DEP program. By doing so, it was envisioned

*The only advertising costs included are the actual media costs. No overhead costs (at about 21% of media costs), profits, and labor costs are included for advertising.

that one would have less need for district dummy variables which were capturing not only omitted demographic factors, but also the relative efficiency or inefficiency of the district commander. Hence, in terms of possibly utilizing the results of the predictive equation to aid in goaling (i.e. setting the optimal levels of quotas) it was felt to be desirable to have a predictive equation which did not capture the efficiency effect; this is both for reasons of equity as well as the fact that district commanders are constantly changing. With this thrust in mind, the new factors included were:

a) A breakdown of GEP - "General" into two types, i.e. those expenditures associated with a relatively low level of involvement, because of the speed of viewing (i.e., TV, radio, billboards) and those expenditures with a higher level of involvement (magazines, direct mail, supplements);

b) Use of LAMS (classified ads) as a separate variable;

c) Elimination of analysis of RAD expenditures as a separate factor since the only data available relates to when the RAD materials (brochures) were sent to the district, and not when they were disseminated to potential recruits. It was felt their inclusion might mask the effects of other advertising and in general add more "noise." It is suggested therefore that the cost of RAD materials (at $2.58M for CY78) be included in with the costs of recruiters in any optimization calculations;

d) Use of GEP-Minority advertising (by district by month) as a separate factor;

e) Use of Joint JADOR Advertising (both general and minority) by district by month as a separate factor;

f) Inclusion of relative pay, i.e. the ratio of the first year's average RMC to average yearly civilian pay (non agricultural and non supervisory workers), by district by month; the RMC includes basic pay, allowances for quarters and subsistence, and the tax advantage;

g) Propensity or perception of military (this is based on responses to a survey administered twice a year to the male youth population); this data is by year by district;

h) "Percent Blacks" in the district; this is by year by district;

i) Urban-Rural mix, i.e., percent of population included in the SMSA for each district; this factor is again by year by district;

j) The total size of the DEP pool, i.e. the number of men who have signed contracts but have not yet shipped; this data, by month by area, is hypothesized to influence leads due to the peer "grapevine" network.

k) The number of monthly HSG shipments that are the result of drawing down the Delayed Entry Pool; this data, by month by area, is related to the degree to which a district's quality quotas are being met from the DEP pipeline and hence perhaps to variations in the monthly productivity of the recruiters (i.e. when the difference between the quality quota and the number coming in the DEP from pipeline is large, one might expect a recruiter to exert himself more than when this difference is small).

It is felt the inclusion of these factors will improve the explanatory power of the models and also provide valuable insights on their relative contributions. A survey of factors and findings from other supply studies is included in Appendix C.

In addition to these types of explanatory or independent variables, two sets of dependent variables were analyzed due to

a change in the Recruiting Command's policy to base their quality quotas both on enlistments from mental categories 1-IIIU, and on High School graduate enlistments. Unfortunately the only available data is on estimates of upper mental category 1-IIIU's, who are also High School graduates. However, in an effort to help shed some insights into the upper mental category supply, we present separate results for HSG graduate enlistment contracts as well as for the Upper Mental category, HSG contracts.

2.3 SUMMARY OF DATA OVER PERIOD JANUARY 1976-DECEMBER 1978.

The following charts are included which summarize some of the key data sources and include some of the advertising detail for 1978. One should appreciate that the actual data base utilized is at the monthly-district level over this three year period; hence there are 36 months x 43 districts = 1,548 separate observations for contracts, recruiters, unemployment rates, advertising, etc. Also included, are the variations in actual and inflation adjusted advertising costs for the period 1964-1978 and the empirical lag factors for the Delayed Entry Program for CY 78 for HSG contracts.

EXHIBIT 7

TOTAL NAVY ADVERTISING BUDGET
(in thousands of dollars)

FY	Current Dollars[1]	Constant Dollars[2]
64	1,004	1,088
65	919	981
66	1,029	1,072
67	1,324	1,342
68	1,298	1,271
69	1,465	1,369
70	1,667	1,474
71	1,798	1,513
72	7,051	5,719
73	23,017	17,815
74	26,753	19,055
75	25,549	16,537
76	16,839	10,150
77[3]	16,389	9,228
78[4]	18,030	9,836

[1]Source: Navy Recruiting Command.

[2]Calender Year 1967 = 100

[3]Change in start of fiscal year from July to October. Advertising expenditures during the transitional quarter (TQ) were $3,318,000 in current dollars and $1,964,000 in constant dollars.

[4]Current dollars and constant dollar figures are not identical in 67 because expenditure figures are FY67 and the deflator is 100 in CY67.

EXHIBIT 8A: DEMOGRAPHICS FOR FY78

No.	RECRUITING DISTRICT	PROPENSITY	POPULATION TOTAL URBAN	POPULATION TOTAL BLACK	POPULATION TOTAL
1.	Albany	.2239	232967	20032	277900
2.	Boston	.2598	318374	13612	412156
3.	Buffalo	.2239	185054	18760	248449
4.	New York	.2210	460530	71631	460530
5.	Harrisburg	.2203	128571	7539	188979
6.	Philadelphia	.2008	269463	53253	283750
7.	Newark	.2239	225386	30716	248055
8.	Montgomery	.2650	108474	55521	189327
9.	Columbia	.2880	117510	68189	194486
10.	Jacksonville	.2818	117912	34159	167244
11.	Atlanta	.2880	116743	55411	191904
12.	Nashville	.2650	138560	27278	223702
13.	Raleigh	.2459	140143	87418	310079
14.	Memphis	.2650	61273	74866	198759
15.	Miami	.2818	186695	34178	208408
16.	Louisville	.2169	92211	18116	216418
17.	Richmond	.2459	144592	52544	218396
18.	Washington	.2577	250319	80567	296783
19.	Cleveland	.2055	209645	28529	246327
20.	Columbus	.2055	211746	26022	279482
21.	Pittsburgh	.2383	122890	12283	205694
22.	Detroit	.1954	367223	54439	427822
23.	Indianapolis	.1954	117593	13843	177769
24.	Chicago	.1515	349215	70461	369788
25.	St. Louis	.2254	125223	24763	230346
26.	Kansas City	.1990	96279	14959	210088
27.	Minneapolis	.1917	140273	2851	213935
28.	Omaha	.1917	63168	4030	195901
29.	Peoria	.1781	132218	11638	251192
30.	Milwaukee	.1717	127757	8230	211457
31.	Denver	.2298	125290	7832	180072
32.	Albuquerque	.2298	77864	6907	148485
33.	Dallas	.2362	184940	35382	219915
34.	Houston	.2362	163080	44257	194311
35.	Little Rock	.2254	78822	42728	163877
36.	New Orleans	.2333	105739	46159	151147
37.	Okalhoma City	.1990	78161	13524	139770
38.	San Antonio	.2362	137561	14769	176170
39.	Los Angeles	.2070	445781	43441	458237
40.	Portland	.2134	133675	4523	227693
41.	San Francisco	.1940	450182	38851	527814
42.	Seattle	.2134	152422	9534	265037
43.	San Diego	.2070	311680	25189	347022

EXHIBIT 8B : DEOMOGRAPHICS FOR FY 77

No.	RECRUITING DISTRICT	PROPENSITY	POPULATION TOTAL URBAN	POPULATION TOTAL BLACK	POPULATION TOTAL
1.	Albany	.2319	205084	19093	274825
2.	Boston	.2489	302743	12970	407360
3.	Buffalo	.2319	183596	17655	249056
4.	New York	.2494	458099	91540	458099
5.	Harrisburg	.2334	130802	7154	191356
6.	Philadelphia	.1886	276008	52514	290336
7.	Newark	.2319	225057	29945	248058
8.	Montgomery	.2772	106520	54875	187722
9.	Columbia	.2836	121392	66490	195800
10.	Jacksonville	.2835	118369	33750	164761
11.	Atlanta	.2836	105535	54554	186359
12.	Nashville	.2772	114342	26284	215252
13.	Raleigh	.2119	140910	85616	309592
14.	Memphis	.2772	60924	73540	193097
15.	Miami	.2835	184038	33869	206730
16.	Louisville	.2299	89619	17535	214711
17.	Richmond	.2119	139338	51693	215620
18.	Washington	.2749	250011	79385	298775
19.	Cleveland	.2130	209593	27926	246403
20.	Columbus	.2130	208242	25061	275605
21.	Pittsburgh	.2168	123307	11919	206015
22.	Detroit	.1826	365358	53371	427621
23.	Indianapolis	.1826	106087	13307	177628
24.	Chicago	.1562	344766	69520	364994
25.	St. Louis	.2512	121844	24552	234275
26.	Kansas City	.1921	93345	14633	209147
27.	Minneapolis	.1810	128652	2532	210193
28.	Omaha	.1810	63419	3515	196169
29.	Peoria	.1797	128185	10876	251937
30.	Milwaukee	.1597	126316	8115	209633
31.	Denver	.2295	108042	7416	181595
32.	Albuquerque	.2295	80397	6681	152181
33.	Dallas	.2302	34229	34421	217013
34.	Houston	.2302	152770	41926	182938
35.	Little Rock	.2512	69917	41990	161540
36.	New Orleans	.2185	99352	45091	147392
37.	Okalhoma City	.1921	76437	12775	135878
38.	San Antonio	.2302	137577	14251	176591
39.	Los Angeles	.2134	430972	41981	443200
40.	Portland	.2284	130160	4255	223352
41.	San Francisco	.2136	450417	37450	527299
42.	Seattle	.2284	151731	9054	265106
43.	San Diego	.2134	311745	23214	347362

EXHIBIT: 9A SUMMARY OF ADVERTISING FOR THE
GENERAL ENLISTED PROGRAM AND THE JADOR PROGRAM

TOTAL 1978

NAME	TV	RADIO	MAGAZINE	MAIL	OUTDOOR	NEWSPAPER	SUPPLEMENT	TOTAL	% OF GRAND TOTAL
GEP MINORITY	0	663,693	90,472.9	0	0	0	0	754,180	.09398
JOINT MINORITY	0	C	27,970.4	0	0	0	30,294.5	58,264.9	.00726
GEP GENERAL	2,715,358	2,109,045	525,620	461,090	0	0	0	5,811,514	.72421
JOINT GENERAL	0	13,914.9	1,337,748	0	0	48,999.4	0	1,400,663	.17455
GRAND TOTAL	2,715,358	2,786,652.9	1,981,811.3	461,090	0	48,999.4	30,294.5	8,024,621.9	
% OF GRAND TOTAL	.33840	.34728	.24698	.05746	0	.00611	.00377		

EXHIBIT 9B : BREAKDOWN OF GEP-GENERAL

FOR CY 1978 BY RECRUITING AREA AND MODE

AREA	TV	RADIO	MAGAZINE	MAIL	OUTDOOR	NEWSPAPER	SUPPLEMENT	TOTAL	% OF GRAND TOTAL
1	568,041	491,600	103,465	82,564.3	0	0	0	1,245,698	.21435
3	417,470	292,107	71,789.8	71,340.8	0	0	0	852,796	.14674
4	525,169	442,700	102,572	90,077.3	0	0	0	1,160,589	.19970
5	446,313	266,623	100,131	93,810.2	0	0	0	906,978	.15607
7	330,717	236,383	61,740.5	81,405.2	0	0	0	710,322	.12223
8	427,648	379,633	85,922.1	41,891.9	0	0	0	935,131	.16091
TOTAL	2,715,358	2,109,045	525,620	461,090	0	0	0	5,811,514	1.00

EXHIBIT 9C: BREAKDOWN OF GEP-MINORITY
FOR CY 78 BY RECRUITING AREA AND MODE

AREA	TV	RADIO	MAGAZINE	MAIL	OUTDOOR	NEWSPAPER	SUPPLEMENT	TOTAL	% OF GRAND TOTAL
1	0	123,484	20,824.2	0	0	0	0	144,309	.19134
3	0	111,072	17,104	0	0	0	0	128,182	.16996
4	0	145,480	22,911.7	0	0	0	0	168,394	.22328
5	0	93,571.6	11,349.4	0	0	0	0	104,922	.13912
7	0	79,410	8,970.78	0	0	0	0	88,382.8	.11719
8	0	110,676	9,312.83	0	0	0	0	119,989	.15909
TOTAL	0	663,693	90,472.9	0	0	0	0	754,180	1.00

EXHIBIT 9D : BREAKDOWN OF JOINT GENERAL
FOR CY 78 BY AREA AND MODE

AREA	TV	RADIO	MAGAZINE	MAIL	OUTDOOR	NEWSPAPER	SUPPLEMENT	TOTAL	% OF GRAND TOTAL
1	0	9,844.94	319,622	0	0	35,288.5	0	364,756	.26042
3	0	0	148,004	0	0	3.7	0	148,008	.10567
4	0	0	262,798	0	0	2.46	0	262,801	.18763
5	0	0	226,899	0	0	0	0	226,899	.16199
7	0	4,069.96	132,692	0	0	7,083.8	0	143,846	.10270
8	0	0	247,733	0	0	6,620.92	0	254,354	.18159
TOTAL	0	13,914.9	1,337,748	0	0	48,999.4	0	1,400,663	1.00

EXHIBIT 9E: BREAKDOWN OF JOINT MINORITY ADVERTISING

FOR CY 78 BY AREA AND MODE

AREA	TV	RADIO	MAGAZINE	MAIL	OUTDOOR	NEWSPAPER	SUPPLEMENT	TOTAL	% OF GRAND TOTAL
1	0	0	5,985.94	0	0	0	4,751.1	10,737	.18427
3	0	0	7,584.78	0	0	0	6,879.48	14,464.3	.24825
4	0	0	6,458.88	0	0	0	9,597.24	16,056.1	.27557
5	0	0	2,927.68	0	0	0	1,198.35	4,126.03	.07081
7	0	0	1,994.96	0	0	0	3,076.25	5,071.22	.08703
8	0	0	3,018.12	0	0	0	4,792.08	7,810.2	.13405
TOTAL	0	0	27,970.4	0	0	0	30,294.5	58,264.9	1.00

EXHIBIT 9F : DELAY FACTORS FOR SHIPMENTS OF HSG CONTRACTS

Delay in Months	0	1	2	3	4	5	6	7	8	9	10	11	12
JAN.	.3508	.1535	.0608	.0244	.0297	.0715	.0801	.0529	.0535	.1087	.0056	.0025	.0056
FEB.	.3167	.1667	.0671	.0408	.0787	.0782	.0754	.0667	.0352	.0543	.0047	.0023	.0130
MARCH	.2901	.1424	.0844	.0964	.0903	.0872	.0858	.0525	.0259	.0373	.0048	.0014	.0014
APRIL	.2919	.1617	.1285	.1007	.1019	.0701	.0575	.0330	.0220	.0264	.0018	.0016	.0005
MAY	.3980	.2019	.1156	.0721	.0598	.0507	.0317	.0141	.0240	.0265	.0016	.0014	.0025
JUNE	.4777	.1461	.0928	.0670	.0244	.0149	.0132	.0177	.0089	.0593	.0093	.0082	.0602
JULY	.4990	.1374	.1090	.0341	.0320	.0185	.0257	.0093	.0010	.0399	.0049	.0702	.0188
AUG.	.5088	.1063	.0968	.0439	.0326	.0270	.0122	.0580	0	.0363	.0773	.0232	.0295
SEPT.	.5320	.1530	.0531	.0336	.0372	.0206	.0136	.0068	.0016	.1129	.0114	.0052	.0042
OCT.	.4952	.1158	.0535	.0526	.0182	.0133	.0069	.0105	.0499	.1555	.0206	.0105	.0058
NOV.	.4517	.0966	.0909	.0281	.0186	.0114	.0215	.0704	.0490	.1456	.0155	.0066	.0019
DEC.	.3925	.1656	.0499	.0264	.0148	.0275	.0950	.0516	.0815	.0756	.0115	.0041	.0039

*EXAMPLE 35.08 percent of contracts signed in January will ship in January and 6.08 percent of the January contracts will ship 2 months later in March.

3.0 RESULTS FROM SIMULTANEOUS REGRESSION ANALYSES: THE SEPARATION OF "MARKET" AND "ALLOCATION" EFFECTS

3.1 Motivation and Factors Included

In the work of 1979, a recursive two system equation was used, one for leads and one for HSG contracts, where leads was in turn an explanatory variable for contracts. In such a recursive system it is only necessary to perform single stage regressions since there is really no interacting simultaneity present. However we now wish to consider the situation in which there are eight endogenous or dependent variables which are all interacting simultaneously.

The key thrust of this simultaneous equation approach is to be able to separate out the following types of issues: 1) to what extent are HSG contracts from certain districts the result of the fact that recruiters have been allocated there, or is it the case that in fact recruiters were allocated there because in the past HSG contracts were obtained from those districts? In other words, one is trying to separate out the very convoluted so-called "market" and "allocation" effects. The "market" effect has to do with the intrinsic recruit potential for the district, independent of the number of recruiters present, whereas the "allocation" effect has to do with the recruit potential due to adding more recruiters there. Hence it is sort of a "chicken and egg" phenomenon as to which is really the cause and effect. 2) The same issue applies for the timing of the advertising, i.e. do contracts result in given months be-

cause the advertising was pulsed in certain months or is the advertising pulsed in certain months because the seasonal distribution of past contracts or leads followed a certain pattern?

The model explored utilized 3 years of monthly-district data to build a two year model with a year's lag of the distribution of HSG contracts and leads included. The past year's HSG contracts were of interest to help possibly explain the assignment of recruiters for the present year. The distribution utilized was, by district, the percent of last year's HSG contracts from the entire nation resulting from that district. Regarding leads, the distribution utilized was, by month, the percent of last year's NOIC leads (from the entire nation) associated with each month. This second distribution was of interest to see if it helped explain the feedback strategy used by the advertising agency to help decide when to pulse their advertising.

The simultaneous model, solved using a two stage, least squares regression approach, utilized the following factors:

1) the number of production recruiters in a district; nationally this averaged 3,320 for CY78;
2) the real dollars of advertising expenditures placed by month by district, from the GEP-General budget, which was spent on the low involvement/instantaneous media of TV, radio and billboards. The amount for CY78 was $4.8M;
3) the real dollars of advertising placed, by district by month, from the GEP-General Program dealing with

printed materials, namely direct mail, magazines, supplements, etc. This excludes LAMS and RAD expenditures and was $.98 M for CY78;

4) the dollars of advertising placed by district by month from the GEP-Minority program (which consists mostly of radio). For CY78 this was $.754M;

5) the total dollars of local lead generating advertising, i.e. LAMS, by month by district; this was $1.317M for CY78;

6) the number of unduplicated national NOIC leads per district by month;

7) the number of HSG enlistment contracts by district by month;

8) the number of non-HSG enlistment contracts by district by month.

The exogenous variables considered are district demographics such as number of High School seniors, propensity to enlist, percent blacks, urban rural mix, relative pay, overall unemployment rate, labor force size and the advertising expenditures for the joint Military Program, i.e. so-called JADOR expenditures (Joint Advertising Dod-wide).

3.2 The Interactions Explored

In formulating a simultaneous model, one first postulates various possible interactions between the endogenous factors and how the exogenous factors make themselves felt. Then, by performing the regressions on an empirical data base, one then either confirms these interactions and quantifies them or re-

jects them, and hypothesizes other interactions.

The assumed interactions and dependencies are depicted in the following Figures, Figure 1 and 2, and are as follows:

1) For a particular year the number of real dollars (adjusted for inflation) of GEP-General advertising spent on TV/radio/billboards advertising expended in month j, district i, was endogenous, i.e. it is the result of interactions of other key decision variables. It was assumed to be a function of the number of male high school seniors present in the district in that month and the percent of all NOIC leads for the past year for the entire nation that came in month j. Hence here we are trying mainly to capture part of the allocation logic possibly used by the advertising agency in pulsing their advertising.

2) The number of recruiters in district i, period j, is also an endogenous variable and is assumed to be a function of the quotas, the number of the HS seniors there, propensity, percent Blacks, urban-rural mix for the district, and the percent of all HSG contracts (for the past year for the entire nation) that came from district i. Hence here we are trying to capture part of the allocation logic possibly used to assign recruiters.

3) The real dollars of local advertising (adjusted for inflation) expended in month j, district i in that district. This endogenous variable is assumed to be a function of the current levels of recruiters in that district, the current levels of national advertising, and the number of HSG seniors there.

4) The real dollars of advertising (adjusted for inflation) spent from the GEP-General budget on printed materials. This endogenous variable was assumed to be a function of the number of high school seniors there, and the

monthly distribution of last year's NOIC leads. Note as before the possible simultaneity of the timing of leads in one year and the timing of the advertising in the next.

5) The real dollars of advertising (adjusted for inflation) spent from the GEP-Minority budget. The endogenous variable was assumed to be a function of the current levels and timing of GEP-General's TV/radio category.*

6) The number of national leads from district i, period j, is also an endogenous variable and is assumed to be a function of the unemployment rate for district i, period j, the number of HS seniors for period j, district i, propensity, percent Blacks, urban rural mix, relative pay, the level of GEP-General's TV/radio, the level of GEP-General's Printed materials, and the level of real Joint Military advertising (considered as an exogenous variable); monthly dummy variables were also included to capture the strong seasonal effects.

7) The number of HSG contracts signed in period j, district i, is also an endogenous dependent variable and was assumed to be a function of the number of recruiters there, the level of local advertising, number of national leads two periods lagged and 1 period lagged, the unemployment rate (lagged 1 month), the relative pay, the current levels of GEP-General's TV/radio, the current levels of GEP-General's printed advertising, the current level of GEP-Minority advertising, and the number of High School seniors; as with leads, monthly dummies were included.

8) Finally the number of non-High School graduate contracts signed in period j, district i, is the final endogenous variable and was assumed to be a function of the number of recruiters, the quotas, the level of local advertising (L_{ij}), the number of High School graduate contracts signed, relative pay, the current levels of GEP-General's TV/radio, the current level of GEP

*The great bulk of the GEP-Minority expenditures are for radio.

General's Printed material, and the current levels of GEP-Minority; once again monthly dummies were included.

The results of this two stage, ordinary least squares analysis are more consistent estimates of the respective elasticities that recognizes the market and allocation interplay.

3.3.1 Interactions Uncovered Using District Dummies

Two sets of runs were made in which district dummy variables were included and one in which the district dummies were excluded. Consider first the case where the district dummies are included.

Figure 1 displays the significant interactions and functional relationships uncovered, whereas Figure 2 shows those other potential interrelationships explored but not found to be significant.

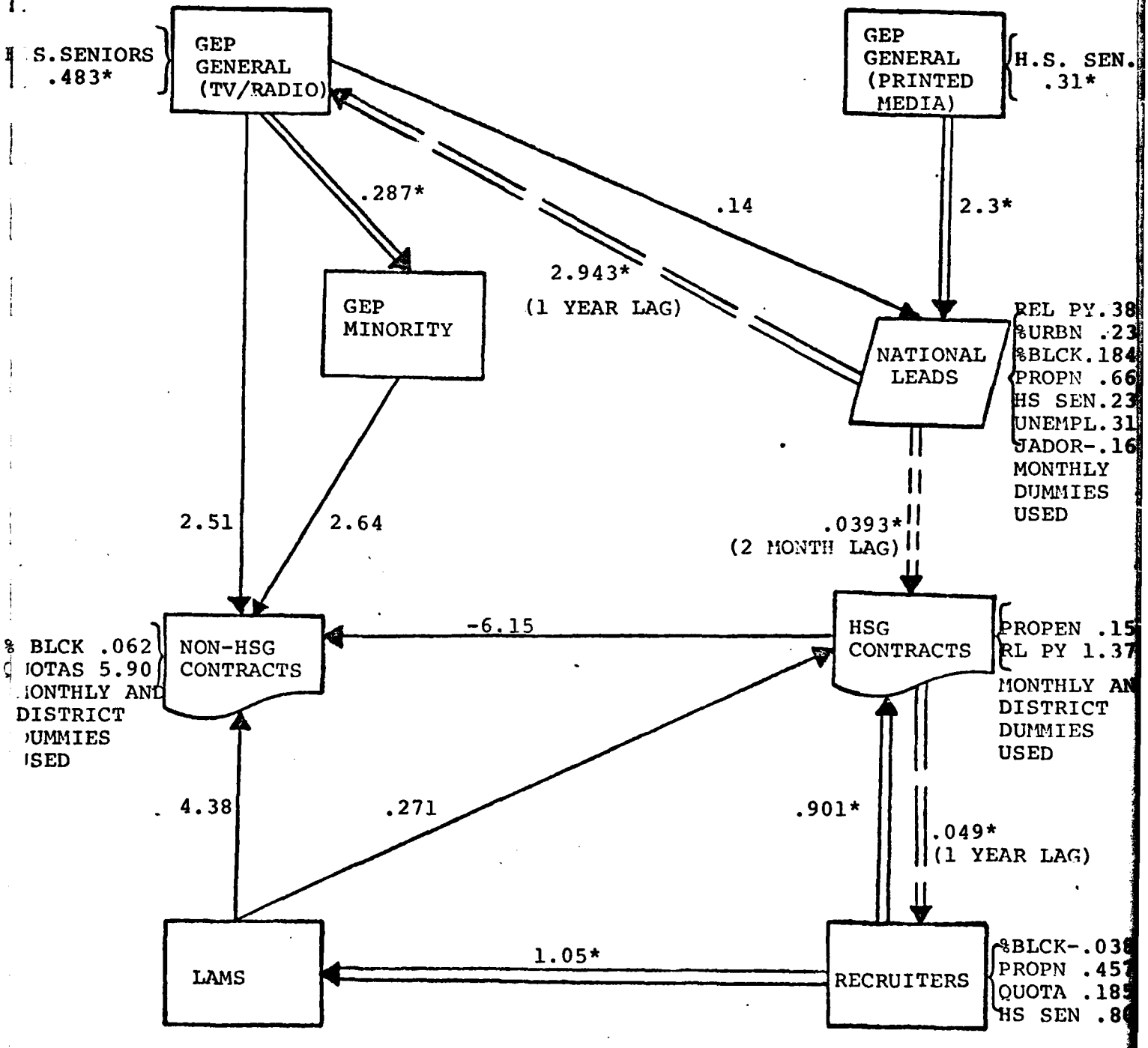
Starting first with the key endogenous variable of HSG contracts, we find an elasticity for recruiters of .901, an elasticity for the propensity to enlist at .158, an elasticity for relative pay at 1.37, and an elasticity on NOIC Leads (2 months lagged) of .039. We note the relative pay elasticity of 1.37 also agrees very well with other studies (e.g., the Gates Commission estimate of 1.25).

Similarly the elasticity on Leads agrees very well with the recent cross sectional work of Beswick and Looper (1980) done for the Air Force using data from April 1977 to March 1978 which found an elasticity for Leads of .04.

Note that an elasticity of .901 for recruiters implies for CY78 if everything else was unchanged that another 33.2 recruiters would yield about 495 or about 14.9 additional HSG contracts per year per recruiter. Note the average for CY78 was about 16.6. The .039 elasticity for NOIC Leads implies that a 1% increase in NOIC Leads leads to a .039% increase in HSG contracts.

FIGURE 1: INTERACTIONS FOUND FROM SIMULTANEOUS MODEL WITH DISTRICT INDICATOR VARIABLES INCLUDED;

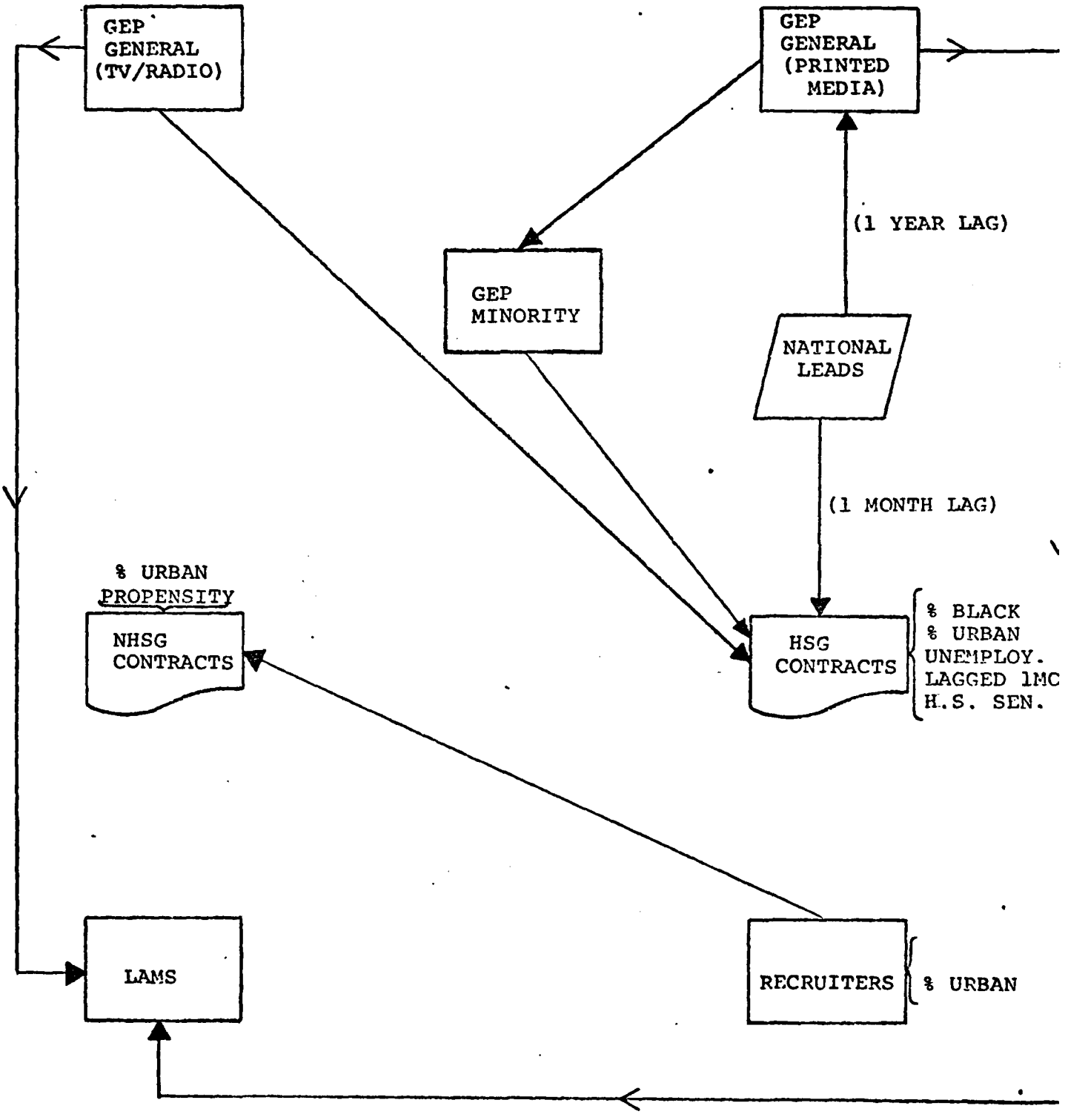
INTERRELATIONSHIPS HYPOTHESIZED AND FOUND TO BE MEANINGFUL



PRESENT — 1 YEAR LAG — 2 MONTH LAG

DOUBLE LINES OR * DENOTE STATISTICAL SIGNIFICANCE AT 10% LEVEL

FIGURE 2:
OTHER POTENTIAL INTERRELATIONSHIPS HYPOTHESIZED
IN SIMULTANEOUS MODEL BUT NOT CONFIRMED



One finds that for national NOIC leads, the elasticities are: .31 for the unemployment rate, .66 for the propensity rate, .184 for the percent blacks, .23 for the urban-rural mix, .38 for relative pay, and 2.3 for GEP-General printed advertising. Hence a 1% increase in GEP-General printed materials ($9,870) would yield a 2.3% increase ($3,550) in NOIC leads.

Turning to the demand limited non HSG contracts, all of the elasticities are statistically insignificant at the 5% level; this agrees with other supply studies which have learned that regression techniques are not well suited to the low quality, demand limited groups. In passing however, it is of interest to note the signs and relative magnitudes of these elasticities, even though the regression program, due to the levels of volatility involved, was not able to deem the results significant at the 5% level. The elasticity related to accession quotas was 5.19; hence if this elasticity is meaningful, one would estimate for CY78 that an increase in the number of NHSG contracts for CY78 of 706, assuming everything else remained the same.

It is also of interest to look at the impact of HSG contracts on NHSG contracts. The elasticity is -6.15 implying that the more HSG contracts signed in a given month, the less the recruiter has to backfill by accepting non HSG contracts. The other variables of interest for non HSG contracts are GEP-Minority Advertising at 2.64, GEP-General (Radio/TV) at 2.51, LAMS at 4.38 and percent blacks at .062.

In terms of the allocation effect, it is seen that the current level of GEP-General TV/radio advertising in a district in a given month is very much related to the past year's monthly distribution of NOIC leads (an elasticity of 2.943) and that the past year's geographical distribution of HSG contracts has a significant impact on the current number of recruiters in a district.

In the same spirit it appears the level of LAMS in any particular month in any district is highly correlated with the number of recruiters there, an elasticity of 1.05 existing for recruiters on LAMS, and that the timing of GEP-Minority advertising follows that of GEP-General's TV/radio.

To summarize the results of the simultaneous model (with the district variables included), we have:

1) The level, timing, and geographical placement of current GEP-General (General Enlisted Program-non-Minority) advertising, associated with TV/radio, affects to a small degree the number and timing of current NOIC leads as well as the current timing of GEP-Minority Advertising; the latter seems to follow that of GEP-General's TV/radio advertising. GEP General's TV/radio expenditure also affect positively the timing, distribution and number of non High School graduate contracts. In turn the GEP-General TV/radio expenditures are effected by the distribution of HS seniors, and the monthly distribution of NOIC leads for the past year.

2) The level, timing and geographical distribution of expenditures for GEP-General printed materials affects strongly those same characteristics for NOIC leads and is in turn affected by the number of High School seniors there.

3) The level, timing and geographical distribution of LAMS

affects to a small degree the same characteristics for HSG and NHSG contracts and is effected strongly by the current number of recruiters present.

4) The level, timing and geographical distribution of GEP-minority advertising effects the numbers, timing and geographical distribution of primarily non HSG contracts obtained, and follows the size and timing of the current GEP-General's TV/radio expenditures.

5) The level, timing, and geographical distribution of National NOIC leads effects strongly, with a 2 month lag, the level of HSG contracts obtained, as well as the next year's distribution of the GEP-General TV/radio budget. The numbers of NOIC leads in turn are affected to a small degree by current expenditures for GEP-General's TV/radio, very strongly by GEP's-General printed related expenditures, and very strongly by the district demographic variables of relative pay, propensity, percent blacks, the urban-rural mix, the number of HS seniors present, and the unemployment rate.

6) The level, timing and geographical distribution of High School graduate contracts are strongly effected by those same characteristics for NOIC leads (with a 2 month lag), strongly by the present levels for Recruiters, and weakly by the level of LAMS. In turn the level, timing and distribution of HSG contracts affect the same characteristics for non High School graduate contracts, and the positioning of recruiters for the next year.

7) The levels, timing and geographical distribution of Non High School graduate contracts are affected strongly and in a negative way by the same characteristics for HSG contracts, as well as by positively by the level of quotas, LAMS, GEP-Minority advertising, GEP-General's TV/radio expenditures , and the percent Blacks.

8) The number and geographical distribution for recruiters effect strongly the same for HSG contracts as well as the current levels of LAMS advertising, and in turn are effected by the distribution of the past year's HSG contracts, the district's percent Black, propensity, quotas and the number of high school seniors present.

3.3.2 Estimated Elasticities for HSG Contracts from Simultaneous Regression

If one makes the algebraic substitution of leads into the HSG contract equation, one obtains as the final elasticities for HSG contracts (from the simultaneous model with the district dummies included), using only the statistically significant (at the 5% level) variables:

ELASTICITIES FROM SIMULTANEOUS REGRESSIONS FOR HSG CONTRACTS WITH DISTRICT DUMMIES INCLUDED

1)	propensity	.025
2)	Urban-Rural mix	.009
3)	Pay	1.39
4)	Unemployment rate for total civilian market	.012
	Youth unemployment rate	.017
5)	Recruiters	.901
6)	LAMS	Statistically insig. but with a positive sign
7)	HS seniors	.009
8)	Minority Advertising	Statistically insig. but with a positive sign
9)	TV/radio (Gep-General)	Statistically insig. but with a positive sign
10)	Printed Material (Gep-General)	.09

11) Percent Blacks .007

12) JADOR Advertising Statistically insig. but with a negative sign

It also says that, from the perspective of HSG contracts, the optimal percent of advertising expenditures, relative to the total recruiting budget (for advertising and recruiters), should be about 9%.* If one inspects the actual situation for CY78, one finds that, exclusive of JADOR expenses, the ratio of GEP media and LAMS media expenditures to all expenditures** is indeed about 9.45% so that the overall mix approximately agrees with that recommended by the simultaneous model. Further, the results imply that the GEP expenditures should be heavily concentrated in printed expenditures. One notes that, in contrast, the bulk of GEP-General's advertising (83%) is in GEP-General's TV/radio budget.

It also appears that the expenditure associated with LAMS, GEP-General's TV/radio expenditures, and the GEP-Minority Advertising have their main measurable impacts on non-HSG contracts.

3.3.3 Possible Insights As To Relative Efficiencies of Districts

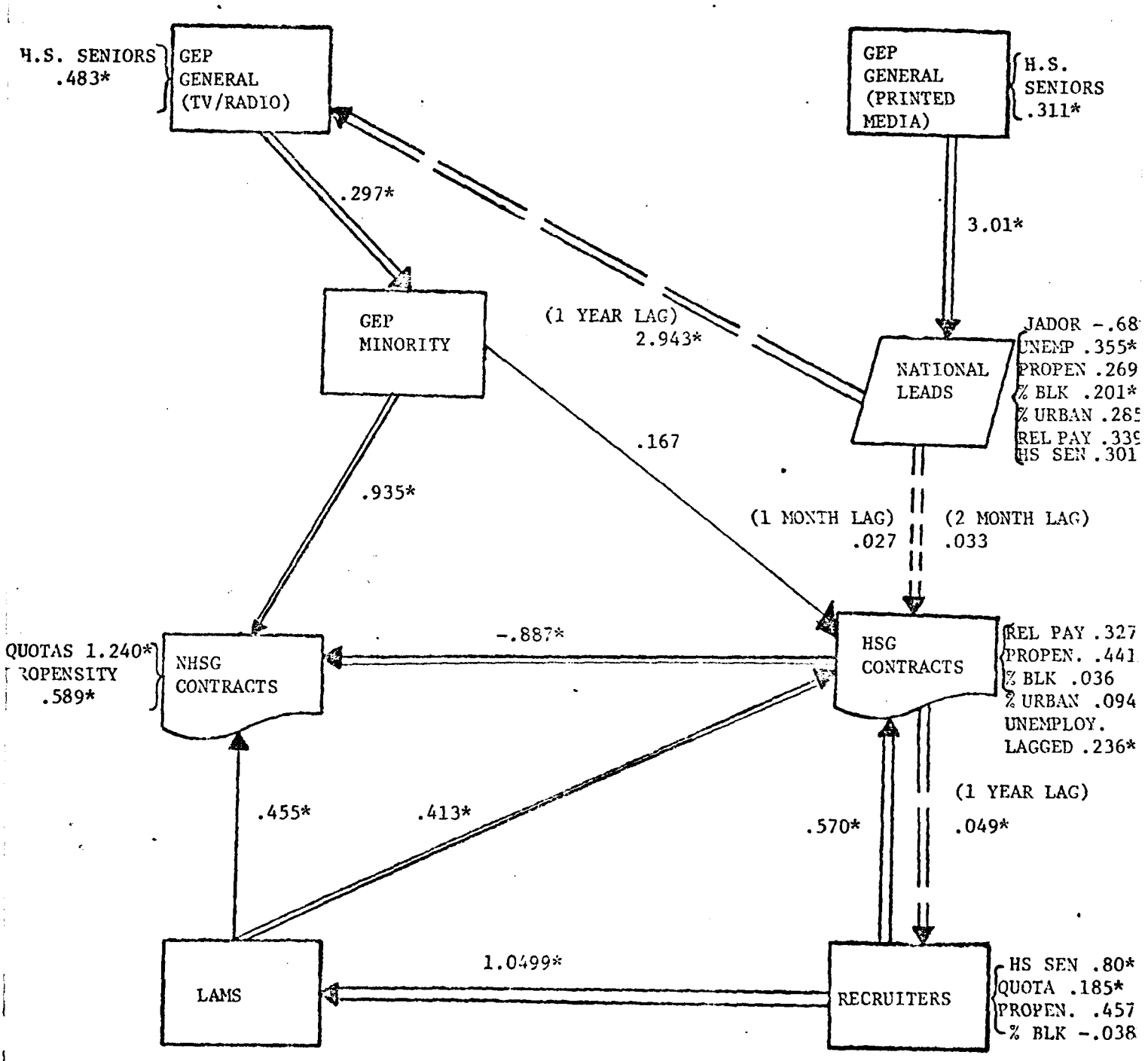
Using the district dummies resulting from the two stage, least squares simultaneous regression, one can have available a sort of approximate efficiency ranking of the districts that adjusts or takes into account the fact that one district may have more favorable demographics, or more recruiters or advertising resources than another. The caveat here is that this ranking may incorporate, in addition to actual differences in efficiency, the impact of other demographic variables not included explicitly in the model. A second problem is that not all the district dummies are statistically significant so that they cannot be

*As before, one needs to include in the 9% all advertising costs (i.e. labor, overhead, profit, media) and all recruiter costs (support, RAD materials, etc.)

**The costs referred to here is recruites cost @$21,190 per recruiter and media costs only.

FIGURE 3

INTERRELATIONSHIPS FROM SIMULTANEOUS REGRESSION
WITHOUT DISTRICT DUMMIES



DOUBLE LINES OR * DENOTE STATISTICAL SIGNIFICANCE AT THE 10% LEVEL.

relied on with great confidence.

For the case in point, only two of the 43 district dummies were statistically significantly different than the assumed base district (San Diego). These two were San Antonio and Oklahoma City, both in Area 700, which were deemed to be significantly poorer than the others. This result also agrees with a more comprehensive ranking provided in Section 4 which shows Oklahoma City to be the very worst performer and San Antonio at the 35th position. Incidentally, the highest ranking district, even though it was not statistically significant, was the Detroit District, which was number 2 on the other ranking.

3.3.4 Impact of Numbers in DEP on HSG Contracts and on NOIC Leads

As an excursion on the above run, the size of the numbers of recruits in the Delayed Entry Program on Leads and on HSG contracts was investigated to discern the interrelationships operating. The hypothesis was that the larger the size of the DEP, the larger the number of Leads and HSG contracts due to the "grapevine" peer network operating. This was indeed the case, a significant elasticity of .19 operating for size of DEP on HSG contracts, and an elasticity of .02 for the size of the DEP pool on NOIC Leads. The factors affecting the DEP pool were naturally the numbers of HSG and non-HSG contracts.

3.3.5 Results of Simultaneous Run When District Dummies Excluded

In this analysis, all of the endogenous variables and hypothesized interrelationship of Section 3.2 were unchanged. The only difference was that the district dummies included in the

results shown in Section 3.3.2 were not included.

The results were very different for those endogenous variables for which the district dummies were omitted, namely HSG contracts and non-HSG contracts. Turning to HSG contracts first, the chief difference was on the elasticity for LAMS which was at the level of .413 and significant at the 1% level. If correct, this would imply for CY78 that another $13,170 of expenditures (namely .01 x $1.317M) in LAMS would have created another 227 HSG contracts (namely .00413 x 55,012) or about $58 per additional contract. The other distrubing results were a pay elasticity of only .327 (compared to 1.37 with the dummies included which agrees with the Gates Commission results), and the fact that NOIC leads were insignificant in predicting HSG contracts. For completeness the results of this analysis are also included (see the following Figure). However, it is the judgment of this Investigator that when dealing with the simultaneous model, the district dummies should be retained and hence any results without those dummies included can be misleading.

4.0 RESULTS FROM SINGLE STAGE MODELS: A COMPARISON OF ESTIMATES FROM ORDINARY LEAST SQUARES METHODS WITH THAT OF HETEROSCEDASTIC APPROACHES

4.1 Motivation

The previous Section, Section 3, has dealt with a simultaneous system of equations that tackles the allocation/market issue in an effort to separate out their confounding effects. These results, utilizing a two stage ordinary least squares regression approach still of course have associated with it the severe (and often unrealistic) assumptions accompanying ordinary least squares approaches: namely, homoscedasticity, i.e., the variances of the error terms are the same, and the assumptions that the error terms, for the different districts and time periods, are uncorrelated. However, we know that the pattern of contracts between districts within a given region may be somewhat related since they are under the common management of a Regional Commander. In addition, there may well be correlation between the error terms for a given district for successive months due to a change in policy promulgated there, a change in employment opportunities, etc.

A second reason for exploring a single stage model is that it is desirable to be able to estimate the long term impact, as well as the short term impact, of changes in recruiters, unemployment, advertising, etc. This was simply not possible in the simultaneous models due to its complexity with eight interacting variables.

4.2 The Heteroscedastic Model

Hence we now focus on the results from a sophisticated regression technique (known as the Park's Technique) which is specifically geared to pooled time series/cross sectional data of the type we have. It allows:

1) heteroscedasticities, i.e., the error terms are not forced to have the same variances;
2) correlations are allowed between the error terms, both over time as well as between districts.

To make this more concrete, suppose the number of enlistment contracts obtained from a given district in a given month were only a function of the number of recruiters present then.

Denote:

$Y_{t,1}$ denote the contracts at period t, district 1,

$Y_{t,2}$ denote the contracts at period t, district 2,

$X_{t,1}$ denote the number of recruiters at period t, district 1,

$X_{t,2}$ denote the number of recruiters at period t, district 2.

Then if we are interested in the impact on contracts of the number of recruiters, one is interested in estimating b where:

$$Y_{t,1} = a + bX_{t,1} + \varepsilon_{t,1}$$

$$Y_{t,2} = a + bX_{t,2} + \varepsilon_{t,2}$$

(or alternatively) for the case of a multiplicative function:

$$\log Y_{t,1} = a + b \cdot \log X_{t,1} + \varepsilon_{t,1}$$

$$\log Y_{t,2} = a + b \cdot \log X_{t,2} + \varepsilon_{t,2}$$

where $\varepsilon_{t,1}$ and $\varepsilon_{t,2}$ are the residuals or error terms. Then under

OLS, it is necessary to assume that the variance of $\varepsilon_{t,1}$, equals the variance of $\varepsilon_{t,2}$ (i.e., that the spread of the error terms are the same for different districts at one point in time). Also OLS assumes that the variance of $\varepsilon_{j,1}$ equals the variance of $\varepsilon_{t,1}$ for all j, i.e., the spread of the error terms is the same (for a given district) for all points in time; it is also assumed that the covariance of $\varepsilon_{t,1}$, $\varepsilon_{t,2}$ is zero as well as the covariances of $\varepsilon_{t,j}$ and $\varepsilon_{t-1,j}$; this is equivalent to assuming that they are uncorelated.

Under the Park's model it is possible to consider situations where Variance $(\varepsilon_{t,1}) \neq \text{VAR}(\varepsilon_{t,2})$, where covariance $(\varepsilon_{t,1}, \varepsilon_{t,2}) \neq 0$ and where the covariance $(\varepsilon_{t-1,1}, \varepsilon_{t,1}) \neq 0$. Hence it is felt the estimates of the elasticities resulting should be more realistic than before.

Our main purpose in this section is to discern how robust or insensitive the key policy recommendations, concerning the mix of advertising and recruiter resources, is to the type of estimation model and assumptions used. To accomplish this we will compare the estimates from the OLS model with those using the heteroscedastic approach. We will also be interested in distinguishing between the short and long term effects of the different factors, a feature made possible by using the Koyck distributed lag model in a single stage approach.

4.3 Prediction of NOIC Leads

4.3.1 Results from Heteroscedastic Model

First consider the results for National Leads (i.e., NOIC

leads). The independent variables included in the Koyck distributed lag model, using the OLS approach and the Park's model, are: number of High school male seniors in the district; the district's demographics including propensity to enlist, percent Blacks, the urban-rural mix, relative pay; the dollars of advertising in the GEP-General Program associated with the instanteous low involvement media (i.e., TV, radio, and billboards); the dollars of advertising in the GEP-General Program associated with the higher involvement printed materials (this includes direct mail, magazines and supplements). We also note that the LAMS & RAD expenditures were not included in the Leads equation as it was felt they do not impact on National Leads but on contracts directly. The final factors included were the General Enlisted Program--Minority Advertising (consisting largely of radio), and Joint Military Advertising (JADOR) of which the great bulk is for Magazines. (Incidentally JADOR expenditure occurred for only CY 1978 in our data base of 1976-78.)

All of the variables, including leads and HSG contracts, were normalized by the size of the labor force in the district as this was found to substantially reduce the correlations between the variables. In addition, monthly dummy variables were included to capture the seasonal effect. Finally a dummy for Dec. 76 (when the GI bill expired) and year dummies for each of the 3 year periods were included. Note that no district level dummies were used in either approach, but more demographics were included. The results for the Leads equation, using the new heteroscedastic Park's regression approach are:

EXHIBIT 10

ESTIMATES OF PARAMETERS FOR

PREDICTING NOIC LEADS FROM THE HETEROSCEDASTIC MODEL

	Variable	Coeff. Estimate and short run elasticity	Standard Error	t-Value	Long Run Elasticity
1)	District propensity to enlist (based on responses to questionnaires)	.4204	.0111	37.795	.779
2)	Percent of Population in district that is Black	.0767	.00433	17.727	.137
3)	Percent of district population within SMSA	.0843	.00728	11.58	.150
4)	Relative pay (ratio of average first year military pay to civilian)	.0636	.0151	4.208	.113
5)	Dollars of expenditures in 1967 dollars for TV/Radio/billboards per labor force member for the General Enlisted General Program	.1921	.0069	28.037	.342
6)	Dollars of expenditures in 1967 dollars for printed materials per labor force member for the General Enlisted General Program (does not include LAMS or RAD materials)	.4895	.0124	39.389	.872
7)	Dollars of expenditures in 1967 dollars for the GEP-Minority Program	.0388	.00918	4.225	.069
8)	Dollars of expenditures in 1967 dollars for the Joint Military Advertising Program (JADOR) per labor force member	-.0467	.0117	-2.525	-.083
9)	One month National Lagged Leads per labor force member	.4388*	.0101	43.261	NA

* This implies that 95% of the total impact of advertising on leads is felt within 3.64 months of the advertising.

4.3.2 Implications of Relative Cost-Effectiveness of Various Media Types to Increase Leads

Hence a 1% increase in real dollars (adjusted for inflation) in the TV/radio portion of the General Enlisted Program-General for any given month is estimated from this model to bring about over the long term an increase in NOIC leads of .342%. The corresponding number for printed material from the General Enlisted Program-General is .872%. Hence, to apply this to CY78, recall that there were 154,336 NOIC unduplicated leads for this year, and actual TV/radio expenditures from the General Enlisted Program-General budget were $4.824 Million; the number is $.987M in printed expenditures from the General Enlisted Program-General budget. Hence an increase of 1% or $48,240 in 78 dollars in the TV/radio budget would be estimated to generate an increase in NOIC leads of 528 (i.e., .00342 x 154,336) for a marginal cost per additional lead of about $91.36 if more TV/radio is used.

Jumping ahead a moment, we will observe later that when we regress HSG contracts on NOIC leads, using the same Park's regression approach, we obtain an elasticity for NOIC leads on HSG contracts of about .00905. Hence since the 528 NOIC leads represents a .342% in leads, we could expect about an additional 1.70 HSG contracts to result over the long term from the marginal expenditure of $48,210 in TV/radio for about $28,353 per additional HSG recruit. (This 1.70 comes about since a 1% increase in NOIC leads is associated with a long term increase in HSG contracts of (.00905)(55,012) = 4.98; hence a .342% increase in leads yields about 1.7 (i.e., .342 x 4.98 HSG contracts.)

Turning to the printed media (exclusive of LAMS and RAD materials), a real increase of $9,862 in CY 1978 for printed

materials within the GEP-General program would be estimated to bring about an increase of .987% in leads or about 1523 more leads. This converts to about 4.92 additional HSG contracts or about $2,005 per contract. (Note the average cost in CY 78 was $1,496.) This result assumes that the print media expenditures for the GEP-General Program would continue in the same proportions as in the 1976-1978 for direct mail, magazines, etc. since the estimates are based on that data base. To the degree that direct mail is presently being used to the maximum extent possible, the elasticity for GEP-General printed materials may be overstated.

In the same vein we note that a 1% increase in GEP-Minority advertising has a long run elasticity on leads of .069, and implies (for CY 78) a real increase in 78 dollars of $7,540. These additional leads are estimated to convert to .34 more HSG contracts for an additional cost per recruit of $22,176.

Note that the above marginal costs assume that no additional production or labor costs are needed. Also they do not include the roughly 20% overhead added on by the advertising agency. Hence the marginal cost numbers should be about 20% higher. Hence for TV/radio, the marginal cost per additional HSG recruit would be $34,024, for printed materials (exclusive or RAD & LAMS), it would be $2,406, and for GEP Minority advertising the number is $26,611.

The key conclusion here is similar to the results from Section 3's simultaneous regression efforts namely, the analysis indicates that the great majority of General Enlisted Program expenditures, in order to obtain more HSG contracts through the lead mechanism, should be in the area of printed materials, i.e., direct mail,

magazines, and newspaper supplements. We shall, in Section 4.4, address the question if there is any discernible impact of the above types of advertising on contracts directly, or it its effects are all through leads.

4.3.3 Comparison of Regression Estimates for NOIC Loads Between OLS Method, Heteroscedastic Method and Simultaneous Model (with and without District dummies)

The following chart compares the elasticities estimated from the various models. We note that for NOIC Leads the estimates between OLS and the heteroscedastic model are very similar, the only real difference being the ability of the heteroscedastic approach to detect the impact of GEP-Minority on Leads. Also the heteroscedastic approach estimates a larger impact of GEP-printed materials than does the OLS method; this is indeed even more the case for the simultaneous models where the timing of TV/radio expenditures in a given year were found to be interrelated with the time-wise distribution of leads the year before.

We note that the heteroscedastic model and the OLS model seem to agree well for the factors of propensity, relative pay, unemployment, recruiters, number of high school seniors, and percent blacks in the district. The heteroscedastic model is further able to detect the individual impact of IAMS, GEP-Minority and Joint Advertising that is not possible with the conventional OLS approach. Hence the ability of the heteroscedastic approach to accommodate correlations over time and between districts, as well as unequal variances, enables it to sift out from the GEP-General expenditures the individual impacts associated with LAMS, GEP-Minority and JADOR expenditures.

EXHIBIT 11

COMPARISON OF ESTIMATES OF LONG TERM ELASTICITIES FOR NOIC LEADS FROM DIFFERENT MODELS

	Single Stage Heteroscedastic Model (without district dummies)	Single Stage OLS Model (without district dummies)	Simultaneous Model With District Dummies	Simultaneous Model Without District Dummies
1) Propensity	.78*	.80*	.66*	.77*
2) Percent Black in district	.14*	.12*	.18*	.20*
3) Urban/Rural mix in District	.15*	.18*	.23*	.29*
4) Relative Pay in District	.11*	.07*	.38*	.34*
5) TV/Radio Expenditures from GEP-General Budget	.342*	.35*	.14	negative and insignificant
6) Printed Expenditures from GEP-General Program	.872*	.63*	2.3*	3.01*
7) GEP-Minority Expenditures in District	.069*	positive & insignificant	negative & insignificant	negative & insignificant
8) JADOR Expenditures in District	-.08	negative & insignificant	-.16	-.68*
9) Number of High School Seniors in District	negative and insignificant	negative but insignificant	.31*	.36*

*Denotes significance at the 5% level.

4.4 Prediction of HSG Enlistment Contracts from Heteroscedastic Model With Leads as an Explanatory Variable

Having subjected the prediction ofNOIC Leads to the heteroscedastic regression model and the OLS model, we can now turn our attention to the prediction of HSG contracts where NOIC leads is one of the explanatory variables. Once again a Koyck distributed lag model was utilized to separate the long term and short term effects of variables such as unemployment, advertising, etc. The significant results for HSG contracts from the single stage heteroscedastic model and the OLS models are:

ESTIMATES OF ELASTICITIES FOR HSG CONTRACTS WITH LEADS AS AN EXPLANATORY VARIABLE

	Short Term Elasticity from Heteroscedastic Model	Standard Error from Heteroscedastic Model	t-Stastic from Heteroscedastic Model	Estimated Long Term Elasticity from Heteroscedastic Model	Estimated Long Term Elasticity from OLS Model
1) Number of HS seniors	.231	.019	12.079	.245	.192
2) NOIC Leads with a 2 period lag	.0091	.0021	4.40	.0096	.020
3) Propensity	.631	.022	28.567	.667	.47
4) Percent Urban	.183	.0096	19.05	.194	.11
5) LAMS	.043	.0058	7.34	.046	negative & insignificant
6) Recruiters	.685	.0145	47.249	.726	.55
7) General Unemployment Rate	.171	.010	15.925	.181	.78
8) Relative Pay	.158	.014	11.149	.167	.10
9) HSG Contracts lagged 1 month (Koyck term)	.057*	.0039	14.718	NA	.25**

*This implies 95% of impact of additional LAMS and recruiters efforts are felt within 1.04 months.

**This implies that 95% of impact of additional LAMS and recruiters efforts felt within 2.16 months.

Hence from the heteroscedastic model, we estimate that a 1% increase in recruiters will produce a .726% increase in HSG contracts. Based on 78 levels, this represents 33.2 more recruiters producing an additional .00726(55,012) = 399.4 HSG contracts or about 12 additional HSG contracts per year per recruiter. (This agrees well with the result from the earlier simultaneous approach of Section 3.) Note the average now is 55,012/3,320 = 16.6. In terms of cost, the additional 33.2 recruiters, costing between $21K and $31K per year each, add on $703K to $1,029K per year. Using the first figure the marginal cost per HSG contract from adding recruiter is $1,761. (This compares with $1,496 at the average for an increase of 18%.) If instead the marginal recruiter cost is $31K per year, the marginal cost would be $2,578 which makes it quite close to the additional cost from additional printed material in the GEP-General Program. Hence the long term impact of recruiters has an elasticity of .726 compared to: the .901 obtained from the simultaneous model with district dummies; the .57 from the simultaneous model without the district dummies; and the .55 from OLS.

4.5 Prediction of HSG Enlistment Contracts from Heteroscedastic Model With Impact of Leads Integrated

If one integrates the above HSG contract equation with the above HSG contract equation with Leads as an explanatory variable with the earlier obtained Leads equation (Section 4.3.1) one obtains the following long term elasticities for HSG contracts:

EXHIBIT 12

ELASTICITIES FOR HSG CONTRACTS

Variable	Long Term Elasticity from Hetero-scedastic Model	Long Term Elasticity from OLS Model	Actual Levels for CY78
1) Recruiters & RAD materials	.726	.739	3,320 man-years of Recruiters and $2.58M of RAD materials
2) LAMS	.045	insig.	$1.317M
3) GEP-General's TV/ Radio/Billboard	.0033	.007	$4.824M
4) GEP-General's Printed materials	.0084	.013	$ .987M
5) GEP-Minority	.0007	insig.	$ .754M
6) JADOR Advertising	-.0008	insig.	$1.458M for all services (Navy's share is $.218M)*
7) Relative Pay Rates	.168	.136	$ .738M
8) Urban/Rural Mix	.192	.41	-
9) Propensity	.674	.64	-
10) Overall Unemployment Rate	.18	.24	5.86% nationally
Youth Unemployment Rate	.257	.34	-
11) HS seniors	.244	.26	1.628M
12) Percent Black	.0013	.002	-

*Note for FY79 JADOR expenses is at the level of $10M and the Navy's share is $2.7M.

Next consider the interesting issue associated with the optimal level of LAMS (classified ads) expenditures. Recall that neither the simultaneous model with the district dummies nor the OLS model could detect any statistically significant impact of LAMS on HSG contracts, either thru leads or directly on the HSG contracts; its impact in the simultaneous model was on non-HSG contracts. In the heteroscedastic model, the LAMS turns out to be significant and has an elasticity of .046. If this is an accurate estimate, then another 1% increase in the LAMS budget would have produced in CY78, 25.3 more HSG contracts Since the level of LAMS expenditures was $1.317M, this translates into an additional $13,170 or about $521 per additional HSG contract. If this estimate is correct, it implies large increases in the LAMS budget are warranted.

4.6 Ranking of District Performances Using Outputs of Heteroscedastic Model

4.6.1 Role of Rankings

As we briefly mentioned in Section 3 with the simultaneous regression results, we can attempt, using the equation from the heteroscedastic equation, to provide an "early warning" system of possible degradation in the efficiency or performance of the individual recruiting districts. It should be stressed such ranking will not replace the need for on-site assessment and field audits, but it can help identify "exceptional" recruiting districts (both superior and inferior) that may have particularly effective practices or problems that need to be dealt with.

The basic approach to the ranking problem is a statistical one, using the predictive HSG contract equation generated from the heteroscedastic model to form appropriate adjustments for each recruiting district of its raw performance data. In this way, each district will be compensated for certain uncontrollable factors in its particular operating environment which tend to handicap its performance. These include less high school seniors, lower unemployment rates, high pay, fewer recruiters, less advertising dollars, etc. Similarly, each district that is affected more favorably than most by those same uncontrollable factors (e.g., those that enjoy a high "propensity" or favorable perception of the military) will no longer enjoy these unfair advantages when compared with its peers. One of the most desirable aspects of such an approach is the objectivity with which the adjustments can be made. Additionally, it will be possible to periodically recompute the adjustments to reflect the dynamic nature of

quality constraints and quotas and individual operating environments.

Once adjustments have been made, it will then be possible to define acceptable ranges for each measure and to assess each district's position relative to these goals. Variations which still exist between districts at this point, after adjustment for noncontrollable factors, should be caused primarily by local management and operating efficiencies which are for the most part controllable. Where these can be quantified, it might eventually be desirable to include these variables in the statistical process to determine, for example, just how much of the remaining performance variation is "explained" by local management's philosophy of building dep, its use and timing of LAMS, how Leads are followed up, etc. While performance data would not be adjusted for these controllable factors, such an exercise might prove to be a useful management tool for the Recruiting Command.

The rankings shown are based only on the performance of the district in terms of HSG contracts; it clearly could be extended to include all contracts, or all upper mental category contracts.

It should once again be emphasized that such rankings will not replace the need for in-depth on-site assessments, once exceptional districts have been identified. In fact, an in-depth annual review process for districts will in some ways become even more essential with the adoption of the proposed methodology. With increased emphasis on quantitative measures it is

important to verify through field level investigations if there are some important new demographical variables that could be the cause of the "exceptional" performance.

4.6.2 Analytical Approach

In this section, we present a simplified version of the statistical model which will be used to compare recruiting district HSG contract production performance. The basic problem is to explain (or partially explain) differences in a type of enlistment rate, i.e., the ratio of HSG contracts obtained over a given period of time (e.g., 1 year) to the number of male HS seniors in the district's population in terms of factors, such as unemployment, recruiters, advertising, propensity, etc., which vary from district to district and which are outside the control of the district. Hopefully, more meaningful inter-district comparisons can be made once adjustments have been made for these factors.

For the purposes of simplifying our discussion, we shall temporarily assume that the district's enlistment rate is our sole measure of interest and that the only independent factors which affect this measure are known to be the propensity and the number of recruiters.

Let the average enlistment rate for district i be denoted by C_i, let the propensity for district i be denoted by A_i, and let the number of recruiters per HS senior in district i be denoted by B_i. A simplified linear* model for the enlistment rate, in terms of propensity and recruiters per HS sneior, may be stated as follows:

$$C_i = K_0 + K_1 A_1 + K_2 B_i + e_i$$

*The model actually being used is a log linear model.

where K_o, K_1, and K_2 are unknown parameters to be estimated and where e_i is a random error term which is indicative of any "unexplained variance", including the inherent randonmness of the data, and the variability due to different operating efficiencies for different districts.

Note that values of C_i, A_i, and B_i are observed for each district i. The problem is to find estimates for K_0, K_1, and K_2, denoted $\hat{K}_0$, $\hat{K}_1$, and $\hat{K}_2$. The Park's heteroscedastic model has already accomplished this, of course.

Now $\hat{C}_i \equiv \hat{K}_0 + \hat{K}_1 A_i + \hat{K}_2 B_i$ may be interpreted as the predicted enlistment rate for district i, disregarding any uncertainty in the data and any differences in operating efficiencies, but having adjusted for the independent, or non-controllable factors of propensity and number of recruiters

Now define $\bar{C} \equiv \hat{K}_0 + \hat{K}_1 \bar{A} + \hat{K}_2 \bar{B}$, where $\bar{A}$ is the average propensity (over all districts) and $\bar{B}$ is the average number of recruiters per HS senior (over all districts) in a district. Thus $\bar{C}$ may be interpreted as the predicted enlistment rate for a district having average propensity and an average number of recruiters per high school senior.

Note that the enlistment rate $\hat{C}_i$ for district i may be written in terms of the predicted rate $\bar{C}$ for an average district as follows:

$$\hat{C}_i = \hat{K}_0 + \hat{K}_1 A_i + \hat{K}_2 B_i$$

$$= \hat{K}_0 + \hat{K}_1 \bar{A} + \hat{K}_2 \bar{B} + \hat{K}_1 (A_i - \bar{A}) + \hat{K}_2 (B_i - \bar{B})$$

$$= \bar{C} + \hat{K}_1 (A_i - \bar{A}) + \hat{K}_2 (B_i - \bar{B}).$$

Thus the predicted rate for district i is just the predicted rate for an average district adjusted by the terms $\hat{K}_1(A_i - \bar{A})$ and $\hat{K}_2(B_i - \bar{B})$ which reflect the effect of non-average propensity and non-average numbers of recruiters per HS senior. Rewriting the above, we have

$$\bar{C} = \hat{C}_i - \hat{K}_1(A_i - \bar{A}) - \hat{K}_2(B_i - \bar{B}),$$

with the interpretation that the predicted rate for a district with average propensity and average number of recruiters per HS senior is the same as the predicted rate for district i, adjusted to account for the non-average propensity and numbers of recruiters per HS senior of district i. This suggests adjusting the actual observed rate (as opposed to the predicted rate) for district i to yield $\tilde{C}_i$, defined by

$$\tilde{C}_i = C_i - \hat{K}_1(A_i - \bar{A}) - \hat{K}_2(B_i - \bar{B})$$

which gives an indication of what the observed enlistment rate would be if district i suddenly had an average propensity and average number of recruiters per HS senior.

4.6.3. Results for Period 1976-1978

The rankings shown in the following Exhibit are based on comparisons of performance for the HSG contracts over the entire three year period (1976-78). The Park's heteroscedastic model was used to estimate the supply parameters (i.e., the K's in the previous example) and the adjustments made using the log linear analogy of the approach presented. The predictive equation includes the year dummies, the seasonal dummies and the GI bill dummies, but no district dummies.

We note that particularly, if we throw out the top two and bottom two districts from each distribution the variability remaining has gone down substantially so that the adjustment process has accounted for much of the inherent variability. Also recall that Oklahoma City is at the bottom of the list based on the heteroscedastic approach and was also one of the two districts found to be statistically inferior using the simultaneous regression equation; the other district found inferior was San Antonio which is 9th from the bottom from this ranking methodology.

5.0 ESTIMATION OF ELASTICITIES FOR THE UPPER MENTAL CATEGORY, HSG CONTRACTS

The Naval Recruiting Command is presently expressing their quality contracts as two separate constraints, one on the percent of all enlistments that are of upper mental category, i.e. Mental Category 1-IIIU (this constraint is currently 74%) and one on the percent of all enlistments that are High School Degree graduates (this is currently 72%). We note in passing that our regressions in the past sections on the supply of High School Graduate contracts actually include the so-called GED's, i.e. those without a high school degree but those who have passed some type of equivalency exam; it is estimated about 94% of the HS graduate contracts are actually HSDG contracts so that the 72% HSDG constraint translates to approximately a 78% HSG quota. Hence if one uses the predictive equations for HSG contracts developed from the 1976-78 data, one needs to be aware that this applies to contracts for Regular Navy and Active Mariners who are male, non-prior service, and have either a HS Diploma or a GED.

Since the Command is interested in predicting the resources needed so that given percentages of enlistments are of upper mental category, we have performed some regressions on contracts which are characterized by being both of HSG's and of Upper Mental category. Unfortunately this is not exactly what is desired (i.e. the constraint is on the percent who are of Upper Mental category only) but it is the best possible at this stage since the only available data for the period 1976-78 is on the percents of HSG contracts who are also of the upper mental category. We also note in passing that for CY78, e.g., about 66.4% of all the HSG contracts were also of the upper mental category and that 80% of all of the male enlistment contracts were HSG's.

Comparisons of the results for upper Mental category, HSG contracts are presented using the OLS method with district dummies, the OLS method without district dummies and the Park's heteroscedastic model.

COMPARISON OF ELASTICITIES FOR HSG, UPPER MENTAL CONTRACTS

		HSG contracts (Parks)	HSG Upper Mental (Parks)	HSG Upper Mental (OLS without dummies)	HSG Upper Mental (OLS with dummies)
1)	Propensity	.674	.712	.772	.552
2)	Urban Rural Mix	.192	.223	.235	.192
3)	Pay	.168	-.057	-.019	-.076
4)	Unemployment Rate	.18	.12	.125	.18
5)	Recruiters	.726	.726	.725	.624
6)	LAMS	.045	.065	.08	.058
7)	HS seniors	.244	.182	.208	.296
8)	Minority Adv.	.0007	.0007	.0007	.0007
9)	TV/radio (GEP-General)	.0033	.0033	.0033	.0033
10)	Printed material (GEP-General)	.0084	.0084	.0084	.0084
11)	Percent Black	.0013	-.084	-.083	-.071

We observe that in general a district with a higher percent of blacks has significantly fewer upper mental category, HSG contracts and that LAMS seems to have a positive effect on the percent of HSG contracts that are the upper mental category. The relative pay has a very small elasticity on the upper mental category, HSG contracts, thereby confirming the hypotheses other researchers have found that the quality recruits are less interested in the short terms compensation considerations but more in the training possibilities and its impact on their long term income streams; this is also the reason that the unemployment rate has less impact on the high quality HSG recruit than on the HSG recruit in general. Recruiters seem to have about the same or somewhat less impact on the quality HSG recruit as they do on the HSG recruit.

If we focus on the recruiter elasticity for quality HSG contracts at .624 (from the OLS model with district dummies), this implies for CY 1978 that an additional 33.2 recruiters would generate an additional 228 upper mental category, HSG recruits or about 6.9 per year for each additional recruiter. Note

the average for 1978 was about 11. On the other hand, using the high estimate of .726, we obtain an estimate of 7.99 additional upper mental category, HSG contracts per year for each additional recruiter.

APPENDIX A: SURVEY OF PREVIOUS SUPPLY STUDIES

RESEARCHERS	DATA AND CATEGORIES STUDIED	THRUST	RESULTS AND VARIATIONS TRIED
1) GOLDBERG (CNA) April 80	Cross-sectional district. Separate single year analyses for FY's 1977, 78 and 79.	Separates districts into those that made annual goal and those that didn't.	For FY 79, recruiter elasticity of .767 and youth unemployment of .41. Pay was insignificant. A statistical test was done to determine if the districts that made goal could be pooled with those that didn't. For FY 79 they should be pooled.
2) SAVINGS (Resources Research Corp.) April 80 (Prepared for Air Force)	Quarterly 1956-77	Obtains relative pay elasticity of .98 for MC I-III, and claims sensitive to measure of wages.	States that even for high quality recruits, one should deal with possible demand limitation by doing analyses on separate skill categories.
3) MARKET FACTS (March 80)	Fall 1979 Survey	Examined 3 enlistment incentives: 1) educational assistance (i.e., eliminating present monthly contributions). 2) increase in current monthly starting pay ($50, $100, $200) 3) change in bonus policy.	All have some positive impact, especially for those not predisposed to military. All 3 appear to have about same impact; recommendation is to increase starting pay by $100, but keep other incentives as is. More extreme changes are likely to produce only small increases.
4) FERNANDEZ (RAND) Feb. 80	3rd quarter of 1970 to 3rd quarter of 1979, 4 services, quarterly accessions.	Utilizes log linear model and concentrates on Regular Navy. HSDG, MC I-II, HSDG, MC IIIA, HSDG, MC IIIB Utilize ratio of first year RMC to average weekly civilian earnings.	Recruiters have elasticity of .33-.47. Youth unemployment at .51 for MC I-II, and insignificant for others. Relative pay elasticities of .24 for MC I-II, and 1.67 for MC IIIB.

RESEARCHERS	DATA AND CATEGORIES STUDIED	THRUST	RESULTS AND VARIATIONS TRIED
5) LOOPER & BEWSICK (Univ. of South Carolina) Jan. 80 (Prepared for Air Force)	All enlistment contracts for April 77 to March 78 (cross-sectional for 538 recruit offices).	No pay variable included.	R^2 of .72. A partial validation effort was done using 269 recruit offices held out of the sample. The R^2 between the model predictions and the actual values was .68. The response functions were used to allocate recruiters and allocations compared to recommendations from extensive field audits for one squadron involving 1600 recruiters. Changes in recommendations concurred with model's in direction but staff recommendations somewhat more conservative Recruiter elasticity of .649 Elasticity for high school seniors of .13 Elasticity for propensity to enlist of .14 National leads of .04
6) GOLDBERG (CNA) Nov. 79	Time series, 3rd quarter of 71 to 4th quarter of 78, quarterly accessions for Regular Navy. Education and Mental Categories studied a) HSG's b) MC I-IIIA	Attempts to forecast quality enlistments, using total enlistments as explanatory variable. Utilizes a linear model with log model for advertising.	Pay Elasticity (Ratio) .46 for HSG .32 for MC I-IIIA Other Elasticities recruiters: HSG's .8, MC I-IIIA 1.17 youth unemployment rate: HSG's .46, MC I-IIIA .55 advertising: HSG's .25, MC I-IIIA 1.17
7) RUETER, HILLMAN & BELL (CONSAD) Sept. 79 (Prepared for Air Force Human Resources Lab)	none used	Develops design specification for their National Skills Market Model which empirically forecasts economic activity in various labor markets. Forecasts accession and retention rates by skill classification.	

RESEARCHERS	DATA AND CATEGORIED STUDIED		THRUST	RESULTS AND VARIATIONS TRIED
8) DE VARY & SHUGART (Resources Research Corp.) July 79 (Prepared for Air Force)	June 69-June 76		2 stage least squares simultaneous model with wait and quality as endogenous.	Elasticity of enlistment quality ratio to pay is .206. Elasticity of supply of accessions to pay, at constant quality, is .5. Pure supply elasticity to pay, removing downward bias from effects of retention, is .735.
9) HUNTER & SICILIA (OSAD) Dec. 78	1971-1972		Notesthe negative effect of DEP option on I.R.R. (Individual Ready Reserve). Some 13,370 man-years were spend in DEP in FY 77 prior to entry on active duty which then represent losses to the IRR program.	About half of 18 year-old youth have graduated from high school. One half of these enter college. To maintain a 69%HSDG rate, the Services must enlist 267,000 or 15% of the HSDG who do not enter college. The remaining 120,000 enlistments are drawn from the 1 million non-high-school-graduates in each 18 year-old cohort. Putting these two categories together, there are 790,000 18 year-olds who are not going to college, and 236,000 of these or 30% of the cohort is needed.
10)GREENSTON & TOIKKA (Urban Inst.) Oct. 78 a) 1% change in relative pay produces .5% change in average AFQT score. b) Military pay plays stronger role among lower quality catagories. c) Eligible pool size and unemployment are dominant in Cat. I-III. The pool size has an elasticity of .5 and hence declining pool not as severe as it might be. d) Formulation with relative pay not appropriate. e) Military pay elasticities of .38-.46 for Cat. I-II and .96 for NHSG III. f) Simultaneity problem between enlistments and youth unemployment not a serious problem.	Quarterly accessions 3rd quarter 1970- 4th quarter 1977	I-II, HSG I-II, NHSG III, HSG III, NHSG IV, HSG IV, NHSG (excludes reservists)	4 years of Base pay only (since allowances did not change much) for military pay component in relative pay factor. 4 years of full time pay used for civilian pay component.	When seasonal dummies excluded it markedly reduced explanatory power and increased unemployment and pay impacts.

APPENDIX A -Cont'd.

RESEARCHERS	DATA AND CATEGORIES STUDIED	THRUST	RESULTS AND VARIATIONS TRIED
11) COOPER (RAND) March 78	1951-76; 18-19 year-old males, 18-24 year-old males.	Develops regression model of youth unemployment as function of overall unemployment, fraction of male youth in total male civilian force and minimum Federal wage as percent of average hourly wage in non-agricultural and non-supervisory workers.	Obtains linear relationship where youth's share of total civilian labor force is an important determinant in youth unemployment rate.
12) GOUDREAU, SOMMERS, ALLEN et al. (GRC) March 78 (Prepared for Pres. Commission on Military Compensation)	Utilizes military pay elasticity of .8, Recruiter elasticity of .33, Advertising elasticity of .06.	Analyzed 5 alternatives for attracting and holding required number of quality enlistees 1) provide a general across-the-board percentage increase in enlisted pay and allowances (RMC) 2) provide an incremental increase in enlisted pay and allowances to all enlisted personnel 3) increase recruiting and advertising 4) increased use of enlistment bonuses 5) increase number of quality women enlistees For each option, each other held at FY 78 levels.	The increase in women enlistees is most efficient, followed very closely by "more enlistment bonuses" and "increased recruiting/advertising", followed by increased incremental salaries and last by across-the-board percentage increases. Stated that military pay elasticities would have to be of order of 25-30 (compared to estimated .8) in order for across-the-board pay increases to be as attractive as the other mechanisms studied.

	DATA AND CATEGORIES STUDIED	THRUST	RESULTS AND VARIATIONS TRIED
	Cross-sectional by state for CY 75.	HSDG, MC I-IIIA White and Non-White and for each service. Does not assume the eligible pool has an elasticity of 1.	Obtains an elasticity of .43 for the eligible population. Hence, as the eligible pool declines, the impact on shortfalls is only about half of what it would be otherwise, i.e., there is less than a proportional decline in quality enlistments as for the decline in the eligible youth population.

Navy Elasticities

	White	Non-White
eligible pool	.44	.35
recruiters	.56	.63
unemployment	0	-.53
civilian pay	.61	1.18

The -.53 is the result of substitution effects, i.e., as unemployment goes up, more white males enlist and hence less slots for non-whites.

14) JEHN & SHUGART (CNA) (Dec. 76)	Cross-sectional on districts for CY 73 and CY 75. Regular Navy, HSG school eligible	Recruiters not important.	The negative elasticity of enlistments to other services means Navy enlistments are at expense of enlistments to other services. Also found including experience of recruiters made no difference compared to simply using number of production recruiters.

Enlistment to Other Services	Urban-Rural mix	%Blacks	Recruiters	Quotas	Unemployment(overall)
Negative	--	-.14	.22	.48	.32
Negative	.31	-.08	.22	.63	--

15) AMEY, FECHTER, HUCK & MIDLAM (GRC) Oct. 76 (Prepared for Navy)	Pooled cross-sectional time series, on census tracts over 1970-74, on MC I-II, HSG MC III, HSG MC I-III, NHSG Use of regional dummies reduced significantly the estimated impact of the recruiters variable. In fact, the regional components are of much higher significance than any of the other exogenous variables. The inclusion of dummies reduced recruiters from .6-.75 without	Analyzed impacts of QMA, civilian pay, youth unemployment, recruiters, paid advertising, and black population.	For the Navy, only recruiters/QMA significant with elasticities in range of .6-1.0 and marginal cost per recruit of $2,300. States that time series show that unemployment considerations exceed pay considerations and is consistent with their risk-averting behavior. Recruiter elasticities: .75-.9 for MC I-II, HSG .85-1.2 for MC III, HSG and MC I-III, NHSG Percent Black had elasticity of -.2.

RESEARCHERS	DATA AND CATEGORIES STUDIED		THRUST	RESULTS AND VARIATIONS TRIED	
16) AMEX, FECHTER, GRISSMER & SICA (GRC) June 76 a) Military pay elasticity at 1.1-1.2. b) Civilian pay elasticity higher. c) Estimate of military cash pay elasticity exceeds that of "in-kind" elasticity. d) Forecast error of 16% in terms of root mean square and over-predicted. e) Quality Blacks and quality non-Blacks have very different pay elasticities, i.e., 3.5 versus .9 for Cat. I-III, HSG. f) There can be a bias in cross-sectional studies of pay elasticities since variations in civilian pay likely to be inversely correlated with factors (such as cost of living) that represent non-pecuniary distaste for Military. (Gray found large pay elasticities when he adjusted for cost of living.) g) Existing models on accessions do not adequately deal with causes of short run variations in enlistment behavior. h) Elasticities from time series models larger than those from cross-sectional models. i) Elasticities from absolute pay models generally larger than those using relative pay. j) The Army generally has highest pay elasticities for each group, followed by Navy, Air Force, and Marine Corps.	1970-75 (monthly) accessions	I-II, HSG III, HSG I-II, NHSG I-III	Pay is known to be highly collinear with recruiters (which is omitted) so estimated pay elasticity should be interpreted as upper limit	Horizon of 3 years, with no discounting, used for pay factor.	Unemployment Elasticities for Dod are: I-II, HSG .45 III, HSG .24 I-II, NHSG -.3 When discounting at 30% used, the pay elasticity went down by about 13%. The negative elasticity represents substitution of HSG for non-HSG under high unemployment.

APPENDIX A - Cont'd.

RESEARCHERS	DATA AND CATEGORIES STUDIED	THRUST	RESULTS AND VARIATIONS TRIED
17) SYSTEM DEVELOPMENT CORP. April 76 (Prepared for Army)	Enlistments from 6/1/74 to 12/31/74 across district recruiting commands. They utilize weighted quality index where MC I, HSG = 6 MC II-III, HSG = 6 MC I, NHSG = 3 MC II-III, NHSG = 3 MC IVA or IVB, HSG = 2 MC IVA or IVB, NHSG = 1	Computes corelations between factors and enlistment rate and quality enlistment rate where latter defined as ratio of sum of weighted enlistments by DRC to sum of weighted available by DRC. Examined impact of environmental factors such as socio-economic level, education and educational facilities available, advertising by magazine (month and theme), recruiters (experience, age, and grade) self-perception, and life-style desired.	Corelation of recruiters with quality enlistment rate is .5. Attitude towards authority (ease with which one can take orders) had a corelation of .21, "dignity and respect importance" had corelation of .27.
18) WITHERS (1976)	Quarterly for 1966-73	Great Britain, U.S., Australia, and pooled cross-sectional for Canada.	Elasticity for relative wage at .28; Unemployment elasticity at .29. Using absolute military wage, he obtained .45 for military pay and .38 for unemployment.
19) FECHTER (Urban Inst.) (1976)	Uses quarterly data for 1958-72	Military pay elasticity of 1.4. Relative pay elasticity of 1.15. "Employment rate" elasticity of 1.12 (compared to 1.25 in Gates study).	When applied to 1973-74, had mean accuracy rate of 10% and root mean square error of 16%.

RESEARCHERS	DATA AND CATEGORIES STUDIED	THRUST	RESULTS AND VARIATIONS TRIED
20) HUCK (GRC) 1974	CY 73 cross-sectional	Weighted least squares used to adjust for heteroscedasity.	Pay variable used was sum of military pay over 3 years, using discount rate of 30%. Recruiters elasticity of .47. Percent Blacks elasticity of -.11.
21) GRISSMER, AMEY, ARMS, HUCK et al. (GRC) Oct. 74 (Prepared for OSAD)	Monthly 1971-73	Marginal cost for one additional HSG enlistment for Navy is $3,300$\pm$700 and marginal annual recruiter productivity is 9$\pm$2.	Recommends more use of advertising and recruiters; suggests need for pooled time series/cross-sectional models. For MC I-III, military pay had elasticity of .44, recruiters of .33, and unemployment of .18.

APPENDIX B

RELATIVE STRENGTHS AND WEAKNESSES OF TIME SERIES ANALYSIS VERSUS CROSS SECTIONAL ANALYSIS FOR ESTIMATING SUPPLY PARAMETERS: THE APPEAL OF "POOLED" METHODS

Some of the key considerations in this debate include:

1) Fechter and Amey (October 76) point out that cross sectional methods alone face severe problems in deriving estimates of elasticity of military pay since they cannot observe variations in military pay over time. They are then constrained to deriving pay elasticities from only civilian pay variations. This has associated with it the possibility of bias associated with the symmetry issue discussed earlier and from potential systematic measurement errors in the civilian pay variable, also mentioned earlier; in contrast the time series methods are able to base their estimates on some of the observed variation.

2) Time Series studies must come to grips with seasonality whereas the cross sectional studies can be considered free of seasonal influences. Fechter and Amey (Oct 76) state that the results from time series methods are sensitive to the use of seasonal or monthly dummies. Inclusion of the dummies lowers the estimates and significance of the elasticities, but increase significantly the R^2's of the models. Other results show that inclusion of the seasonal dummies is important in attempting to explain HSG enlistment behavior (in terms of accessions) but not the non HSG's. When the seasonal dummies are excluded, there is often a shift (unwarranted in this reviewer's opinion) in the variables found significant.

3) Amey and Fechter claim that, if one works with cross sectional methods only, there can be a significant downward bias in the pay elasticity since variations in the civilian pay are probably inversely correlated with factors (such as cost of living) that represent the set of non pecuniary distaste for the military. Gray (using data for 1964) obtained larger pay elasticities

than those without this distributed feature. This result conflicts with Fisher's assumed instanteous supply adjustment.

5) A major strength of pooled time series and cross sectional models is its ability to account for variance in enlistment patterns both geographically as well as longitudinally. It should be recognized that this type of treatment with its "constant slope" assumption for all regions, i.e. same elasticity for all regions (but possibly different levels due to the use of regional dummies) is geared to measuring the degree of effectiveness of nationwide policies, since it assumes the same directional response to increasing recruiters, pay, advertising, unemployment, population, percent Black, etc. across all regions.

6) Time series models typically have given higher elasticities than those using cross sectional methods, perhaps because of the reasons suggested in 4 associated with not accounting for military distaste, but also because of the earlier discussed problems with handling the eligible pool. Time series models that do not include recruiters unequivocally have been found to overstate the impact of pay.

7) In time series analyses, high correlation between pay and recruiter has made it almost impossible to separate out their effect. In fact, in recent analyses by Fernandez (1979), using data for the period 1970 (third quarter) to 1979, (third quarter) neither variable was significant by itself but the combination was jointly significant.

8) In cross sectional, Grissmer says it is almost impossible to separate out regional differences in civilian wages, unemployment and propensity to enlist. In his 1974 work he strongly suggests need for pooled analyses.

APPENDIX C:

FACTORS FROM PREVIOUS STUDIES THAT IMPACT ON FIRST TERM SUPPLY OF QUALITY RECRUITS:

i) Unemployment Rate - Most studies generally include the unemployment rate for the eligible group. In one study (1977) the unemployment rate was adjusted to give larger weights to larger deviations from a "natural" unemployment rate of 4%; in this case the transformed rate was $(U-4.0)^{1.5}$ where U is the total labor unemployment rate. Fernandez (1980) and Cooper (1978) have both studied the relationship between youth unemployment and total unemployment via regression. Fernandez utilizes a relationship that converts overall unemployment to youth unemployment by raising overall unemployment to the power .699. Cooper also includes the Federal minimum wage and the percent of the total male work force represented by the 18-19 male civilian work force. He points out that use of youth unemployment figures are biased since they don't include the youth in the military. Most unemployment elasticities are in the range of .19 to .5.

ii) Recruiting Effort - Those early studies (e.g. Gates) that did not include recruiters overstated the impact of pay. Most studies include recruiters by dividing production recruiters by QMA. Some have utilized a factor to weight the recruiters by their experience. For quality recruits, the elasticities for recruiters range from .3 (Cooper) to .77 for Goldberg and .6 for Fernandez. Morey (1980) has explored a "moderator" effect on recruiters, in which the elasticity for recruiters is a constant plus a term which is a function of the difference between their quality quotas and the amount due in from the Delayed Entry Program pipeline. The premise here was that recruiters may work harder whenever the gap between their quotas and their "dues in" is large. Preliminary results seem to support this.

Several of the cost-effectiveness studies have recommended that increasing recruiters is the most cost-effective option for meeting future

requirements. The recruiter elasticity is typically much higher for the lower quality recruit.

iii) Advertising - The services spend annually over $125 M on military advertising covering such media as TV/radio, magazines, classified ads, direct mail campaigns, etc. Fechter found advertising to have an elasticity of .16 - .25 for Mental category III. HSG's Goudreau (1978), in their cost-effectiveness analyses, utilized .06 for advertising versus .33 for recruiters. Current efforts by Morey seem to show the optimal mix of dollar resources for advertising and recruiters should be in about a 15% to 85% split, respectively. Also the classified ads (called LAMS) as well as the minority type advertising appear reasonably effective in obtaining quality recruits. Morey's efforts are also aimed at optimizing the timing of the Navy's advertising and assessing the impact of the Joint Advertising programs (JADOR), begun in 1978.

iv) Demography - The variables that have been tried and found to be helpful in cross sectional analyses, in increasing the explanatory power of quality recruits, include i) percent Black in the region (negative correlation), ii) urban-rural mix (i.e. percent of region's population included in the SMSA, iii) propensity to enlist (based upon responses to questionnaires geared to general perceptions of military), iv) percent of youth in college, v) extent of military presence, vi) number of high school seniors, vii) labor force, viii) dispersion of area (i.e. population/sq. mile), etc., ix) area educator level, x) per capita income. These variables are particularly useful in improving recruiter allocation and in goaling models. The use of dummy variables in cross sectional studies also has considerable merit in that it captures differences in recruiter efficiency and other demographic variables omitted, and generally gives rise to lower estimates than if the area dummies were excluded. It is this reviewer's opinion that without the district dummies, the elasticities tend to be overstated.

v) Seasonality - In time series models, particularly for quality high school graduate recruits, the inclusion of monthly or seasonal dummies has been found to greatly increase the explanatory power of the models and are sorely needed to not bias the estimates. The advantage of cross sectional analysis is that these effects do not have to be dealt with.

vi) Special Events - Special situations, such as the termination of the GI bill in December 1976 or a policy switch to utilize paid TV advertising, require the analyst to use dummy variables so as not to bias the time series models. For example, December 1976 was the month in which contracts greatly exceeded any other month (due to the fact that it was the last month for signing an enlistment contract for which the benefits of the GI bill were still obtainable. Hence any analyses that did not adjust for this event could be led to very misleading results.

vii) Quotas and Demand Limitation - One study by Jehn and Shugart (Dec 76), using cross sectional data for 73 and 75 felt there was an inhibiting effect of quotas, even on quality enlistments, and that the goal setting process used by the Recruiting Command is extremely important in determining the overall efficiency of the recruiting campaign.

Most researchers feel taht regressions can safely be applied to the HS graduates/school eligible supply estimation area since they are not demand limited, i.e. the services will essentially take all they can get of those types. However, Savings (1980) mentions that, if there are not enough school slots at any given time for certain skill categories (e.g. electricians), then, even though one is dealing with high quality recruits, a demand limitation is still operating. To take this into account, he suggests performing separate analyses for the truly supply limited skill categories.

Morey is treating the demand aspect in 2 ways: first, to take into account the possible inhibiting effect of quotas on recruiters, he is using a "moderator" regression technique which expresses the elasticity for recruiters as a

constant plus a term which is a function of the difference in the quality quota for the recruiters and the number arriving from the DEP pipeline. The hypothesis is that recruiters are more productive when they are in jeopardy of not meeting their quotas. The second and more comprehensive attempt revolves around the use of simultaneous variables in a 2-step least squares regression where quality and non-quality contracts are treated as endogenous variables. In this case the number of non-HSG contracts signed is a function of the number of HSG contracts signed and quotas, so that non-HSG contracts are viewed as a way of backfilling to reach the quota. In this simultaneous version, the number of HSG contracts obtained from a given district in one year influences in part the number of recruiters assigned to that district in the following year.

viii) Inter-Service Competition - Some studies such as Hansen (1980) and Goldberg (1980) have tried to control for the actions of other services by inclusion of other services' recruiters, advertising or accessions to other services. Hansen states that the Army, as the market share leader (at least in the amount of spending) is helped by the Navy advertising.

ix) Delayed Entry Program - The option for a recruit to delay his actual accession or shipping date for up to a year from the time he signs an enlistment contract has become a very powerful variable in recruiting analysis. By FY 1977, 71% of all of the Navy's accessions were through the DEP program. Time in the DEP counts against the 6 year obligation (IRR) and as longevity for pay purposes.

Some analysts have argued that the wait in the DEP has a negative effect on recruits since if they can't ship directly, they remain unemployed until they do. De Vary and Shugart and Burnwirght attempt to compute elasticities of the mean wait in DEP to enlistments. However Horey has found that the

size of the DEP pool is a positive factor on leads, most likely through the peer grapevine network.

Finally it is felt to be important in time series or pooled time series/ cross sectional analyses to utilize contracts as the dependent variable of interest (in contrast to accessions). Only Morey (1980) and Beswick (1980) have utilized contracts for their analysis. It becomes important since advertising, recruiters, pay, unemployment, etc. have their impact not so much on when the individual ships, but on whether or not he signs a contract and when. Hence time series models using accessions as the dependent variable must include large lag effects to have any chance of accuracy; on the other hand this feature introduces multi-collinearity which can distort the estimates sought for.

x) Miscellaneous Factors: Length of Term, Education, Self Perceptions, Life Style Type Desired - Other important characteristics include the required length of the first term (the Army has experimented with a various year contracts; the impact of reducing the 6 year contract to 3 or 4 years resulted in a 10-40% increase in enlistment), size of enlistment bonuses, kind of vocational training available, and size of post-service educational benefits. It should be mentioned that most previous models have not included these factors and worked relatively well (i.e. error rates of 10-16% up until 1978). On the other hand most forecasts for 78 and 79 have severely overestimated the number of enlistees from the higher mental categories. Hence inclusion of such additional factors, together with more emphasis on pooled methods, on enlistment contracts (in contrast to accessions) may be needed (see also (vi) for other reasons).

Wise (Math-Tech, 1980), based on a longitudinal study of 1972 HSG cohorts, found that individuals most likely to enlist are those from families with

middle to lower middle family incomes and average to slightly below average math and vocabulary skills. He also found that the long term income stream is the major factor and that very near term income streams are not.

Finally System Development Corporation in April 76 and Foti (Naval Post Graduate School, 1978) computed correlations of many personal factors such as socio-economic level, education, self perceptions (in terms of worth), attitudes toward authority, desire for "respect and dignity", "good marriage", etc. with quality enlistment rates. They found many of these to be highly correlated, both positively and negatively.

xi.) CETA Programs Providing Civilian Employment Opportunities for Youth - Beginning in late 1977 the U. S. Government began spending several billions of dollars aimed at providing initial employment and training for youth. The Program involved some 360,000 men for 3-month periods and could well be one of the major causes of the 15,000 drop in HSG contracts in 1978.

APPENDIX D: RESULTS OF POM OPTIMIZATION RUNS USING SUPPLY PARAMETERS OBTAINED FROM EARLIER STUDY

The model utilizes for elasticites (relating the number of regular Navy and reservist contracts for non-prior service, male, high school graduates to i) number of production recruiters and ii) dollars of aggregrated advertising expenditures impacting on the market) the results of multiplicative regressions obtained in 1979 based on three years of data, namely calendar years 1976, 1977, and 1978. The data imputs were monthly observations on a district level so that there were 43 x 36 = 1,548 observations. The elasticities are:

	Long Term	Present Month	1 Month Lag	2 Month Lag	3 Month Lag
Recruiters	.5465	.4513	.0786	.0137	.0024
Advertising	.0839	.0693	.0121	.0021	-

Hence, to illustrate, a 1% increase in the dollars of advertising in say just the month of January would produce over the long run an increase of .0839% in the number of male non-prior High School graduate contracts enlisting for active duty. Many of these would be in the delayed entry program and would not show up as an accession until later. Associated with this 1% increase in advertising in January, one oculd expect a .0693% in the number of such contracts in January itself, .0121% increase in February, etc. The other elasticities found are: .0962 for the unemployment rate (for the total labor force), and .3581 for the number of male high school seniors.

The degree of fit by month over the country as a whole for CY1978 for the predictive equation utilized is displayed in the attached figure. The precent error, when applied to CY78, is given in the last column; note the maximum deviation is about 2.7%. The accompanying figure visually depicts the degree of fit attained, the straight line depicting the line on which all the points

would lie if the predictor were perfect. The additional charts show the degree of fit attained at the individual area levels; while it is not as good as that attained at the national level (because of the advantage of smoothing when summing over the nation) the fit is still seen to be reasonably good. 2) Before considering the 16 scenarios (combining different Fiscal years, different quotas and different economy assumptions, i.e. vigorous economy, less vigorous and recession) it is helpful to have some concrete benchmarks. If the budget building program were run on CY78 demographics, using the initial conditions (in terms of the recruiters and advertising in place for the last few months of CY77) and assuming recruiters cost of $21,190 per year, one would obtain the following:

	Quota of 55,000 HSG enlistments	Quota of 65,000
Total cost	$77.64M (in 1978 dollars)	$102.01M
Number of Recruiters	3,176	4,174
$ of Advertising	$10.33M	$ 13.57M

(Note the advertising budget does not include any overhead dollars.)

To put these numbers in perspective the actual situation for CY78 was an attainment of 54,988 high school graduate contracts, at a total cost (not including JADOR advertising) of about $81.52M (using $21,190 as the recruiter costs), broken down as 3,320 recruiters and $11.17M on advertising (exclusive of JADOR). Hence the model says that, 1) if there were no budgetary constraints relative to the split between recruiter related expenses and advertising expenses 2)if the allocations of recruiters to areas, and advertising to area and time of year, were optimized, then a savings of the order of $4M (about 5%) might have been possible. On the other hand, in order to meet the desired 76% High School degree mix, one would have desired some 65,000 HSG contracts, costing about another $20M. 3) With this benchmark as our perspective, we now address the scenarios analyzed and the initial contitions utilized.

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THE IMPACTS OF VARIOUS TYPES OF ADVERTISING MEDIA, DEMOGRAPHICS--ETC(U)
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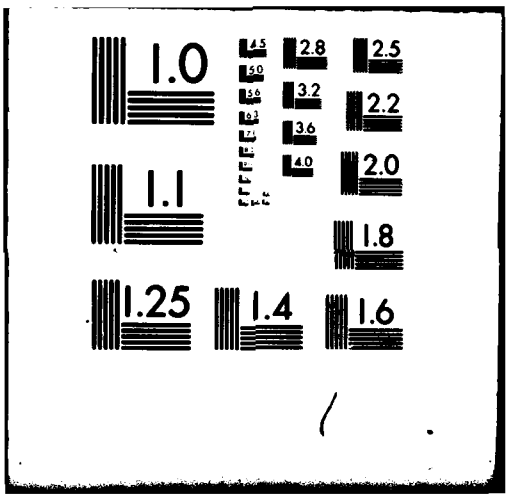
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The following matrix represents the runs (scenarios) made:

Quota HSG	Economy Scenario UNEM	POM - YEAR FY 1982	FY 1983	FY 1984	FY 1985	FY 1986
65K	V	X	X	X	X	X
	LV	X				
	R	X				X
55K	V	X				X
	LV	X				
	R	X	X	X	X	X

KEY:

HSG = High school graduate new contracts recruited
UNEM = Unemployment
V = Vigorous expansion unemployment scenario
LV = Less vigorous expansion unemployment scenario
R = Expansion and recession unemployment scenario
X = Desired scenario to be run and returned to Navy Recruiting Command

Consider the initial conditions assumed for all the FY82 runs, i.e. what numbers of recruiters were being used prior to the start of FY82 and what level of advertising was being used. Note these inputs are needed due to the lagged effects of both advertising and recruiter efforts. Hence, in order to run the model it is necessary to have estimates, by area and by month, of the number of recruiters and the dollar levels of advertising being expended just prior to the year in question.

Based on inputs from the Recruiting Command, it was assumed that in the few months prior to FY82, i.e. July-Sept. 1981 the total number of recruiters over the nation was 3,947, i.e. an increase of some 23% over the 1978 levels and that they were positioned by area in an optimal manner. The optimal distribution of the 3,947 recruiters was based on the percentages arrived at from applying the optimal budget generation model to CY78. Hence this gives rise to a certain

number of recruiters present in each area in the period July-September 1981. These numbers are" Area 100-988 recruiters, Area 300-833 recruiters, Area 400-743, Area 500-264, Area 700-444, Area 800-676, Total of 3,947. The same logic was used for arriving at the initial conditions for advertising; the total annual level of expenditures for the months prior to FY82 being identical to that expended in CY78. To summarize, regarding the initial conditions for all of six FY82 runs, the estimated annual recruiters and advertising levels (obtained from the Recruiting Command) were used and assumed to be in an optimal cost-effective manner. While changes in these assumed initial conditions will make some changes to the budgets developed, their impact is not large (i.e. estimated at less than a couple of percent) since the lagged effect of advertising and recruiters is relatively small.

Next consider how the initial conditions were arrived at for the other runs, i.e. those for fiscal years 83, 84, 85 and 86. It was felt the results of the runs would be more credible if they were coupled, i.e. even though the optimization is only over the particular year in question, the outputs of the previous year become the initial conditions for the next year. Hence to illustrate, the initial conditions assumed for the recession scenario run for FY83 and a quota of 55,000 were the outputs (in terms of numbers of recruiters and advertising by month and by area) resulting from the FY82 run where the same scenario held for the economy and the quota was the same. Hence for the vigorous economy run for FY83, and a quota of 65,000, the outputs from the FY82 run for a vigorous economy, quota of 65,000, were utilized. For the vigorous economy run for FY86 and a quota of 65,000, the outputs from the FY85 run for a vigorous economy, quota of 65,000 were utilized.

Finally for those FY86 runs where a corresponding FY85 run was not to be run, the initial conditions were taken from the outputs of the appropriate FY82 run. In this way then there is a realistic handling of the year to year interactions which could easily be expanded to include differences in quota by year.

SUMMARY OF BUDGET GENERATION RUNS

YEAR	SCENARIO FACTORS	QUOTA ON HIGH SCHOOL GRADUATES ENLISTMENTS 55000			QUOTA ON HIGH SCHOOL GRADUATES ENLISTMENTS 65000		
CY 1978	Recruiter cost-(million dollars)	67.31			88.44		
	Advertising expenses-(million dollars)	10.33			13.57		
	Total cost-(million dollars)	77.64			102.01		
	Avg. cost/HSG	1411.64			1569.38		
	Recruiters (man years)	3,176			4,174		
	High School Seniors	1,618,829.			1,618,829.		
	National unemployment rate (%)	5.87			5.87		
	Type of Economy	Vigorous	Less Vigorous	Recession	Vigorous	Less Vigorous	Recession
	National Unemployment	4.05%	5.30%	**	4.05%	5.30%	*
FY 1982	Recruiter cost-(million dollars)	75.57	71.84	67.83	990.00	94.12	88.85
	Advertising expenses-(million dollars)	11.60	11.03	10.42	15.21	14.46	13.65
	Total cost-(million dollars)	87.18	82.87	78.23	114.21	108.57	102.49
	Avg. cost/HSG-(million dollars)	$1585.00	$1507.00	$1422.00	$1757.60	$1670.00	$1577.00
	Recruiters (man years)	3,567	3,390	3,200	4,6 2	4,442	4,193
	High School Seniors			1,508,425			
FY 1983	Recruiter cost- (million dollars)	***	***	68.64	100.81	***	***
	Advertising expenses-(million dollars)			10.54	15.48		
	Total cost-(million dollars)			79.19	116.29		
	Avg. cost/HSG-(million dollars)			$1440.00	$1789.00		
	Recruiters (man years)			3,239	4,757		
	High School Seniors			1,459,051			
FY 1984	Recruiter cost- (million dollars)	***	***	69.40	103.15	***	***
	Advertising expenses-(million dollars)			10.66	15.84		
	Total cost-(million dollars)			80.05	118.99		
	Avg. cost/HSG-(million dollars)			$1455.00	$1831.00		
	Recruiters (man years)			3,275	4,868		
	High School Seniors			1,410,486			
FY 1985	Recruiter cost-(million dollars)	***	***	70.01	104.29	***	***
	Advertising expenses-(million dollars)			10.75	16.02		
	Total cost-(million dollars)			80.76	120.31		
	Avg. cost/HSG-(million dollars)			$1468.00	$1851.00		
	Recruiters (man years)			3,304	4,922		
	High School Seniors			1,385,880			
FY 1986	Recruiter cost-(million dollars)	79.82	***	69.99	104.26	***	91.48
	Advertising expenses-(million dollars)	12.26		10.75	16.01		14.05
	Total cost-(million dollars)	92.08		80.74	120.28		105.53
	Avg. cost/HSG-(million dollars)	$1674.00		$1468.00	$1850.00		$1624.00
	Recruiters (man years)	3,767		3,303	4,920		4,317
	High School Seniors			1,306,851			

* For every type of economy, for each year, unemployment rate per area per month is available and were used for computer runs. For vigorous and less vigorous economies, the unemployment rates remained the same for four years. National unemployment rates are given for quick comparisons.

** The unemployment rates for recession varied for over a period of four years unlike the other two types of economies. For quick comparison, the national unemployment rates for recession are: 7.23 for FY 1982, 7.71 for FY 1983 and 8.19 for FY 1984-FY 1986.

*** [illegible]

KEY IMPLICATIONS FOR FY 82

OF VARIOUS ECONOMIC SCENARIOS

FOR AN ASSUMED QUOTA OF 55,000 HIGH SHCOOL GRADUATE ENLISTMENTS

1) Compared to CY 78, the impact of an assumed shrinkage in High School senior population of 6.8%, and

   i) the recession scenario (i.e. 7.23% unemployment) combine to yield about the same cost as in CY 78 (in 78 dollars)

   ii) If instead the economy is in the "less vigorous" state (i.e. unemployment at 5.32 compared to 5.87% in CY 78) the additional cost needed is 5.9% more than in (1,i)

   iii) If instead, the economy is in the vigorous state (i.e. unemployment at 4.05%), then the additional funds needed are 11.4% more than in (1,i).

GENERAL COMMENTS ON RESULTS

For a given quota and a given economic scenario, (e.g. vigorous economy with quota of 65,000, or recession with quota of 55,000) the different types of costs, and number of recruiters increase each year with they exception of fiscal year 86. This is due to an assumed decreasing number of high school graduates since more efforts are required to obtain the contracts from a smaller sized population. As soon as this shrinking stops, there is a slight drop in the total costs required. Also as the economy weakens, there are less civilian opportunities (both perceived and actual) in the market, and, hence less efforts are required to obtain contracts from them. This is confirmed when the average

cost per HSG enlistment is compared for fiscal year 82 for each quota. The average cost is of course highest for the vigorous economy scenario and lowest for the weak economy. Note also that the average cost per HSG enlistment is uniformly lower for a quota of 55,000 than for the 65,000 quota. This is due to the non-linear diminishing return character of additional recruiters and advertising. We observe the percent increases in total costs for each year are higher for the vigorous economy scenario compared to that for weak economy. Turning to the change in results between fiscal years 82 and 86, we see that for quota of 65,000, the total costs for the vigorous economy scenario has gone up about 5.31% whereas for the weak economy scenario, the total costs has risen only 2.96%. Similarly for the quota of 55,000, the corresponding percentages are 5.61% increase and 3.22%. Thus for the vigorous economy the percent increase over the 4 year in total efforts is almost doubled that for the weak economy.

INSPECTION OF RESULTS

The national yearly unemployment rate for CY1978 was 5.87%. The national yearly unemployment rate postulated for the vigorous economy scenario is 4.05% and for the less vigorous economy, it is 5.30% per fiscal years 82-86. For the recession scenario, the national unemployment rates assumed are 7.23, 7.71 and 8.19 for fiscal years 82, 83 and 84-86. This puts the economic conditions of the benchmark year 78 somewhere between less vigorous economy and recession of fiscal year 82.

The fiscal year 82 has as initial conditions 3947 recruiters optimally allocated. The incremental increases in total costs for FY82, relative to the optimized values for CY78, for the 55,000 quota is $9.54M, $5.23M and $.59M for the vigorous, less vigorous and recession economy scenarios, respectively. The similar increases for the 65,000 HSG quota are $12.2M, $6.56M and $0.48M

for vigorous, less vigorous and recession economy. The cost increase for a quota of 65,000 is higher than that for quota 55,000; this is due in part to the initial conditions assumed at the beginning of 82, namely the 3947 recruiters assumed to be in place at the beginning of the FY year 82. Therefore, for the 55,000 the impact of the relatively large number of recruiters, through the lagged effect, is working to help keep the cost down in FY82. This is not so for the quota of 65,000 since more recruiters are needed in this case than those available at the beginning of the year. As a result the impact of the efforts of recruiters are rather low in the beginning of the year. As a result the costs required are slightly higher than it would be if there had been better initial conditions.

Comparing the vigorous economies for FY82 and FY86 for a quota of 55,000, the total cost is expected to increase $4.90M (5.62%) over four years or an average about $1.22M (1.41%) increase every year. This cost increase is due solely to shrinkage in the high school senior population.

In summary for FY82, we can see that relative to the recession scenario, (at 7.23% unemployment), the additional percentage cost required, assuming the 55,000 quota, for the less vigorous economy (namely 5.3% unemployment) is 5.9%. It is 11.4% more for the case of the vigorous economy (namely a 4.05% unemployment rate). Also, for the recession scenario, relative to the optimized results for CY78, the impact of a 6.8% shrinkage in the high school senior population (from CY78 to FY82) and a 23% increase in the unemployment rate (i.e. from 5.87% in CY78 to 7.23% in the FY82 recession scenario) combine to yield a total cost very similar to that for an optimized CY78 (really about $.5M more).

For the vigorous economy in FY82, compared to the recession scenario for FY82, the decrease in unemployment rate from 7.23% to 4.05% (namely a 44% drop) gives rise to a 11.4% increase in cost.

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This research is geared towards determining the most cost-effective mix of various types of advertising and recruiters to meet the quality enlistment goals for the enlisted Navy. The impacts of five different types of advertising, recruiters, numerous demographic variables, relative pay, and the size of the delayed entry program are estimated and compared using a variety of regression approaches. The data base used is a pooled time series-cross sectional one providing over 1500 observations over the 3 year period 1976-78.

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