```
theory Hnr_Rules_Bind
  imports Hnr_Base Keep_Drop Norm Merge
begin

lemma hnr_bind [hnr_rule]:
  assumes
    "hnr Γ vi Γ₁ v"
    "⋀x xi. hnr (Γ₁ x xi) (fi xi) (Γ' x xi) (f x)"
    "⋀x xi r ri. Keep_Drop (Γ' x xi r ri) (Γ'' r ri) (Γ₁' x xi r ri)"
    "⋀r ri. Norm (Γ'' r ri) (Γ''' r ri)"
  shows
    "hnr Γ (do { x ← vi; fi x }) Γ''' (do { x ← v; f x })"
  supply[sep_heap_rules] = assms(1, 2)[THEN hnrD]
  apply(rule hnrI)
  apply(sep_auto split: option.splits Option.bind_splits(2))
  apply(sep_drule r: assms(3)[unfolded Keep_Drop_def])
  apply(sep_drule r: assms(4)[unfolded Norm_def])
  by sep_auto

end
```