The Euler equation for the hardy operator

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We define the Euler equation for the (generalized) Hardy operator

$$Tf(x) = v(x) \int_a^x u(t) f(t)\, dt$$

from $L^p(I)$ into $L^q(I)$, where $I = (a, b)$, $v \in L^q(I)$ and $u \in L^{p'}(I)$ $(1/p + 1/p' = 1)$. We discuss the relationship between the "eigenvalues" of the Euler equation and the approximation numbers $a_n(T)$, $n = 1, 2, \cdots$. In the case $p = q$, it can be shown that "the eigenvalue = the approximation numbers".