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An alternative proof of the Mathias-Silver theorem using the Kastanas game

The Kastanas game was introduced by Kastanas as a game-theoretic characterisation of (completely) Ramsey subsets of $[\mathbb{N}]^\infty$. While, by Borel determinacy, this immediately implies the Galvin-Prikry theorem (every Borel subset of $[\mathbb{N}]^\infty$ is Ramsey), the characterisation alone is insufficient to conclude the Mathias-Silver theorem (every analytic subset of $[\mathbb{N}]^\infty$ is Ramsey). We prove that, by considering the same game in the space $[\mathbb{N}]^\infty \times 2^\mathbb{N}$, we may utilise this characterisation to conclude the Mathias-Silver theorem. We will also briefly discuss how we may apply this argument to weak A2 spaces, a class of spaces which includes topological Ramsey spaces and countable vector spaces.