is an exact sequence of complexes, and this gives the first long exact sequence. The second one is even simpler.

Q.E.D.

Γ

$$\begin{tikzcd}
0 \arrow[r] & M' \arrow[r] & M \arrow[r] & M'' \arrow[r] & 0 \\
0 \arrow[r] & E_0' \arrow[r] \arrow[u] \arrow[ur, phantom, "\circlearrowright"] & E_0' \oplus E_0'' \arrow[r] \arrow[u] \arrow[ur, phantom, "\circlearrowright"] & E_0'' \arrow[r] \arrow[u] \arrow[l, dashed, bend left, "r"] & 0 \\
0 \arrow[r] & E_1' \arrow[r] \arrow[u] \arrow[ur, phantom, "\circlearrowright"] & E_1' \oplus E_1'' \arrow[r] \arrow[u] \arrow[ur, phantom, "\circlearrowright"] & E_1'' \arrow[r] \arrow[u] \arrow[l, dashed, bend left, "r"] & 0
\end{tikzcd}$$

$\Rightarrow$ Cross sections commute with boundary maps. $\Rightarrow$

$$\begin{tikzcd}
 & \mathrm{Hom}(M', N) \arrow[d] & \mathrm{Hom}(M, N) \arrow[l] \arrow[d] & \mathrm{Hom}(M'', N) \arrow[l] \arrow[d] & 0 \arrow[l] \\
0 & \mathrm{Hom}(E_0', N) \arrow[l] \arrow[d] & \mathrm{Hom}(E_0, N) \arrow[l] \arrow[d] & \mathrm{Hom}(E_0'', N) \arrow[l] \arrow[d] & 0 \arrow[l] \\
 & {} & {} & {} &
\end{tikzcd}$$

//

Given $0 \longrightarrow N' \longrightarrow N \longrightarrow N'' \longrightarrow 0$ and

$E_n \to E_{n-1} \to \cdots \to E_0 \to M \longrightarrow 0$,