

FROM PIMS TO DESIGN MATRIX FOR 2 AGE CLASSES AND 4 TIME PERIODS

EXAMPLE 1: Set up S(a) using design matrix

1. Set up PIMS for most general model

PIMS Adult				PIMS Juvenile			
1	2	3	4	5	2	3	4
	2	3	4		6	3	4
		3	4			7	4
			4				8

2. Set up decomposed equation

$$\text{logit}(S) = b_1 + b_2(\text{age})$$

3. Set up design matrix

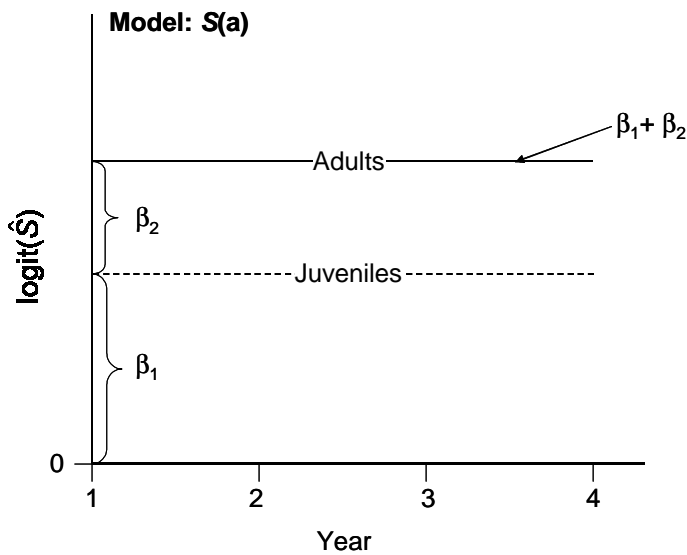
		PIM Parm		intercept age	
				β_1	β_2
Rows correspond to PIM numbers	Adults	1	S_{a1}	1	1
		2	S_{a2}	1	1
		3	S_{a3}	1	1
		4	S_{a4}	1	1
	Juveniles	5	S_{j1}	1	0
		6	S_{j2}	1	0
		7	S_{j3}	1	0
		8	S_{j4}	1	0

4. Check design matrix with equations

	$\text{logit}(S_{a1}) = b_1(1) + b_2(1)$	$\text{logit}(S_{a1}) = b_1 + b_2$
Adults	$\text{logit}(S_{a2}) = b_1(1) + b_2(1)$	$\text{logit}(S_{a2}) = b_1 + b_2$
	$\text{logit}(S_{a3}) = b_1(1) + b_2(1)$	$\text{logit}(S_{a3}) = b_1 + b_2$
	$\text{logit}(S_{a4}) = b_1(1) + b_2(1)$	$\text{logit}(S_{a4}) = b_1 + b_2$

	$\text{logit}(S_{j1}) = b_1(1) + b_2(0)$	$\text{logit}(S_{j1}) = b_1$
Juveniles	$\text{logit}(S_{j2}) = b_1(1) + b_2(0)$	$\text{logit}(S_{j2}) = b_1$
	$\text{logit}(S_{j3}) = b_1(1) + b_2(0)$	$\text{logit}(S_{j3}) = b_1$
	$\text{logit}(S_{j4}) = b_1(1) + b_2(0)$	$\text{logit}(S_{j4}) = b_1$

5. Draw a graph to fully illustrate the situation!



FROM PIMS TO DESIGN MATRIX FOR 2 AGE CLASSES AND A TREND OVER 4 TIME PERIODS

EXAMPLE 2: Set up S(a)+T using design matrix

1. Set up PIMS for most general model

PIMS Adult				PIMS Juvenile			
1	2	3	4	5	2	3	4
	2	3	4		6	3	4
		3	4			7	4
			4				8

2. Set up decomposed equation

$$\text{logit}(S) = b_1 + b_2(\text{age}) + b_3(\text{year})$$

3. Set up design matrix

PIM	Parm	intercept		
		age	year	
		β_1	β_2	β_3
Adults	1 S_{a1}	1	1	1
	2 S_{a2}	1	1	2
	3 S_{a3}	1	1	3
	4 S_{a4}	1	1	4
Juveniles	5 S_{j1}	1	0	1
	6 S_{j2}	1	0	2
	7 S_{j3}	1	0	3
	8 S_{j4}	1	0	4

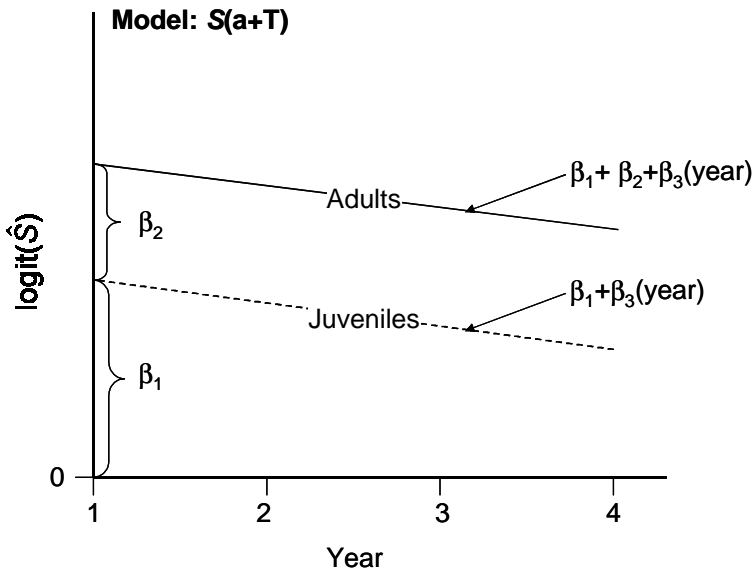
Rows correspond to PIM numbers

4. Check design matrix with equations

	$\text{logit}(S_{a1}) = b_1(1) + b_2(1) + b_3(1)$	$\text{logit}(S_{a1}) = b_1 + b_2 + b_3 \times 1$
Adults	$\text{logit}(S_{a2}) = b_1(1) + b_2(1) + b_3(2)$	$\text{logit}(S_{a2}) = b_1 + b_2 + b_3 \times 2$
	$\text{logit}(S_{a3}) = b_1(1) + b_2(1) + b_3(3)$	$\text{logit}(S_{a3}) = b_1 + b_2 + b_3 \times 3$
	$\text{logit}(S_{a4}) = b_1(1) + b_2(1) + b_3(4)$	$\text{logit}(S_{a4}) = b_1 + b_2 + b_3 \times 4$

	$\text{logit}(S_{j1}) = b_1(1) + b_2(0) + b_3(1)$	$\text{logit}(S_{j1}) = b_1 + b_3 \times 1$
Juveniles	$\text{logit}(S_{j2}) = b_1(1) + b_2(0) + b_3(2)$	$\text{logit}(S_{j2}) = b_1 + b_3 \times 2$
	$\text{logit}(S_{j3}) = b_1(1) + b_2(0) + b_3(3)$	$\text{logit}(S_{j3}) = b_1 + b_3 \times 3$
	$\text{logit}(S_{j4}) = b_1(1) + b_2(0) + b_3(4)$	$\text{logit}(S_{j4}) = b_1 + b_3 \times 4$

5. Draw a graph to fully illustrate the situation!



FROM PIMS TO DESIGN MATRIX FOR 2 AGE CLASSES AND A TREND OVER 4 TIME PERIODS

EXAMPLE 3: Set up $S(a^T)$ using design matrix

1. Set up PIMS for most general model

PIMS Adult				PIMS Juvenile			
1	2	3	4	5	2	3	4
	2	3	4		6	3	4
		3	4			7	4
			4				8

2. Set up decomposed equation

$$\text{logit}(S) = b_1 + b_2(\text{age}) + b_3(\text{year}) + b_4(\text{age} * \text{year})$$

3. Set up design matrix

	PIM	Parm	intercept	age	Year	age*year
			β_1	β_2	β_3	β_4
Adults	1	S_{a1}	1	1	1	1
	2	S_{a2}	1	1	2	2
	3	S_{a3}	1	1	3	3
	4	S_{a4}	1	1	4	4
Juveniles	5	S_{j1}	1	0	1	0
	6	S_{j2}	1	0	2	0
	7	S_{j3}	1	0	3	0
	8	S_{j4}	1	0	4	0

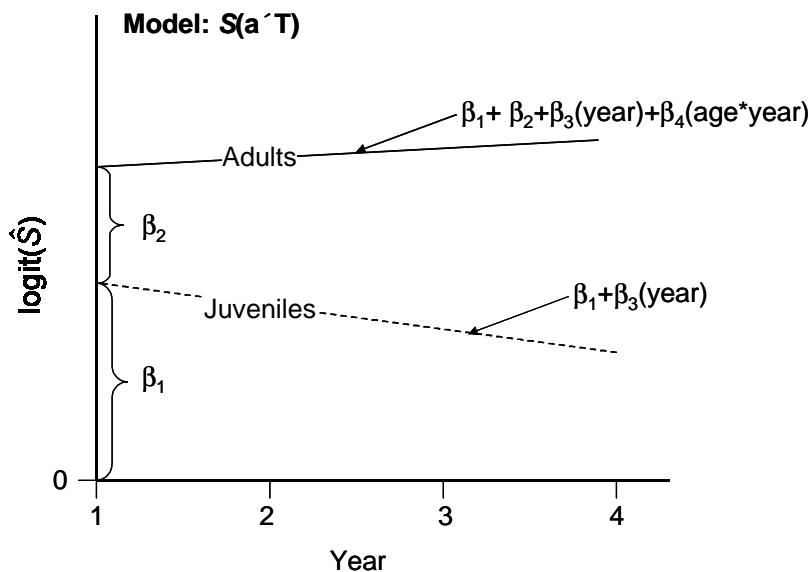
Rows correspond to PIM numbers

4. Check design matrix with equations

	$\text{logit}(S_{a1}) = b_1(1) + b_2(1) + b_3(1) + b_4(1)$	$\text{logit}(S_{a1}) = b_1 + b_2 + b_3 \times 1 + b_4 \times 1$
Adults	$\text{logit}(S_{a2}) = b_1(1) + b_2(1) + b_3(2) + b_4(2)$	$\text{logit}(S_{a2}) = b_1 + b_2 + b_3 \times 2 + b_4 \times 2$
	$\text{logit}(S_{a3}) = b_1(1) + b_2(1) + b_3(3) + b_4(3)$	$\text{logit}(S_{a3}) = b_1 + b_2 + b_3 \times 3 + b_4 \times 3$
	$\text{logit}(S_{a4}) = b_1(1) + b_2(1) + b_3(4) + b_4(4)$	$\text{logit}(S_{a4}) = b_1 + b_2 + b_3 \times 4 + b_4 \times 4$

	$\text{logit}(S_{j1}) = b_1(1) + b_2(0) + b_3(1) + b_4(0)$	$\text{logit}(S_{j1}) = b_1 + b_3 \times 1$
Juveniles	$\text{logit}(S_{j2}) = b_1(1) + b_2(0) + b_3(2) + b_4(0)$	$\text{logit}(S_{j2}) = b_1 + b_3 \times 2$
	$\text{logit}(S_{j3}) = b_1(1) + b_2(0) + b_3(3) + b_4(0)$	$\text{logit}(S_{j3}) = b_1 + b_3 \times 3$
	$\text{logit}(S_{j4}) = b_1(1) + b_2(0) + b_3(4) + b_4(0)$	$\text{logit}(S_{j4}) = b_1 + b_3 \times 4$

5. Draw a graph to fully illustrate the situation!



FROM PIMS TO DESIGN MATRIX FOR 2 AGE CLASSES AND 4 TIME PERIODS

EXAMPLE 4: Set up S(t) using design matrix

1. Set up PIMS for most general model

PIMS Adult				PIMS Juvenile			
1	2	3	4	5	2	3	4
	2	3	4		6	3	4
		3	4			7	4
			4				8

2. Set up decomposed equation

$$\text{logit}(S) = b_1 + b_2(t_1) + b_3(t_2) + b_4(t_3)$$

3. Set up design matrix

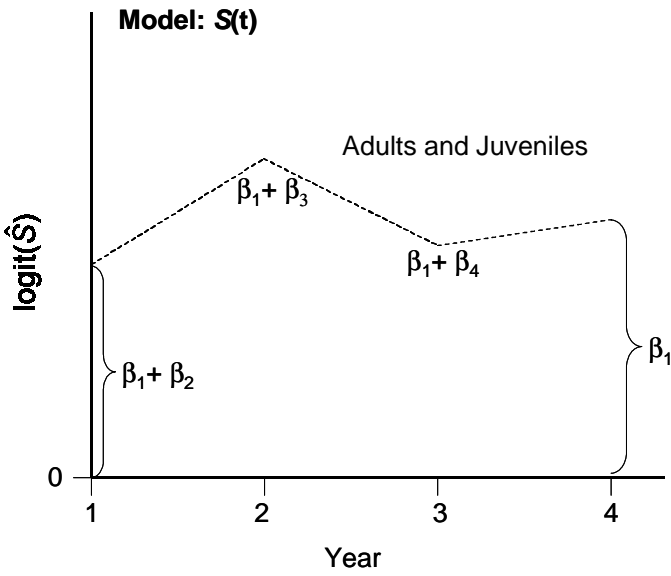
	PIM	Parm	intercept			
			β_1	β_2	β_3	β_4
Adults	1	S_{a1}	1	1	0	0
	2	S_{a2}	1	0	1	0
	3	S_{a3}	1	0	0	1
	4	S_{a4}	1	0	0	0
Juveniles	5	S_{j1}	1	1	0	0
	6	S_{j2}	1	0	1	0
	7	S_{j3}	1	0	0	1
	8	S_{j4}	1	0	0	0

Rows correspond to PIM numbers

4. Check design matrix with equations

	$\text{logit}(S_{a1}) = b_1(1) + b_2(1) + b_3(0) + b_4(0)$	$\text{logit}(S_{a1}) = b_1 + b_2$
Adults	$\text{logit}(S_{a2}) = b_1(1) + b_2(0) + b_3(1) + b_4(0)$	$\text{logit}(S_{a2}) = b_1 + b_3$
	$\text{logit}(S_{a3}) = b_1(1) + b_2(0) + b_3(0) + b_4(1)$	$\text{logit}(S_{a3}) = b_1 + b_4$
	$\text{logit}(S_{a4}) = b_1(1) + b_2(0) + b_3(0) + b_4(0)$	$\text{logit}(S_{a4}) = b_1$
<hr/>		
	$\text{logit}(S_{j1}) = b_1(1) + b_2(1) + b_3(0) + b_4(0)$	$\text{logit}(S_{j1}) = b_1 + b_2$
Juveniles	$\text{logit}(S_{j2}) = b_1(1) + b_2(0) + b_3(1) + b_4(0)$	$\text{logit}(S_{j2}) = b_1 + b_3$
	$\text{logit}(S_{j3}) = b_1(1) + b_2(0) + b_3(0) + b_4(1)$	$\text{logit}(S_{j3}) = b_1 + b_4$
	$\text{logit}(S_{j4}) = b_1(1) + b_2(0) + b_3(0) + b_4(0)$	$\text{logit}(S_{j4}) = b_1$

5. Draw a graph to fully illustrate the situation!



FROM PIMS TO DESIGN MATRIX FOR 2 AGE CLASSES AND 4 TIME PERIODS

EXAMPLE 5: Set up $S(a+t)$ using design matrix

1. Set up PIMS for most general model

PIMS Adult				PIMS Juvenile			
1	2	3	4	5	2	3	4
	2	3	4		6	3	4
		3	4			7	4
			4				8

2. Set up decomposed equation

$$\text{logit}(S) = b_1 + b_2(\text{age}) + b_3(t_1) + b_4(t_2) + b_5(t_3)$$

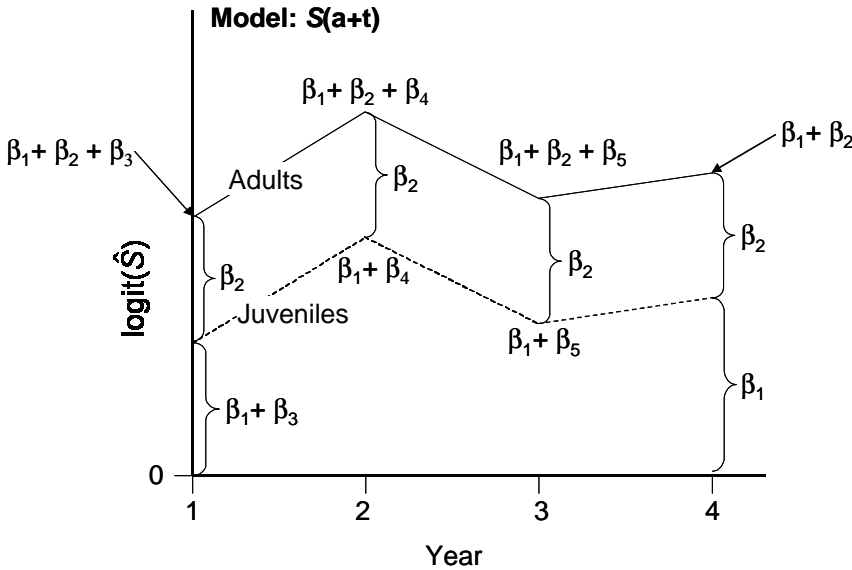
3. Set up design matrix

	PIM	Parm	intercept				
			age	t1	t2	t3	
			β_1	β_2	β_3	β_4	β_5
Adults	1	S_{a1}	1	1	1	0	0
	2	S_{a2}	1	1	0	1	0
	3	S_{a3}	1	1	0	0	1
	4	S_{a4}	1	1	0	0	0
Juveniles	5	S_{j1}	1	0	1	0	0
	6	S_{j2}	1	0	0	1	0
	7	S_{j3}	1	0	0	0	1
	8	S_{j4}	1	0	0	0	0

4. Check design matrix with equations

	$\text{logit}(S_{a1}) = b_1(1) + b_2(1) + b_3(1) + b_4(0) + b_5(0)$	$\text{logit}(S_{a1}) = b_1 + b_2 + b_3$
Adults	$\text{logit}(S_{a2}) = b_1(1) + b_2(1) + b_3(0) + b_4(1) + b_5(0)$	$\text{logit}(S_{a2}) = b_1 + b_2 + b_4$
	$\text{logit}(S_{a3}) = b_1(1) + b_2(1) + b_3(0) + b_4(0) + b_5(1)$	$\text{logit}(S_{a3}) = b_1 + b_2 + b_5$
	$\text{logit}(S_{a4}) = b_1(1) + b_2(1) + b_3(0) + b_4(0) + b_5(0)$	$\text{logit}(S_{a4}) = b_1 + b_2$
<hr/>		
	$\text{logit}(S_{j1}) = b_1(1) + b_2(0) + b_3(1) + b_4(0) + b_5(0)$	$\text{logit}(S_{j1}) = b_1 + b_3$
Juveniles	$\text{logit}(S_{j2}) = b_1(1) + b_2(0) + b_3(0) + b_4(1) + b_5(0)$	$\text{logit}(S_{j2}) = b_1 + b_4$
	$\text{logit}(S_{j3}) = b_1(1) + b_2(0) + b_3(0) + b_4(0) + b_5(1)$	$\text{logit}(S_{j3}) = b_1 + b_5$
	$\text{logit}(S_{j4}) = b_1(1) + b_2(0) + b_3(0) + b_4(0) + b_5(0)$	$\text{logit}(S_{j4}) = b_1$

5. Draw a graph to fully illustrate the situation!



FROM PIMS TO DESIGN MATRIX FOR 2 AGE CLASSES AND 4 TIME PERIODS
EXAMPLE 6: Set up $S(a^*t)$ using design matrix

1. Set up PIMS for most general model

PIMS Adult				PIMS Juvenile			
1	2	3	4	5	2	3	4
	2	3	4		6	3	4
		3	4			7	4
			4				8

2. Set up decomposed equation

$$\text{logit}(S) = b_1 + b_2(\text{age}) + b_3(t_1) + b_4(t_2) + b_5(t_3) + b_6(\text{age} * t_1) + b_7(\text{age} * t_2) + b_8(\text{age} * t_3)$$

3. Set up design matrix

				intercept	age	t_1	t_2	t_3	age*t1	age*t2	age*t3
		PIM	Param	β_1	β_2	β_3	β_4	β_5	β_6	β_7	β_8
Rows correspond to PIM numbers	Adults	1	S_{a1}	1	1	1	0	0	1	0	0
		2	S_{a2}	1	1	0	1	0	0	1	0
		3	S_{a3}	1	1	0	0	1	0	0	1
		4	S_{a4}	1	1	0	0	0	0	0	0
	Juveniles	5	S_{j1}	1	0	1	0	0	0	0	0
		6	S_{j2}	1	0	0	1	0	0	0	0
		7	S_{j3}	1	0	0	0	1	0	0	0
		8	S_{j4}	1	0	0	0	0	0	0	0

4. Check design matrix with equations

Adults

$$\begin{aligned} \text{logit}(S_{a1}) &= b_1(1) + b_2(1) + b_3(1) + b_4(0) + b_5(0) + b_6(1) + b_7(0) + b_8(0) \\ \text{logit}(S_{a2}) &= b_1(1) + b_2(1) + b_3(0) + b_4(1) + b_5(0) + b_6(0) + b_7(1) + b_8(0) \\ \text{logit}(S_{a3}) &= b_1(1) + b_2(1) + b_3(0) + b_4(0) + b_5(1) + b_6(0) + b_7(0) + b_8(1) \\ \text{logit}(S_{a4}) &= b_1(1) + b_2(1) + b_3(0) + b_4(0) + b_5(0) + b_6(0) + b_7(0) + b_8(0) \end{aligned}$$

$$\begin{aligned} \text{logit}(S_{a1}) &= b_1 + b_2 + b_3 + b_6 \\ \text{logit}(S_{a2}) &= b_1 + b_2 + b_4 + b_7 \\ \text{logit}(S_{a3}) &= b_1 + b_2 + b_5 + b_8 \\ \text{logit}(S_{a4}) &= b_1 + b_2 \end{aligned}$$

Juveniles

$$\begin{aligned} \text{logit}(S_{j1}) &= b_1(1) + b_2(0) + b_3(1) + b_4(0) + b_5(0) + b_6(0) + b_7(0) + b_8(0) \\ \text{logit}(S_{j2}) &= b_1(1) + b_2(0) + b_3(0) + b_4(1) + b_5(0) + b_6(0) + b_7(0) + b_8(0) \\ \text{logit}(S_{j3}) &= b_1(1) + b_2(0) + b_3(0) + b_4(0) + b_5(1) + b_6(0) + b_7(0) + b_8(0) \\ \text{logit}(S_{j4}) &= b_1(1) + b_2(0) + b_3(0) + b_4(0) + b_5(0) + b_6(0) + b_7(0) + b_8(0) \end{aligned}$$

$$\begin{aligned} \text{logit}(S_{j1}) &= b_1 + b_3 \\ \text{logit}(S_{j2}) &= b_1 + b_4 \\ \text{logit}(S_{j3}) &= b_1 + b_5 \\ \text{logit}(S_{j4}) &= b_1 \end{aligned}$$

5. Draw a graph to fully illustrate the situation!

