Supplementary figure legends

**Supplementary Figure S1.** Small cell neuroendocrine carcinoma and large cell neuroendocrine carcinoma with lobular differentiation. *A, B* SCNEC5 and *C, D* LCNEC4, with single-file growth patterns and negative immunohistochemistry for E-cadherin (*B,D*).

**Supplementary Figure S2.** Additional Nottingham grade 3 neuroendocrine tumors and invasive breast carcinomas with neuroendocrine differentiation. *A-C* NET4, with diffusely positive synaptophysin expression (*B*) and positive INSM1 (*C*) immunostaining. *D-F* Invasive ductal carcinoma with neuroendocrine differentiation (IDC-NED2), with patchy positive synaptophysin (*E*) and positive ER (*F*) expression. *G-I* Invasive lobular carcinoma with neuroendocrine differentiation (ILC-NED), with patchy positive INSM1 (*H*) and aberrant E-cadherin (*I*) expression.

**Supplementary Figure S3.** *RB1* and *TP53* co-alteration in neuroendocrine carcinomas compared to Nottingham grade 3 invasive ductal carcinomas of no special type. *p*<0.05

**Supplementary Figure S4.** Mixed large cell neuroendocrine carcinoma and invasive ductal carcinoma of no special type. *A* LCNEC1, comprised of mixed components of LCNEC and IDC-NST (*left*, IDC-NST; *right*, LCNEC). *B* Synaptophysin highlights the NEC component. *C,D* Higher power images of IDC-NST (*C*) and LCNEC (*D*). *E* Chromosomal copy number plots reveal multiple gains and losses that are shared between the IDC-NST and LCNEC components, with additional alterations only in LCNEC (*red arrows*).
