The theorem now follows from (5.8), (5.9), (5.10), and (5.15). Q.E.D.

Since

$$E(x) \leqslant \sum_{p \leqslant x} p^{-1} = \log_2 x + O(1) \qquad \text{for} \quad x \geqslant 2,$$

one would always want to choose $v \leqslant \log_2 x$. Thus (1.23) is superior to (5.4) whenever $y \geqslant (\log_2 x)^{1/2}$. Furthermore, consideration of derivatives shows that

$$y - v - y \log(y/v) \leqslant (p_1 - 1)v - y \log p_1 \qquad \text{for} \qquad 0 < v \leqslant y \leqslant p_1 v,$$

and hence Lemma 5.3 is superior to Theorem 1.21 whenever

$$1 \leqslant v \leqslant y \leqslant p_1 v - v^{1/2}.$$

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