

$$V(X'') | X' = 0, X \sim N\left(-\frac{X\Lambda}{\sigma^2}, \Sigma\right) \quad \text{fixed.}$$

$\Sigma = \Sigma(t_0)$

Make the substitution, $Z = X'' + \frac{X\Lambda}{\sigma^2} \sim N(0, \Sigma)$
 into the inner integral
 to yield:

$$\int_V p(x) \int \mathbf{1}[\|Z/X\| > u] \mathbf{1}[x > v] \times \left| \det\left(Z - \frac{x\Lambda}{\sigma^2}\right) \right| dz dp(z) dx$$

$$\left| \det\left(Z - \frac{x\Lambda}{\sigma^2}\right) \right| = \sum_{k=0}^D b_k(Z) |x|^k \quad \boxed{b_k \geq 0 \text{ b.t.}}$$

where $b_k(Z)$ are polynomials in the elements of Z \leftrightarrow not depending on x
 and have $b_D(Z) = \frac{\det(\Lambda)}{\sigma^{2D}} \det(\Lambda)$

as Λ is the definite?

$$\leq \int_V p(x) \int \mathbf{1}[\|Z/X\| > u] \mathbf{1}[x > v] \sum_k |b_k(Z)| |x|^k dp(z) dx$$