VI. CONTRIBUTED PAPERS

WORKLOAD ESTIMATION AND FORECASTING IN ARIZONA*

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An accurate projection of future workload activity is a necessary condition for assuring that appropriate staff, facilities, and other resources are available to provide UI claimants with timely and quality service. In Arizona, the projection of future workload activity is done by the UI Research and Reports Section of the Unemployment Insurance Administration.

Workload projections are provided, on a monthly basis, to the Resource Management Section. Workload items are estimated for the current quarter and forecast for two quarters into the future. In addition, two-year forecasts are provided to the Resource Management Section on an annual basis to assist them with their federal fiscal year workload estimates. Besides being used by the Resource Management Section, projections (particularly the monthly ones) also are used by local office managers and the joint legislative budget committee.

It will be useful at this point to distinguish between the two types of projections provided, since different procedures have been implemented for producing them. Estimates are derived on the basis of incomplete information regarding the workload for a specific item during the current quarter. The estimating procedure is always used when we know the workload for one or two months of the quarter. When a quarter has just ended, we present the final count for all workload items for that quarter in

*The projections described here are exclusively for regular UI programs; special programs (i.e., TRA, DUA, etc.) are handled differently and are not discussed in this paper.

the column otherwise used for estimates. Forecasts, on the other hand, are derived strictly on the basis of historical experience. The forecast procedure is always used for future quarters, and is used for the current quarter, if the quarter has just begun and no data is yet available. Note that this latter situation always corresponds to the one where our "estimates" column in fact is an actual enumeration of the quarter just ended. The procedures for both estimating and forecasting are described below.

It should be noted that all basic data is taken from the relevant federal report. Thus, initial claims data is taken from the ETA5-159, Appeals data from the MA5-130, etc. All data is transferred from its respective report to printed worksheets and entered from these on to "floppy" disk files to be read by programs on our WANG minicomputer. These files constitute our workload database which is composed of both monthly data (a 13-year historical series) and quarterly data (a 41-year historical series). A number of service routines have been written to present and manipulate this data (i.e., print, plot, update, copy, etc.) The workload database is thus available for rapid access to answer any number of questions as the need arises.

I. Estimating Procedure

The estimating procedure generates an estimate of the workload for the current quarter for a particular item by inflating the known data (either one or two month's data) by the inverse of the proportion of the total quarterly workload for that item which has, on average, occurred by the end of the first or second month of the quarter. The term "on average" as used here refers specifically to the average percent of the total workload accounted for by the first or second month of selected quarters which occurred during the years 1970 through the present; the quarters

being selected because of their typicality with respect to the current economic situation. These proportions will be referred to simply as monthly factors. Each item has a unique monthly factor or shares a factor with other items, in which case any items to which it is applied have been used in deriving it. Table 1 indicates the names and selected values for the factors currently in use. Notice that any month representing the end of a quarter has no factors since by the end of the third month all workload is always accounted for and all factors would be one. At this point, an example may best clarify the estimating procedure.

Suppose that the month of January has just ended and we desire an estimate of total initial claims for the first calendar quarter. From the ETA5-159 we transfer the various initial claims figures to our worksheets and enter them in the database. We then need to generate estimates for each of these items and sum them to get our total initial claims estimate. Assume there were 15,000 new initial claims in January, and that our monthly factor (the average proportion of new initial claims during the first quarter accounted for by the end of January) for new initial claims is .33. Our estimate for new initial claims would be 15,000/.33 = 45,454. Inflating each of the other initial claims items by its monthly factor would provide an estimate of the total initial claims in the first quarter based on the data received in January. Doing this for all workload items provides the estimates for the first quarter workload. Now suppose we receive 12,000 new initial claims in February. If our February monthly factor for new initial claims is .71 (i.e., the average proportion of new initial claims during the first quarter accounted for by the end of February), then our second estimate for new initial claims would be (15,000 + 12,000)/.71 = 38,028. As before, we would repeat this

process for the other initial claims items and the other workload items and would obtain our estimates for first quarter workload activity based on the data received in January and February. When March data becomes available, we would simply add up the three months of data and provide an actual count for first quarter workload activity.

As our example indicates, a second month's data could result in a significant change in the estimate over that which was provided with one month's data. In addition, while this procedure is generally quite accurate, there are circumstances when some adjustments would be warranted. For example, if we had prior knowledge of a large layoff or labor dispute coming in February or March we would obviously wish to have larger estimates in January than would result solely on the basis of the monthly factor method. Conversely, a large number in January or February which was not expected to continue would have to be scaled back so as not to add unduly to our quarterly estimate. In any event, once we have the estimates, (or actuals for a quarter just ended) they become the benchmark from which our forecasts of future quarters are derived.

II. Forecasting Procedure

In order to develop forecasts for the various workload activities, some assumptions must be made regarding future economic conditions, so that we may properly increase or decrease our base estimate. These assumptions also allow us to take the resulting forecast and properly increase or decrease it in order to derive the next quarter out forecast; and so on out for as many quarters as we are going to forecast. In Arizona, we use the expected quarterly total unemployment rate as the indicator of economic conditions.

Once we have made a decision as to the quarterly total unemployment rate for each of the calendar quarters

we wish to forecast, we examine a historical series of the quarterly total unemployment rate. We then choose, for each calendar quarter we wish to forecast, a year during which the level of the total unemployment rate during the previous calendar quarter and the change in the level from the previous calendar quarter is similar to what we expect for the calendar quarter we are forecasting. Given these base years, we next construct, for each item, the ratio of that item in the calendar quarter to be forecast during the base year to that item in the prior quarter during the base year. When we multiply this ratio for the "next" to present calendar quarter by the previously generated estimate (or actual count) for that item in the present calendar quarter we get our forecast for the next quarter. Once we have this forecast we can use it along with the ratio for the following quarter to derive our two quarter out forecast. We repeat this process until we have generated forecasts for all quarters we desire. In essence, all we are doing is making our forecasts differ from a given calendar quarter in the same manner that the items differed from that same calendar quarter during a year when the unemployment rate was similar to what we expect it to be in the future. Note that this process is an iterative one: every forecast can be used with a base year ratio to produce another forecast one additional quarter out. An example should help clarify this procedure.

Recall that in our previous example we wound up with an estimate of 38,028 new initial claims during the first quarter based on January and February data. Suppose we now desire forecasts for total initial claims in the second and third quarters. Assume that the total unemployment rate increased from 5.0% in the fourth quarter to 5.7% in the first quarter and we believe the total unemployment

rate will increase from 5.7% in the first quarter to 6.0% in the second quarter, and then to 6.2% in the third quarter. Assume further that an examination of the historical series for the total unemployment rate indicates that in, say 1976, the rate increased from 5.6% to 6.0% from the first quarter to the second quarter (after having been 5.1% in the fourth quarter of 1975) and in 1978 the rate increased from 5.9% to 6.1% from the second quarter to the third quarter (after having been 5.5% in the first quarter). On the basis of these changes, we choose 1976 as our base year from which to construct ratios to forecast the second quarter and 1978 as our base year from which to construct ratios to forecast the third quarter. When making a forecast, we try to find total unemployment rates during the base period which are similar to those expected during the forecast period at least through consecutive quarters - the forecast quarter and the two quarters prior to the forecast quarter. This allows initial claims to develop into continued claims, and continued claims to develop into nonmonetary determinations and appeals. When we are unable to find unemployment rates which match, we look for percentage (not percentage point) changes in the unemployment rates which match - (e.g., a change from 3% to 4% is the same percentage change as a change from 6% to 8%, but not the same percentage point change). It is almost always possible to find quarters which match using one or the other of these criteria (unemployment rates or percentage changes in the unemployment rates).

Returning to our example, we wish to forecast second and third quarter new initial claims given our estimate of 38,028 new initial claims for the first quarter and the previously mentioned assumptions regarding the unemployment rate. Suppose that actual new initial claims during the

second quarter of 1976 totaled 45,000 and during the first quarter of 1976 had been 42,000. Our forecast for second quarter would then be:

$$\frac{\text{(2nd Qtr. Base Year)}}{\text{(1st Qtr. Base Year)}} * \text{1st Qtr. Estimate} = (45{,}000/42{,}000) * 38{,}028 = 40{,}744$$

To get our estimate for third quarter, assume there were 36,000 new initial claims during the third quarter of 1978 and there had been 35,500 during the second quarter of 1978. Our third quarter forecast would be:

$$\frac{\text{(3rd Qtr. Base Year)}}{\text{(2nd Qtr. Base Year)}} * \text{2nd Qtr. Forecast} = (36{,}000/35{,}500) * 40{,}744 = 41{,}318$$

This process can continue for as many quarters as desired, each forecast becoming the base for the next one. Also, as before, each item would be done and then summed to get the totals (i.e., total initial claims). When numerous items are used to get a total, we often use the ratio for the largest item to generate the forecast. This is generally accurate and eliminates the need to deal with a large number of ratios which would have to be applied to small numbers, and which would have little effect on the forecast (e.g., UCX higher appeals where one or two cases a quarter is normal).

This is a good time to raise two potential problems with this forecasting method. One, alluded to above, arises when using years where an item has a small base to create ratios which are then applied to much larger bases. For instance, suppose we choose 1974 as a base year for our second quarter forecast and during that year there were six higher UCX appeals in the second quarter and two in the first quarter. If we had an estimate for this item of, say, 15 during the first quarter, our ratio method would give us (6/2)*15=45, clearly a number which is too large. Letting the ratio for the largest item (i.e., regular UI higher appeals) be applied to the first quarter

estimate for this item provides a better forecast than we would get using its actual ratio.

Another problem related to this type of small item occurs when a base year is chosen where zero activity occurred during the prior quarter, thus giving us zero divisor problems in our formula. Again, using the larger item's ratio to generate this item's forecast solves the problem since the larger items are unlikely to have zero activity during a quarter.

The major restrictions to this "base year" forecasting method are that the same quarters must be used to create the ratios for all items in a given quarter, and the same calendar quarter we are forecasting must be used to create the ratios. For example, to get a second quarter forecast we must use the second to first quarter ratio in a given base year; we cannot arbitrarily choose, say, third to fourth quarter ratios to construct our second quarter forecast. This works reasonably well, however.

While this method forecasts items based solely on their historical activity, with no explicit causal relationships among items, implicitly the relationships clearly are there (e.g., between initial claims and weeks claimed, weeks claimed and nonmonetary determinations, etc.). Tables 2 and 3 present a sample two-quarter and three-quarter forecast. The two-quarter forecasts are done each month for the Resource Management Section. Notice that Column 1 indicates that a quarter has just ended and provides a count for it; Column 2 is thus a forecast for the current quarter and the estimating procedure discussed has not been used to generate any of these figures; all columns except the first were generated by the forecasting method.

III. Accuracy

We are just beginning a systematic evaluation of

the accuracy of our workload estimating and forecasting procedures. Evaluating the accuracy is somewhat complex because we do not want to evaluate the accuracy of each item forecast. In order to evaluate the accuracy of the entire forecast the individual items must be aggregated somehow. We are aggregating them on the basis of MPU's. Our goals are the following:

1. Total MPU's estimated for the current quarter should be within ± 5% at least 90% of the time (this is at most a two-month ahead estimate).
2. Total MPU's forecast for one quarter ahead should be within ± 15% at least 90% of the time (this is at most a 5-month ahead forecast).
3. Total MPU's forecast for two quarters ahead should be within ± 25% at least 90% of the time (this is at most an 8-month ahead forecast).

In general we have met these goals. Charts showing our historical track record are being prepared and will appear in the next issue of the UI Research Exchange. An explanation of how the items are aggregated into a total MPU forecast also will be provided.

IV. Information and Availability

Readers wishing more information may contact Joseph T. Sloane, Manager, UI Program Research Unit at (602) 255-3661 or write to:

1720 W. Madison, Site Code 910B
Phoenix, Arizona 85007

We would be happy to send more information regarding our methods, the computer software we have developed to manage workload forecasting and estimation, or our workload database generally.

TABLE 1

WORKLOAD MONTHLY FACTORS

	JANUARY	FEBRUARY	APRIL	MAY	JULY	AUGUST	OCTOBER	NOVEMBER
REG UI - INITIAL	.391	.694	.337	.660	.345	.655	.333	.680
REG UI - WEEKS	.334	.675	.355	.694	.324	.690	.315	.660
REG UI - NONMONS	.313	.634	.322	.662	.325	.698	.350	.690
REG UI - LOWER	.333	.617	.346	.680	.291	.709	.334	.648
REG UI - HIGHER	.309	.615	.289	.548	.303	.745	.271	.713
UCFE/X - INITIAL	.398	.721	.291	.602	.382	.724	.324	.671
UCFE/X - WEEKS	.318	.670	.354	.693	.340	.705	.327	.667
UCFE/X - NONMONS	.327	.624	.319	.561	.344	.712	.342	.679
UCFE/X - LOWER	.329	.614	.380	.649	.284	.716	.436	.753
UCFE/X - HIGHER	.174	.668	.329	.575	.267	.747	.343	.759

TABLE 2

ARIZONA DEPARTMENT OF ECONOMIC SECURITY
UNEMPLOYMENT INSURANCE ADMINISTRATION
WORKLOAD FORECASTS
JULY 31, 1981

=== REGULAR U.I., UCFE,UCX ===

	FEDERAL FY 1981 QUARTER 3 (3 MOS ACTUAL)	FEDERAL FY 1981 QUARTER 4 (FORECAST)	FEDERAL FY 1982 QUARTER 1 (FORECAST)
TOTAL INITIAL CLAIMS	50,754	48,190	50,373
NEW IC - REG. U.I.	24,113	20,080	20,454
NEW IC - UCFE	894	1,389	1,027
NEW - UCX	475	694	724
ADDITIONAL CLAIMS	13,961	13,312	14,056
INTERSTATE AGENT	6,934	7,440	8,904
INTERSTATE LIABLE	4,377	5,276	5,207
TOTAL WEEKS CLAIMED	328,891	279,814	271,403
INTRASTATE (UI,UCFE,UCX)	252,530	209,401	191,985
INTERSTATE AGENT	53,053	47,657	57,077
INTERSTATE LIABLE	23,308	22,756	22,341
TOTAL NONMON DETERM & REDETER	27,765	29,792	28,969
NONMON - REG. U.I.	26,643	28,117	27,611
NONMON - UCFE	489	803	626
NONMON - UCX	633	872	732
TOTAL APPEALS (DECISIONS ISSUED)	3,609	4,183	3,740
LOWER APPEALS - REG. U.I.	3,189	3,792	3,336
LOWER APPEALS - UCFE	14	6	8
LOWER APPEALS - UCX	26	3	1
HIGHER APPEALS - REG. U.I.	377	379	390
HIGHER APPEALS - UCFE	2	2	3
HIGHER APPEALS - UCX	1	2	1
TOTAL LOWER APPEALS (FILED)	3,225	3,699	3,294
LOWER APPEALS - REG. U.I.	3,194	3,690	3,287
LOWER APPEALS - UCFE	4	5	6
LOWER APPEALS - UCX	27	4	0

...3456...Transient Claims Filed During The Quarter Were Not Used In This Report.

PREPARED BY: U.I. RESEARCH AND REPORTS SECTION

TABLE 3

ARIZONA DEPARTMENT OF ECONOMIC SECURITY
UNEMPLOYMENT INSURANCE ADMINISTRATION
WORKLOAD FORECASTS
JULY 31, 1981

=== REGULAR U.I., UCFE, UCX ===

	FEDERAL FY 1981 QUARTER 3 (3 MOS ACTUAL)	FEDERAL FY 1981 QUARTER 4 (FORECAST)	FEDERAL FY 1982 QUARTER 1 (FORECAST)	FEDERAL FY 1982 QUARTER 2 (FORECAST)
TOTAL INITIAL CLAIMS	50,754	48,190	50,373	55,404
NEW IC - REG. U.I.	24,113	20,080	20,454	25,653
NEW IC - UCFE	894	1,389	1,027	817
NEW - UCX	475	694	724	659
ADDITIONAL CLAIMS	13,961	13,312	14,056	15,998
INTERSTATE AGENT	6,934	7,440	8,904	6,825
INTERSTATE LIABLE	4,377	5,276	5,207	5,452
TOTAL WEEKS CLAIMED	328,891	279,814	271,403	342,550
INTRASTATE (UI,UCFE,UCX)	252,530	209,401	191,985	242,088
INTERSTATE AGENT	53,053	47,657	57,077	73,027
INTERSTATE LIABLE	23,308	22,756	22,341	27,435
TOTAL NONMON DETERM & REDETER	27,765	29,798	28,969	30,745
NONMON - REG. U.I.	26,643	28,117	27,611	29,600
NONMON - UCFE	489	803	626	390
NONMON - UCX	633	878	732	755
TOTAL APPEALS (DECISIONS ISSUED)	3,609	4,183	3,740	3,951
LOWER APPEALS - REG. U.I.	3,189	3,792	3,336	3,558
LOWER APPEALS - UCFE	14	6	8	9
LOWER APPEALS - UCX	26	3	1	1
HIGHER APPEALS - REG. U.I.	377	379	390	383
HIGHER APPEALS - UCFE	2	2	3	1
HIGHER APPEALS - UCX	1	2	1	3
TOTAL LOWER APPEALS (FILED)	3,225	3,699	3,294	3,858
LOWER APPEALS - REG. U.I.	3,194	3,690	3,287	3,850
LOWER APPEALS - UCFE	4	5	6	6
LOWER APPEALS - UCX	27	4	0	2

...3456... Transient Claims Filed During the Quarter Were Not Used In This Report.
Base Years For Forecasts Were.. 1975 , 1976 , 1978

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