

Table S1 Demographic and clinical characteristics of the study cohort

Characteristics	Total	Training sets	Validation sets	P
Total	27593 (100)	19315 (70)	8278 (30)	
Age, years				0.913
<60	14906 (54.0)	10430 (54.0)	4476 (54.1)	
≥60	12687 (46.0)	8885 (46.0)	3802 (45.9)	
Race				0.160
White	20881 (75.7)	14631 (75.7)	6250 (75.5)	
Black/other <sup>†</sup>	6712 (24.3)	4684 (24.3)	2088 (25.2)	
Grade				0.892
G1	2469 (8.9)	1725 (8.9)	744 (9.0)	
G2	11374 (41.2)	7943 (41.1)	3431 (41.4)	
G3	13683 (49.6)	9598 (49.7)	4085 (49.3)	
G4	67 (0.2)	49 (0.3)	18 (0.2)	
T-stage				0.484
T1	1032 (3.7)	736 (3.8)	296 (3.6)	
T2	3032 (11.0)	2125 (11.0)	907 (11.0)	
T3	14996 (54.3)	10469 (54.2)	4527 (54.7)	
T4	8533 (30.9)	5985 (31.0)	2548 (30.8)	
N-stage				0.436
N0	7222 (26.2)	5021 (26.2)	2201 (26.6)	
N1	11843 (42.9)	8330 (43.1)	3513 (42.4)	
N2	4387 (15.9)	3044 (15.8)	1343 (16.2)	
N3	4141 (15.0)	2920 (15.1)	1221 (14.7)	
M-stage				0.741
M0	18814 (68.2)	13158 (68.1)	5656 (68.3)	
M1	8779 (31.8)	6157 (31.9)	2622 (31.7)	
Surgery				0.884
No/unknown	7275 (26.4)	5085 (26.3)	2190 (26.4)	
Partial mastectomy	3722 (13.5)	2618 (13.6)	1104 (13.3)	
Mastectomy	16595 (60.1)	11612 (60.1)	4984 (60.2)	
Chemotherapy				0.125
Yes	19452 (70.5)	13563 (70.2)	5889 (71.1)	
No/unknown	8141 (29.5)	5752 (29.8)	2389 (28.9)	
Radiation				0.135
Yes	13827 (50.1)	9622 (49.8)	4205 (50.8)	
No/unknown	13766 (49.9)	9693 (50.2)	4073 (49.2)	
Bone metastasis				0.956
Yes	5601 (20.3)	3919 (20.3)	1682 (20.3)	
No	21992 (79.7)	15396 (79.7)	6596 (79.7)	
Brain metastasis				0.572
Yes	567 (2.1)	403 (2.1)	164 (2.0)	
No	27026 (97.9)	18912 (97.9)	8114 (98.0)	
Visceral metastasis				0.329
Yes	4125 (14.9)	2861 (14.8)	1264 (15.3)	
No	23468 (85.1)	16454 (85.2)	7014 (84.7)	
ER status				0.664
Positive	20172 (73.1)	14135 (73.2)	6037 (72.9)	
Negative	7421 (26.9)	5180 (26.8)	2241 (27.1)	
PR status				0.528
Positive	16608 (60.2)	11602 (60.0)	5006 (60.5)	
Negative	10985 (39.8)	7713 (40.0)	3272 (39.5)	
HER2 status				0.199
Positive	6624 (24.0)	4595 (23.8)	2029 (24.5)	
Negative	20969 (76.0)	14720 (76.2)	6249 (75.5)	
Pathology				0.906
Invasive ductal carcinoma	19092 (69.2)	13376 (69.2)	5716 (69.0)	
Lobular carcinoma	3981 (14.4)	2775 (14.4)	1206 (14.6)	
Other <sup>‡</sup>	4520 (16.4)	3164 (16.4)	1356 (16.4)	

<sup>†</sup>, including American Indian/Alaskan native and Asian/Pacific Islander. <sup>‡</sup>, including mucous adenocarcinoma, inflammatory carcinogenesis, intracystic carcinoma, tubular adenocarcinoma, adenocarcinoma, etc.

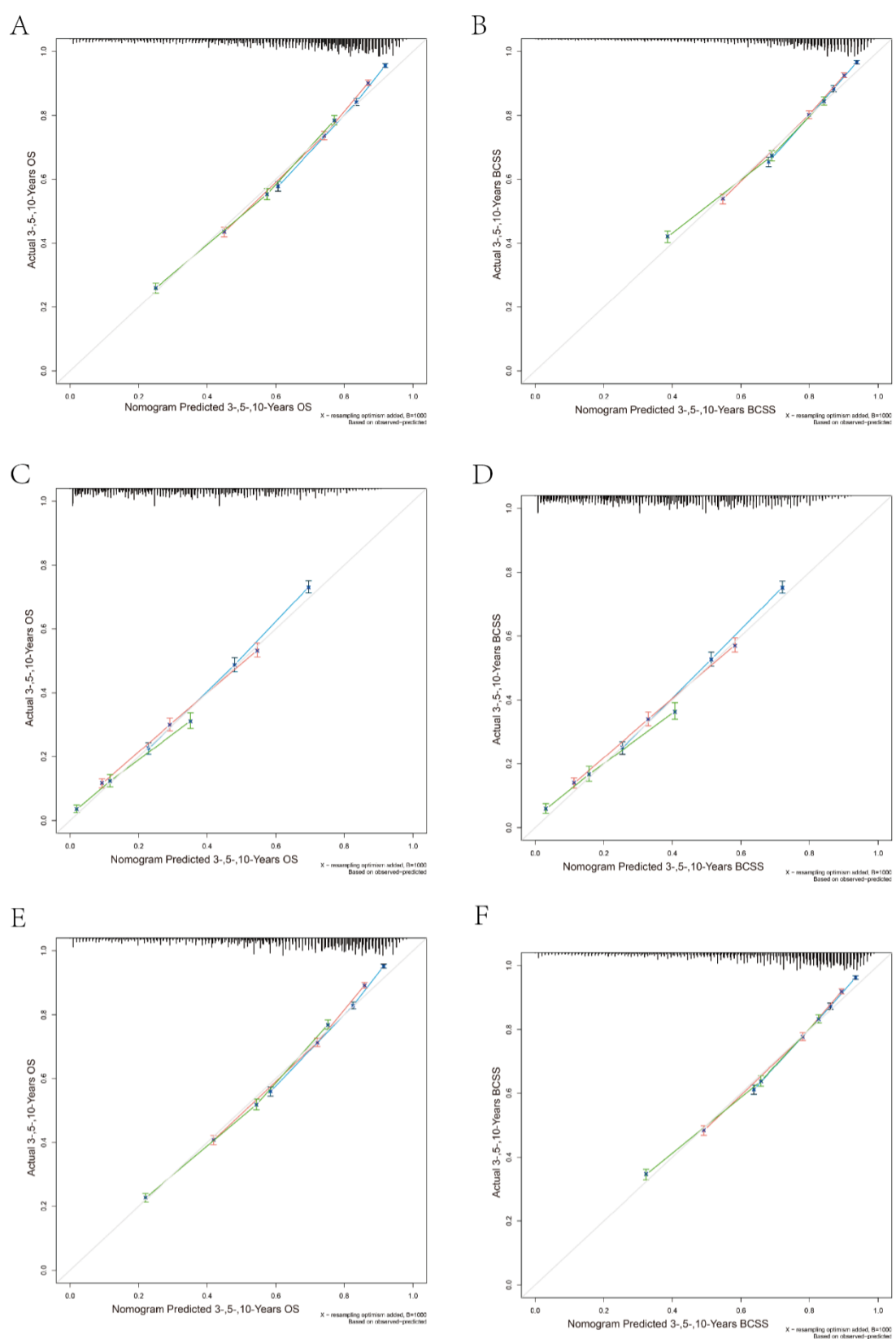
**Table S2** Univariate survival analysis for the surgery group

Characteristics	OS (months)			BCSS (months)		
	Mean	95% CI	P (log rank)	Mean	95% CI	P (log rank)
Age, years			<0.001			<0.001
<60	105	104.097–106.353		109	107.556–109.786	
≥60	84	82.172–84.868		100	98.676–101.495	
Race			<0.001			<0.001
White	97	96.191–98.192		107	105.767–107.745	
Black/other <sup>†</sup>	91	89.073–92.834		100	97.638–101.432	
Grade			<0.001			<0.001
G1	113	110.631–115.635		124	122.018–126.422	
G2	104	102.740–105.319		114	112.498–114.971	
G3	86	84.849–87.451		95	93.484–96.114	
G4	85	65.475–105.839		94	73.912–114.849	
T-stage			<0.001			<0.001
T1	82	76.068–88.483		88	81.438–94.248	
T2	72	68.183–74.828		76	72.962–79.921	
T3	106	104.879–106.956		115	113.568–115.557	
T4	79	77.349–80.822		90	89.073–92.741	
N-stage			<0.001			<0.001
N0	107	105.119–108.420		120	118.681–121.669	
N1	100	98.629–101.404		108	107.084–109.805	
N2	90	87.735–91.832		98	95.680–99.853	
N3	75	72.573–76.934		82	79.287–83.883	
M-stage			<0.001			<0.001
M0	102	101.203–103.081		112	111.482–113.290	
M1	66	63.988–68.114		71	69.086–73.460	
Surgery			<0.001			<0.001
No/unknown	–	–		–	–	
Partial mastectomy	99	96.970–101.077		110	107.645–111.633	
Mastectomy	95	94.023–95.983		104	103.085–105.041	
Chemotherapy			<0.001			<0.001
Yes	101	100.474–102.458		107	105.894–107.861	
No	78	76.663–80.256		99	97.351–101.199	
Radiation			<0.001			<0.001
Yes	103	102.946–104.110		110	108.757–110.886	
No	85	83.563–86.473		98	96.430–99.415	
Bone metastasis			<0.001			<0.001
Yes	67	64.022–69.319		71	68.161–73.744	
No	99	98.102–99.942		109	108.077–109.878	
Brain metastasis			<0.001			<0.001
Yes	31	22.701–39.725		33	23.845–41.720	
No	96	95.236–97.005		106	104.622–106.378	
Liver metastasis			<0.001			<0.001
Yes	55	50.444–59.870		58	53.349–63.219	
No	97	96.239–98.002		107	105.809–107.571	
Lung metastasis			<0.001			<0.001
Yes	53	48.774–56.789		58	54.031–62.831	
No	98	96.742–98.528		107	106.225–107.988	
ER status			<0.001			<0.001
Positive	101	99.924–101.885		115	113.781–115.700	
Negative	82	79.727–83.445		94	92.410–96.357	
PR status			<0.001			<0.001
Positive	104	102.753–104.857		117	116.207–118.233	
Negative	83	81.862–84.862		97	95.498–98.675	
HER2 status			<0.001			<0.001
Positive	104	102.964–105.525		114	112.600–116.189	
Negative	93	92.374–94.402		107	106.788–108.840	
Pathology			<0.001			<0.001
Other <sup>‡</sup>	96	93.567–97.863		107	104.786–109.031	
Invasive ductal carcinoma	93	92.040–94.248		102	100.880–103.093	
Lobular carcinoma	106	104.380–108.285		116	113.811–117.533	

<sup>†</sup>, including American Indian/Alaskan native and Asian/Pacific Islander. <sup>‡</sup>, including mucous adenocarcinoma, inflammatory carcinogenesis, intracystic carcinoma, tubular adenocarcinoma, adenocarcinoma, etc.

**Table S3** Multivariate survival analysis for the surgery group

Characteristics	OS		BCSS	
	HR (95% CI)	P (Cox)	HR (95% CI)	P (Cox)
Age, years	1.606 (1.523–1.694)	<0.001	1.255 (1.181–1.333)	<0.001
Race	1.162 (1.097–1.230)	<0.001	1.166 (1.092–1.245)	<0.001
Grade				
G1	Reference	<0.001	Reference	<0.001
G2	1.388 (1.248–1.549)	<0.001	1.543 (1.343–1.774)	<0.001
G3	1.932 (1.728–2.162)	<0.001	2.270 (1.968–2.618)	<0.001
G4	2.164 (1.265–3.701)	0.005	2.262 (1.230–4.161)	0.008
T-stage				
T1	Reference	<0.001	Reference	<0.001
T2	1.161 (0.980–1.376)	0.085	1.092 (0.910–1.309)	0.345
T3	1.043 (0.880–1.237)	0.624	0.972 (0.809–1.167)	0.759
T4	1.667 (1.409–1.972)	<0.001	1.475 (1.231–1.768)	<0.001
N-stage				
N0	Reference	<0.001	Reference	<0.001
N1	1.407 (1.311–1.511)	<0.001	1.655 (1.514–1.810)	<0.001
N2	1.883 (1.737–2.040)	<0.001	2.341 (2.122–2.581)	<0.001
N3	2.431 (2.244–2.634)	<0.001	3.119 (2.832–3.435)	<0.001
M-stage	1.506 (1.352–1.679)	<0.001	1.744 (1.553–1.959)	<0.001
Surgery				
No/unknown	–	–	–	–
Partial mastectomy	Reference		Reference	
Mastectomy	1.083 (1.011–1.161)	0.023	1.111 (1.024–1.205)	0.011
Chemotherapy	0.537 (0.505–0.570)	<0.001	0.695 (0.645–0.748)	<0.001
Radiation	0.761 (0.723–0.802)	<0.001	0.793 (0.746–0.842)	<0.001
Bone metastasis	1.281 (1.159–1.415)	<0.001	1.393 (1.254–1.549)	<0.001
Brain metastasis	2.888 (2.285–3.649)	<0.001	3.186 (2.427–3.923)	<0.001
Liver metastasis	1.814 (1.610–2.044)	<0.001	1.828 (1.614–2.069)	<0.001
Lung metastasis	1.263 (1.131–1.410)	<0.001	1.328 (1.181–1.493)	<0.001
ER status	0.813 (0.754–0.875)	<0.001	0.802 (0.738–0.872)	<0.001
PR status	0.656 (0.614–0.702)	<0.001	0.620 (0.574–0.670)	<0.001
HER2 status	0.576 (0.539–0.616)	<0.001	0.518 (0.480–0.559)	<0.001
Pathology				
Other	Reference	0.867	Reference	0.617
Invasive ductal carcinoma	0.986 (0.921–1.054)	0.674	1.012 (0.935–1.096)	0.760
Lobular carcinoma	0.976 (0.889–1.072)	0.617	1.056 (0.944–1.181)	0.340



**Figure S1** Calibration curves using bootstrap resampling. Calibration curves of OS (A) and BCSS (B) in the LABC group. Calibration curves of OS (C) and BCSS (D) in the MBC group. Calibration curves of OS (E) and BCSS (F) in the surgery group.