OREGON CORRECTIONS POPULATION FORECAST

Annual Review of Methodology

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June 2006

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Foreword

The Office of Economic Analysis (OEA) issues the Oregon Corrections Population Forecast. Executive Order EO-95-06 and Oregon Revised Statute (ORS) 184.351 direct OEA to issue this forecast each April and October. The Oregon Department of Corrections (DOC) uses the forecast for planning and budgeting. This paper describes the methods used to produce the forecast.

Two committees help OEA with the forecast. The Corrections Population Forecasting Advisory Committee consists of ten members who know about the criminal justice system and trends that can affect DOC's population. Members are appointed by the Governor and serve four-year terms. The Committee helps OEA interpret current trends and set assumptions about the future. A separate technical advisory committee consists of people who are familiar with forecasting and criminal justice data. They provide critical review and advice about forecasting methods.

Readers with questions about this paper or the forecast may contact Suzanne Porter at (503)378-5732. Both documents are available at our website: http://www.oea.das.state.or.us.

I. Overview

The Corrections Population forecast projects ten years into the future. It consists of state prison inmates and the felony community supervision caseload.

State prison inmates are in State correctional facilities. The community supervision caseload consists of offenders on felony probation, parole, post-prison supervision, or Local Control (LC). LC consists of felons sentenced to incarceration for 12 or fewer months. Community supervision offenders are in local custody but their supervision is funded by the DOC.

Oregon's sentencing laws underwent major revisions in 1989, 1995, and 1997 (see section II B, below). These changes affected whether felons went to prison or community corrections, and they affected sentence length. OEA's forecasts of prison and community supervision offenders are the sum of several smaller forecasts of offenders grouped by sentencing law.

The forecast is produced with a *flow* model. A flow model works by moving cases through various points in the criminal justice system. These points are arrest, prosecution, intake, release, and revocation. The model is integrated so that each point in the system is affected by earlier points. OEA based some parts of the forecast model on a model used by the State of Texas.

The source data are stored as SPSS[1] files. At OEA, we use SPSS to extract cases and to conduct statistical tests. We produce the preliminary intake forecast and seasonal indices with EViews. The final intake and population forecasting models are Excel spreadsheets.

The population forecast is actually a forecast of intakes and releases. The population is calculated for the first day of each month. Using February 1 as an example, the equation to forecast the population is:

FEBRUARY 1 POPULATION = JANUARY 1 POPULATION + INTAKES DURING JANUARY – RELEASES DURING JANUARY.

Intakes are forecast based on recent intake trends, arrest trends, court case filings, demographics, future population growth, and on the likelihood of re-offending after being placed on probation or post-prison supervision. Releases are calculated by using typical lengths of stay or projected release dates for each offender group.

Forecasts are released each April 1st and October 1st. Prison population forecasts begin January 1st and July 1st, respectively. Community corrections forecasts begin with October 1st of the previous year and April 1st, respectively. Community corrections data are final about four months after the fact, so the caseload as of October 1st is available after February 1st of the following year, and the caseload for April 1st is available after September 1st.

[1] Statistical Package for the Social Sciences

II. Forecast Elements

a. Data Sources

These data sources are used in the forecast:

- DOC Corrections Information System (CIS) data.
- Oregon Criminal Justice Commission (OCJC), Felony Guidelines Sentencing Reports
- Law Enforcement Data Systems (LEDS), Report of Criminal Offenses and Arrests.
- Oregon Office of Economic Analysis, Oregon population forecast by age.
- U.S. Census Bureau and the Oregon Population Research Center, Oregon historical population by age.
- Oregon Judicial Department (OJD), ORS Charge Counts

DOC provides data from July 1991 to present on intakes to prison and community supervision. Some of the most important data elements for the forecast are listed below.

- Type of intake (prison, probation, local control, etc.)
- Major crime of conviction
- Date of intake
- Previous supervision status
- Actual or projected release date
- Birth date (age)
- Reason for intake (new conviction or parole or probation violation)
- Reason for release (revocation or successful completion)

OCJC data provide additional information about the sentences imposed on felony offenders. LEDS and OEA data are used to develop a forecast of arrests by birth cohort that is used to determine *new* intakes.[2] OJD data are used to refine the new intake forecast for the near term.

b. Offender Groups

The corrections population consists of several offender groups. They are defined below.

Measure 11

Measure 11 (ORS 137.700 and 707) was passed by Oregon voters and took effect in April 1995. It mandates minimum sentences for any of 21 violent crimes, ranging from 70 to 300 months. Measure 11 inmates must serve their entire sentence and are not eligible for credit for good behavior (called *earned time credit)*. Juveniles aged 15 and older who are charged with a Measure 11 crimes are automatically waived into the adult justice system.

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[2]*New* means the offender is not on felony community supervision at the time of a new conviction.

Repeat Property Offenders (RPOs)
ORS 137.717 took effect in July 1997. It established 13 or 19 month presumptive sentences for repeat property offenders (RPOs). The 1999 Legislative Assembly created the crime of Identity Theft (ORS 165.800) and added it to the list of crimes covered by RPO. The 2001 Legislative Assembly added Forgery 1 to the RPO list.

All Other Prison Inmates
Most offenders are sentenced under Sentencing Guidelines (ORS 137.010). Sentencing Guidelines were established in 1989. They establish a range of punishment based on the crime of conviction and the offender's criminal history. This range is called the *presumptive sentence*. The Court may impose a sentence below the presumptive range if there are mitigating facts. A sentence above the presumptive range can be imposed if a jury finds there were aggravating facts. A sentence outside of the presumptive range is called a *departure*.

A Sentencing Guidelines sentence can be reduced only by credit for time already served, and by earned time credit (ETC). If the Court allows it, an inmate can earn time credit for good behavior. The maximum available ETC is 20 percent of the sentence. Some Sentencing Guidelines inmates are eligible to participate in alternative incarceration programs. An inmate who successfully completes such a program can earn a reduction of more than 20 percent.

Local Control (LC)
ORS 137.124 took effect in January 1997. It pertains to these felony offenders:

- Convicted of a felony and sentenced to 12 months or fewer of incarceration.
- Revoked from felony community supervision and sentenced to 12 months or fewer of incarceration.

Level III Sanctions
These are felons that are sanctioned to 31 to 90 days while on probation, parole, or post-prison supervision. [3]

LC and Level III Sanctions offenders were part of the state prison population until 1997. Now they are locally supervised but funded by the DOC.

Felony Probation, Parole, and Post-Prison Supervision
The forecast covers the *funded caseload*, which consists of all actively supervised felony probationers and parolees. It includes offenders with an Oregon sentence who are supervised in another state.[4] Most offenders on *outcount* status are not included. *Outcount* means the offender is not being supervised. Absconding is the most common reason for being placed on outcount.

[3] A sanction is a punishment for violating of the terms of community supervision.

[4] These are called "Compact Out" or CMPO cases.

Parole pertains to released prison inmates who committed their crime before November 1, 1989, when Sentencing Guidelines took effect. Inmates sentenced under Sentencing Guidelines serve a term of *Post-Prison Supervision* (PPS) after release from prison or LC.

c. INTAKE GROWTH – NEW COMMITMENTS

This section describes the process used to forecast new commitments to prison, local control, and probation. *New offenders* are those who are not on any type of community supervision when they are convicted of a new crime. We use a different process to forecast intakes that are on community supervision when they are convicted of a new crime. That process is described in section II d on page 8. Just under half of all felony intakes are defined as *new*.

We begin by analyzing arrest rates by birth cohort and crime type. [5] In Oregon, arrest rate changes have followed consistent trends. For example, Oregon's adult arrest rate increased nearly every year between 1985 and 1995, and it fell nearly every year from 1996 to 2002.[6]

Behind the overall trend, there is little variation in the relative contribution of age groups and genders.[7] The arrest rate increases rapidly in the teenage years, then declines slowly beginning in the early to mid-twenties. The arrest rate for males is higher than for females.

Although the *relative* contribution of an age group to the overall arrest rate in a given year varies little, the arrest rate by age group does vary over time. The arrest rate by age for different birth cohorts varies even more. Figure 1 compares the arrest rate by age group for violent crime in Oregon for 1985 and 1990. Figure 2 compares two birth cohorts, 1964 and 1969, which were aged 21 in 1985 and 1990, respectively.

Figure 1 shows two arrest rate curves that follow the same pattern, but the 1990 violent crime arrest rate was higher than the 1985 rate for nearly all age groups. Figure 2 reveals marked differences in the arrest rate patterns of Oregonians born in 1964 versus 1969. The 1969 cohort followed a more classic pattern, with the arrest rate peaking at age 21 and slowly declining thereafter. The 1964 cohort did not peak until age 25, and the rate of decline has been slower. The individual differences between cohorts in terms of arrest rate and overall size are taken into account in the arrest forecast that underlies the corrections forecast.

[5] "Crime type" means person, property, or behavioral crime. The intake forecast covers all person and property crimes and the behavioral crimes of drug and weapons offenses.

[6] *Report of Criminal Offenses and Arrests*, Law Enforcement Data System, 1985 through 2002. Rate is per 100,000 population. Population estimates provided by the Oregon Population Research Center.

[7] Gottfredson, Michael R. and Hirschi, Travis, *A General Theory of Crime*, Stanford, CA: Stanford University Press, 1990, pp. 124-149.

Figure 1: Arrest Rate by Age Group for Violent Crime – 1985 vs. 1990

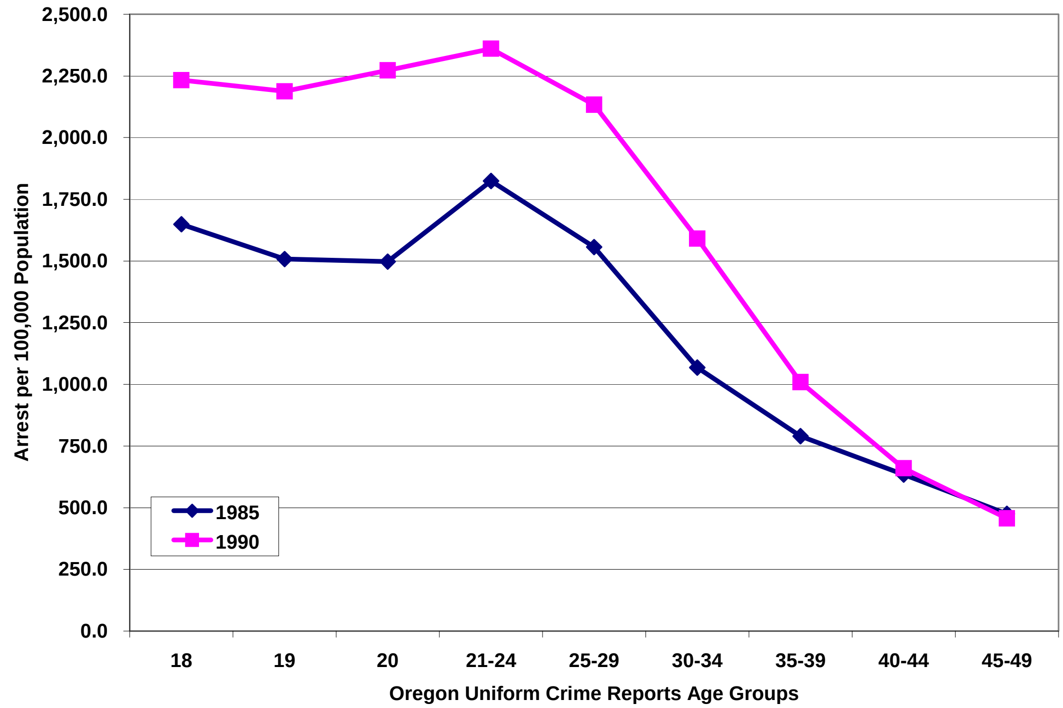
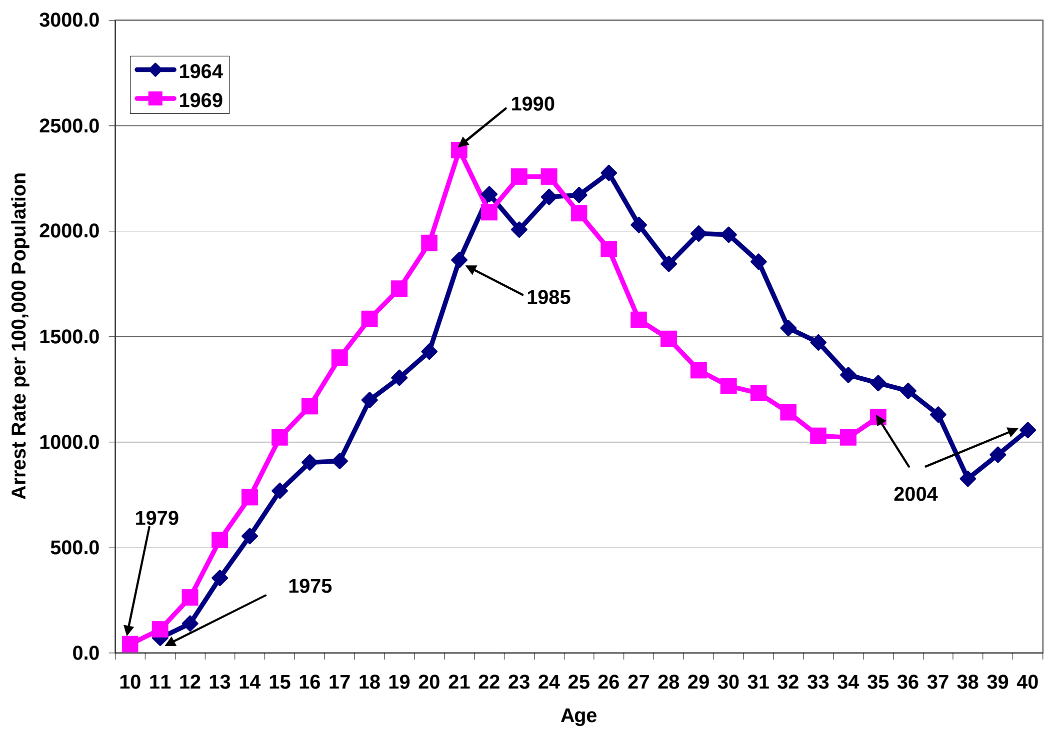


Figure 2: Violent Crime Rate for Birth Cohorts 1964 and 1969



We begin with age group divisions based on LEDS arrest data. The groups we use are 18 to 24 years old by individual age group and 5-year age cohorts between 25 and 49. Fewer than 3 percent of *new* offenders are older than 49 at intake.

1. We separate arrest data by age group and then by crime type. For each group, we disaggregate the age groups in to individual age cohorts using the Karup-King method.[8] Age cohorts are rearranged into birth year cohorts.

2. The average arrest rate by year of age and crime type for the last 20 years is calculated. Each cohort's historical arrest rates are compared to the average rates. An index for that cohort is created. To forecast arrest rate for a cohort, the index is applied to the average rate for ages the cohort has not yet reached. The result is forecast of arrest the cohort's arrest rate through age 49. The forecast rate is applied to an independent forecast of population by single age. The result is a forecast of arrests by crime type for the cohort through age 49.

3. Future arrest rates for cohorts that are younger than 18 years old at the beginning of the forecast are developed using a different method. Arrest rates for juveniles are used to develop a forecast of demand for youth correctional services. This arrest rate method is described in another methodology review. [9]

4. Cohorts are re-combined into the standard LEDS age groups. We analyze the historical disposition rate by age group and crime type. [10] In Oregon's criminal justice system, the disposition rate varies among age groups as well as crime types. For example, a 30 year-old convicted of a property crime is more likely to receive prison over probation than an 18 year-old. This is because the 30 year-old is more likely to have a criminal history, which increases the penalty under Sentencing Guidelines The disposition rate is the ratio of intakes to arrests:

   $DR_{\,at\,x} = NI_{\,at\,x} / NA_{\,at\,x-1}$

   Where:

   DR = disposition rate
   NI = number of intakes to the disposition
   NA = number of arrests
   a = age group
   t = crime type
   x = a given year

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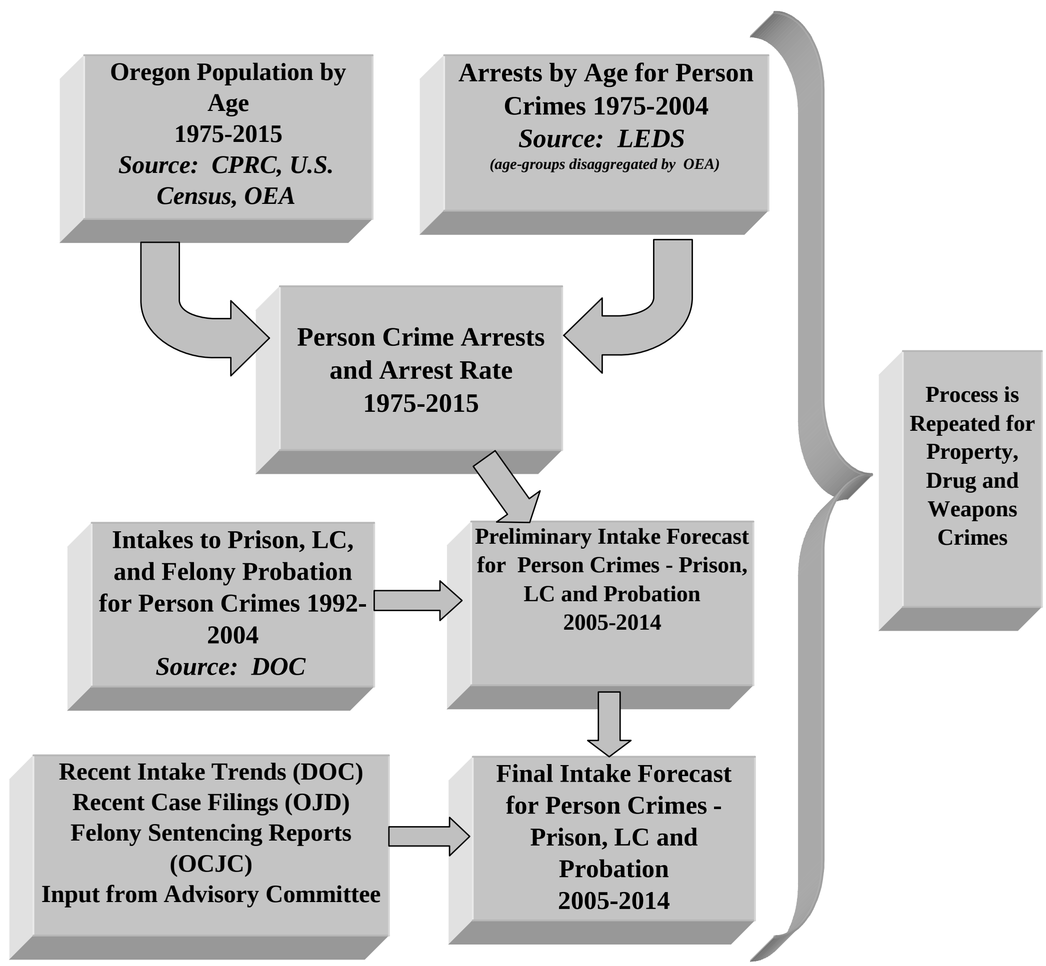
[8] *The Methods and Materials of Demography*, Shryock, Henry S, Siegel, Jacob S, et al. Condensed edition, Stockwell, Edward G., ed. Academic Press Inc, Orlando, FL 1976. p 534.

[9] Oregon Youth Authority Close Custody Demand Forecast, Biennial Review of Methodology, May 2004. http://www.oea.das.state.or.us/DAS/OEA/docs/oya/oyamethod.pdf

[10] Disposition means the division between prison, felony probation, and local control.

We use a one-year lag between arrests and intakes. The choice of lag is limited because LEDS arrest data by age group are available only on an annual basis.

Figure 3: Forecasting Process for New Intakes



4. We choose a future disposition rate or rates. The rates we choose are nearly always from the latest historical data. The rate is applied to the forecast of arrests by crime type and age group developed in Steps 1 - 3. The result is a preliminary forecast of *new* intakes to prison, felony probation, and local control for the next decade. The forecast is expressed as the number of intakes and as an annual growth rate.

5. We adjust the preliminary intake forecast using recent DOC intake trends, recent arrest data, recent court case filings, and Advisory Committee opinion. Intakes and related court case filings are analyzed with Vector Autregression (VAR).[11] There is typically a 3 to 6 month lag

[11] Enders, Walter, *Applied Econometric Time Series*, Hoboken, NJ: John Wiley & Sons, Inc., 2004, pp. 264-269.

between the case filing and felony intake. The VAR analysis is useful for projecting intakes during the first year of the forecast.

d. INTAKE GROWTH - COMMUNITY SUPERVISION FAILURES

Prison and LC intakes also result from failures of probation, parole, or PPS. A *failure* is either a technical revocation of a community supervision sentence, or the receipt of a new conviction while serving a community supervision sentence.

By studying historical data, we can estimate the rate at which offenders fail their supervision during each month after being placed on supervision. This *failure rate* tends to peak during the first year, and then gradually decline. This type of intake can be forecast by applying failure rates to a forecast of probation intakes and to a forecast of prison and LC releases.

Probation Revocations

In SPSS, we extract a file of all felony probation intakes and releases. Then we search prison and local control intakes and flag the offenders who moved from active probation supervision to incarceration. This movement is called the *critical event.* Probation cases ending with the critical event receive an event flag of 1; all others are flagged as 0.

We compute the variable *t*, which is a measure of time:

- Open probation cases: $t = T - t_o$(event flag=0)
- Probation cases closed for reason other than incarceration: $t = t_c - t_o$(event flag=0)
- Probation cases closed by incarceration: $t = t_f - t_o$(event flag=1)

where

- t_o=date of probation intake
- t_f=date of incarceration
- t_c=date of probation release
- T=end of observation period

The probability of failure is calculated with the following SPSS syntax:

```
SURVIVAL
  TABLE=t
  /INTERVAL=THRU 9999 BY 1
  /STATUS=event(1)
  /PRINT=TABLE .
```

This returns the probability of probation failure in each month after intake to probation. The output is similar to Table 1, below. The array in column C is the probability of failing probation in each month after intake. We call the array the *probation failure profile*.

The probability of failing during any given month after intake has changed over time as probation officers follow evolving supervision policies. We develop profiles based on several periods and apply them to historical probation intakes. We choose a profile that accurately predicts probation failures for the latest 6 to 12 months. The profile we choose is applied to the forecast of felony probation intakes that we developed in section II C, pages 4 through 8.

Table 1: Sample Probation Failure Probability Data

This subfile contains:	12530 observations						
Life	Table						
Survival	Variable		NEWLOS				
			A	B	C=B/A		E
Intrvl Start Time	Number Entrng this Intrvl	Number Wdrawn During Intrvl	Number Exposd to Risk	Number of Termnl Events	Propn Termi-nating	Propn Sur-viving	Cumul Propn Surv at End
------	------	------	------	------	------	------	------
0	12377	152	12301	238	0.02	0.98	0.98
1	11987	117	11928.5	95	0.01	0.99	0.97
2	11775	132	11709	120	0.01	0.99	0.96
3	11523	109	11468.5	146	0.01	0.99	0.95
4	11268	131	11202.5	156	0.01	0.99	0.94
5	10981	118	10922	168	0.02	0.98	0.92
6	10695	117	10636.5	173	0.02	0.98	0.91
7	10405	95	10357.5	143	0.01	0.99	0.90
8	10167	151	10091.5	171	0.02	0.98	0.88
9	9845	115	9787.5	163	0.02	0.98	0.87
10	9567	99	9517.5	166	0.02	0.98	0.85
11	9302	125	9239.5	177	0.02	0.98	0.83
12	9000	132	8934	168	0.02	0.98	0.82

Figure 4 shows a sample portion of the worksheet that computes probation revocation intakes to prison and Local Control. Probation intakes in column H are multiplied by the corresponding failure probability in row 4. Row 4 is based on an array that would come from column C in Table 1, the probability of failure (terminating).

Figure 4: Probation Revocation Worksheet

		PROBATION REVOCATIONS									
								COL I	COL J	COL K	
			COL D				COL H	Probability of Failure			
					ROW 4			0.54%	0.91%	1.25%	1.30%
Actual Revocations		Forecast revocations					Probation	Months Since Admission			
during month		during month...			Month		Admits	0	1	2	3
	344	Oct-03	310		Oct-03		1005	5	7	11	10
	272	Nov-03	310		Nov-03	h	819	4	9	10	11
	321	Dec-03	309		Dec-03	i	875	5	7	13	11
	267	Jan-04	309		Jan-04	s	883	5	8	10	13
	317	Feb-04	308		Feb-04	t	974	5	8	11	11
	356	Mar-04	309		Mar-04	o	1054	6	9	11	11
	374	Apr-04	311		Apr-04	r	952	5	10	12	11
	313	May-04	312		May-04	i	858	5	9	13	13
	346	Jun-04	313		Jun-04	c	950	5	8	12	14
	316	Jul-04	314		Jul-04	a	859	5	9	11	12
	293	Aug-04	314		Aug-04	l	938	5	8	12	11
	301	Sep-04	314		Sep-04		888	5	9	11	12
		Oct-04	**314**		**Oct-04**		943	5	8	12	11
APR 02 to Pres.		Nov-04	315		Nov-04		865	5	9	11	12
actual	**3820**	Dec-04	315		Dec-04	f	843	5	8	12	12
forecast	**3731**	Jan-05	315		Jan-05	o	921	5	8	11	12
-89	**-2.3%**	Feb-05	315		Feb-05	r	902	5	8	11	11
Forecast Prob Intakes		Mar-05	315		Mar-05	e	1024	6	8	12	11
		Apr-05	316		Apr-05	c	944	5	9	11	12
		May-05	317		May-05	a	1009	5	9	13	12
		Jun-05	319		Jun-05	s	959	5	9	12	13
		Jul-05	320		Jul-05	t	901	5	9	13	12
					From New Intake Forecast						
					(Section III c, above)						

In Figure 4, the number of failures is shown in the columns to the right of column H. The number in row x, column H is multiplied by the number in column I of row 4. The product appears in column I, row x. The number in row x, column H is multiplied by the number in row 4 column J. The product appears in column J of row x+1. This process continues as the number in a given row *x* in column H is multiplied by each variable in row 4, and the products appear diagonally across the table.

For example, of the 943 offenders placed on probation during October 2004, we expect 5 to be revoked in October, 9 in November, 12 in December, and so on. Column D sums of the failures for the corresponding row (x-1).[12] The 315 revocations expected in November 2004 are based on offenders placed on probation in October 2004, September 2004, and so on for the preceding several years.

Column C in Table 1 is based on a declining denominator. The workbook in Figure 2 uses a fixed denominator (column H). To remedy this, the initial array in column C, Table 1 is multiplied by column E in Table 1. Column E is the percentage of the original intake cohort that remains in the risk pool. The number in row *x* of column C, Table 1 is multiplied by the number in row *x-1* in column E, Table 1. The resulting array would appear in Row 4 of Figure 2.
Column D in Figure 2 shows the total number of revocations. Total revocations are divided between prison and LC using current disposition patterns.

Parole/Post-Prison Supervision Revocations

Offenders who fail Pa/PPS are returned Local Control or prison. Prison and LC intakes originating from the Pa/PPS caseload are forecast in the same manner as probation revocations.

When inmates are released from prison or LC, they normally enter the Pa/PPS caseload. In SPSS, we extract a file of all prison and LC releases. Then we search prison and LC intakes and flag the offenders who move from active Pa/PP supervision back to incarceration. This movement is called the *critical event.* Cases ending with the critical event receive an event flag of 1; all others are flagged as 0.

We compute the variable *t*, which is a measure of time:

- Open supervision cases: $t = T - t_o$ (event flag=0)
- Supervision cases closed for reason other than incarceration: $t = t_c - t_o$ (event flag=0)
- Supervision cases closed for incarceration: (event flag=1)

$$t = t_f - t_o$$

where

- t_o=date of initial release
- t_f=date of next incarceration
- t_c=date of supervision release
- T=end of observation period

[12] Failures lagged by one month to avoid a circular reference error in the model.

The probability of failure is developed and tested in the same manner as for probation failures. The final profile is applied to the monthly prison and LC releases that are generated by the model. Releases are lagged by one month to avoid a circular reference error in the model.

e. INTAKES TO PAROLE AND POST-PRISON SUPERVISION

Intakes to the Pa/PPS caseload are based on historical and forecast releases from prison and LC. For example, Measure 11 prison releases become parole/PPS intakes with a person crime conviction, and repeat property offender prison releases become parole/PPS intakes with a property crime conviction.

The intake categories for parole/PPS are based on whether the offender was released from prison or LC, and within those divisions, the crime type of conviction. The various intake categories are necessary because they receive significantly different terms of post-prison supervision under Sentencing Guidelines.

f. RELEASES - LENGTH OF STAY

Prison

Oregon prison inmates' projected lengths of stay (LOS) are known with reasonable certainty. They serve the imposed sentence with credit for time already served. Some receive up to 20 percent credit for good behavior (ETC). The DOC computes a projected release date, which includes an estimate of total ETC. LOS is expressed in months and is the difference between the date of intake and the projected release date.

The prison population forecast begins with the on-hand or *stock* population as of the beginning date of the forecast. The model releases the stock population according to the projected release date provided by DOC. April forecasts start with the stock population on January 1 of the current year. October forecasts start with the stock population on July 1 of the current year.

Projected release dates vary from actual release dates. The main cause is a difference between estimated and actual ETC. This can be a critical factor for accuracy in the first six months of the forecast. When we compare actual and projected release dates, we find systematic error for inmates with less than six months to serve. Stock releases for the first six months of the forecast are adjusted according to this error pattern.

To release future prison intakes, we divide them into the inmate groups discussed in section II B, pages 2 and 3. Under Sentencing Guidelines, prior criminal history can increase the sentence. Therefore, intakes are further divided into five groups according to community supervision status and whether the intake resulted from a new crime or a revocation.

Using SPSS, we compute a survival probability array using the "Survival – Life Tables" command syntax. A sample probability array is shown in Table 2. We use the array in Column G to release future intakes. Unless there is reason to do otherwise, the LOS for an inmate group is based on the last 24 months of intakes.

Community Supervision
For community supervision intakes, we know length of supervision (LOSu) only for those offenders who have been released. This is referred to as *indeterminate* sentencing. Offenders who have been released are flagged, and their actual LOSu is calculated. For offenders who haven't yet been released, LOSu equals the time served so far.

LOSu is developed separately for probation, Pa/PPS, and LC. Within these groups, the populations are further divided. Probation and Pa/PPS are divided according to the current crime type. LC intakes are divided according to whether the inmate came from probation, Pa/PPS, or directly from the Court.

In SPSS, we compute a survival probability curve using the "Survival – Life Tables" command syntax (page 8). The "Status" function is based on whether the offender has been released. We compute arrays based all intakes, the last 12 months, and on several recent years. These arrays are used to develop a length of supervision (LOSu) profile. The *cumulative survival probability*

Table 2: Sample Length of Stay Profile

This subfile contains 342 observations							
Life	Table						
Survival	Variable	NEWLOS					
	A	**B**	**C**	**D**	**E=D/C**	**F=1-E**	**G2=G1*F2**
	Number	Number	Number	Number			Cumul
Intrvl	Entrng	Wdrawn	Exposd	of	Propn	Propn	Propn
Start	this	During	to	Termnl	Termi-	Sur-	Surv
Time	Intrvl	Intrvl	Risk	Events	nating	viving	at End
------	------	------	------	------	------	------	------
0	342	0	342	1	0.0029	0.9971	0.9971
1	341	0	341	1	0.0029	0.9971	0.9942
2	340	0	340	0	0	1	0.9942
3	340	0	340	0	0	1	0.9942
4	340	0	340	4	0.0118	0.9882	0.9825
5	336	0	336	2	0.006	0.994	0.9766
6	334	0	334	1	0.003	0.997	0.9737
7	333	0	333	11	0.033	0.967	0.9415
8	322	0	322	17	0.0528	0.9472	0.8918
9	305	0	305	25	0.082	0.918	0.8187
10	280	0	280	29	0.1036	0.8964	0.7339

(column G, Table 2) is applied to monthly intakes. The *survival probability* (column F, Table 2) is applied to the current stock population. Table 2 shows that 98.25 percent of intakes will stay longer than four months, and 99.4 percent of those who stay longer than four months will stay longer than five months.

Developing a valid LOSu profile involves assembling LOSu data from several time periods and validating the results. First, we run simulations with the LOSu array and historical intakes, and then we compare the results with the current population. For example, historical intakes through December 2005 would be modeled with the test LOSu array. The resulting population as of January 1, 2006 should be very close to the actual population on January 1, 2006. Next, the actual population is arranged by time served to date. This is compared to the population resulting from historical intakes and the test LOSu array. The test population should be similarly *aged* in the system as the actual population.

Finally, the test LOSu array is combined with the intakes forecast in steps II c through e, above. Forecast releases are compared to recent historical releases. Any sudden change in forecast releases is analyzed to find its cause.

g. SEASONALITY AND MONTHLY GROWTH

Some correctional intakes are seasonal. For each *new* intake group forecast in section II C, we examine the last 5 years of monthly intakes. Intakes are analyzed for seasonality using the U.S. Census Bureau's X-12 method provided in EViews software.[13] If intakes are significantly seasonal, the forecast of annual intakes is converted to a monthly basis using the final seasonal factors generated by the X-12 method.

For *new* non-seasonal intakes, converting annual intakes to a monthly basis simply by dividing them by 12 can result in a sudden increase in the forecast population that is not likely to occur in the actual population. This is particularly troublesome in instances where strong annual growth is expected. Therefore, annual growth is gradually distributed over the year.

h. POPULATION

Intakes, the LOS profile, and seasonal indices are entered into the forecasting model. The model returns a population forecast for each month over the next decade. The forecast for each group begins with the group's starting, or *stock* population. Intakes are added and releases are subtracted from both intakes and the stock population.

[13] U. S. Department of Commerce, U. S. Census Bureau, X-12 Monthly Seasonal Adjustment Method, Release Version 0.2.7.

Population from Intakes

Figure 3 shows a sample portion of the intake forecasting model for RPO NCY intakes.[14] The full spreadsheet covers 120 months. Row 4 is the *cumulative probability of survival.* This is the array that would appear in Column G of the survival probability output for the population (Table 2, page 12). Annual Intakes in column B are not seasonal, so they are distributed over the year in column I. If they were seasonal, the annual intakes in column B would be multiplied by seasonal factors in column H and the product would appear in column I. The numbers in column I are summed in column F to check them against column B. If this were a new law, the beginning date would be entered in cell i-1. Zeroes would appear in column I up to the beginning date.

Figure 3: Sample of Population Forecasting Model

		Population			Month to Begin Admits			←	cell i-1	Continues 120 months →			
	COL B	rpo ncy	COL D	COL E	COL F		COL H	COL I	COL J	COL K			
									Cumulative Survival Rate				
Annual Intakes							ROW 4 →		99.7%	99.5%	99.2%	98.9%	98.6%
2004	487	Population as of		Monthly	Annual	Monthly	Seasonal	Monthly	Months Since Admission				
2005	585	First Day of Month		Releases	Admissions	Admits	Factors	Admissions	0	1	2	3	4
2006	621	Feb-05	40	0	566	Jan-05	100.0%	41	40				
2007	630	Mar-05	82	0		Feb-05	100.0%	42	42	40			
2008	640	Apr-05	126	0		Mar-05	100.0%	44	44	42	40		
2009	651	May-05	171	0		Apr-05	100.0%	45	45	44	42	40	
2010	657	Jun-05	217	1		May-05	100.0%	47	47	45	44	42	40
2011	663	Jul-05	265	1		Jun-05	100.0%	49	49	47	45	43	42
2012	668	Aug-05	312	2		Jul-05	100.0%	49	49	48	47	45	43
2013	674	Sep-05	359	2		Aug-05	100.0%	49	49	49	48	47	45
2014	681	Oct-05	402	7		Sep-05	100.0%	49	49	49	49	48	46
		Nov-05	438	13		Oct-05	100.0%	50	50	49	49	48	48
		Dec-05	468	20		Nov-05	100.0%	50	50	49	49	49	48
		Jan-06	494	24		Dec-05	100.0%	50	50	50	49	49	49
		Feb-06	518	27	618	Jan-06	100.0%	50	50	50	50	49	49

The number in row *x*, column I is multiplied by the number in column J of row 4. The product appears in column J, row *x*. The number in row *x*, column I is multiplied by the number in row 4 column K. The product appears in column K of row *x*+1. This process continues as the number in a given row *x* in column I is multiplied by each variable in row 4, and the products appear diagonally across the table. Column D, the population in month *x*, is the sum of row x. Monthly releases in column E are the difference between the sum of row *x* and the sum of row *x-1*. The releases in column E are linked to the forecast of intakes to the Pa/PPS caseload.

Stock Population

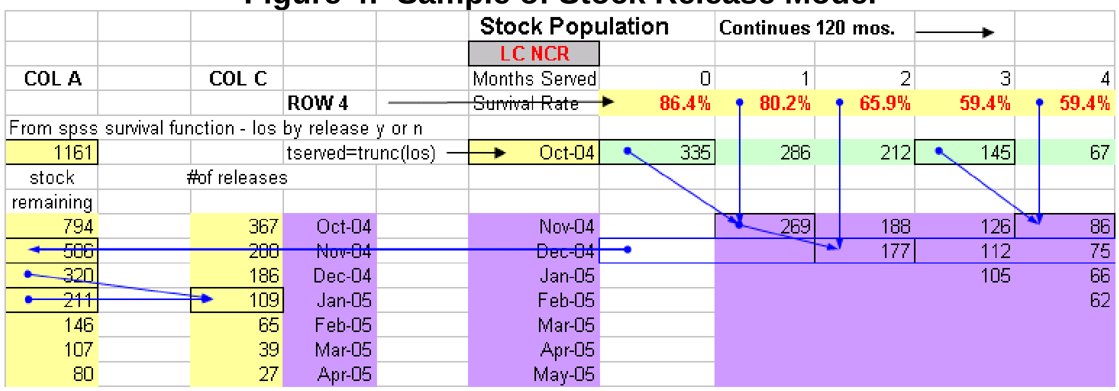
As mentioned above, the beginning stock population for prison is released according to a projected release date. LC, sanctions, probation, and Pa/PPS offenders don't have projected release dates; they serve *indeterminate* sentences (see *Community Supervision*, page 12). The method for releasing the stock population of offenders serving indeterminate sentences is shown in Figure 4, below.

The model begins with a *time served* cohort. In Figure 4, the stock population of 1,161 is arranged along the "Oct-04" row according to truncated time served in months. In the example, 335 offenders have served less than one month. Row 4 is the *survival rate.* This is the array that would appear in Column F of the survival probability output for the population (Table 2). We multiply the "month 0" cohort by its survival rate (80.2%) to obtain the number that will remain in stock as of November 1. The 269 remaining on November 1 are multiplied by the next

[14] Repeat Property Offenders who were not on community supervision prior to prison intake (*new).*

survival rate (65.9%) to obtain the number that will remain on December 1 (177). The 145 inmates who have survived 3 months are multiplied by the month 4 survival rate (59.4%) to obtain the number who will survive 4 months (86).

Figure 4: Sample of Stock Release Model



The total stock remaining in a given month *x* is shown in column A and is the sum of row *x*. Releases are shown in column C and are the difference between row *x-1* and row *x*. The releases in column C are linked to the forecast of intakes to the Pa/PPS caseload.

Alternative Incarceration Programs

DOC offers Alternative Incarceration Programs (AIPs) to qualified inmates. These are strict, structured programs of at least 270 days. Inmates who successfully complete a program and transition to the community save an average of 10.4 months from their prison sentence. However, the savings is not reflected in inmates' records until after they have been released. Therefore, the forecast needs to be adjusted for the effects of the AIPs. Adjustments are made for the program *stock* population and for inmates that will enter the programs in the future.

For the latter group, we calculate the monthly population of *successful* participants with their actual length of stay, then again with time they would have served in the absence of the program. The monthly population of the former is subtracted from the latter. The difference is subtracted from the total monthly prison population forecast.

For inmates in the programs as of the beginning date of the forecast, we need to adjust for those who will successfully complete and those who will not. At any point in time, the programs contain inmates who will successfully complete the programs and earn time off their original sentence, and inmates who will fail the program and finish their original sentences. In other words, the LOS for these inmates is *indeterminate.* The same method is used to release the AIP stock as is used to release other indeterminate populations (see Figure 4). The main difference is that the beginning stock population is arranged in a spreadsheet by time served *in the program*, not time served in prison. LOS is the time elapsed between the date of entry into the AIP and the release date. The probability of survival based on that LOS (Table 2, Column F) is placed along Row 4 (Figure 4).

i. JUVENILES CONVICTED IN ADULT COURT

Juveniles aged 15 or older may be *waived* or *remanded* into the adult justice system. A waiver is a petition filed with the Court. If the Court grants the waiver, the juvenile offender is prosecuted as an adult. Waiver is automatic for juveniles charged with Measure 11 crimes.

These inmates are in the legal custody of the DOC, but Oregon law requires them to be sent initially to the Oregon Youth Authority (OYA). The law allows these inmates to stay at OYA until age 25. OYA may return anyone older than 15 to DOC if the inmate poses a discipline or security risk. Inmates in their early twenties sometimes choose to transfer to adult prison.

The total population of Adult Court juveniles must be divided between those housed at OYA and those housed at DOC. The total population is forecast using the methods described above for the prison population forecast. The OYA portion of the total population is forecast using methods that are detailed in another document.[15] The DOC portion is the difference between the total population and the OYA portion of the total.

III. Model Performance

The current model has been used since the April 2000 Forecast. Community corrections forecasts have been produced since April 2001. Tables 3 and 4 compare actual and forecast populations.

Table 3 shows the error in the last 12 prison population forecasts, plus two earlier forecasts that were used for biennial budgets. Error is shown for the entire life of the forecast, and for the 6 to 30 month window.[16]

Most early forecasts have trended lower than the actual population, and more recent forecasts have trended higher than the actual

Table 3: Prison Inmate Forecast Compared to Actual Population

Forecast Pulication Date	Forecast Start Date	Forecast Age in Months	Average Error	Average Error 6 - 30 mos.
April-97	***1/1/1997***	***112***	***4.0%***	***0.1%***
April-99	***1/1/1999***	***88***	***0.8%***	***0.7%***
April-00	1/1/2000	76	-0.8%	-1.1%
October-00	7/1/2000	70	-1.5%	-0.4%
April-01	***1/1/2001***	***64***	***-3.1%***	***-2.3%***
October-01	7/1/2001	58	-3.8%	-3.4%
April-02	1/1/2002	52	-1.4%	-1.3%
October-02	7/1/2002	46	-1.1%	-1.4%
April-03	***1/1/2003***	***40***	***0.4%***	***0.1%***
October-03	7/1/2003	34	1.8%	1.9%
April-04	1/1/2004	28	2.1%	
October-04	7/1/2004	22	2.7%	
April-05	1/1/2005	16	1.5%	
October-05	7/1/2005	10	0.3%	

Rows in italic are forecasts actually used in biennial budgets.
Population at the first of each month is compared.
Positive error means the forecast was too high; negative error means the forecast was too low.

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[15] Oregon Youth Authority Close Custody Population Forecast Biennial Review of Methodology, Oregon Department of Administrative Services, Office of Economic Analysis, May 2004.

[16] The 6 to 30-month range is critical because the State of Oregon's biennial budget for Corrections is based on the April forecast in odd-numbered years. The forecast will be 6 months old at the start of the biennium and 30 months old at the end of the biennium. For community corrections forecasts, the critical forecast period is from 9 to 33 months.

population. Eight of the 14 are within 1.5 percent of the actual average monthly population. Ten forecasts are 30 or more months old. Seven of those had average error within 1.5 percent between 6 and 30 months.

Table 4: Community Corrections Forecast Compared to Actual Caseload

Forecast Pulication Date	Forecast Start Date	Forecast Age in Months	Average Error	Average Error 9 - 33 mos.
April-01	***10/1/2000***	***62***	***3.3%***	***1.4%***
October-01	4/1/2001	56	2.0%	1.8%
April-02	10/1/2001	50	3.8%	4.9%
October-02	4/1/2002	44	2.0%	3.3%
April-03	***10/1/2002***	***38***	***1.1%***	***2.0%***
October-03	4/1/2003	32	-0.6%	
April-04	10/1/2003	26	-2.9%	
October-04	4/1/2004	20	-2.7%	
April-05	10/1/2004	14	-1.9%	
October-05	4/1/2005	8	-0.9%	

Rows in italic are forecasts actually used in biennial budgets.
Caseload at the first of each month is compared.
Positive error means the forecast was too high; negative error means the forecast was too low.

Table 4 shows the error in the last 10 community corrections forecasts. Six of the 10 have average forecast error within two percent Three of the 5 forecasts aged 33 months or more are within two percent average error. The large positive errors in the 2002 forecasts were caused by budget cuts to the court system starting in March 2003. Class-C non-person felony cases were postponed until July 2003. Convictions for these kinds of cases typically result in a probation sentence. Postponing the cases caused the community corrections caseload to decline by 2 percent (800 cases) by mid-2003. These unusual circumstances should be kept in mind when evaluating community corrections model performance for the 2002 editions.

IV. Planned Improvements

During 2006 we will explore the feasibility of housing source data in MS Access rather than SPSS. Data are housed in SPSS because survival probability and other statistical tests are performed using that software. However, there are many more instances where data are tabulated from SPSS and pasted into Excel spreadsheets. There may be significant time savings realized if spreadsheets can be automatically updated from source data stored in Access.

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