



# Stability in dynamic matching markets

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## Abstract

A dynamic two-sided matching market is considered. We examine two existing notions of stability—the core and recursive core—for this multi-period market and argue that they both have limitations. We define two new notions of stability and label them, *self-sustaining stability* and *strict self-sustaining stability*. Both concepts can be viewed as the recursive core with more stringent conditions for when deviating coalitions are effective. We show that these concepts overcome some of the weaknesses of the core and the recursive core. We also provide conditions for the existence of our concepts.

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## 1. Introduction

Many trading arrangements in the real world do not satisfy the assumptions of a Walrasian model of exchange. A special class of such arrangements is *two-sided matching markets*. These markets are characterized by two important features. First, participants belong to two disjoint sets; they cannot switch from one side of the market to the other no matter what the market condition. A second feature is the bilateral nature of exchange; the

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contrast is with centralized goods markets where the identity of one's trading partner is a matter of indifference. Examples of two-sided markets include many labor markets, as well as auction markets.

In this paper, we are concerned with a subclass of two-sided matching markets, namely those in which matches are *one-to-one*: each participant may be matched with at most one partner from the other side. Historically, the two sides of the market have been labeled the *males* and the *females*, and the model termed a *marriage market*. In many applications, a many-to-one relationship is more realistic but the issues we are concerned with can be discussed in the simpler class of one-to-one matching markets.

Any testable theory of a matching market must place some restrictions on the kind of outcomes that one expects to observe. An obvious restriction is that outcomes be “stable.” In thinking about stability, we have in mind cooperative concepts similar to the *core*. An outcome that is not in the core is, by definition, susceptible to blocking by rational players. In general, there will of course be many other restrictions imposed by the incentives and rules associated with a particular trading institution. We consider the requirement of stability because it represents a minimal constraint in markets where participation is voluntary. In addition, the cooperative notion of stability only requires a very general description of the game and so is applicable to many markets, whereas issues of non-cooperative behavior depend crucially on the particular trading and information structure under consideration.

A large and very successful literature has considered stability in the special case of a static market (Roth and Sotomayor, 1990 provide an excellent summary). Existence of the core has been established and many of its interesting characteristics noted. In many markets, however, participants trade repeatedly. Indeed, investigating stability in a dynamic market is a necessary first step to studying more realistic models where agents have to learn about the values of matches as they occur over time.

When there are multiple periods, a *matching plan* specifies a partner for each participant, at each point in time. An obvious candidate notion of stability is the core over the set of feasible matching plans. The core, however, has a particularly unsatisfactory property in a dynamic game: it can admit matching plans that are not “time-consistent.” Unless players can make binding agreements, elements in the core may be blocked at some later point in time.

The *recursive core*—defined by Becker and Chakrabarti (1995) in the context of a capital accumulation model—overcomes this. In our context, it requires that the continuation of a matching plan be in the core of the continuation market at all times.

Unfortunately, the recursive core is frequently empty. The reason is that it admits “incredible” deviations. In judging the stability of the grand coalition's matching plan—that is, the plan for all players—the recursive core requires that the plan be immune to blocking by coalitions at every point in time. However, no deviating coalition is subject to the same requirement.

The issue of what constitutes a “credible” deviation turns out to be very important in a dynamic matching market (in ways that are not apparent in a static market). Appropriately modifying the recursive core to deal with issues of credibility leads to a stability concept that is always non-empty.

We begin by imposing the requirement that blocking coalitions be “self-sustaining.” They must choose matching plans in which no subset of the coalition can reach an agree-

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