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Econometrics
second order conditions

compare two functions

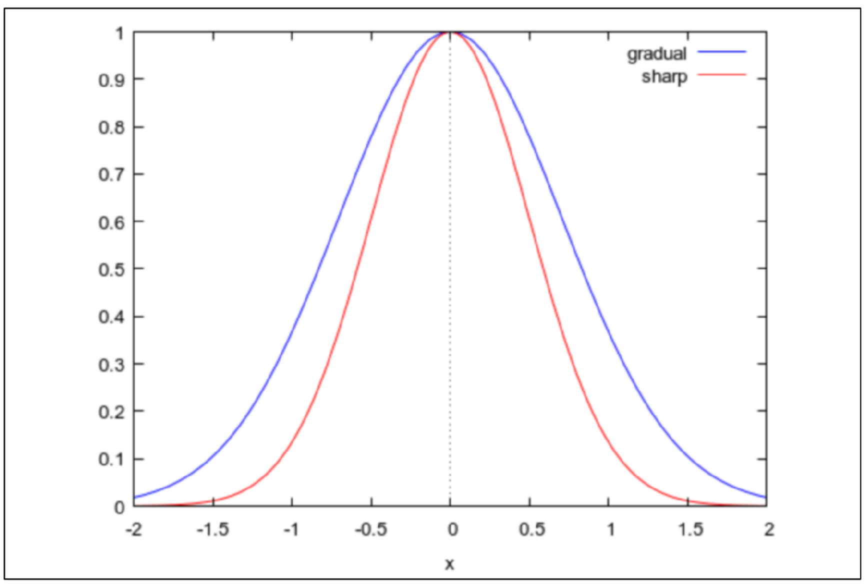
```
(%i6) print("")$
      gradual(x):=exp(−1·x^2);
      sharp(x):=exp(−2·x^2);

      print("")$
      wxplot2d([gradual,sharp],[x,−2,2])$
      print("")$
```

(%o2) gradual$(x):=\exp((-1)\,x^2)$

(%o3) sharp$(x):=\exp((-2)\,x^2)$

(%t5)



but it's the quadratic part that yields the peak,
so take the log and compare the parabolas

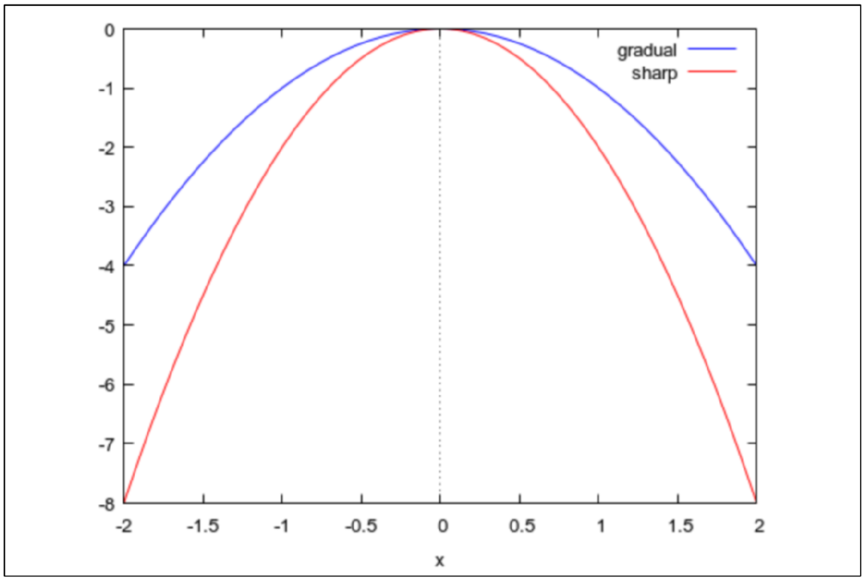
(%i12)
```
print("")$
gradual(x):=−1·x^2;
sharp(x):=−2·x^2;

print("")$
wxplot2d([gradual,sharp],[x,−2,2])$
print("")$
```

(%o8) gradual $(x):=(-1)\,x^2$

(%o9) sharp $(x):=(-2)\,x^2$

(%t11)



now calculate the standard errors

```
(%i29) print("")$
gradual(x):=−1·x^2;
sharp(x):=−2·x^2;

print("")$
print("first derivatives")$
g(x):=''(diff(gradual(x),x));
s(x):=''(diff(sharp(x),x));
print("maximum when x=0")$
print("")$

print("second derivatives")$
gg(x):=''(diff(g(x),x));
ss(x):=''(diff(s(x),x));
print("")$

print("the negative of the inverse of the second−derivatives is the standard error")$
ggi(x):=''(−1/gg(x));
ssi(x):=''(−1/ss(x));
print("")$
```

(%o14) $\text{gradual}(x) := (-1)\, x^2$

(%o15) $\text{sharp}(x) := (-2)\, x^2$

first derivatives

(%o18) $g(x) := -2\, x$

(%o19) $s(x) := -4\, x$

maximum when x=0

second derivatives

(%o23) $gg(x) := -2$

(%o24) $ss(x) := -4$

the negative of the inverse of the second−derivatives is the standard error

(%o27) $ggi(x) := \frac{1}{2}$

(%o28) $ssi(x) := \frac{1}{4}$

(%i36)
```
print("The standard error is lower when the curve comes to a sharp peak.")$
print("")$
/· print("sharp(x)=−x^2 comes to a sharper peak than gradual(x)=(−1/2)·x^2.")$ ·/ ""$

print("when x=0, \"se. of sharp\" is: ",float(ssi(0))," and \"se. of gradual\" is: ",float(ggi(0)),
print("")$

wxplot2d([gradual,sharp],[x,−2,2])$
print("")$
```

The standard error is lower when the curve comes to a sharp peak.

when x=0, "se. of sharp" is: 0.25 *and "se. of gradual" is:* 0.5 *.*

(%t35)