

Supplementary Table S1. Clinicopathological characteristics of the invasive breast cancer cohort

Variables	No (%)
Age at diagnosis	
<50	137 (29%)
≥50	342 (71%)
Menopausal status	
Premenopausal	156 (32%)
Post-menopausal	323 (68%)
Tumour size Groups	
≤ 2cm	289 (60%)
> 2cm	190(40%)
Grade	
Grade 1	84 (17%)
Grade 2	200 (42%)
Grade 3	195 (41%)
Tubule	
1	39 (8%)
2	135 (28%)
3	305 (64%)
Polymorphism	
1	7 (1%)
2	158 (33%)
3	314 (66%)
Mitosis	
1	259 (54%)
2	89 (19%)
3	131 (27%)
Histologic tumour types	
No Special Type (NST)	300 (62%)
Lobular	51 (11%)
Other special types	24 (5%)
NST mixed	104 (22%)
Lymphovascular invasion	
Absent	353 (74%)
Present	126 (26%)
Lymph node status	
Absent	309 (65%)
Present	170 (35%)
Nottingham prognostic index	
Good prognostic group	172 (36%)
Moderate prognostic group	239 (50%)
Poor prognostic group	68 (14%)
Ki67 expression	
Low ≤ 14%	201 (57%)
High>14%	152 (43%)
Molecular subtypes	
Luminal A	183 (45%)
Luminal B	141 (35%)
HER2 enriched.	21 (5%)

Triple negative	63 (15%)
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Supplementary Table S2. Clinicopathological characteristics of the DCIS cohort

Categories	Number (percentage)
Age	
<50	59 (28%)
≥50	158 (72%)
Tumour size	
≤2cm	88 (40%)
>2cm	129 (60%)
Tumour grade	
Low grade	29 (13%)
Intermediate grade	63 (29%)
High grade	125 (58%)
Molecular subtype	
Luminal A	90 (55%)
Luminal B	30 (19%)
HER2+	27 (17%)
Triple Negative	15 (9%)
Comedo necrosis	
Negative	73 (34%)
Positive	144 (66%)
ER Status	
Negative	45 (24%)
Positive	139 (76%)
PR Status	
Negative	72 (39%)
Positive	114 (61%)
HER2 Status	
Negative	86 (80%)
Positive	21 (20%)
Recurrence	
No recurrence	194 (89%)
Recurrence	23 (11%)
Ki67 expression	
Low (≤14)	134 (75%)

High (>14)

45 (25%)

HER2, human epidermal growth factor receptor 2 Significant P values are in bold.

Supplementary Table S3. Relationship between cytoplasmic CDK2 and clinicopathological parameters in invasive breast cancer.

Variables	Cytoplasmic CDK2 expression		X ² P-value
	Negative /low H. score ≤70	Positive/ high H. score >70	
Age at diagnosis (years)			
<50	70 (51%)	67 (49%)	0.06
≥50	179 (52%)	163 (48%)	0.8
Menopausal state			
Premenopausal	80 (51%)	76 (49%)	0.04
Post-menopausal	169 (52%)	154 (48%)	0.83
Tumour size (cm)			
≤2	150 (52%)	139 (48%)	0.002
>2	99 (52%)	91 (48%)	0.96
Histologic tumour grade			
Grade 1	38 (45%)	46 (55%)	1.9
Grade 2	108 (54%)	92 (46%)	0.38
Grade 3	103 (53%)	92 (47%)	
Tubule formation			
1	20 (51%)	19 (49%)	2.3
2	63 (47%)	72 (53%)	0.3
3	166 (54%)	139 (46%)	
Polymorphism			
1	3 (43%)	4 (57%)	2.2
2	75 (47%)	83 (53%)	0.32
3	171 (54%)	143 (46%)	
Mitosis			
1	138 (53%)	121 (47%)	1.1
2	48 (54%)	41 (46%)	0.58
3	63 (48%)	68 (52%)	
Histologic tumour types			
No special type (NST)	148 (49%)	152 (51%)	
Lobular	33 (65%)	18 (35%)	4.3
Other special types	12 (50%)	12 (50%)	0.22
NST mixed	56 (54%)	48 (46%)	
Molecular subtypes			
Luminal A	94 (51%)	89 (49%)	0.7
Luminal B	74 (53%)	67 (47%)	0.87
HER2 enriched.	12 (57%)	9 (43%)	
Triple negative	30 (48%)	33 (52%)	
Lymph node invasion			
Absent	158 (51%)	151(49%)	0.25
Present	91 (54%)	79 (46%)	0.62
Lymphovascular invasion			
Absent	177 (51%)	176 (49%)	1.8
Present	72 (57%)	54 (43%)	0.1
Nottingham prognostic index			
Good prognostic group	86 (50%)	86 (50%)	2.2
Moderate prognostic group	122 (51%)	117 (49%)	0.32

Poor prognostic group	41 (60%)	27 (40%)	
Ki67 index			
Low $\leq 10\%$	103 (51%)	98 (49%)	0.1
High $>10\%$	75 (49%)	77 (51%)	0.7

Supplementary Table S4. Relationship between combination of nuclear (N)/ cytoplasmic (C) CDK2 co-expression and clinicopathological parameters in invasive breast cancer.

Categories	Negative N - negative C CDK2	Positive N - negative C CDK2	Positive N - positive C CDK2	Positive C – negative N CDK2	X ² <i>P</i> -value
Age					2.2
<50	34 (25%)	36 (26%)	38 (28%)	29 (21%)	0.51
≥50	104 (30%)	75 (22%)	85 (25%)	78 (23%)	
Menopausal status					0.5
Premenopausal	45 (29%)	35 (22%)	43 (28%)	33 (21%)	0.91
Post-menopausal	93 (28%)	76 (24%)	80 (25%)	74 (23%)	
Tumour size					5.7
≤ 2cm	92 (32%)	58 (20%)	72 (25%)	67 (23%)	0.12
> 2cm	46 (24%)	53 (28%)	51 (27%)	40 (21%)	
Tumour grade					
Grade 1	25 (30%)	13 (15%)	13 (16%)	33 (39%)	49.8
Grade 2	66 (33%)	42 (21%)	38 (19%)	54 (27%)	<0.0001
Grade 3	47 (24%)	56 (29%)	72 (37%)	20 (10%)	
Tubule					
1	14 (36%)	6 (15%)	4 (10%)	15 (39%)	18.214
2	32 (24%)	31 (23%)	33 (24%)	39 (29%)	0.006
3	92 (30%)	74 (24%)	86 (28%)	53 (18%)	

Polymorphism					
1	1 (13%)	2 (29%)	2 (29%)	2 (29%)	33.66
2	45 (29%)	30 (19%)	25 (16%)	58 (36%)	<0.0001
3	92 (29%)	79 (25%)	96 (31%)	47 (15%)	
Mitosis					
1	87 (33%)	51 (20%)	43 (17%)	78 (30%)	48.6
2	22 (25%)	26 (29%)	24 (27%)	17 (19%)	<0.0001
3	29 (22%)	34 (26%)	56 (43%)	12 (9%)	
Histologic types					
No special type (NST)	77 (26%)	71 (24%)	96 (32%)	56 (18%)	29.4
Lobular	17 (33%)	16 (31%)	6 (12%)	12 (24%)	
Other special types	5 (21%)	7 (29%)	2 (8%)	10 (42%)	
Mixed NST	39 (38%)	17 (16%)	19 (18%)	29 (28%)	
Molecular subtype					
Luminal A	59 (32%)	35 (19%)	33 (18%)	56 (31%)	27.7
Luminal B	38 (27%)	36 (26%)	41 (29%)	26 (18%)	0.001
HER2 +	6 (29%)	6 (29%)	7 (33%)	2 (9%)	
Triple negative	17 (27%)	13 (20%)	27 (43%)	6 (10%)	
Lymph node status					
Negative	97 (31%)	61 (20%)	77 (25%)	74 (24%)	7.6
Positive	41 (24%)	50 (29%)	46 (27%)	33 (20%)	0.05

Lymphovascular invasion					
Absent	102 (29%)	75 (21%)	85 (24%)	91 (26%)	10.6
Present	36 (29%)	36 (29%)	38 (30%)	16 (12%)	0.01
Nottingham Prognostic Index					
Good prognostic group	58 (34%)	28 (16%)	31 (18%)	55 (32%)	30.5
Moderate prognostic group	64 (27%)	58 (24%)	72 (30%)	45 (19%)	<0.0001
Poor prognostic group	16 (24%)	25 (37%)	20 (29%)	7 (10%)	
Ki67 expression					9.7
Low≤14	64 (32%)	39 (19%)	41 (20%)	57 (29%)	0.021
High>14	38 (25%)	37 (24%)	48 (32%)	29 (19%)	
HER2, human epidermal growth factor receptor 2 Significant P values are in bold.					

Supplementary Table S5. Relationship between combination of nuclear CDK2/P53 co-expression and clinicopathological parameters in invasive breast cancer.

	CDK2-/P53-	CDK2+/P53-	CDK2+ /P53+	CDK2-/P53+	X ²
Categories					P-value
Age					8.8
<50	42 (33%)	35 (28%)	32 (25%)	17 (14%)	0.03
≥50	111 (39%)	100 (35%)	40 (14%)	33 (12%)	
Menopausal status					2.7
Premenopausal	49 (35%)	42 (30%)	30 (22%)	18 (13%)	0.42
Post-menopausal	104 (39%)	93 (34%)	42 (15%)	32 (12%)	
Tumour size					4.6
≤ 2cm	96 (40%)	80 (33%)	35 (14%)	32 (13%)	0.2
> 2cm	57 (34%)	55 (33%)	37 (22%)	18 (11%)	
Tumour grade					
Grade 1	41 (59%)	17 (24%)	4 (6%)	8 (11%)	77.1
Grade 2	79 (48%)	58 (35%)	9 (6%)	18 (11%)	<0.0001
Grade 3	33 (19%)	60 (34%)	59 (34%)	24 (13%)	
Tubule					
1	21 (61%)	5 (15%)	3 (9%)	5 (15%)	28.4
2	50 (44%)	45 (40%)	9 (8%)	9 (8%)	<0.0001
3	82 (31%)	85 (32%)	60 (23%)	36 (14%)	
Polymorphism					

1	3 (43%)	4 (57%)	0 (0%)	0 (0%)	37.1
2	71 (55%)	37 (28%)	7 (5%)	15 (12%)	<0.0001
3	79 (29%)	94 (34%)	65 (24%)	35 (13%)	
Mitosis					
1	109 (52%)	66 (31%)	12 (6%)	24 (11%)	65.7
2	24 (31%)	26 (33%)	18 (23%)	10 (13%)	<0.0001
3	20 (16%)	43 (36%)	42 (35%)	16 (13%)	
Histologic types					
No special type (NST)	78 (30%)	91 (34%)	65 (24%)	32 (12%)	38.18
Lobular	21 (51%)	16 (39%)	2 (5%)	2 (5%)	
Other special types	10 (47%)	6 (29%)	1 (5%)	4 (19%)	
Mixed NST	44 (54%)	22 (27%)	4 (5%)	12 (14%)	
Molecular subtype					
Luminal A	79 (53%)	46 (31%)	10 (7%)	14 (9%)	64.8
Luminal B	40 (32%)	50 (40%)	21 (17%)	15 (11%)	<0.0001
Triple negative	11 (20%)	12 (21%)	24 (43%)	9 (16%)	
HER2 +	2 (11%)	4 (22%)	9 (50%)	3 (17%)	
Lymph node status					
Negative	108 (41%)	83 (32%)	38 (14%)	35 (13%)	7.9
Positive	45 (31%)	52 (36%)	34 (23%)	15 (10%)	0.04

Lymphovascular invasion					
Absent					8.39
Present	123 (42%)	90 (30%)	48 (16%)	37 (12%)	0.03
	30 (27%)	45 (40%)	24 (21%)	13 (12%)	
Nottingham Prognostic Index					
Good prognostic group					37.87
Moderate prognostic group	74 (52%)	41 (29%)	7 (5%)	20 (14%)	<0.0001
Poor prognostic group	67 (31%)	72 (35%)	47 (23%)	22 (11%)	
	12 (20%)	22 (37%)	18 (30%)	8 (13%)	
Ki67 expression					
Low≤14	81 (51%)	50 (31%)	15 (9%)	15 (9%)	22.1
High>14	40 (29%)	44 (32%)	37 (27%)	17 (12%)	<0.0001
HER2, human epidermal growth factor receptor 2 Significant P values are in bold.					

Supplementary Table S6. Clinicopathological significance of nuclear CDK2 and nuclear CDK4 co-expression in breast cancers.

	CDK2-/CDK4-	CDK2+/CDK4+	CDK2+/CDK4-	CDK2-/CDK4+	X2
					P-value
Tumour size					
≤ 2cm	50 (63%)	81 (56%)	38 (55%)	90 (65%)	3.46
> 2cm	29 (37%)	63 (44%)	31 (45%)	48 (35%)	0.326
Tumour grade					
Grade 1	9 (11%)	20 (14%)	4 (6%)	41 (30%)	60.21
Grade2	43 (55%)	58 (40%)	14 (20%)	63 (45%)	<0.0001
Grade 3	27 (34%)	66 (46%)	51 (74%)	34 (25%)	
Tubule formation					
1	6 (8%)	6 (4%)	3 (4%)	19 (14%)	18.86
2	21 (26%)	47 (33%)	12 (18%)	45 (33%)	0.004
3	52 (66%)	91 (63%)	54 (78%)	74 (53%)	
Pleomorphism					
1	0 (0%)	4 (3%)	0 (0%)	3 (2%)	42.80
2	21 (27%)	40 (28%)	8 (12%)	70 (51%)	<0.0001
3	58 (73%)	100 (69%)	61 (88%)	65 (47%)	
Mitosis					
1	45 (57%)	71 (49%)	14 (20%)	99 (72%)	52.29
2	16 (20%)	27 (19%)	20 (29%)	18 (13%)	<0.0001

3	18 (23%)	46 (32%)	35 (51%)	21 (15%)	
Histologic types					
No special type (NST)	55 (70%)	92 (64%)	60 (87%)	68 (49%)	35.25
Lobular	8 (10%)	17 (12%)	2 (3%)	14 (10%)	<0.0001
Other special types	5 (6%)	7 (5%)	1 (1%)	9 (7%)	
Mixed NST	11 (14%)	28 (19%)	6 (9%)	47 (34%)	
Lymph node status					
Absent	51 (65%)	82 (57%)	43 (62%)	99 (72%)	6.79
Present	28 (35%)	62 (43%)	26 (38%)	39 (28%)	0.079
Lymphovascular invasion					
Absent	62 (79%)	97 (67%)	46 (67%)	109 (79%)	7.44
Present	17 (21%)	47 (33%)	23 (33%)	29 (21%)	0.059
Nottingham Prognostic index					
Good prognostic group	29 (37%)	41 (28%)	12 (17%)	69 (50%)	28.73
Moderate prognostic group	43 (54%)	77 (54%)	44 (64%)	56 (41%)	<0.0001
Poor prognostic group	7 (9%)	26 (18%)	13 (19%)	13 (9%)	
ER status					
Negative	15 (19%)	24 (17%)	24 (35%)	16 (12%)	16.68
Positive	64 (81%)	119 (83%)	45 (65%)	121 (88%)	0.001
PgR status					
Negative	25 (32%)	48 (34%)	35 (51%)	47 (34%)	8.01

Positive	52 (68%)	95 (66%)	33 (49%)	91 (66%)	0.046
HER2 status					
Negative	70 (89%)	127 (89%)	53 (77%)	127 (92%)	10.32
Positive	9 (11%)	16 (11%)	16 (23%)	11 (8%)	0.016
Ki67 expression					
Low≤14	30 (54%)	58 (53%)	14 (33%)	80 (71%)	20.02
High>14	26 (46%)	51 (47%)	28 (67%)	32 (29%)	<0.0001
Molecular subtypes					
Luminal A	28 (42%)	54 (44%)	76 (63%)	9 (15%)	41.67
Luminal B	27 (41%)	45 (37%)	30 (25%)	27 (46%)	<0.0001
Triple negative	9 (14%)	18 (14%)	10 (8%)	17 (29%)	
HER2 +	2 (3%)	6 (5%)	5 (4%)	6 (10%)	
Menopausal status					
Premenopausal	30 (38%)	48 (33%)	27 (39%)	36 (26%)	5.05
Postmenopausal	49 (62%)	96 (67%)	42 (61%)	102 (74%)	0.168
Age at diagnosis					
<50	29 (37%)	48 (33%)	23 (33%)	26 (19%)	11.05
≥50	50 (63%)	96 (67%)	46 (67%)	112 (81%)	0.011

Supplementary Table S7. Clinicopathological significance of nuclear CDK2 and nuclear CDK6 co-expression in breast cancers.

	CDK2-/CDK6-	CDK2+/CDK6+	CDK2+/CDK6-	CDK2-/CDK6+	X ² P-value
Tumour size					
≤ 2cm	90 (63%)	39 (65%)	71 (53%)	42 (64%)	4.75
> 2cm	52 (37%)	21 (35%)	64 (47%)	24 (36%)	0.191
Tumour grade					
Grade 1	23 (16%)	15 (25%)	9 (7%)	23 (35%)	68.75
Grade2	73 (52%)	25 (42%)	34 (25%)	30 (45%)	<0.0001
Grade 3	46 (32%)	20 (33%)	92 (68%)	13 (20%)	
Tubule formation					
1	11 (8%)	5 (8%)	5 (4%)	11 (17%)	15.82
2	46 (32%)	22 (37%)	32 (24%)	18 (27%)	0.015
3	85 (60%)	33 (55%)	98 (72%)	37 (56%)	
Pleomorphism					
1	1 (1%)	3 (5%)	1 (1%)	2 (3%)	52.69
2	47 (33%)	25 (42%)	18 (13%)	38 (58%)	<0.0001
3	94 (66%)	32 (53%)	116 (86%)	26 (39%)	
Mitosis					
1	86 (61%)	36 (60%)	38 (28%)	50 (76%)	56.46
2	27 (19%)	11 (18%)	32 (24%)	8 (12%)	<0.0001
3	29 (20%)	13 (22%)	65 (48%)	8 (12%)	
Histologic types					
No special type (NST)	95 (67%)	27 (45%)	109 (81%)	20 (30%)	59.07
Lobular	11 (8%)	9 (15%)	8 (6%)	11 (17%)	<0.0001
Other special types	7 (5%)	6 (10%)	2 (1%)	6 (9%)	
Mixed NST	29 (20%)	18 (30%)	16 (12%)	29 (44%)	
Lymph node status					
Absent	92 (65%)	34 (57%)	78 (58%)	49 (74%)	6.36
Present	50 (35%)	26 (43%)	57 (42%)	17 (26%)	0.095
Lymphovascular invasion					

Absent	106 (75%)	37 (62%)	93 (69%)	57 (86%)	11.14
Present	36 (25%)	23 (38%)	42 (31%)	9 (14%)	0.011
Nottingham Prognostic index					
Good prognostic group	56 (40%)	25 (42%)	21 (16%)	36 (54%)	37.60
Moderate prognostic group	70 (49%)	26 (43%)	87 (64%)	25 (38%)	<0.0001
Poor prognostic group	16 (11%)	9 (15%)	27 (20%)	5 (8%)	
ER status					
Negative	23 (16%)	9 (15%)	39 (29%)	5 (8%)	15.57
Positive	118 (84%)	51 (85%)	95 (71%)	60 (92%)	0.001
PgR status					
Negative	50 (36%)	23 (38%)	57 (43%)	20 (30%)	3.29
Positive	90 (64%)	37 (62%)	76 (57%)	46 (70%)	0.349
HER2 status					
Negative	125 (88%)	53 (88%)	113 (84%)	61 (92%)	2.78
Positive	17 (12%)	7 (12%)	21 (16%)	5 (8%)	0.427
Ki67 expression					
Low≤14	62 (57%)	33 (70%)	37 (39%)	42 (84%)	30.20
High>14	46 (43%)	14 (30%)	57 (61%)	8 (16%)	<0.0001
Molecular subtypes					
Luminal A	59 (48%)	30 (57%)	29 (25%)	41 (74%)	46.19
Luminal B	46 (37%)	14 (26%)	49 (42%)	9 (16%)	<0.0001
Triple negative	12 (10%)	7 (13%)	28 (24%)	3 (6%)	
HER2 +	6 (5%)	2 (4%)	10 (9%)	2 (4%)	
Menopausal status					
Premenopausal	46 (32%)	21 (35%)	49 (36%)	17 (26%)	2.36
Postmenopausal	96 (68%)	39 (65%)	86 (64%)	49 (74%)	0.501
Age at diagnosis					
<50	37 (26%)	16 (27%)	51 (38%)	13 (20%)	8.57
≥50	105 (74%)	44 (73%)	84 (62%)	53 (80%)	0.035

Supplementary Table S8. Relationship between nuclear CDK2 and clinicopathological parameters in the DCIS

Categories	Negative /low H. score ≤5	Positive /high H. score ≤5	X ² <i>P</i> -value
Age			1.4 0.233
<50	26 (44%)	33 (56%)	
≥50	84 (53%)	74 (47%)	
Tumour size			3.1 0.07
≤2cm	51 (58%)	37 (42%)	
>2cm	59 (46%)	70 (54%)	
Tumour grade			0.48 0.78
Low grade	16 (55%)	13 (45%)	
Intermediate grade	30 (48%)	33 (52%)	
High grade	64 (51%)	61 (49%)	
Molecular subtype			5.1 0.16
Luminal A	55 (61%)	35 (39%)	
Luminal B	15 (50%)	15 (50%)	
HER2+	11 (41%)	16 (59%)	
Triple Negative	6 (40%)	9 (60%)	
Comedo necrosis			1.3 0.25
Negative	41 (56%)	32 (44%)	
Positive	69 (48%)	75 (52%)	
ER Status			3.2 0.07
Negative	19 (42%)	26 (58%)	
Positive	80 (58%)	59 (42%)	
PR Status			6.9

			0.009
Negative	30 (42%)	42 (58%)	
Positive	70 (61%)	44 (39%)	
HER2 Status			0.91
			0.34
Negative	86 (56%)	68 (44%)	
Positive	21 (48%)	23 (52%)	
Recurrence			1.1
			0.3
No recurrence	96 (49%)	98 (51%)	
Recurrence	14 (61%)	9 (39%)	
Ki67 expression			14.238
			<0.0001
Low (≤ 14)	85 (63%)	49 (37%)	
High (> 14)	14 (31%)	31 (69%)	
HER2, human epidermal growth factor receptor 2 Significant P values are in bold			

Supplementary Table S9. Relationship between cytoplasmic CDK2 and clinicopathological parameters in the DCIS

Categories	Negative /low H. score ≤20	Positive /high H. score ≤20	X ² <i>P</i> -value
Age			0.4 0.52
<50	32 (54%)	27 (46%)	
≥50	77 (49%)	79 (51%)	
Tumour size			0.09 0.75
≤2cm	43 (49%)	44 (51%)	
>2cm	66 (52%)	62 (48%)	
Tumour grade			16.4 <0.0001
Low grade	7 (24%)	22 (76%)	
Intermediate grade	25 (41%)	36 (59%)	
High grade	77 (62%)	48 (38%)	
Molecular subtype			9.9 0.01
Luminal A	35 (40%)	53 (60%)	
Luminal B	18 (60%)	12 (40%)	
HER2+	19 (70%)	8 (30%)	
Triple Negative	9 (60%)	6 (40%)	
Comedo necrosis			9.2 0.002
Negative	26 (36%)	46 (64%)	

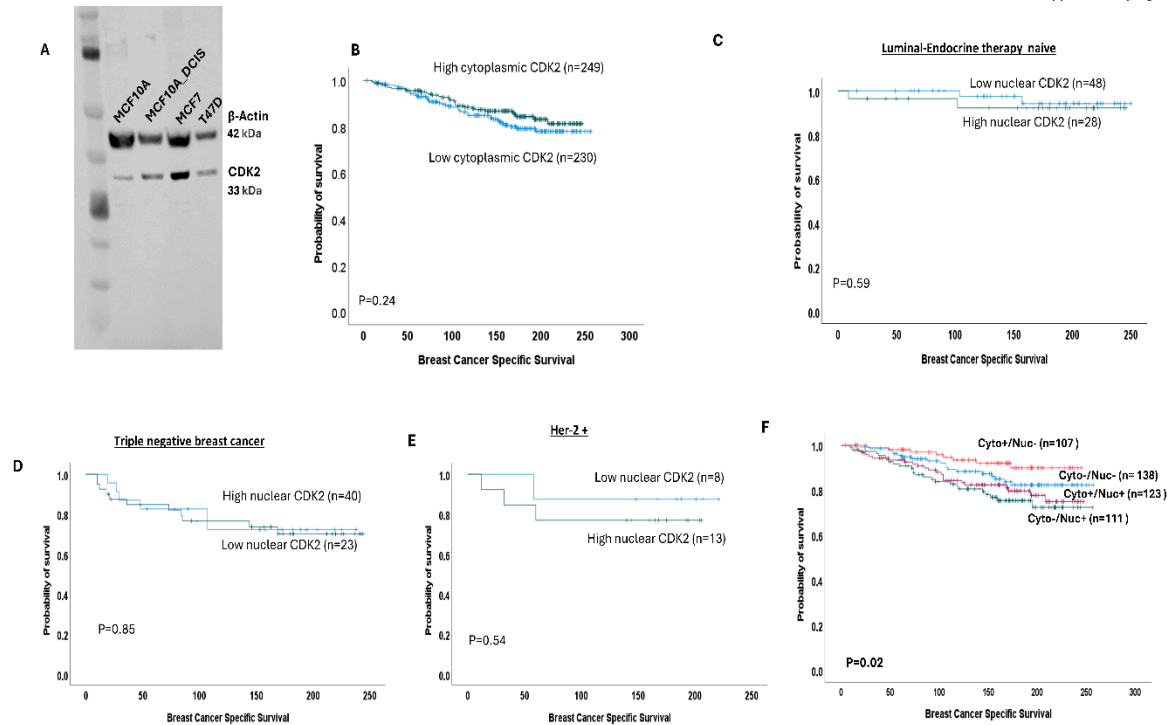
Positive	83 (58%)	60 (42%)	
ER Status			6.6 0.01
Negative	30 (67%)	15 (33%)	
Positive	61 (44%)	76 (56%)	
PR Status			9.9 0.002
Negative	46 (64%)	26 (36%)	
Positive	45 (40%)	67 (60%)	
HER2 Status			3.3 0.07
Negative	105 (65%)	56 (35%)	
Positive	35 (79%)	9 (21%)	
Recurrence			1.1 0.29
No recurrence	136 (68%)	65 (32%)	
Recurrence	18 (78%)	5 (22%)	
Ki67 expression			3.4 0.06
Low (≤ 14)	61 (46%)	71 (54%)	
High (> 14)	28 (62%)	17 (38%)	

Supplementary Table S10. Relationship between nuclear(N)/ cytoplasmic (C) CDK2 co-expression and clinicopathological parameters in the DCIS cohort

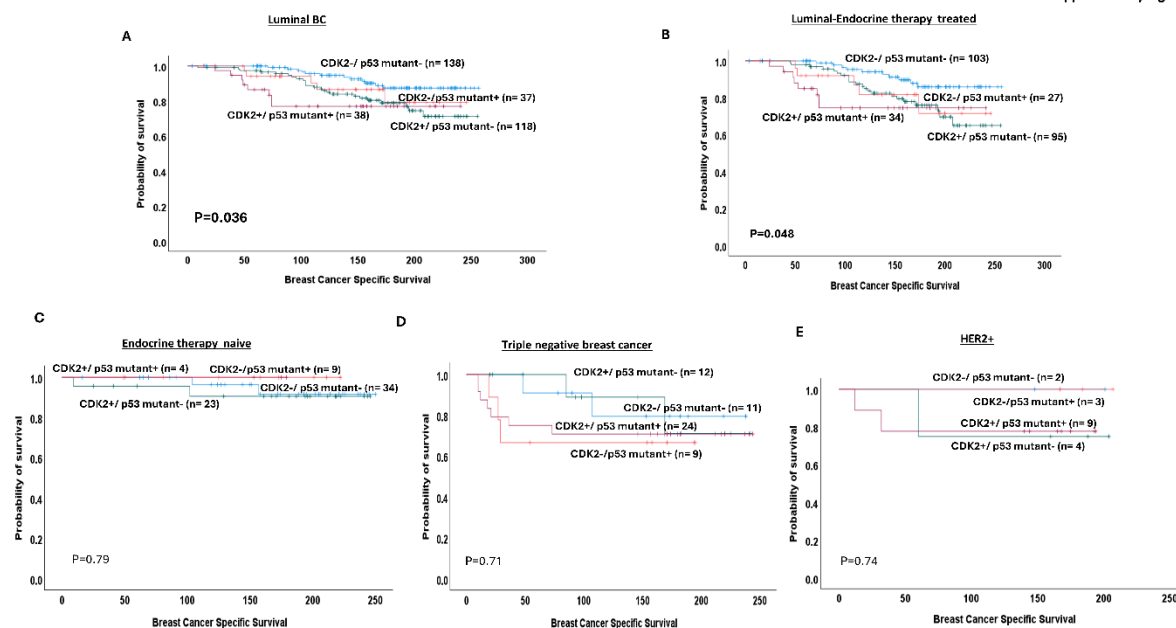
Categories	Negative N - negative C CDK2	Positive N - negative C CDK2	Positive N - positive C CDK2	Positive C - negative N CDK2	X ² P-value
Age					
<50	20 (34%)	15 (25%)	11 (19%)	13 (22%)	1.4
≥50	47 (30%)	35 (23%)	27 (17%)	47 (30%)	0.71
Tumour size					3.56 0.3
≤2cm	30 (34%)	16 (18%)	13 (15%)	28 (33%)	
>2cm	37 (28%)	34 (27%)	25 (20%)	32 (25%)	
Tumour grade					12.9 0.043
Low grade	6 (20%)	4 (14%)	8 (28%)	11 (38%)	
Intermediate grade	16 (26%)	11 (18%)	15 (25%)	19 (31%)	
High grade	45 (36%)	35 (28%)	15 (12%)	30 (24%)	
Molecular subtype					19.87 0.01
Luminal A	27 (31%)	12 (14%)	14 (15%)	35 (40%)	
Luminal B	11 (37%)	7 (23%)	7 (23%)	5 (17%)	
HER2+	7 (26%)	12 (44%)	3 (11%)	5 (19%)	
Triple Negative	5 (34%)	6 (40%)	2 (13%)	2 (13%)	
Comedo type necrosis					9.4 0.024
Negative	21 (29%)	9 (13%)	16 (22%)	26 (36%)	
Positive	46 (32%)	41 (29%)	22 (15%)	34 (24%)	
ER Status					13.5

					0.004
Negative	14 (31%)	18 (40%)	5 (11%)	8 (18%)	
Positive	45 (33%)	21 (15%)	26 (19%)	45 (33%)	
PR Status					14.2
					0.003
Negative	25 (34%)	23 (32%)	12 (17%)	12 (17%)	
Positive	33 (29%)	16 (14%)	19 (17%)	44 (40%)	
HER2 Status					4.930
					0.177
Negative	91 (35%)	129 (50%)	31 (12%)	9 (3%)	
Positive	41 (48%)	35 (41%)	7 (8%)	2 (3%)	
Recurrence					1.07
					0.62
No recurrence	58 (30%)	47 (24%)	34 (18%)	53 (28%)	
Recurrence	9 (39%)	3 (13%)	4 (18%)	7 (30%)	
Ki67 expression					18.3
					<0.0001
Low	45 (34%)	20 (15%)	18 (14%)	49 (37%)	
High	11 (24%)	18 (40%)	10 (22%)	6 (14%)	

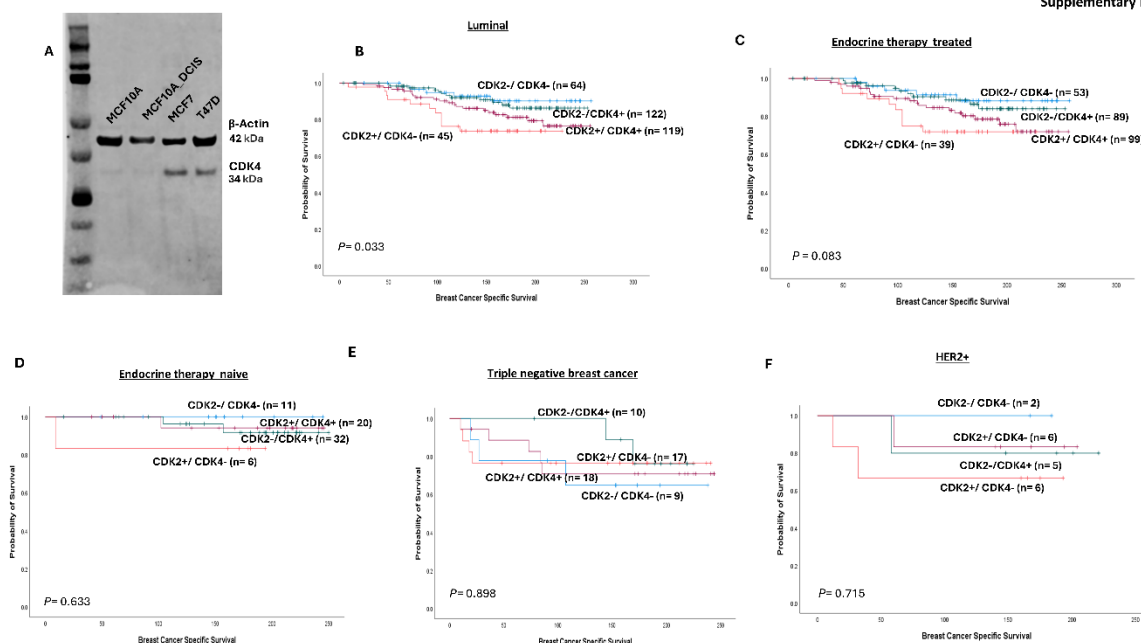
HER2, human epidermal growth factor receptor 2 Significant P values are in bold.



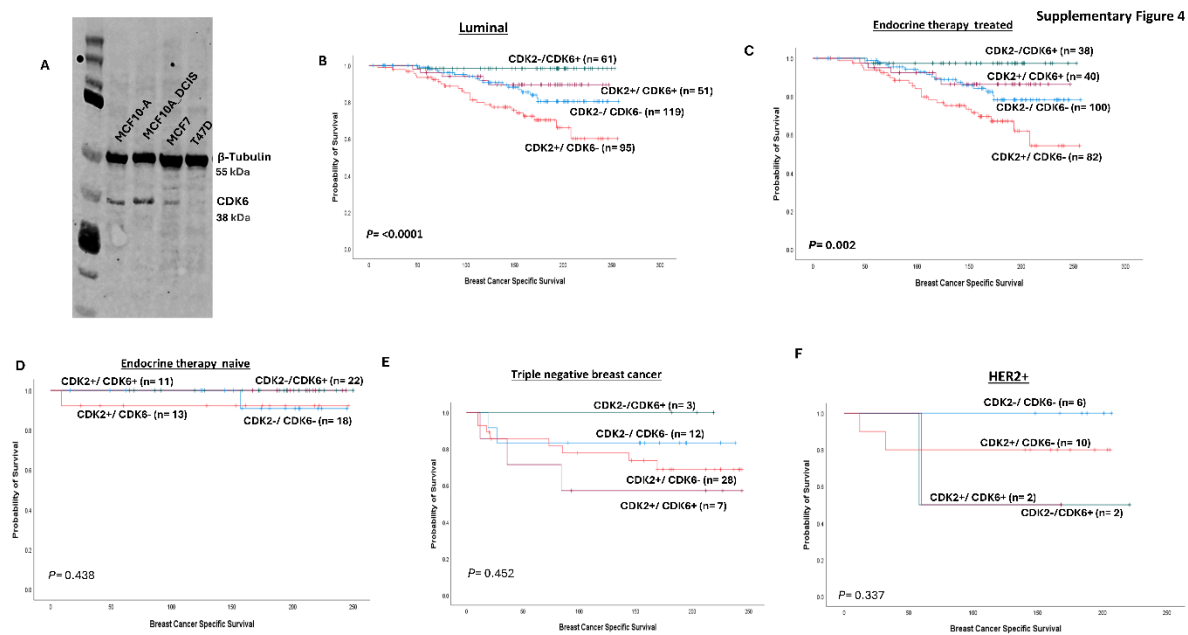
Supplementary Figure S1: CDK2 expression in BC. (A) Western blot of CDK2 antibody shows specific bands at 33 KDa. (B) Kaplan-Meier curve for CDK2 cytoplasmic expression and BCSS in the whole cohort. (C) Kaplan-Meier curve for CDK2 nuclear expression and BCSS in the endocrine therapy naive patients. (D) Kaplan-Meier curve for CDK2 nuclear expression and BCSS in triple negative BC. (E) Kaplan-Meier curve for CDK2 nuclear expression and BCSS in HER2 enriched BC. (F) Kaplan-Meier curve for CDK2 nuclear/ cytoplasmic co-expression and BCSS in the whole cohort.



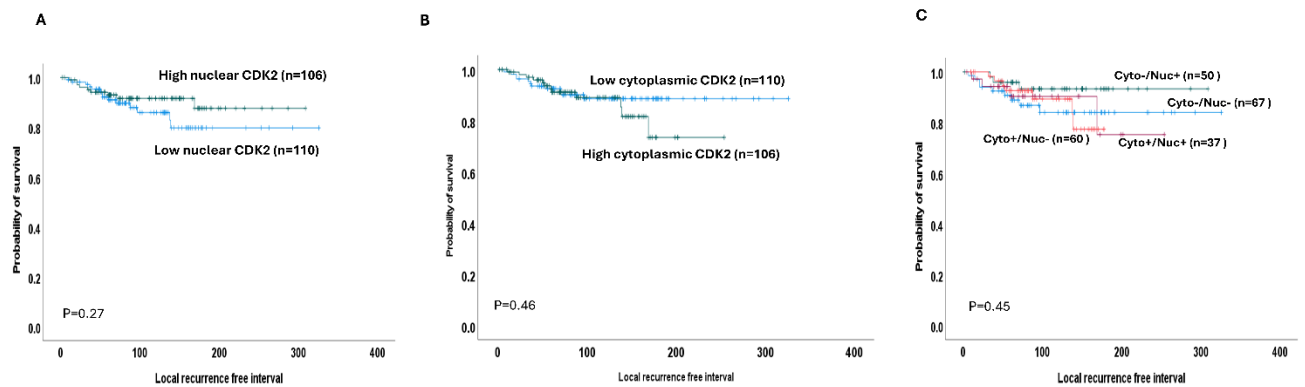
Supplementary figure S2: CDK2/p53 co-expression in BC (A) Kaplan-Meier curve for CDK2/p53 co-expression and BCSS in luminal BC. (B) Kaplan-Meier curve for CDK2/p53 co-expression and BCSS in the endocrine therapy treated patients. (C) Kaplan-Meier curve for CDK2/p53 co-expression and BCSS in the endocrine therapy naïve patients. (D) Kaplan-Meier curve for CDK2/p53 co-expression and BCSS in triple negative BC. (E) Kaplan-Meier curve for CDK2/p53 co-expression and BCSS in HER2 enriched BC.



Supplementary figure S3: CDK2/CDK4 co-expression in BC. (A) Western blot of CDK4 antibody shows specific bands at 34 KDa. (B) Kaplan-Meier curve for CDK2/CDK4 co-expression and BCSS in the luminal BC. (C) Kaplan-Meier curve for CDK2/CDK4 co-expression and BCSS in the endocrine therapy treated patients. (D) Kaplan-Meier curve for CDK2/CDK4 co-expression and BCSS in the endocrine therapy naïve patients. (E) Kaplan-Meier curve for CDK2/CDK4 co-expression and BCSS in triple negative BC. (F) Kaplan-Meier curve for CDK2/CDK4 co-expression and BCSS in the HER2 enriched BC.



Supplementary figure S4: CDK2/CDK4 co-expression in BC. (A) Western blot of CDK6 antibody shows specific bands at 38 KDa. (B) Kaplan-Meier curve for CDK2/CDK6 co-expression and BCSS in luminal BC. (C) Kaplan-Meier curve for CDK2/CDK6 co-expression and BCSS in the endocrine therapy treated patients. (D) Kaplan-Meier curve for CDK2/CDK6 co-expression and BCSS in the endocrine therapy naïve patients. (E) Kaplan-Meier curve for CDK2/CDK6 co-expression and BCSS in triple negative BC. (F) Kaplan-Meier curve for CDK2/CDK6 co-expression and BCSS in HER2 enriched BC.



Supplementary figure S5: CDK2 expression in DCIS. (A) Kaplan-Meier curve for nuclear CDK2 expression in DCIS. (B) Kaplan-Meier curve for cytoplasmic CDK2 expression in DCIS. (C) Kaplan-Meier curve for CDK2 nuclear/cytoplasmic co-expression in DCIS.