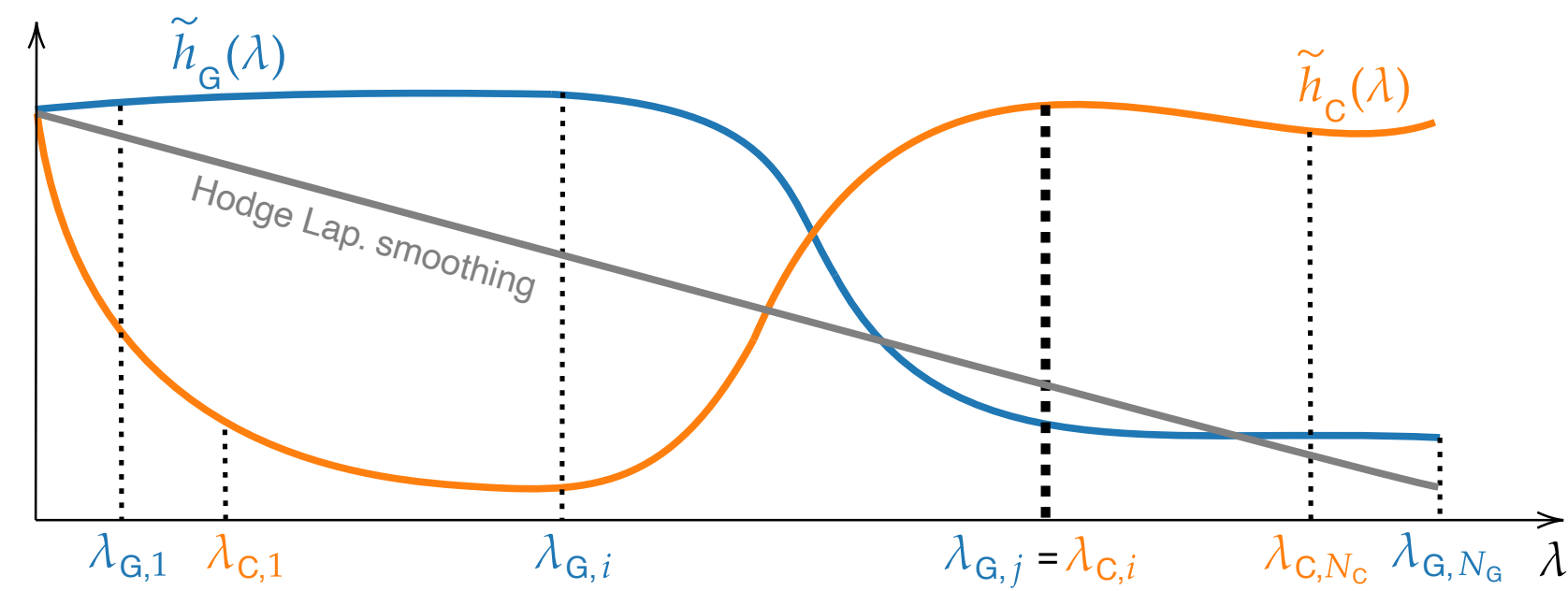


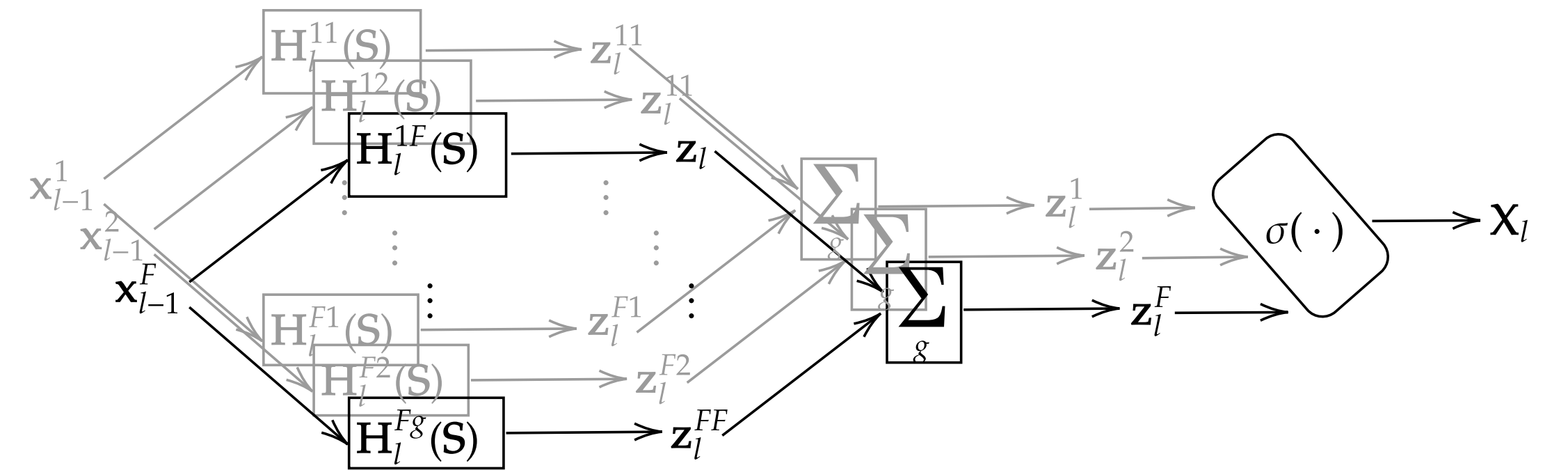
Convolutional Learning on SCs

Linear

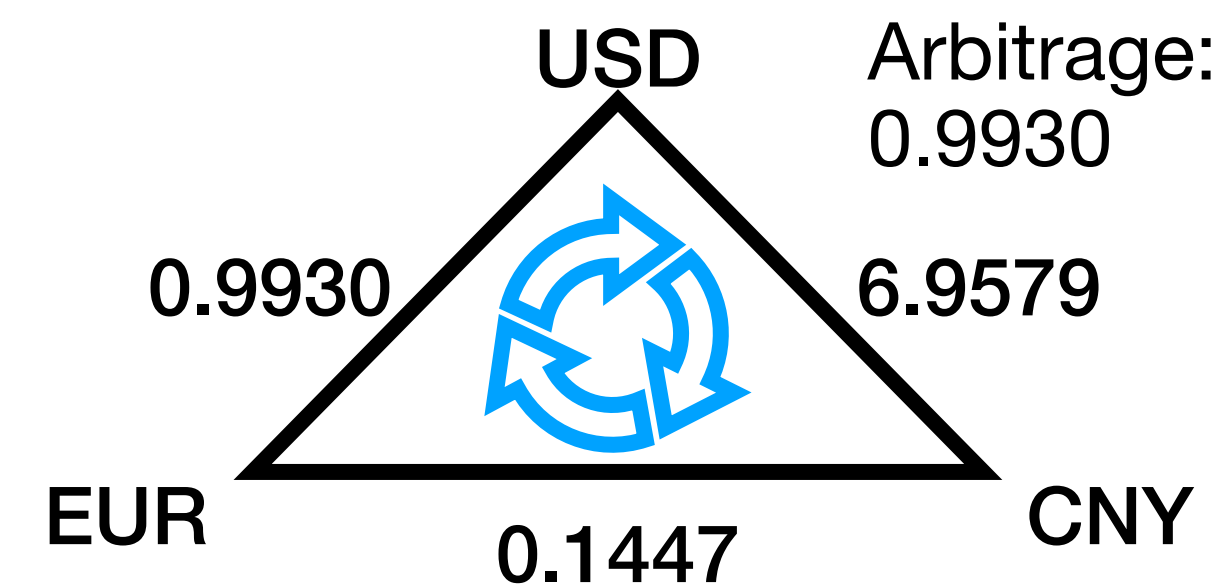
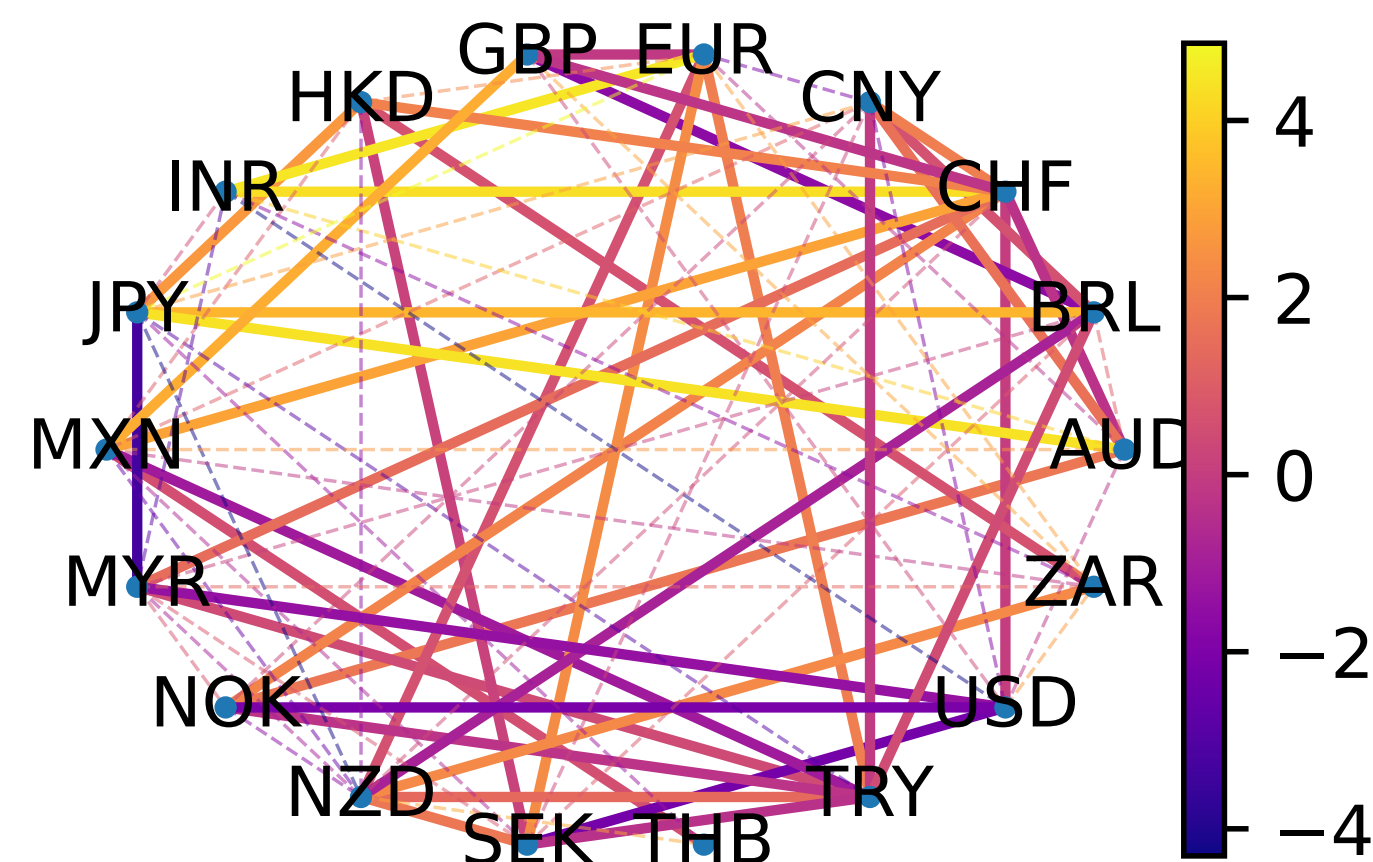
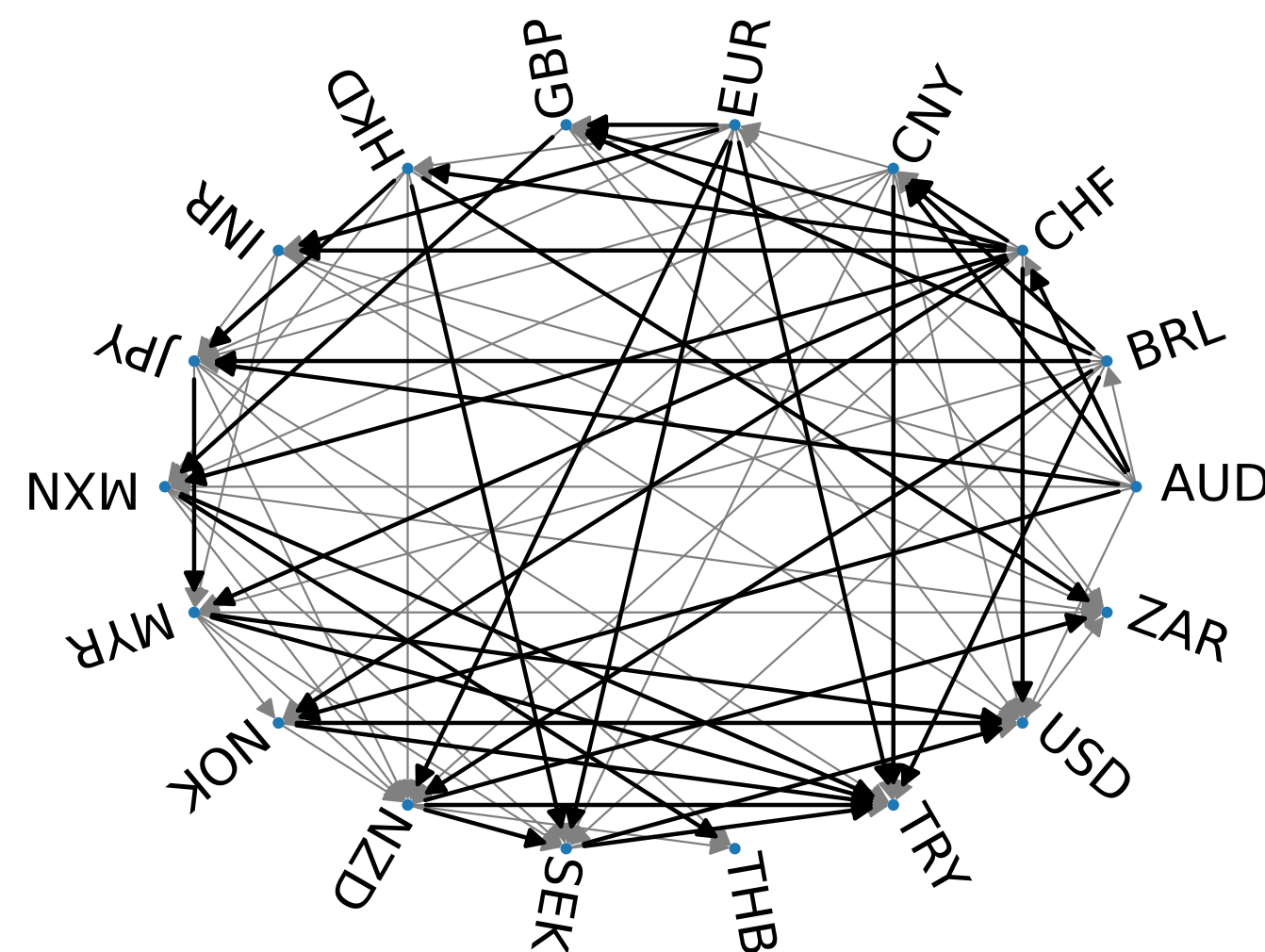
$$\mathbf{H} := \mathbf{H}(\mathbf{L}_d, \mathbf{L}_u; \boldsymbol{\alpha}, \boldsymbol{\beta}) = \sum_{k=0}^{K_d} \alpha_k \mathbf{L}_d^k + \sum_{k=0}^{K_u} \beta_k \mathbf{L}_u^k$$



Non-Linear



Learning for Forex



$$r^{a/b} r^{b/c} = r^{a/c} \quad \text{Arbitrage-free}$$

$$f_{[a,b]} + f_{[b,c]} - f_{[a,c]} = 0 \quad \text{Curl-free}$$

Table 1: Forex results (nmse|total arbitrage, ↓).

Methods	Random Noise	Curl Noise	Interpolation
Input	0.119 \pm 0.004 29.19 \pm 0.874	0.552 \pm 0.027 122.4 \pm 5.90	0.717 \pm 0.030 106.4 \pm 0.902
Baseline (ℓ_2 regularization)	0.036 \pm 0.005 2.29 \pm 0.079	0.050 \pm 0.002 11.12 \pm 0.537	0.534 \pm 0.043 9.67 \pm 0.082
SNN (Ebli et al., 2020)	0.110 \pm 0.005 23.24 \pm 1.03	0.446 \pm 0.017 86.95 \pm 2.20	0.702 \pm 0.033 104.74 \pm 1.04
PSNN (Roddenberry et al., 2021)	0.008 \pm 0.001 0.984 \pm 0.170	0.000 \pm 0.000 0.000 \pm 0.000	0.009 \pm 0.001 1.13 \pm 0.329
MPSN (Bodnar et al., 2021b)	0.039 \pm 0.004 7.74 \pm 0.88	0.076 \pm 0.012 14.92 \pm 2.49	0.117 \pm 0.063 23.15 \pm 11.7
SCCNN, id	0.027 \pm 0.005 0.000 \pm 0.000	0.000 \pm 0.000 0.000 \pm 0.000	0.265 \pm 0.036 0.000 \pm 0.000
SCCNN, tanh	0.002\pm0.000 0.325\pm0.082	0.000 \pm 0.000 0.003 \pm 0.003	0.003\pm0.002 0.279\pm0.151