Counterexample:

Let $V = F^4$. Let $B = (e_1, e_2, e_3, e_4)$ basis of V.

Consider $U = \{(x, y, z, z) \in F^4 : x, y, z \in F\}$ a subspace of V.

$e_1, e_2 \in U$, $e_3, e_4 \notin U$

But, $B' = (e_1, e_2)$ is NOT a basis of U.
For example we can't form $v = (1, 1, 2, 2) \in U$ as a lin. combination of e_1, e_2.