$$\int_{\|z\| > v^{1/2}\eta} z^i \, p_Z(z)\, dz$$

$u^{1/2} Z \neq 2uA$

$$Z = 2u^{1/2} P + 2H$$

$$= \mathbb{E}\left[z^i 1\left[\|z\| > v^{1/2}\eta\right]\right] \qquad \text{Condition on } P$$

$$= \mathbb{E}\left[b_k(2u^{1/2}P + 2H)\, 1\left[\|2u^{1/2}P + 2H\| > v^{1/2}\eta\right]\right]$$

$$\leq \|2u^{1/2}P\| + \|2H\|$$

$$= \int b_k(2u^{1/2}p + 2h)\, f_{P,H}(p,h)\, dp\, dh$$

$$\Rightarrow \|2H\| > v^{1/2}\eta/2$$

$$\text{or } \|2u^{1/2}P\| > v^{1/2}\eta/2$$