$$\begin{split} &\Phi(\Phi^T\Phi)^{-1}\Phi^T(R+\gamma P^\pi\Phi\omega^\pi)=\Phi\omega^\pi,\,\Phi\text{ lin. indep}\Longrightarrow\Phi^{-1}\text{ exists}\\ &\Longrightarrow\Phi^{-1}\Phi(\Phi^T\Phi)^{-1}\Phi^T(R+\gamma P^\pi\Phi\omega^\pi)=\Phi^{-1}\Phi\omega^\pi\\ &\Longrightarrow(\Phi^T\Phi)^{-1}\Phi^T(R+\gamma P^\pi\Phi\omega^\pi)=\omega^\pi\\ &\Longrightarrow(\Phi^T\Phi)(\Phi^T\Phi)^{-1}\Phi^T(R+\gamma P^\pi\Phi\omega^\pi)=(\Phi^T\Phi)\omega^\pi\\ &\Longrightarrow\Phi^T(R+\gamma P^\pi\Phi\omega^\pi)=(\Phi^T\Phi)\omega^\pi\\ &\Longrightarrow\Phi^TR+\Phi^T\gamma P^\pi\Phi\omega^\pi=(\Phi^T\Phi)\omega^\pi\\ &\Longrightarrow\Phi^TR=\Phi^T\Phi\omega^\pi-\Phi^T\gamma P^\pi\Phi\omega^\pi\\ &\Longrightarrow\Phi^TR=(\Phi^T\Phi-\Phi^T\gamma P^\pi\Phi)\omega^\pi\\ &\Longrightarrow\Phi^TR=(\Phi^T\Phi-\Phi^T\gamma P^\pi\Phi)\omega^\pi\\ &\Longrightarrow\Phi^TR=(\Phi^T\Phi-\gamma P^\pi\Phi)\omega^\pi\\ &\Longrightarrow\Phi^TR=(\Phi^T\Phi-\gamma P^\pi\Phi))\omega^\pi\\ &\Longrightarrow(\Phi^T(\Phi-\gamma P^\pi\Phi))^{-1}\Phi^TR=\omega^\pi\end{split}$$