

$C=1$

The deformed
Marčenko - Pastur

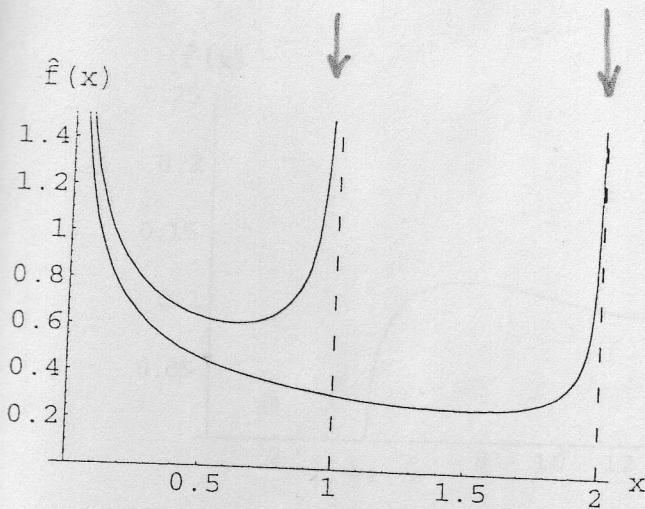


Figure 2. Constrained spectral density $\hat{f}(x)$ for the barrier at $\zeta = 1$ and $\zeta = 2$.

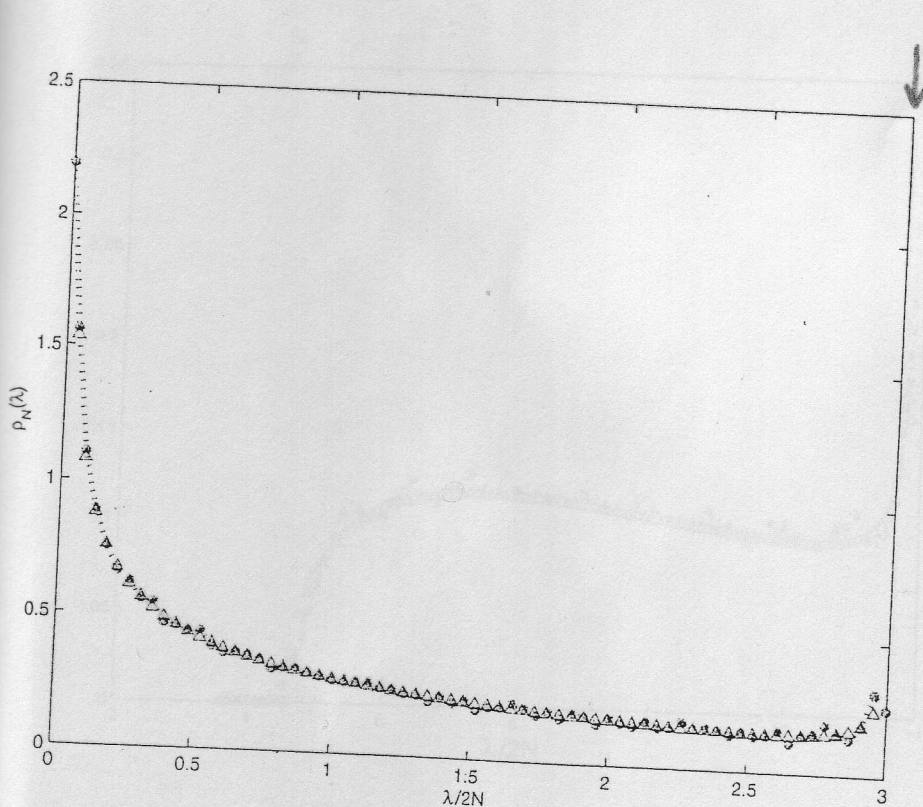


Figure 6. Constrained spectral density $\hat{\rho}_N(\lambda)$ for $N = M = 30$. The barrier is at $\zeta = 3$. In dotted green is the histogram of rescaled eigenvalues over an initial sample of 3×10^5 matrices ($\beta = 2$). In triangled red is the theoretical distribution.

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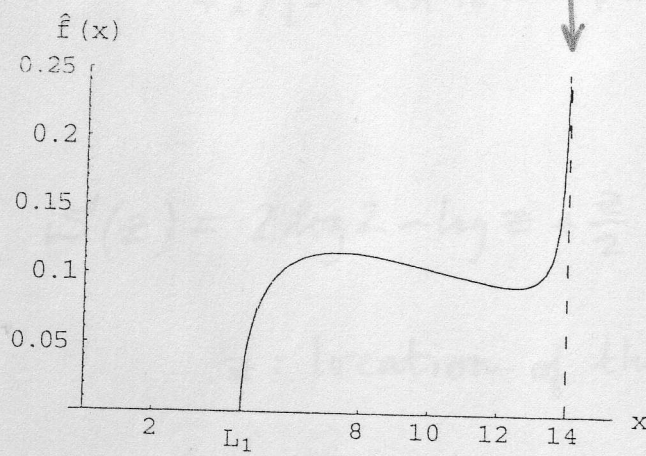


Figure 4. Constrained spectral density $\hat{f}(x)$ for $c = 0.1$ and $\zeta = 14$.

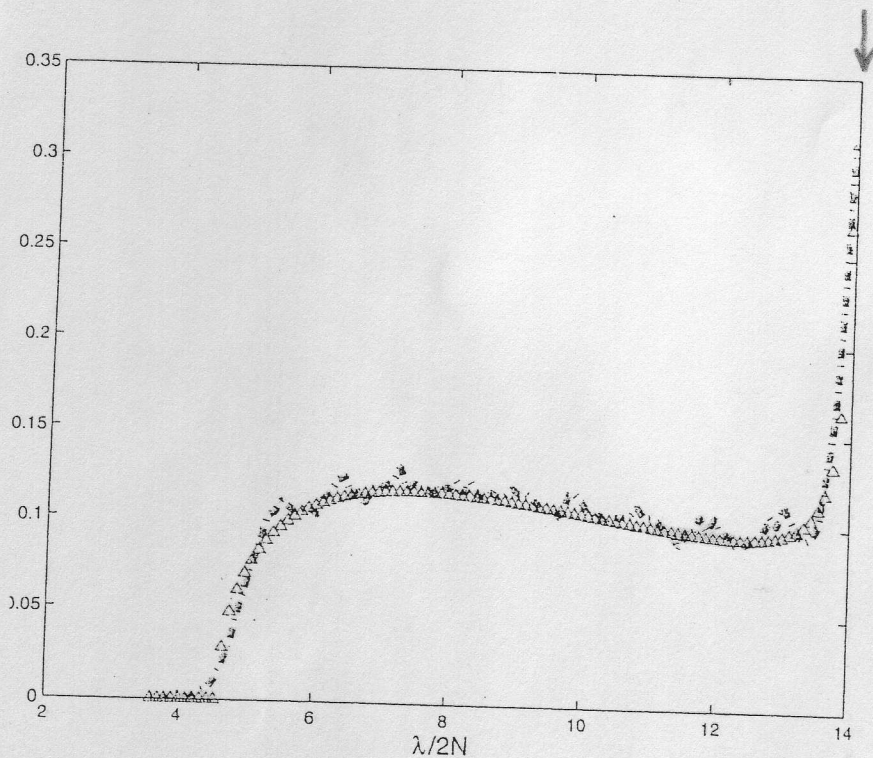


Figure 8. Constrained spectral density $\hat{\rho}_N(\lambda)$ for $N = 10$, $M = 100$ ($c = 0.1$). The barrier is at $\zeta = 14$. In dash-dotted green is the histogram of rescaled eigenvalues over an initial sample of $5 \cdot 10^5$ matrices ($\beta = 2$). In triangled red is the theoretical distribution.

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Saddle point action

Gaussian
WD

$$S'(z) = -\frac{1}{216} \left\{ 72z^2 - 2z^4 + (30z + 2z^3)\sqrt{6+z^2} \right. \\ \left. + 27[3 + \ln 1296 - 4 \ln(-z + \sqrt{6+z^2})] \right\}$$

Wishart

$$S'(z) = 2 \log 2 - \log z + \frac{z}{2} - \frac{z^2}{32}$$

z : location of the barrier

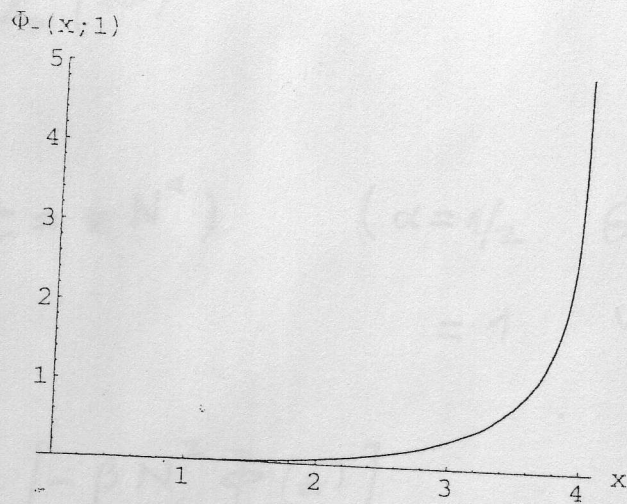


Figure 3. Rate function $\Phi_-(x; 1)$ (see (36)).

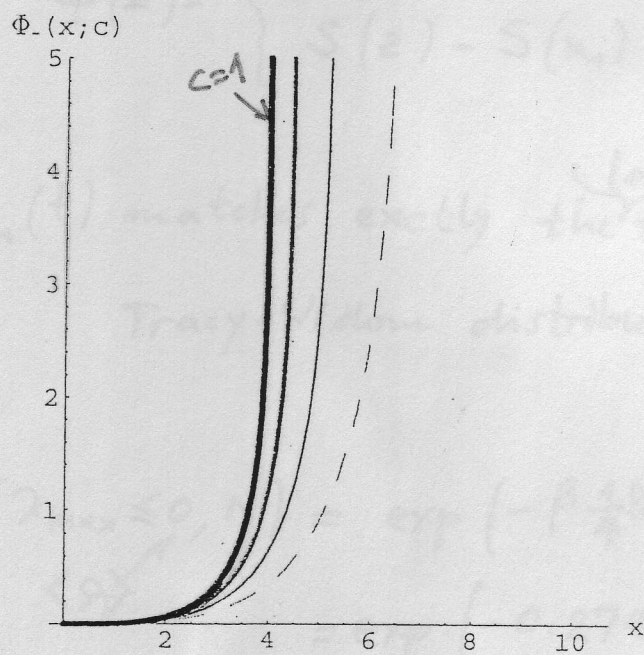


Figure 5. Rate function $\Phi_-(x; c)$ for the following values (from right to left) of $c = 0.2, 0.4, 0.6, 0.8, 1$. See also figure 3.

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$$Q_N(t) = \frac{Z_N(t)}{Z_N(\infty)} = \text{Prob} \{ \lambda_{\max} < t \}$$

$$Q_N(t = z N^\alpha) \quad \left(\begin{array}{l} \alpha = 1/2 \quad \text{Gaussian} \\ \alpha = 1 \quad \text{Wishart} \end{array} \right)$$

$$\approx \exp \left[-\beta N^2 \Phi(z) \right]$$

$$\Phi(z) = \begin{cases} S(z) - S(\sqrt{2}) & \text{Gaussian WD} \\ S(z) - S(x_*) & \text{Wishart} \end{cases}$$

$Q_N(t)$ matches exactly the ^(left) tail of the Tracy-Widom distribution

$$\begin{aligned} \text{Prob}(\lambda_{\max} \leq 0, N) &= \exp \left(-\beta \frac{1}{4} \ln 3 \right) N^2 \\ &= \exp \left(-0.2746 \beta N^2 \right) \end{aligned} \quad \text{Wigner Dye}$$

$$\begin{aligned} \text{Probability} \{ \lambda_{\max} < N; N \} &= \exp \left(-\beta \left(\log 2 - \frac{33}{64} \right) \cdot N^2 \right) \\ &= \exp \left(-\beta \left(\log 2 - \frac{33}{64} \right) \cdot N^2 \right) \\ &= \exp \left(-0.1775 \cdot \beta N^2 \right) \end{aligned}$$

Wishart