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Integration of PREPAS and EPS Attrition and Reenlistment Rate Forecasts

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Two distinct, unrelated systems exist to develop plans for the "cradle" (recruitment) to "grave" (leaving the Marine Corps) movement of Marines. The systems are not linked together and each produces forecasts of losses and reenlistments. This leads to training and overall strength plans being produced with different forecasts of personnel strengths and flows. This report describes the methods used to generate attrition rates and reenlistment rates for the Precise Personnel Assignment System (PREPAS) using Enlisted Planning System (EPS) rates and data as the foundation.

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Foreword

This effort was conducted under program element 0602131M (Manpower Technology) under the mission sponsorship of the Marine Corps Systems Command (AW). The objective of this effort was to develop new forecasting technologies to link attrition rate and reenlistment rate forecasts across two systems.

This report documents the results from an analysis of the two systems. It presents reasons why new forecasting technologies were not developed, and it describes the methods used to produce attrition rates and reenlistment rates for the Precise Personnel Assignment System (PREPAS).

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Summary

Background

The Manpower Department of Headquarters, USMC engages in a large complex planning process to develop an adequate inventory of trained personnel. This process encompasses enlisted Marines from their "cradles" (recruitment) to their "graves" (leaving the Marine Corps). Two distinct, unrelated systems exist to develop plans for the "cradle to grave" movement of Marines. These systems are not linked together, and each produces forecasts of losses and reenlistment. As a result, training plans and overall strength plans are produced with different forecasts of personnel strengths and flows.

Objective

The objective of this effort was to develop forecasting technologies which would link forecasts of attrition losses and reenlistments across two modelling systems.

Approach

A thorough review of the components of the Training Management System (TRAMS) and the Enlisted Planning System (EPS) was conducted. Results from this review indicated that the development of a new technology was unnecessary. Attrition rates and reenlistment rates were developed for TRAMS using EPS data (in the case of the attrition rates) and actual EPS-produced reenlistment rates.

Conclusion

The rates developed are only applicable for a definitive set of MOSs. Any change in the MOS skill structure will require new rates. Additionally, the rates (especially the reenlistment rates) will be substantially impacted by drawdown or career force controls policies. The implementation of new policies will likely require the reestimation of the rates.

Contents

Introduction

Background

The Manpower Department of Headquarters, U.S. Marine Corps (USMC) engages in a large, complex planning process to develop an adequate inventory of trained personnel. This process encompasses enlisted Marines from their "cradles" (recruitment) to their "graves" (leaving the USMC). Along the way, a number of significant events define a Marine's career. They make reenlistment decisions, get promoted or reduced in grade, change skills, and finally leave the service. To ensure that the USMC has sufficient numbers of trained personnel with the right skills, the Manpower Department must plan these events carefully. The planning process must take into account the dynamic nature of the events. For example, a loss from the Marine Corps creates a vacancy in the personnel system which can only be filled by accessions or promotions. Two distinct, unrelated systems exist to develop plans for the "cradle to grave" movements of Marines. The Enlisted Planning System (EPS) is used to determine overall strength and personnel flow targets. The Training Management System (TRAMS) is designed to develop training requirements. These two systems are not linked together functionally, and each produces forecasts of losses and reenlistments. As a result, training plans and overall strength plans are produced with different forecasts of strengths and reenlistment.

At the beginning of FY92, the Navy Personnel Research and Development Center was tasked by the Headquarters, USMC with developing "technological linkages" between these two systems. It was hoped that these linkages would provide the means for both planning processes to use the same forecasts of inventories and flows. This report documents the work performed under the Manpower Management and Assignment Modelling Research task. A brief overview of the two systems will be presented first. This will be followed by a discussion of the forecasting methods and procedures which were used to develop attrition rates for TRAMS. A comparable discussion related to the production of reenlistment rates will follow. The report will conclude with caveats which must be acknowledged when using the rates.

Systems Overview

TRAMS is one component of a much larger modelling system known as PREPAS (Precise Personnel Assignment System). The components of PREPAS can be divided into two distinct groups--models which perform planning functions, and models which perform execution functions.[1] TRAMS is a planning model. Despite the large number of models under PREPAS and despite the two very different functions which are performed by these models, consistency in model inputs and outputs is preserved by the PREPAS Dictionary. The Dictionary provides a common set of input data, control parameters, and rates for all system components.

[1]Planning models are used to develop specific plans and policies. For example, a training planning model would be used to develop training schedules or class sizes. Execution models are used to "make the plans happen." For example, an assignment model would be used to assign Marines to the training courses included in the training plan.

Of primary concern in this effort were two models which perform planning functions, TRAMS and the Enlisted Population Model (EPM). The EPM projects the *current* first-term force 60 months into the future by estimating losses and reenlistments. The EPM uses attrition rates and reenlistment rates contained in the Dictionary. The rates are applied to the first-term inventory population to determine losses and reenlistments. Output from the EPM is a projected first-term enlisted end strength from the current population. This projection, in turn, is used as an input by TRAMS. TRAMS develops accession, classification and training plans for a population *not currently on board.* It uses the EPM-produced projected inventory as an input to its projection process. Again, the PREPAS Dictionary is the source of the loss rates and reenlistment rates used by TRAMS. The output from TRAMS is directly used to produce the first-term force training plan.

The EPS is a set of computer models, a supporting database, and a user interface which produce forecasts of enlisted inventories and flows for 7 fiscal-years. The central component of EPS is the Inventory Projection Model (IPM). Using an actual begin fiscal year inventory, the IPM forecasts losses, accessions, reenlistments, and promotions at the OCCFIELD level of skill aggregation. These forecasts are then aggregated across all OCCFIELDs to produce an ALMAR (total enlisted) forecast of inventories and personnel flows.

One of the newest components of EPS is the Selective Reenlistment Bonus (SRB) Planning Model. This model forecasts in-year and out-year reenlistments at the Military Occupational Specialty (MOS) level of skill aggregation.[2] This model allows the user to examine the impact of varying SRB multiples on retention by changing the default set of multiples.

Table 1 depicts the major attributes and levels of aggregation in the EPS and TRAMS. Based on the findings from the analysis of the two systems, the decision was made to forgo the development of a new technology and instead produce attrition rates and reenlistment rates for TRAMS which will be compatible to the greatest extent possible with the rates used by EPS.

[2]In-year reenlistments are those reenlistments which occur in the same fiscal year as the Marine's End of Active Service (EAS) date. Out-year reenlistments occur in the fiscal year before the fiscal year in which a Marine's EAS expires.

Table 1

Characteristic of Major USMC Enlisted Planning Models

	TRAMS (MPP-80)	EPS (MPP-20)
Population	First-term force	Entire enlisted force
Skill	MOS	Occupational field
Paygrade	None	All (9)
Year of Service	None	All (31)
Losses	ETC losses[a] Attrition losses[b]	EAS losses[c] Attrition losses
Reenlistments	Yes[d]	In-year Out-year

Note. USMC = U.S. Marine Corps, TRAMS = Training Management System, MPP= Manpower Plans and Policies Division, EPS = Enlisted Planning System, MOS = Military Occupational Specialty, EAS = End of Active Service, ETC = End of Tour Control.

[a]ETC losses are those losses resulting from a Marine's movement out of the first term force (and into the career force) and losses resulting from a Marine reaching the end of his contract and not reenlisting.

[b]Attrition losses (including discharges, convenience of the government, & death) are losses which occur before a Marine reaches the end of his enlistment.

[c]EAS losses are those losses resulting from the successful completion of an enlistment contract.

[d]TRAMS accounts for reenlistment, however, it is unclear whether both in-year and out-year reenlistments are considered.

Data

The source of all data for EPS is the Enlisted Personnel Database. This database contains a single record per quarter for every enlisted Marine who was on active duty anytime during the quarter. The quarterly records are then merged to produce an annual record for each Marine. The Enlisted Personnel Database contains data from FY81-FY91 and is updated annually. See Mullins (1987) for a detailed description of the development of the Enlisted Personnel Database.

MPP-80 provided a list of 235 MOSs which apply to the first-term force. These MOSs are listed in Appendix A. The two recruit MOSs, 9900 and 9971, were combined to form a single recruit MOS. Six other MOS conversions were necessary: (1) MOS 3072 was converted to MOS 6672; (2) MOS 3073 was converted to MOS 6673; (3) MOS 3061 was converted to 3361; (4) MOSs 3421 and 3431 were converted to MOS 3432; (5) MOS 4131 was converted to MOS 4133; and (6) MOSs 5571, 5574, 5577, and 5593 were converted to MOS 9812.

Methods and Results

Attrition Rates

Boyle and Mullins (1989) provides a description of the approach used to forecast attrition rates in EPS.[3] The same approach was adopted to provide attrition rates for the PREPAS Dictionary. EPS applies several univariate time-series techniques to each of the series to be forecasted. The techniques are then ranked by mean absolute deviation (MAD) as defined below. The winning technique, the technique which is found to be the most accurate, is used to generate the forecasts for the series under consideration. The majority of attrition rate series in EPS are forecasted with simple or linear exponential smoothing methods. The linear exponential smoothing technique is the clear winner in most of these cases.

Simple exponential smoothing models are weighted average models in which the weights decline exponentially into the infinite past. This relationship can be represented algebraically as

$$F_{t+1} = \alpha R_t + (1 - \alpha) F_t \tag{1}$$

where α is the "smoothing parameter" lying between 0 and 1. Note that the forecast for the next period, F_{t+1}, is a compromise between the current rate, R_t, and the forecast for the current period, F_t. When $\alpha = 0$, the model ignores the current rate, and the forecast is constant from year to year. At the other extreme, when $\alpha = 1$, the model completely ignores the current forecast and immediately adapts to the new level of the series. This case is frequently called the naive forecast. In EPS, three models corresponding to the values $\alpha = .2, .5, .8$, are chosen to represent the exponential smoothing technique. The best model is the model which yields the minimum MAD (i.e., the smallest of the average absolute one step ahead forecast errors).

It should be noted that to initiate the process in equation (1), an initial forecast must be supplied. Any convenient value can be chosen. For example, often the average of the first few values of the series is used or the average of the entire series. The attrition rate generator in EPS uses the latter convention.

Holt's linear exponential smoothing technique is an extension of the simple exponential smoothing technique. The forecasting equations are

$$S_t = \alpha R_t + (1 - \alpha) F_t \tag{2}$$

$$T_t = \beta (S_t - S_{t-1}) + (1 - \beta) T_{t-1} \tag{3}$$

$$F_{t+1} = S_t + T_t \tag{4}$$

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[3]Attrition losses (also known as non-EAS losses) are those losses which occur before a Marine reaches then end of his enlistment. In contrast, losses which are the result of the successful completion of an enlistment are known as EAS losses.

where again the smoothing parameters, α and β, assume values between 0 and 1. Equation (2) supplies a new level, S_t, as a weighted average of the new observation and the previous forecast. Equation (3) updates a trend, T_t, in a similar manner. The new forecast, F_{t+1}, given by equation (4), is the sum of the new level and the new trend. Holt's linear exponential smoothing models can adapt to both changing level and changing trend in a time series. In EPS, nine models corresponding to all possible combinations of α, β = .2, .5, .8 are chosen to represent the linear exponential smoothing technique. Again, the best model is the model associated with the minimum MAD.

As in the simple exponential smoothing models, start-up values, S_0 and T_0, are needed to begin the process. An initial level and initial trend can be chosen in a number of ways. Frequently, choices for these start-up values are obtained by performing a simple linear regression of the available data against time and setting the initial level and initial trend equal to the intercept and slope, respectively, of the fitted regression line. Another common practice which is simpler to implement is to set the initial level equal to the series average, as in the simple exponential smoothing case, and set the initial trend equal to 0. This latter convention is implemented in EPS.[4]

Since the linear exponential smoothing technique is the most frequently used method in EPS, this was the method used to produce the attrition rate forecasts for the PREPAS Dictionary. Table 2 illustrates details for MOS 0311. Note the start-up values are the initial level S_0 = 2.376%, the average of the 36 historical attrition rates, and the initial trend $T_0 = 0$. Recall t = 1 corresponds to the quarter ending 8212 (i.e., the first quarter of FY83). The values of the smoothing parameters, α = .5 and β = .2, are those yielding the smallest MAD. Once the start-up values are set, the forecast F_1= 2.376% is determined from equation (4). The next level S_1 = 2.712% is obtained from equation (2), and the next trend T_1 = .067% comes from equation (3). Again, invoking equation (4) yields F_2 = 2.779%. This process is continued, generating all one-step ahead forecasts in the last column of Table 2, terminating with F_{37} = 1.532%. This is the first forecasted attrition rate for MOS 0311 supplied to the PREPAS Dictionary. Appendix A contains the forecasted attrition rates for all first-term MOSs for 16 quarters. The rate appearing in column 3 in Appendix A, which is common to all MOSs, is the forecasted recruit attrition rate.

The remaining forecasts in Appendix A, columns 5-18, complete the 16 quarters of attrition rate forecasts required by the PREPAS models. Normally, when linear exponential smoothing is employed, forecasts for several steps ahead are projected using the relation

$$F_{\tau+m} = S_\tau + mT_\tau \qquad (5)$$

where the last data point occurs at time t = and m takes on all integer values corresponding to the forecast horizon. For example, applying (5) to the series in Table 2 would lead to F_{37} = 1.532% and $F_{36+15} = F_{51}$ = 1.591% + 15 (-.059%) = .706%. Siegel (1983) offers an alternative to this procedure when forecasting loss rates over a horizon of time. He argues that a variety of important variables such as civilian and military pay and benefit levels, civilian unemployment, and promotion opportunities ultimately influence loss behavior. Because these variables are difficult to

[4]A thorough and very readable presentation of exponential smoothing models and their equivalent forms can be found in Makridakis, Wheelwright, & McGee (1983).

Table 2

Holt's Linear Exponential Smoothing ($\alpha = .5$, $\beta = .2$) Applied to MOS 0311 Attrition Rates

Time t	Rate(%) R_t	Level(%) S_t	Trend(%) T_t	Forecast(%) F_t
0	-	2.376	0	-
1	3.047	2.712	.067	2.376
2	2.372	2.575	.026	2.779
3	3.331	2.966	.099	2.602
4	4.195	3.630	.212	3.066
5	3.819	3.831	.210	3.842
6	2.736	3.388	.079	4.040
7	2.642	3.055	-.003	3.468
8	2.947	2.999	-.014	3.052
9	2.621	2.804	-.050	2.986
10	2.490	2.622	-.076	2.754
11	1.985	2.265	-.132	2.545
12	2.262	2.198	-.119	2.133
13	2.088	2.083	-.118	2.078
14	2.266	2.115	-.088	1.965
15	2.350	2.189	-.056	2.027
16	2.152	2.142	-.054	2.133
17	2.466	2.277	-.016	2.088
18	2.347	2.304	-.008	2.261
19	2.266	2.281	-.011	2.296
20	2.571	2.421	.019	2.271
21	2.563	2.502	.032	2.440
22	2.152	2.343	-.006	2.533
23	2.139	2.237	-.026	2.336
24	2.261	2.236	-.021	2.211
25	2.524	2.369	.010	2.215
26	2.350	2.365	.007	2.379
27	2.272	2.322	-.003	2.371
28	2.285	2.302	-.006	2.319
29	1.800	2.048	-.056	2.296
30	1.858	1.925	-.069	1.992
31	1.815	1.835	-.073	1.856
32	1.883	1.822	-.061	1.762
33	1.341	1.551	-.103	1.761
34	2.351	1.899	-.013	1.448
35	1.371	1.629	-.064	1.886
36	1.617	1.591	-.059	1.564
37	-	-	-	1.532

Notes. 1. MOS = Military Occupational Specialty.
2. Average rate = 2.376%.
3. Dash indicates data not available.

forecast into the future, a conservative approach where the forecasts "wear-off" to some historical average is suggested. This approach was adopted and is reflected in columns 4-18 of Appendix A. Again, considering MOS 0311, the forecasts "wear-off" on a straight line from 1.532% to the historical average of 2.376%. This "wear-off" strategy is depicted in Figure 1.

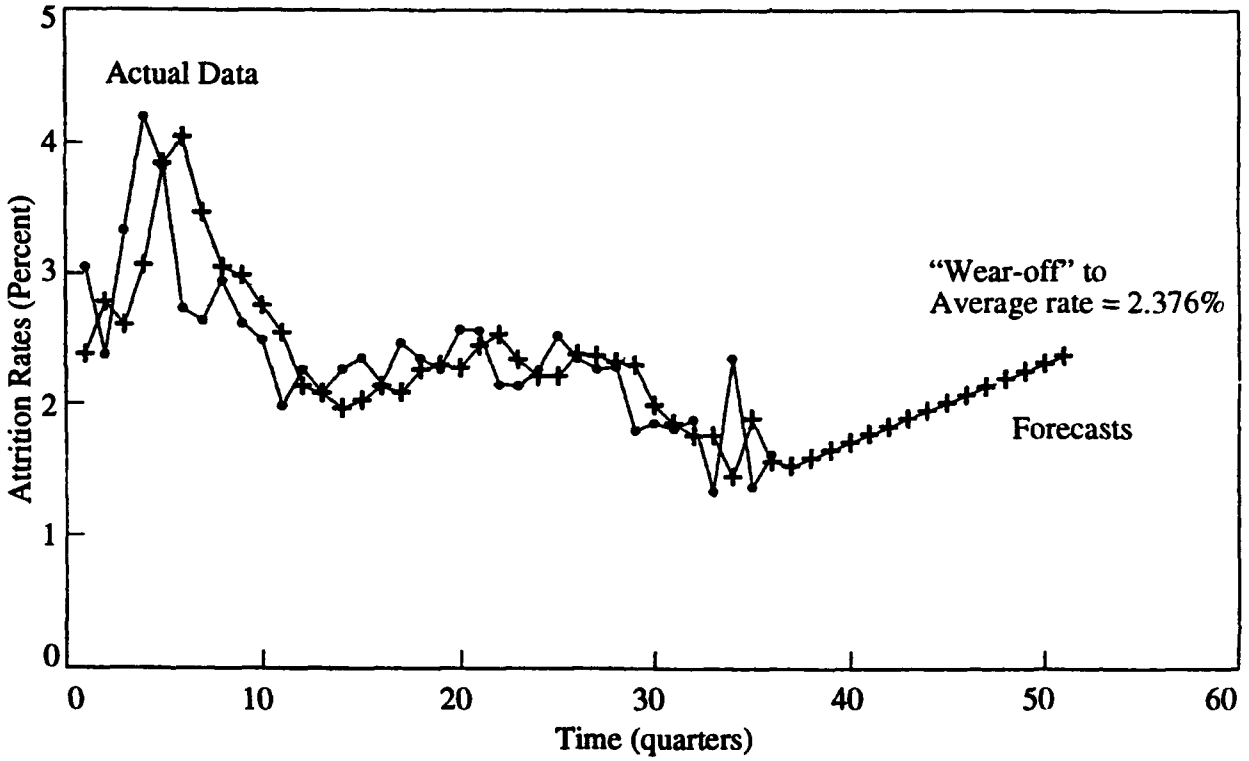

Figure 1. Holt's method applied to Military Occupational Specialty (MOS) 0311.

Finally, all historical attrition rates for six MOSs (5528, 6124, 6145, 6175, 6325, 6494) were zero and, thus, the forecasts were all zeros. These forecasts were replaced by the averages of the forecasts for all other MOSs in the same OCCFIELD. For instance, note the MOS 5528 forecasts in columns 4-18 are the averages of the corresponding forecasts for MOSs 5526 and 5534-5565.

Reenlistment Rates

A different approach was used to develop the reenlistment rates needed by the PREPAS Dictionary. The SRB Planning Model in EPS provided the foundation for the development of these rates.

The SRB Planning Model uses a begin fiscal year inventory which has been divided into three populations: the population at risk in the current year, the population at risk in the next fiscal year, and the population not at risk.[5] Since individuals can reenlist up to 1 year prior to the expiration of

[5]A Marine's "at risk" status is determined by his EAS date. If his EAS expires in the current year, he is considered to be at risk to leave the Marine Corps in the current year. Similarly, an individual with an EAS date next year will be in the population at risk to leave the Marine Corps next fiscal year. All other Marines are considered to be in the population not at risk.

their EAS date, only the first two populations are relevant for forecasting reenlistments. Individuals who are in the population at risk current year and reenlist are considered in-year reenlistments. All other reenlistments are considered out-year reenlistments. The SRB Planning Model uses in-year and out-year reenlistment rates to determine forecasted reenlistments. The in-year rate reflects the application of the most recent set of SRB multiples to applicable MOSs.[6] These rates are at the MOS, paygrade, and year of service level of detail.

Because the PREPAS Dictionary requires only a single reenlistment rate for each MOS, the rates used by the SRB Planning Model had to be aggregated along the paygrade and years of service dimensions. Furthermore, PREPAS applies only to the first-term force, while the rates used by the SRB Planning Model are associated with the entire enlisted force. The rates had to be adjusted to account for this difference in population.[7]

The Headquarters Master File (HMF) for end FY88, FY89, and FY90 were used to develop distribution factors needed to define the first term force. All enlisted Marines with first-term MOSs and either a "1" or an "A" in the first byte of the Source of Entry data element were extracted from the HMF. The Marines' paygrade and Armed Forces Active Duty Base Date (AFADBD) were also extracted. Year of service for each Marine was then calculated using AFADBD. For this sample for each of the 3 fiscal-years, paygrade by year of service distributions were produced and analyzed. Based on this analysis and the stability of the populations in the 3 years, a simple weighted average of the 3 fiscal-years distributions were used to produce first term distribution percentages. Table 3 presents the resulting distribution.

The first-term distribution percentages were then applied to the three begin FY92 inventory populations used by the SRB Planning Model. This was done for each MOS. This process provided three first-term inventory populations (which were a subset of the original populations). Next, the reenlistment rates used by the SRB Planning Model were applied to the applicable populations: the in-year reenlistment rates were applied to the first-term at risk current year inventory population and the out-year reenlistment rates were applied to the first-term at risk in the next fiscal year population. The total number of reenlistments were summed across the three populations and then divided by the total first-term population. This final step resulted in a single reenlistment rate for each first-term MOS. Appendix B contains the reenlistment rates resulting from the procedure described above.

Final Comments

Two files have been provided to MPP-80. The first file contains attrition rates for 16 quarters for all first-term MOSs. The second file contains a single reenlistment rate for the same set of first-term MOSs. Using any PC editor, these files can be modified and then uploaded directly into the PREPAS Dictionary.

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[6]See Boyle (in process) for a general discussion of econometric methods and their application to forecasting losses and reenlistments.

[7]The first-term force is composed of all Marines who have either a "1" or an "A" in the first byte of the Source of Entry field on the HMF. The Enlisted Personnel Database does not contain this data element.

Table 3

First-term Distribution Percentages

YOS	Paygrade				
	E-1	E-2	E-3	E-4	E-5
1	99.28	99.83	98.67	33.66	15.01
2	99.68	99.77	99.67	89.24	6.82
3	99.40	99.47	99.67	98.24	50.58
4	99.03	99.48	98.65	95.91	83.21
5	92.75	83.73	72.09	58.65	68.55
6	66.36	37.42	53.06	25.27	42.05
7	35.84	27.28	27.31	8.76	3.91
8	25.02	29.06	24.35	9.53	1.13
9	17.51	38.45	33.30	15.66	.86
10	12.11	19.98	28.56	20.03	.85

Note. YOS = Years of service.

A few words of caution about using these files. First, since both of these files are MOS-based, any changes in the definition of first-term MOSs need to be accounted for in these files. Second, any significant changes in SRB multiples will likely have an impact on the reenlistment rates contained in the reenlistment rate file. And third, policies implemented to effect the drawdown and/ or career force controls policies may have a substantial impact on reenlistments (e.g., raising promotion flow points or limiting reenlistments with retraining options).

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Appendix A

First-term Attrition Rates

Table A-1

First-term Attrition Rates

Card	MOS	QTR 1	QTR 2	QTR 3	QTR 4	QTR 5	QTR 6	QTR 7	QTR 8	QTR 9	QTR 10	QTR 11	QTR 12	QTR 13	QTR 14	QTR 15	QTR 16
42	0121	7.85	1.90	1.89	1.88	1.87	1.86	1.85	1.84	1.83	1.82	1.82	1.81	1.80	1.79	1.78	1.77
42	0131	7.85	1.74	1.74	1.74	1.74	1.74	1.73	1.73	1.73	1.73	1.72	1.72	1.72	1.72	1.72	1.71
42	0151	7.85	1.59	1.61	1.63	1.66	1.68	1.70	1.72	1.74	1.77	1.79	1.81	1.83	1.85	1.88	1.90
42	0161	7.85	2.04	2.03	2.02	2.02	2.01	2.00	1.99	1.98	1.97	1.97	1.96	1.95	1.94	1.93	1.92
42	0231	7.85	0.31	0.37	0.42	0.48	0.54	0.59	0.65	0.70	0.76	0.81	0.87	0.93	0.98	1.04	1.09
42	0261	7.85	1.81	1.71	1.60	1.49	1.38	1.27	1.16	1.05	0.94	0.83	0.72	0.61	0.50	0.39	0.28
42	0311	7.85	1.53	1.59	1.65	1.71	1.77	1.83	1.89	1.95	2.01	2.07	2.13	2.19	2.25	2.31	2.37
42	0313	7.85	1.07	1.07	1.07	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06
42	0331	7.85	1.83	1.86	1.89	1.93	1.96	2.00	2.03	2.07	2.10	2.14	2.17	2.21	2.24	2.28	2.31
42	0341	7.85	1.51	1.57	1.63	1.69	1.75	1.81	1.87	1.93	1.99	2.05	2.11	2.16	2.22	2.28	2.34
42	0351	7.85	1.33	1.40	1.48	1.55	1.63	1.71	1.78	1.86	1.93	2.01	2.08	2.16	2.24	2.31	2.39
42	0352	7.85	1.41	1.43	1.46	1.48	1.51	1.53	1.56	1.58	1.60	1.63	1.65	1.68	1.70	1.73	1.75
42	0411	7.85	1.48	1.49	1.51	1.53	1.55	1.57	1.59	1.61	1.63	1.65	1.67	1.69	1.71	1.72	1.74
42	0431	7.85	1.14	1.17	1.20	1.23	1.25	1.28	1.31	1.34	1.37	1.40	1.43	1.46	1.49	1.52	1.55
42	0451	7.85	0.39	0.47	0.55	0.64	0.72	0.80	0.89	0.97	1.05	1.13	1.22	1.30	1.38	1.47	1.55
42	0481	7.85	1.14	1.21	1.29	1.37	1.45	1.53	1.61	1.69	1.77	1.85	1.93	2.00	2.08	2.16	2.24
42	0811	7.85	1.70	1.75	1.80	1.85	1.91	1.96	2.01	2.06	2.11	2.16	2.21	2.26	2.31	2.36	2.41
42	0842	7.85	1.59	1.60	1.62	1.63	1.64	1.66	1.67	1.69	1.70	1.71	1.73	1.74	1.75	1.77	1.78
42	0842	7.85	0.86	0.92	0.99	1.06	1.13	1.20	1.27	1.34	1.41	1.47	1.54	1.61	1.68	1.75	1.82
42	0844	7.85	0.10	0.22	0.33	0.45	0.57	0.68	0.80	0.92	1.03	1.15	1.27	1.38	1.50	1.62	1.73
42	0847	7.85	1.26	1.31	1.35	1.40	1.44	1.49	1.53	1.58	1.62	1.66	1.71	1.75	1.80	1.84	1.89
42	1141	7.85	1.39	1.43	1.48	1.52	1.57	1.61	1.66	1.71	1.75	1.80	1.84	1.89	1.93	1.98	2.02
42	1142	7.85	1.49	1.47	1.45	1.44	1.42	1.40	1.39	1.37	1.35	1.34	1.32	1.31	1.29	1.27	1.26
42	1161	7.85	1.19	1.23	1.26	1.30	1.34	1.37	1.41	1.45	1.49	1.52	1.56	1.60	1.64	1.67	1.71
42	1171	7.85	1.45	1.48	1.52	1.56	1.60	1.63	1.67	1.71	1.75	1.78	1.82	1.86	1.90	1.93	1.97
42	1181	7.85	1.09	1.17	1.25	1.32	1.40	1.48	1.56	1.64	1.72	1.79	1.87	1.95	2.03	2.11	2.18
42	1316	7.85	2.03	2.02	2.01	2.00	1.99	1.98	1.96	1.95	1.94	1.93	1.92	1.91	1.90	1.89	1.88
42	1341	7.85	2.25	2.23	2.20	2.17	2.15	2.12	2.10	2.07	2.05	2.02	1.99	1.97	1.94	1.92	1.89
42	1345	7.85	1.56	1.57	1.58	1.58	1.59	1.60	1.61	1.62	1.63	1.64	1.65	1.65	1.66	1.67	1.68
42	1361	7.85	1.10	1.03	0.97	0.90	0.83	0.77	0.70	0.63	0.57	0.50	0.44	0.37	0.30	0.24	0.17
42	1371	7.85	1.30	1.36	1.41	1.47	1.53	1.59	1.65	1.71	1.76	1.82	1.88	1.94	2.00	2.06	2.11

Table A-1 (Continued)

Card	MOS	QTR 1	QTR 2	QTR 3	QTR 4	QTR 5	QTR 6	QTR 7	QTR 8	QTR 9	QTR 10	QTR 11	QTR 12	QTR 13	QTR 14	QTR 15	QTR 16
42	1391	7.85	1.51	1.57	1.63	1.69	1.75	1.81	1.87	1.93	1.99	2.06	2.12	2.18	2.24	2.30	2.36
42	1521	7.85	0.00	0.15	0.31	0.47	0.63	0.79	0.95	1.11	1.27	1.43	1.59	1.75	1.91	2.07	2.23
42	1811	7.85	2.01	2.03	2.05	2.07	2.09	2.11	2.13	2.14	2.16	2.18	2.20	2.22	2.24	2.26	2.28
42	1812	7.85	0.30	0.28	0.26	0.24	0.22	0.20	0.18	0.16	0.14	0.12	0.10	0.08	0.06	0.04	0.02
42	1833	7.85	0.44	0.58	0.72	0.85	0.99	1.13	1.27	1.41	1.55	1.69	1.83	1.97	2.11	2.25	2.39
42	2111	7.85	1.99	1.97	1.95	1.93	1.91	1.90	1.88	1.86	1.84	1.82	1.80	1.79	1.77	1.75	1.73
42	2131	7.85	1.15	1.19	1.23	1.27	1.31	1.35	1.39	1.43	1.47	1.51	1.55	1.59	1.63	1.67	1.71
42	2141	7.85	0.98	0.96	0.95	0.94	0.92	0.91	0.89	0.88	0.87	0.85	0.84	0.83	0.81	0.80	0.78
42	2143	7.85	0.06	0.12	0.17	0.23	0.29	0.35	0.41	0.46	0.52	0.58	0.64	0.70	0.75	0.81	0.87
42	2145	7.85	1.58	1.60	1.62	1.64	1.65	1.67	1.69	1.71	1.72	1.74	1.76	1.78	1.79	1.81	1.83
42	2146	7.85	0.00	0.04	0.08	0.12	0.16	0.20	0.24	0.28	0.32	0.36	0.40	0.44	0.48	0.52	0.56
42	2147	7.85	1.77	1.74	1.71	1.67	1.64	1.61	1.58	1.55	1.52	1.49	1.46	1.43	1.39	1.36	1.33
42	2161	7.85	0.92	0.95	0.98	1.01	1.04	1.07	1.10	1.13	1.16	1.20	1.23	1.26	1.29	1.32	1.35
42	2171	7.85	0.99	1.04	1.08	1.13	1.18	1.23	1.28	1.32	1.37	1.42	1.47	1.52	1.56	1.61	1.66
42	2311	7.85	1.71	1.73	1.76	1.78	1.80	1.83	1.85	1.88	1.90	1.92	1.95	1.97	1.99	2.02	2.04
42	2512	7.85	1.45	1.49	1.53	1.57	1.61	1.65	1.69	1.73	1.77	1.81	1.85	1.89	1.93	1.97	2.01
42	2513	7.85	0.52	0.57	0.63	0.69	0.74	0.80	0.86	0.92	0.97	1.03	1.09	1.14	1.20	1.26	1.32
42	2531	7.85	1.42	1.46	1.50	1.55	1.59	1.63	1.68	1.72	1.76	1.81	1.85	1.89	1.93	1.98	2.02
42	2532	7.85	0.72	0.79	0.85	0.91	0.98	1.04	1.10	1.17	1.23	1.29	1.36	1.42	1.48	1.55	1.61
42	2534	7.85	1.30	1.31	1.31	1.32	1.32	1.33	1.33	1.34	1.34	1.35	1.36	1.36	1.37	1.37	1.38
42	2535	7.85	0.00	0.01	0.03	0.05	0.06	0.08	0.10	0.12	0.13	0.15	0.17	0.19	0.20	0.22	0.24
42	2536	7.85	0.00	0.02	0.04	0.06	0.08	0.11	0.13	0.15	0.17	0.19	0.22	0.24	0.26	0.28	0.30
42	2542	7.85	2.19	2.17	2.14	2.12	2.09	2.06	2.04	2.01	1.98	1.96	1.93	1.91	1.88	1.85	1.83
42	2621	7.85	1.61	1.57	1.53	1.48	1.44	1.40	1.36	1.31	1.27	1.23	1.19	1.14	1.10	1.06	1.02
42	2631	7.85	0.32	0.35	0.39	0.42	0.45	0.49	0.52	0.55	0.58	0.62	0.65	0.68	0.72	0.75	0.78
42	2651	7.85	0.61	0.64	0.67	0.69	0.72	0.75	0.78	0.81	0.83	0.86	0.89	0.92	0.95	0.97	1.00
42	2671	7.85	0.06	0.10	0.13	0.17	0.21	0.25	0.29	0.32	0.36	0.40	0.44	0.48	0.52	0.55	0.59
42	2673	7.85	0.00	0.01	0.02	0.04	0.05	0.06	0.08	0.09	0.10	0.12	0.13	0.14	0.16	0.17	0.18
42	2674	7.85	0.14	0.18	0.23	0.28	0.32	0.37	0.42	0.46	0.51	0.56	0.60	0.65	0.70	0.74	0.79
42	2675	7.85	0.84	0.83	0.82	0.82	0.81	0.81	0.80	0.80	0.79	0.79	0.78	0.78	0.77	0.77	0.76
42	2811	7.85	1.05	1.04	1.03	1.02	1.00	0.99	0.98	0.97	0.96	0.94	0.93	0.92	0.91	0.90	0.88

Table A-1 (Continued)

Card	MOS	QTR 1	QTR 2	QTR 3	QTR 4	QTR 5	QTR 6	QTR 7	QTR 8	QTR 9	QTR 10	QTR 11	QTR 12	QTR 13	QTR 14	QTR 15	QTR 16
42	2813	7.85	0.00	0.05	0.11	0.17	0.22	0.28	0.34	0.39	0.45	0.51	0.57	0.62	0.68	0.74	0.79
42	2818	7.85	2.57	2.47	2.38	2.29	2.19	2.10	2.00	1.91	1.81	1.72	1.62	1.53	1.43	1.34	1.24
42	2822	7.85	6.07	5.68	5.29	4.90	4.51	4.11	3.72	3.33	2.94	2.55	2.16	1.77	1.38	0.98	0.59
42	2831	7.85	0.00	0.04	0.08	0.12	0.16	0.21	0.25	0.29	0.33	0.37	0.42	0.46	0.50	0.54	0.59
42	2841	7.85	0.80	0.81	0.83	0.84	0.85	0.87	0.88	0.89	0.91	0.92	0.93	0.95	0.96	0.97	0.99
42	2871	7.85	2.17	2.06	1.96	1.86	1.75	1.65	1.55	1.45	1.34	1.24	1.14	1.03	0.93	0.83	0.72
42	2881	7.85	1.22	1.20	1.18	1.16	1.14	1.12	1.10	1.08	1.06	1.03	1.01	0.99	0.97	0.95	0.93
42	2884	7.85	0.82	0.84	0.86	0.87	0.89	0.90	0.92	0.94	0.95	0.97	0.98	1.00	1.02	1.03	1.05
42	2885	7.85	0.00	0.02	0.04	0.07	0.09	0.12	0.14	0.17	0.19	0.22	0.24	0.27	0.29	0.32	0.34
42	2887	7.85	3.25	3.10	2.94	2.79	2.64	2.48	2.33	2.17	2.02	1.86	1.71	1.55	1.40	1.24	1.09
42	3043	7.85	2.07	2.06	2.05	2.04	2.02	2.01	2.00	1.99	1.97	1.96	1.95	1.94	1.93	1.91	1.90
42	3051	7.85	2.28	2.26	2.25	2.24	2.22	2.21	2.20	2.18	2.17	2.15	2.14	2.13	2.11	2.10	2.09
42	3052	7.85	2.72	2.65	2.59	2.52	2.45	2.38	2.31	2.24	2.18	2.11	2.04	1.97	1.90	1.84	1.77
42	3112	7.85	2.74	2.64	2.53	2.43	2.33	2.22	2.12	2.02	1.91	1.81	1.70	1.60	1.50	1.39	1.29
42	3361	7.85	2.75	2.74	2.73	2.72	2.71	2.70	2.69	2.68	2.67	2.66	2.65	2.64	2.63	2.62	2.61
42	3381	7.85	1.90	1.97	2.05	2.13	2.20	2.28	2.36	2.44	2.51	2.59	2.67	2.75	2.82	2.90	2.98
42	3432	7.85	1.67	1.67	1.66	1.66	1.65	1.65	1.64	1.64	1.63	1.63	1.63	1.62	1.62	1.61	1.61
42	3451	7.85	1.68	1.65	1.62	1.59	1.56	1.53	1.50	1.47	1.44	1.41	1.38	1.35	1.32	1.29	1.26
42	3513	7.85	3.68	3.58	3.48	3.37	3.27	3.17	3.07	2.97	2.87	2.77	2.67	2.57	2.47	2.37	2.26
42	3521	7.85	1.54	1.57	1.60	1.63	1.66	1.69	1.72	1.75	1.77	1.80	1.83	1.86	1.89	1.92	1.95
42	3531	7.85	1.82	1.86	1.91	1.95	1.99	2.04	2.08	2.13	2.17	2.21	2.26	2.30	2.35	2.39	2.43
42	3533	7.85	1.36	1.38	1.40	1.42	1.44	1.46	1.49	1.51	1.53	1.55	1.57	1.59	1.62	1.64	1.66
42	4034	7.85	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.61	1.61	1.61	1.61	1.61	1.61	1.61	1.61
42	4063	7.85	1.62	1.58	1.54	1.50	1.46	1.41	1.37	1.33	1.29	1.25	1.21	1.16	1.12	1.08	1.04
42	4133	7.85	1.26	1.29	1.32	1.35	1.38	1.41	1.44	1.47	1.50	1.53	1.56	1.59	1.62	1.65	1.68
42	4313	7.85	5.41	5.11	4.80	4.50	4.19	3.88	3.58	3.27	2.97	2.66	2.36	2.05	1.74	1.44	1.13
42	4321	7.85	2.03	1.97	1.92	1.87	1.82	1.77	1.71	1.66	1.61	1.56	1.50	1.45	1.40	1.35	1.29
42	4421	7.85	2.03	2.01	1.99	1.97	1.95	1.93	1.91	1.89	1.87	1.85	1.83	1.81	1.79	1.77	1.75
42	4611	7.85	1.72	1.74	1.76	1.78	1.80	1.82	1.84	1.86	1.88	1.89	1.91	1.93	1.95	1.97	1.99
42	4621	7.85	2.36	2.35	2.34	2.32	2.31	2.30	2.29	2.28	2.27	2.26	2.25	2.24	2.23	2.22	2.21
42	4641	7.85	0.96	1.03	1.09	1.16	1.22	1.29	1.35	1.42	1.48	1.55	1.61	1.68	1.74	1.81	1.87

Table A-1 (Continued)

Card	MOS	QTR 1	QTR 2	QTR 3	QTR 4	QTR 5	QTR 6	QTR 7	QTR 8	QTR 9	QTR 10	QTR 11	QTR 12	QTR 13	QTR 14	QTR 15	QTR 16
42	4653	7.85	0.00	0.12	0.24	0.37	0.49	0.62	0.74	0.87	0.99	1.12	1.24	1.37	1.49	1.62	1.74
42	4671	7.85	2.19	2.11	2.03	1.94	1.86	1.78	1.69	1.61	1.53	1.45	1.36	1.28	1.20	1.11	1.03
42	5526	7.85	6.08	5.77	5.46	5.15	4.84	4.53	4.22	3.91	3.60	3.29	2.97	2.66	2.35	2.04	1.73
42	5528	7.85	1.41	1.40	1.40	1.39	1.38	1.38	1.37	1.37	1.36	1.36	1.35	1.34	1.34	1.33	1.33
42	5534	7.85	1.78	1.77	1.75	1.74	1.72	1.71	1.69	1.68	1.66	1.65	1.63	1.62	1.60	1.59	1.57
42	5536	7.85	3.47	3.40	3.34	3.27	3.21	3.14	3.07	3.01	2.94	2.88	2.81	2.74	2.68	2.61	2.55
42	5537	7.85	1.45	1.43	1.40	1.38	1.36	1.34	1.31	1.29	1.27	1.25	1.22	1.20	1.18	1.16	1.13
42	5541	7.85	1.32	1.31	1.29	1.27	1.26	1.24	1.22	1.21	1.19	1.18	1.16	1.14	1.13	1.11	1.09
42	5543	7.85	0.00	0.08	0.16	0.25	0.33	0.41	0.50	0.58	0.66	0.75	0.83	0.92	1.00	1.08	1.17
42	5544	7.85	0.00	0.08	0.16	0.24	0.32	0.40	0.48	0.56	0.64	0.73	0.81	0.89	0.97	1.05	1.13
42	5546	7.85	0.00	0.06	0.13	0.19	0.26	0.32	0.39	0.46	0.52	0.59	0.65	0.72	0.78	0.85	0.92
42	5547	7.85	0.21	0.25	0.29	0.33	0.37	0.41	0.45	0.49	0.54	0.58	0.62	0.66	0.70	0.74	0.78
42	5563	7.85	1.18	1.17	1.16	1.16	1.15	1.15	1.14	1.14	1.13	1.12	1.12	1.11	1.11	1.10	1.10
42	5565	7.85	0.00	0.10	0.20	0.30	0.40	0.51	0.61	0.71	0.81	0.92	1.02	1.12	1.22	1.32	1.43
42	5711	7.85	1.27	1.29	1.30	1.31	1.32	1.33	1.34	1.35	1.36	1.37	1.38	1.39	1.41	1.42	1.43
42	5811	7.85	1.28	1.29	1.29	1.29	1.30	1.30	1.30	1.31	1.31	1.31	1.32	1.32	1.32	1.33	1.33
42	5812	7.85	1.23	1.20	1.17	1.15	1.12	1.10	1.07	1.05	1.02	0.99	0.97	0.94	0.92	0.89	0.87
42	5831	7.85	2.14	2.10	2.06	2.02	1.98	1.93	1.89	1.85	1.81	1.77	1.73	1.69	1.65	1.60	1.56
42	5921	7.85	0.00	0.06	0.12	0.19	0.25	0.32	0.38	0.45	0.51	0.58	0.64	0.70	0.77	0.83	0.90
42	5922	7.85	1.48	1.45	1.43	1.41	1.38	1.36	1.33	1.31	1.29	1.26	1.24	1.22	1.19	1.17	1.14
42	5923	7.85	0.00	0.08	0.16	0.24	0.33	0.41	0.49	0.58	0.66	0.74	0.83	0.91	0.99	1.08	1.16
42	5929	7.85	1.87	1.82	1.77	1.72	1.67	1.61	1.56	1.51	1.46	1.41	1.36	1.30	1.25	1.20	1.15
42	5937	7.85	1.90	1.84	1.78	1.73	1.67	1.61	1.56	1.50	1.44	1.38	1.33	1.27	1.21	1.16	1.10
42	5942	7.85	1.77	1.70	1.62	1.55	1.47	1.40	1.32	1.25	1.17	1.10	1.02	0.95	0.87	0.80	0.72
42	5943	7.85	5.04	4.77	4.50	4.23	3.96	3.68	3.41	3.14	2.87	2.60	2.33	2.06	1.79	1.51	1.24
42	5944	7.85	1.25	1.20	1.15	1.10	1.05	1.00	0.95	0.90	0.85	0.80	0.75	0.70	0.65	0.60	0.55
42	5945	7.85	0.13	0.18	0.24	0.29	0.34	0.40	0.45	0.51	0.56	0.61	0.67	0.72	0.77	0.83	0.88
42	5952	7.85	1.95	1.88	1.81	1.74	1.67	1.61	1.54	1.47	1.40	1.33	1.26	1.19	1.12	1.06	0.99
42	5953	7.85	0.48	0.49	0.50	0.52	0.53	0.55	0.56	0.58	0.59	0.60	0.62	0.63	0.65	0.66	0.68
42	5954	7.85	0.79	0.79	0.78	0.78	0.78	0.77	0.77	0.77	0.76	0.76	0.76	0.75	0.75	0.75	0.74
42	5962	7.85	1.84	1.78	1.72	1.66	1.60	1.54	1.48	1.42	1.36	1.30	1.24	1.18	1.12	1.06	1.00

Table A-1 (Continued)

Card	MOS	QTR 1	QTR 2	QTR 3	QTR 4	QTR 5	QTR 6	QTR 7	QTR 8	QTR 9	QTR 10	QTR 11	QTR 12	QTR 13	QTR 14	QTR 15	QTR 16
42	5983	7.85	1.07	1.08	1.09	1.10	1.11	1.12	1.14	1.15	1.16	1.17	1.18	1.19	1.20	1.21	1.22
42	5984	7.85	3.49	3.35	3.22	3.09	2.95	2.82	2.69	2.55	2.42	2.29	2.15	2.02	1.89	1.75	1.62
42	6012	7.85	0.00	0.06	0.12	0.18	0.24	0.31	0.37	0.43	0.49	0.56	0.62	0.68	0.74	0.80	0.87
42	6013	7.85	2.85	2.73	2.61	2.49	2.37	2.25	2.13	2.01	1.89	1.77	1.65	1.53	1.41	1.29	1.18
42	6014	7.85	0.88	0.88	0.89	0.89	0.89	0.90	0.90	0.90	0.91	0.91	0.91	0.92	0.92	0.92	0.93
42	6015	7.85	0.99	0.98	0.97	0.96	0.95	0.94	0.93	0.92	0.91	0.91	0.90	0.89	0.88	0.87	0.86
42	6016	7.85	0.29	0.36	0.42	0.49	0.56	0.63	0.70	0.77	0.84	0.91	0.98	1.04	1.11	1.18	1.25
42	6017	7.85	1.12	1.11	1.09	1.08	1.07	1.06	1.05	1.04	1.02	1.01	1.00	0.99	0.98	0.97	0.96
42	6018	7.85	1.49	1.45	1.41	1.37	1.33	1.29	1.26	1.22	1.18	1.14	1.10	1.06	1.02	0.98	0.94
42	6022	7.85	1.17	1.19	1.20	1.21	1.22	1.24	1.25	1.26	1.28	1.29	1.30	1.32	1.33	1.34	1.36
42	6023	7.85	2.17	2.11	2.04	1.97	1.91	1.84	1.77	1.71	1.64	1.57	1.50	1.44	1.37	1.30	1.24
42	6025	7.85	1.31	1.30	1.29	1.28	1.27	1.26	1.26	1.25	1.24	1.23	1.22	1.21	1.20	1.20	1.19
42	6026	7.85	0.00	0.04	0.09	0.14	0.19	0.24	0.29	0.34	0.39	0.43	0.48	0.53	0.58	0.63	0.68
42	6027	7.85	2.13	2.05	1.98	1.90	1.82	1.75	1.67	1.59	1.52	1.44	1.37	1.29	1.21	1.14	1.06
42	6046	7.85	1.57	1.54	1.51	1.48	1.45	1.42	1.39	1.36	1.34	1.31	1.28	1.25	1.22	1.19	1.16
42	6047	7.85	0.85	0.88	0.90	0.93	0.95	0.97	1.00	1.02	1.05	1.07	1.10	1.12	1.14	1.17	1.19
42	6052	7.85	0.62	0.64	0.66	0.68	0.70	0.72	0.74	0.76	0.78	0.80	0.82	0.84	0.86	0.88	0.90
42	6053	7.85	1.96	1.92	1.87	1.83	1.78	1.74	1.69	1.65	1.61	1.56	1.52	1.47	1.43	1.39	1.34
42	6055	7.85	0.88	0.89	0.90	0.91	0.92	0.92	0.93	0.94	0.95	0.96	0.97	0.98	0.99	1.00	1.01
42	6056	7.85	0.75	0.80	0.85	0.91	0.96	1.01	1.06	1.11	1.16	1.21	1.27	1.32	1.37	1.42	1.47
42	6057	7.85	1.63	1.56	1.49	1.42	1.35	1.28	1.21	1.14	1.07	1.00	0.94	0.87	0.80	0.73	0.66
42	6058	7.85	0.14	0.26	0.37	0.49	0.60	0.72	0.83	0.95	1.06	1.18	1.29	1.40	1.52	1.63	1.75
42	6060	7.85	1.23	1.21	1.19	1.17	1.16	1.14	1.12	1.10	1.08	1.06	1.04	1.03	1.01	0.99	0.97
42	6072	7.85	1.10	1.09	1.09	1.09	1.09	1.08	1.08	1.08	1.08	1.08	1.07	1.07	1.07	1.07	1.07
42	6073	7.85	0.81	0.78	0.75	0.72	0.69	0.66	0.63	0.60	0.57	0.54	0.51	0.48	0.45	0.42	0.39
42	6075	7.85	1.16	1.16	1.16	1.16	1.16	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.18	1.18
42	6082	7.85	0.00	0.03	0.06	0.09	0.12	0.15	0.18	0.21	0.24	0.27	0.30	0.33	0.36	0.40	0.43
42	6083	7.85	0.00	0.05	0.10	0.16	0.21	0.26	0.32	0.37	0.43	0.48	0.53	0.59	0.64	0.69	0.75
42	6085	7.85	0.23	0.29	0.34	0.40	0.45	0.51	0.56	0.62	0.68	0.73	0.79	0.84	0.90	0.95	1.01
42	6086	7.85	5.19	4.89	4.59	4.29	4.00	3.70	3.40	3.10	2.81	2.51	2.21	1.91	1.62	1.32	1.02
42	6087	7.85	1.01	0.99	0.96	0.94	0.92	0.90	0.88	0.86	0.83	0.81	0.79	0.77	0.75	0.73	0.70

Table A-1 (Continued)

Card	MOS	QTR 1	QTR 2	QTR 3	QTR 4	QTR 5	QTR 6	QTR 7	QTR 8	QTR 9	QTR 10	QTR 11	QTR 12	QTR 13	QTR 14	QTR 15	QTR 16
42	6088	7.85	0.00	0.06	0.13	0.19	0.26	0.33	0.39	0.46	0.53	0.59	0.66	0.73	0.79	0.86	0.93
42	6092	7.85	3.08	2.99	2.90	2.80	2.71	2.62	2.52	2.43	2.34	2.25	2.15	2.06	1.97	1.87	1.78
42	6093	7.85	0.70	0.72	0.73	0.75	0.77	0.79	0.81	0.82	0.84	0.86	0.88	0.90	0.92	0.93	0.95
42	6095	7.85	1.55	1.52	1.48	1.45	1.42	1.39	1.36	1.33	1.30	1.26	1.23	1.20	1.17	1.14	1.11
42	6096	7.85	0.64	0.66	0.69	0.71	0.74	0.76	0.79	0.81	0.83	0.86	0.88	0.91	0.93	0.96	0.98
42	6097	7.85	1.68	1.65	1.61	1.58	1.54	1.51	1.47	1.44	1.40	1.37	1.33	1.30	1.27	1.23	1.20
42	6098	7.85	0.00	0.09	0.18	0.27	0.36	0.46	0.55	0.64	0.73	0.83	0.92	1.01	1.10	1.20	1.29
42	6112	7.85	1.18	1.18	1.17	1.17	1.16	1.15	1.15	1.14	1.14	1.13	1.13	1.12	1.12	1.11	1.11
42	6113	7.85	1.12	1.11	1.11	1.10	1.09	1.08	1.07	1.06	1.05	1.04	1.03	1.02	1.01	1.01	1.00
42	6114	7.85	1.35	1.33	1.32	1.31	1.30	1.29	1.28	1.27	1.26	1.25	1.24	1.23	1.21	1.20	1.19
42	6115	7.85	0.92	0.94	0.97	0.99	1.02	1.04	1.06	1.09	1.11	1.14	1.16	1.19	1.21	1.23	1.26
42	6122	7.85	0.95	0.99	1.02	1.06	1.09	1.13	1.17	1.20	1.24	1.27	1.31	1.35	1.38	1.42	1.45
42	6123	7.85	0.83	0.85	0.87	0.89	0.91	0.94	0.96	0.98	1.00	1.02	1.04	1.06	1.09	1.11	1.13
42	6124	7.85	0.87	0.87	0.88	0.88	0.88	0.88	0.89	0.89	0.89	0.89	0.90	0.90	0.90	0.90	0.91
42	6125	7.85	0.71	0.74	0.78	0.81	0.84	0.88	0.91	0.94	0.98	1.01	1.04	1.08	1.11	1.15	1.18
42	6132	7.85	2.42	2.33	2.23	2.14	2.05	1.95	1.86	1.76	1.67	1.58	1.48	1.39	1.30	1.20	1.11
42	6142	7.85	1.05	1.04	1.03	1.02	1.01	1.00	1.00	0.99	0.98	0.97	0.96	0.95	0.94	0.93	0.93
42	6143	7.85	0.55	0.58	0.62	0.66	0.70	0.73	0.77	0.81	0.85	0.88	0.92	0.96	1.00	1.03	1.07
42	6144	7.85	0.45	0.49	0.52	0.56	0.60	0.63	0.67	0.70	0.74	0.78	0.81	0.85	0.89	0.92	0.96
42	6145	7.85	0.87	0.87	0.88	0.88	0.88	0.88	0.89	0.89	0.89	0.89	0.90	0.90	0.90	0.90	0.91
42	6152	7.85	1.14	1.13	1.11	1.10	1.09	1.07	1.06	1.05	1.03	1.02	1.00	0.99	0.98	0.96	0.95
42	6153	7.85	0.28	0.31	0.35	0.38	0.42	0.45	0.48	0.52	0.55	0.59	0.62	0.66	0.69	0.73	0.76
42	6154	7.85	1.31	1.29	1.28	1.26	1.25	1.23	1.22	1.20	1.19	1.17	1.15	1.14	1.12	1.11	1.09
42	6155	7.85	0.00	0.06	0.13	0.19	0.26	0.32	0.39	0.46	0.52	0.59	0.65	0.72	0.78	0.85	0.92
42	6172	7.85	0.71	0.67	0.63	0.58	0.54	0.49	0.45	0.41	0.36	0.32	0.28	0.23	0.19	0.14	0.10
42	6173	7.85	0.27	0.25	0.23	0.22	0.20	0.18	0.17	0.15	0.13	0.12	0.10	0.08	0.07	0.05	0.03
42	6174	7.85	0.46	0.43	0.40	0.37	0.34	0.32	0.29	0.26	0.23	0.20	0.17	0.15	0.12	0.09	0.06
42	6175	7.85	0.87	0.87	0.88	0.88	0.88	0.88	0.89	0.89	0.89	0.89	0.90	0.90	0.90	0.90	0.91
42	6312	7.85	0.49	0.52	0.55	0.58	0.61	0.64	0.67	0.70	0.73	0.76	0.79	0.82	0.85	0.88	0.91
42	6313	7.85	1.30	1.27	1.24	1.21	1.18	1.15	1.12	1.10	1.07	1.04	1.01	0.98	0.95	0.92	0.89
42	6315	7.85	1.08	1.05	1.02	0.99	0.96	0.92	0.89	0.86	0.83	0.80	0.76	0.73	0.70	0.67	0.64

Table A-1 (Continued)

Card	MOS	QTR 1	QTR 2	QTR 3	QTR 4	QTR 5	QTR 6	QTR 7	QTR 8	QTR 9	QTR 10	QTR 11	QTR 12	QTR 13	QTR 14	QTR 15	QTR 16
42	6316	7.85	1.83	1.76	1.68	1.61	1.53	1.46	1.38	1.31	1.23	1.16	1.09	1.01	0.94	0.86	0.79
42	6317	7.85	1.01	0.99	0.97	0.96	0.94	0.92	0.90	0.89	0.87	0.85	0.84	0.82	0.80	0.79	0.77
42	6318	7.85	2.31	2.16	2.00	1.85	1.70	1.55	1.39	1.24	1.09	0.93	0.78	0.63	0.48	0.32	0.17
42	6322	7.85	0.93	0.93	0.93	0.93	0.94	0.94	0.94	0.95	0.95	0.95	0.96	0.96	0.96	0.96	0.97
42	6323	7.85	1.45	1.42	1.39	1.36	1.33	1.30	1.28	1.25	1.22	1.19	1.16	1.13	1.10	1.07	1.05
42	6324	7.85	0.53	0.55	0.57	0.59	0.61	0.63	0.64	0.66	0.68	0.70	0.72	0.74	0.76	0.78	0.80
42	6325	7.85	1.09	1.07	1.05	1.03	1.01	1.00	0.98	0.96	0.94	0.92	0.90	0.88	0.86	0.84	0.82
42	6333	7.85	1.02	1.00	0.99	0.98	0.97	0.95	0.94	0.93	0.91	0.90	0.89	0.87	0.86	0.85	0.84
42	6335	7.85	1.12	1.12	1.11	1.11	1.10	1.10	1.09	1.09	1.08	1.08	1.07	1.07	1.06	1.06	1.05
42	6336	7.85	1.01	1.03	1.05	1.06	1.08	1.10	1.11	1.13	1.15	1.17	1.18	1.20	1.22	1.23	1.25
42	6337	7.85	0.31	0.32	0.32	0.33	0.34	0.34	0.35	0.36	0.36	0.37	0.38	0.38	0.39	0.40	0.40
42	6353	7.85	0.71	0.73	0.75	0.77	0.80	0.82	0.84	0.87	0.89	0.91	0.93	0.96	0.98	1.00	1.02
42	6386	7.85	1.29	1.26	1.22	1.18	1.15	1.11	1.07	1.03	1.00	0.96	0.92	0.89	0.85	0.81	0.78
42	6412	7.85	0.30	0.32	0.34	0.36	0.38	0.40	0.42	0.44	0.46	0.48	0.50	0.52	0.54	0.56	0.58
42	6413	7.85	1.37	1.33	1.29	1.25	1.21	1.17	1.13	1.09	1.04	1.00	0.96	0.92	0.88	0.84	0.80
42	6423	7.85	0.71	0.68	0.64	0.61	0.57	0.53	0.50	0.46	0.43	0.39	0.35	0.32	0.28	0.25	0.21
42	6432	7.85	1.45	1.41	1.38	1.35	1.32	1.29	1.25	1.22	1.19	1.16	1.13	1.09	1.06	1.03	1.00
42	6433	7.85	0.85	0.86	0.87	0.88	0.90	0.91	0.92	0.93	0.94	0.96	0.97	0.98	0.99	1.01	1.02
42	6462	7.85	0.62	0.59	0.56	0.53	0.50	0.47	0.44	0.41	0.38	0.35	0.32	0.29	0.26	0.23	0.20
42	6463	7.85	0.54	0.54	0.53	0.53	0.52	0.52	0.51	0.51	0.50	0.49	0.49	0.48	0.48	0.47	0.47
42	6464	7.85	0.43	0.40	0.38	0.35	0.33	0.30	0.27	0.25	0.22	0.20	0.17	0.15	0.12	0.09	0.07
42	6465	7.85	1.15	1.10	1.05	0.99	0.94	0.89	0.84	0.79	0.74	0.69	0.63	0.58	0.53	0.48	0.43
42	6466	7.85	1.13	1.06	0.99	0.93	0.86	0.80	0.73	0.66	0.60	0.53	0.47	0.40	0.33	0.27	0.20
42	6467	7.85	0.00	0.02	0.04	0.06	0.08	0.10	0.12	0.14	0.16	0.18	0.20	0.22	0.24	0.26	0.28
42	6468	7.85	0.48	0.46	0.44	0.41	0.39	0.37	0.35	0.33	0.30	0.28	0.26	0.24	0.21	0.19	0.17
42	6482	7.85	0.00	0.04	0.08	0.12	0.16	0.20	0.24	0.28	0.32	0.36	0.40	0.44	0.48	0.52	0.56
42	6483	7.85	1.24	1.18	1.12	1.06	1.00	0.94	0.88	0.82	0.76	0.70	0.64	0.58	0.52	0.46	0.40
42	6484	7.85	0.57	0.54	0.51	0.48	0.44	0.41	0.38	0.35	0.32	0.28	0.25	0.22	0.19	0.15	0.12
42	6492	7.85	1.06	1.03	1.01	0.98	0.96	0.93	0.91	0.88	0.86	0.83	0.80	0.78	0.75	0.73	0.70
42	6493	7.85	0.00	0.02	0.05	0.07	0.10	0.12	0.15	0.17	0.20	0.22	0.25	0.27	0.30	0.33	0.35
42	6494	7.85	0.70	0.68	0.66	0.64	0.63	0.61	0.59	0.57	0.55	0.54	0.52	0.50	0.48	0.46	0.44

Table A-1 (Continued)

Card	MOS	QTR 1	QTR 2	QTR 3	QTR 4	QTR 5	QTR 6	QTR 7	QTR 8	QTR 9	QTR 10	QTR 11	QTR 12	QTR 13	QTR 14	QTR 15	QTR 16
42	6521	7.85	1.62	1.61	1.59	1.58	1.56	1.55	1.53	1.52	1.50	1.48	1.47	1.45	1.44	1.42	1.41
42	6531	7.85	1.36	1.34	1.32	1.31	1.29	1.27	1.26	1.24	1.22	1.21	1.19	1.17	1.16	1.14	1.12
42	6541	7.85	1.96	1.91	1.86	1.80	1.75	1.70	1.65	1.60	1.55	1.50	1.45	1.40	1.35	1.30	1.25
42	6672	7.85	1.67	1.66	1.64	1.63	1.61	1.60	1.59	1.57	1.56	1.55	1.53	1.52	1.50	1.49	1.48
42	6673	7.85	0.57	0.59	0.61	0.64	0.66	0.68	0.70	0.72	0.74	0.76	0.78	0.80	0.82	0.85	0.87
42	6821	7.85	1.68	1.66	1.64	1.62	1.60	1.59	1.57	1.55	1.53	1.52	1.50	1.48	1.46	1.44	1.43
42	7011	7.85	1.89	1.87	1.84	1.81	1.79	1.76	1.73	1.71	1.68	1.65	1.62	1.60	1.57	1.54	1.52
42	7041	7.85	1.32	1.31	1.31	1.30	1.29	1.29	1.28	1.28	1.27	1.27	1.26	1.25	1.25	1.24	1.24
42	7051	7.85	1.05	1.11	1.18	1.24	1.30	1.36	1.43	1.49	1.55	1.61	1.67	1.74	1.80	1.86	1.92
42	7212	7.85	1.47	1.48	1.48	1.48	1.49	1.49	1.49	1.50	1.50	1.50	1.51	1.51	1.51	1.51	1.52
42	7222	7.85	2.21	2.17	2.13	2.09	2.05	2.01	1.97	1.93	1.89	1.85	1.81	1.77	1.73	1.69	1.65
42	7234	7.85	1.72	1.70	1.68	1.66	1.64	1.62	1.60	1.58	1.56	1.54	1.52	1.50	1.48	1.46	1.44
42	7242	7.85	1.02	1.02	1.01	1.00	0.99	0.98	0.98	0.97	0.96	0.95	0.95	0.94	0.93	0.92	0.91
42	7312	7.85	0.62	0.63	0.65	0.66	0.68	0.69	0.70	0.72	0.73	0.75	0.76	0.78	0.79	0.80	0.82
42	7322	7.85	1.45	1.42	1.40	1.37	1.35	1.32	1.29	1.27	1.24	1.22	1.19	1.17	1.14	1.11	1.09
42	7372	7.85	0.00	0.03	0.07	0.11	0.15	0.19	0.23	0.27	0.31	0.35	0.39	0.43	0.47	0.51	0.55
42	7382	7.85	0.95	0.95	0.95	0.94	0.94	0.94	0.94	0.94	0.93	0.93	0.93	0.93	0.93	0.92	0.92
42	9812	0	3.19	3.07	2.94	2.82	2.70	2.57	2.45	2.33	2.20	2.08	1.96	1.83	1.71	1.59	1.46

Appendix B

First-term Reenlistment Rates

Table B-1

First-term Reenlistment Rates

Card no.	MOS	Rates	Card no.	MOS	Rates	Card no.	MOS	Rates
47	121	6.07	47	1371	3.81	47	2811	12.67
47	131	5.00	47	1391	4.17	47	2813	8.68
47	151	5.47	47	1521	8.04	47	2818	10.71
47	161	3.35	47	1811	2.58	47	2822	6.99
47	231	5.79	47	1812	1.39	47	2831	7.43
47	261	7.53	47	1833	2.60	47	2841	6.80
47	311	2.80	47	2111	4.62	47	2871	15.76
47	313	1.77	47	2131	7.93	47	2881	7.62
47	331	2.83	47	2141	5.06	47	2884	11.51
47	341	2.91	47	2145	7.24	47	2885	9.49
47	351	2.84	47	2146	3.79	47	2887	3.72
47	352	2.79	47	2147	3.30	47	3043	5.74
47	411	4.61	47	2161	5.82	47	3051	5.97
47	431	4.17	47	2171	5.29	47	3052	8.14
47	451	4.28	47	2311	6.16	47	3072	5.56
47	481	8.38	47	2512	5.97	47	3073	5.36
47	811	3.62	47	2513	3.48	47	3112	5.16
47	842	3.91	47	2531	4.13	47	3361	2.65
47	844	3.92	47	2532	24.14	47	3381	5.06
47	847	4.32	47	2534	2.26	47	3432	5.53
47	861	3.01	47	2535	4.74	47	3451	12.86
47	1141	6.27	47	2536	7.09	47	3513	6.25
47	1142	2.55	47	2542	3.18	47	3521	3.31
47	1161	5.75	47	2621	4.90	47	3531	4.24
47	1171	4.50	47	2631	6.00	47	3553	3.11
47	1181	4.82	47	2651	3.38	47	4034	7.38
47	1316	3.39	47	2671	9.68	47	4063	4.07
47	1341	3.26	47	2673	5.24	47	4131	4.46
47	1345	3.08	47	2674	6.47	47	4313	3.81
47	1361	5.65	47	2675	6.54	47	4321	6.42

Table B-1 (Continued)

Card no.	MOS	Rates	Card no.	MOS	Rates	Card no.	MOS	Rates
47	4421	13.88	47	5952	7.65	47	6083	12.92
47	4611	5.62	47	5953	5.96	47	6085	14.21
47	4621	6.49	47	5954	6.33	47	6086	12.47
47	4641	5.55	47	5962	9.85	47	6087	10.75
47	4653	4.43	47	5963	10.13	47	6088	12.91
47	4671	4.91	47	5964	23.89	47	6092	5.68
47	5526	0.00	47	6012	10.86	47	6093	5.01
47	5528	0.00	47	6013	11.70	47	6095	9.67
47	5534	5.12	47	6014	0.39	47	6096	7.74
47	5536	7.51	47	6015	13.37	47	6097	12.28
47	5537	2.30	47	6016	5.26	47	6098	6.30
47	5541	2.97	47	6017	4.31	47	6112	4.18
47	5543	4.43	47	6018	4.71	47	6113	11.60
47	5544	5.25	47	6022	11.88	47	6114	8.85
47	5546	3.06	47	6023	6.74	47	6122	3.97
47	5547	0.73	47	6025	4.17	47	6123	4.58
47	5563	1.55	47	6026	4.14	47	6124	6.65
47	5565	0.00	47	6027	4.57	47	6132	4.34
47	5711	13.60	47	6046	4.26	47	6142	12.02
47	5811	4.45	47	6047	6.57	47	6143	5.65
47	5812	4.15	47	6052	8.32	47	6144	9.01
47	5831	2.67	47	6053	12.35	47	6152	6.14
47	5921	13.13	47	6055	11.19	47	6153	12.49
47	5922	9.89	47	6056	9.49	47	6154	7.71
47	5923	7.85	47	6057	6.71	47	6155	0.00
47	5929	7.32	47	6058	8.72	47	6172	9.91
47	5937	7.92	47	6060	7.21	47	6173	6.24
47	5942	12.47	47	6072	8.96	47	6174	6.48
47	5943	12.01	47	6073	5.82	47	6312	7.28
47	5944	4.47	47	6075	7.06	47	6313	7.09
47	5945	3.14	47	6082	13.33	47	6315	6.07

Table B-1 (Continued)

Card no.	MOS	Rates	Card no.	MOS	Rates	Card no.	MOS	Rates
47	6316	4.24	47	6432	3.03	47	6521	4.55
47	6317	3.00	47	6433	2.69	47	6531	5.67
47	6318	3.92	47	6462	2.34	47	6541	4.96
47	6322	11.52	47	6463	4.75	47	6821	10.22
47	6323	10.38	47	6464	1.59	47	7011	3.97
47	6324	6.88	47	6465	4.99	47	7041	3.96
47	6333	8.02	47	6466	4.29	47	7051	2.60
47	6335	9.13	47	6467	2.70	47	7212	4.62
47	6336	5.92	47	6468	4.91	47	7222	4.71
47	6337	3.67	47	6482	10.28	47	7234	14.82
47	6353	5.96	47	6483	1.93	47	7242	4.91
47	6386	12.91	47	6484	3.97	47	7312	12.48
47	6412	2.27	47	6492	3.19	47	7322	11.11
47	6413	6.00	47	6493	2.42	47	7372	12.49
47	6423	2.15	47	6494	4.12	47	7382	4.65

Distribution List

Commanding General, Marine Corps Research Development and Acquisition Command
HQMC (Assistant DC/S M&RA), HQMC (MP), HQMC (MPP-20), HQMC (MPP), HQMC (MA)
Defense Technical Information Center (DTIC) (4)