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# Nonparametric Estimation of Matching Efficiency and Elasticity in a Marriage Agency Platform: 2014–2025

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**Abstract**

This paper examines monthly matching efficiency in the Japanese marriage market using novel data from IBJ, the country's largest structured matching platform. Unlike administrative or dating app data, IBJ provides full search, dating, and matching logs based on verified profiles and confirmed engagements. Users are highly selected into serious marriage search via costly screening. Covering 3.3% of national marriages annually, the data offer rare behavioral granularity. Using a nonparametric approach, I estimate time-varying matching functions and elasticities. Efficiency rises fourfold over time, illustrating how digital intermediation transforms partner search in modern marriage markets.

**Keywords**: matching function, matching efficiency, matching elasticity, marriage agency platform, dating

**JEL code**: J12, J10, D83

## 1 Introduction

Understanding how individuals find partners in modern marriage markets is central to the study of family economics (Chiappori and Salanié 2023). As marriage rates decline and matching tech-

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Declarations of interest: none

nologies proliferate, questions surrounding search efficiency, partner availability, and market design have grown increasingly salient. While theoretical models of two-sided search abound, empirical research has been hampered by data limitations: traditional sources such as administrative records or surveys capture only realized marriages, omitting the entire search and matching process that precedes them, as well as the presence of singles who are not seriously seeking partners. Consequently, little is known about the dynamics of partner search, how modern platforms shape matching outcomes, or how efficiently modern markets operate. This study addresses these limitations by using novel data from IBJ, Japan's largest structured marriage matching platform, which accounts for approximately 3.3% of all marriages in Japan in 2024. The dataset includes over 10,000 confirmed engagements annually and allows for behavioral analysis of the full matching process, including search, proposals, and formal engagements. In this note, we focus on documenting macro-level trends on the platform as a first step toward more detailed analysis, leaving in-depth investigations of user behavior and underlying mechanisms to future work.

There are four distinctive and advantageous features of the IBJ data compared to dating apps (Hitsch *et al.* 2010, Ong and Wang 2015, Bapna *et al.* 2016, Egebark *et al.* 2021, Rios *et al.* 2023), speed date events (Fisman *et al.* 2006, Belot and Francesconi 2013), and government records (Chiappori *et al.* 2017). First, the data contain rich and verified user demographics, which are linked to official records such as tax withholding documents and certified health checkup results. Second, users are highly selected into serious partnership search due to substantial screening and financial costs. Third, the dataset records full, time-stamped logs of search and interaction behavior linked to confirmed outcomes, and includes information on whether users were active or inactive in their marriage search at each point in time. Fourth, the data are observed at the level of individual user behavior logs, enabling high-frequency analysis. Importantly, the IBJ data's richness and granularity, combined with its one-to-one matching structure, enable a direct analogy to labor market matching function estimation (Petrongolo and Pissarides 2001), allowing us to assess platform-level efficiency and responsiveness.

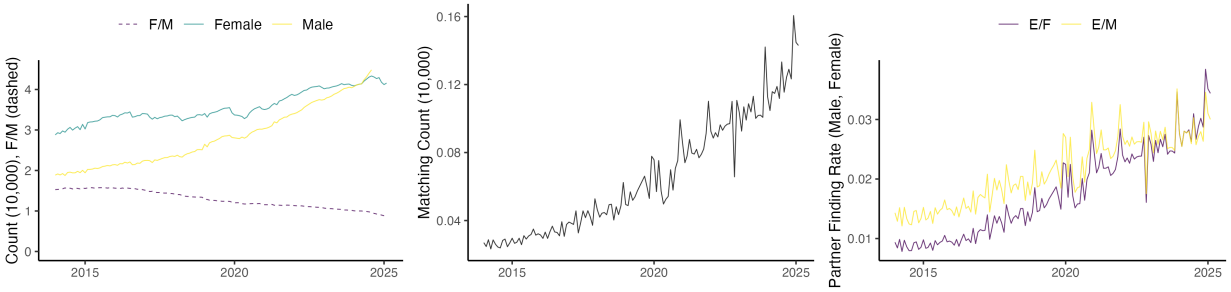
Using this dataset, I estimate a matching function following the nonparametric approach of Lange and Papageorgiou (2020) to evaluate the platform's performance.[1] I find that matching efficiency increased fourfold between 2014 and 2025, with sharp gains beginning in 2017, coinciding

[1]Their approach is widely applied to labor market settings. See Otani (2024a,b) and Kanayama and Otani (2024).

with major platform consolidation. Engagement formation also became more responsive to user composition, as indicated by rising elasticities. These results underscore the role of digital intermediation in shaping modern family formation. Unlike traditional arrangements mediated by kinship networks or local norms, platforms like IBJ provide structured, data-rich environments where frictions are minimized, outcomes are verified, and behavioral dynamics are observable, enabling new empirical insights.

## 2 Data

I use confidential data from IBJ covering the period 2014–2025. In 2024, IBJ accounted for 3.3% of all marriages in Japan, with over 10,000 engagements annually. While this share is smaller than administrative marriage registers, IBJ offers unique visibility into the pre-marriage process. The platform collects verified user data, including age, income, education, and marital status, and tracks the full sequence of user actions: search, proposals, messages, and dates. All records are time-stamped and linked to observed engagement outcomes. IBJ users are highly selected into serious long-term partnership search. Entry requires screening and significant upfront, monthly, and exit fees, which effectively exclude casual users. In contrast to dating apps that rely on self-reported profiles and open-ended interactions, IBJ functions as a closed, consultant-mediated two-sided matching platform where mutual consent leads to a confirmed engagement. This structured environment makes the data well-suited for analyzing matching efficiency and responsiveness over time.




(a) Female $F$, Male $M$, and tightness ($\frac{F}{M}$)

(b) Engagement $E$

(c) Patner Finding Rate ($\frac{E}{F}, \frac{E}{M}$)

Figure 1: Trends of key variables 2014-2025

Panels (a) and (b) in Figure 1 display trends in the number of active users and engagements on the IBJ platform from 2014 to 2025. Both female $F$ and male $M$ participation rise steadily, with male user growth outpacing that of females—particularly after 2020—leading to a gradual decline in market tightness, measured as the gender balance ratio $\frac{F}{M}$. Alongside this compositional shift, the number of engagements $E$ remains relatively flat until around 2020, after which it increases sharply. This acceleration likely reflects improvements in platform performance, such as better algorithmic matching, increased user activity, or broader social adoption of digital matching services.

Panel (c) illustrates the partner finding rates for female and male users per month, measured respectively as $\frac{E}{F}$ and $\frac{E}{M}$. Both rates increase over time, with females consistently achieving higher matching rates. This suggests improved match formation efficiency on the platform, particularly for female users, despite the growing supply of male participants. The male rate displays greater month-to-month volatility, pointing to more sensitivity to changes in market conditions.

## 3 Empirical Framework

This paper conceptualizes the marriage market as a two-sided search environment, where female users seek partners and male users are potential partners.[2] A successful match occurs when both parties agree to engage. Drawing on the matching function framework from labor economics, I estimate the number of engagements as a function of efficiency input and market tightness captured by the gender balance ratio.

Let $E_t$ denote the number of engagements at time $t$, $F_t$ and $M_t$ the number of active female and male users, and $A_t$ a time-varying matching efficiency parameter. Let $(A, F, M)$ denote random variables corresponding with realizations subscripted by time $t$. Let assume that $M$ and $A$ are independent conditional on $F$, that is $M \perp A|F$. I assume a matching function of the form $E_t = m(A_t F_t, M_t)$ with constant returns to scale. Given the assumptions, by applying the nonparametric identification results of Matzkin (2003) to avoid functional form assumptions, Proposition 1 of Lange and Papageorgiou (2020) shows that the observed joint distribution of engagements, female

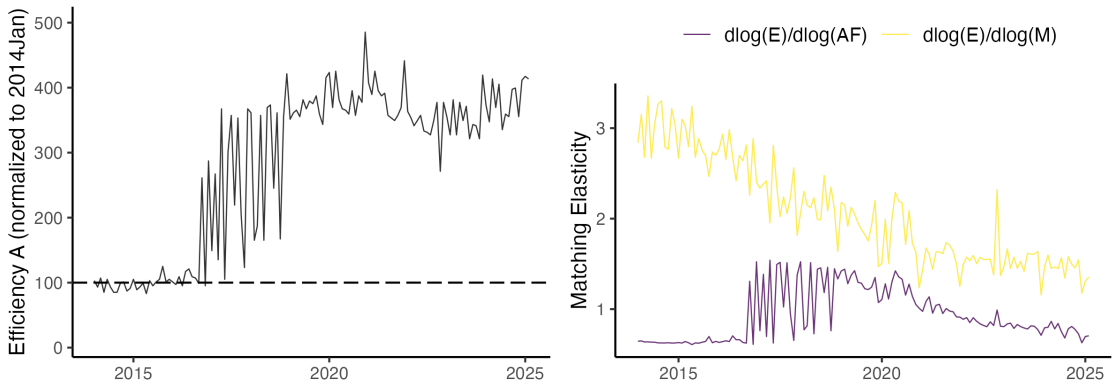
[2]While an influential strand of the literature models marriage markets as stable, frictionless matching environments and estimates preference-based matching patterns using equilibrium assumptions (e.g., Chiappori and Salanié 2023), this study takes a different empirical approach. Rather than recovering structural preferences under the assumption of stable matching, I focus on the empirical measurement of platform-level matching efficiency and elasticity over time. Our interest lies in understanding how the IBJ platform transforms search input into actual matches.

users, and male users, denoted as $G(E, F, M)$, nonparametrically identifies the joint distribution of matching efficiency and female participation, $H(A, F)$, as well as the matching function $m(AF, M) : \mathbb{R}^2_+ \to \mathbb{R}_+$, up to a normalization of the efficiency parameter $A$ at a given point $A_0$ in the support of $(A, F, M)$.

# 4 Results

Using nonparametric methods proposed by Lange and Papageorgiou (2020), I estimate time-varying matching efficiency $A_t$ and elasticities with respect to effective female search input $A_t F_t$ and male users $M_t$.[3]

## 4.1 Matching efficiency and elasticity in the marriage platform




(a) Matching Efficiency ($A$) (b) Matching Elasticity ($\frac{d \ln m}{d \ln AF}$, $\frac{d \ln m}{d \ln M}$)

Figure 2: IBJ platform 2014-2025

Note: I normalize matching efficiency in January 2014 to 100.

In Figure 2, matching efficiency increases more than fourfold from baseline levels in 2014, with particularly rapid acceleration beginning around 2017 and continuing through the post-2020 period. Notably, the efficiency nearly triples between 2017 and 2019. This sharp improvement may be partly attributable to structural changes within the platform, including the consolidation of other major marriage agencies into the IBJ network. For example, the integration of ZWEI—another nationwide marriage consultation service—into the IBJ Group during this period likely expanded the effective

[3]Details are shown in Appendix. Finite sample performance via Monte Carlo simulations is also shown in Otani (2024b).

user base and improved cross-platform coordination. Such developments may have enhanced the breadth of matching opportunities and the sophistication of recommendation mechanisms, thereby contributing to substantial gains in match formation efficiency. Elasticity with respect to female-side input ranges from 0.5 to 1.2, while male-side elasticity frequently exceeds 1.0, indicating that the platform has become increasingly responsive to shifts in both sides of the market.

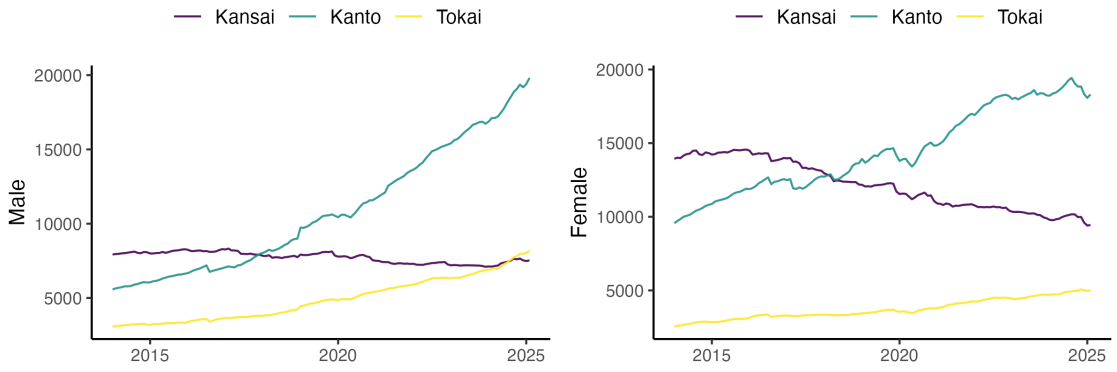
Together, these trends indicate that the IBJ platform has become not only more efficient in producing engagements but also more responsive to shifts in both sides of the user base. The increase in efficiency and elasticity suggests improved functionality in the underlying matching process, possibly driven by better recommendation algorithms, increased user base scale, or more targeted user engagement strategies.

### 4.2 Regional differences in matching efficiency and elasticity

I also explore regional variation across three major areas in Japan: Kanto (Tokyo), Kansai (Osaka), and Tokai (Aichi) in Figure 3. All regions show improved matching efficiency normalized to January 2014, Kanto, with Kanto consistently leading. Elasticities are broadly similar across regions, suggesting stable platform functionality nationwide. Overall, the IBJ platform exhibits increasing matching efficiency and stable elasticity patterns across major metropolitan areas, reflecting both platform-level improvements and region-specific user growth.

## 5 Conclusion

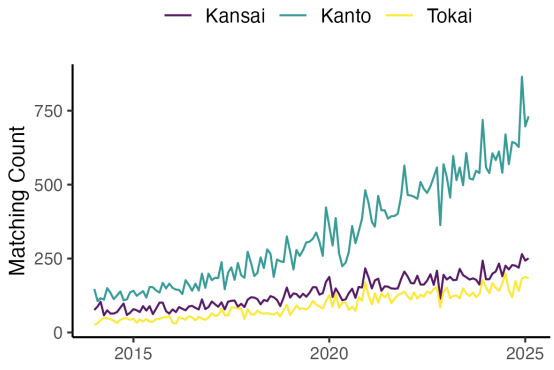
This paper documents substantial improvements in matching efficiency on a large-scale marriage platform in Japan. Leveraging verified user data and well-defined engagement outcomes, I apply a nonparametric approach to estimate time-varying matching functions. Efficiency and elasticity estimates indicate that the platform has become more effective and responsive to user-side dynamics. Regional analysis confirms consistent functionality across major urban areas. These findings highlight the potential of digital matching platforms to reshape traditional partner search markets through structured intermediation and algorithmic improvements.



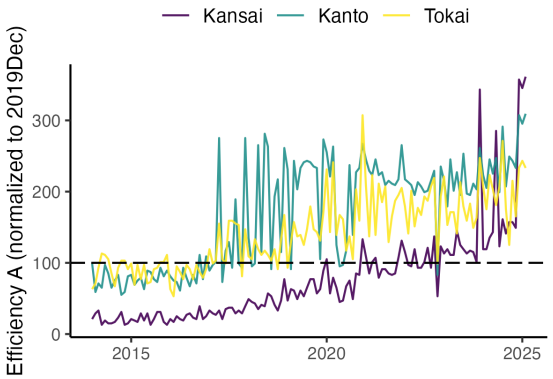

(a) Male ($M$)



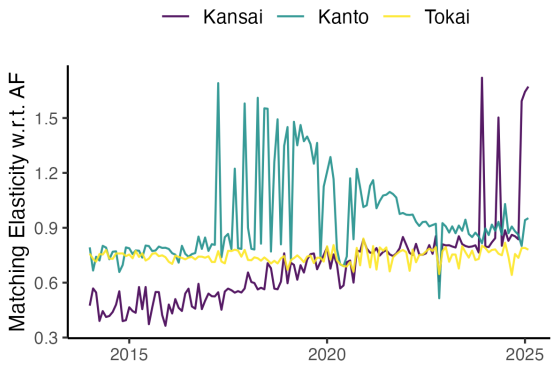

(b) Female ($F$)



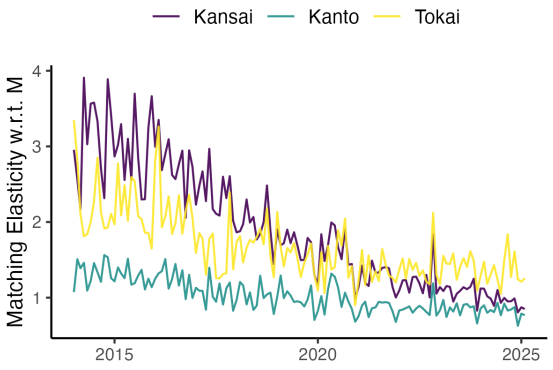

(c) Engage ($E$)




(d) Matching Efficiency ($A$)




(e) Matching Elasticity ($\frac{d \ln m}{d \ln AF}$)




(f) Matching Elasticity ($\frac{d \ln m}{d \ln M}$)

Figure 3: IBJ platform 2014-2025

Note: I normalize matching efficiency in January 2014, Tokyo to 100.

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# A Online Appendix (Not for publication)

## A.1 Estimation details

I begin by estimating the distribution function $F(A_0 \mid F)$, following the identification strategy in Lange and Papageorgiou (2020). The logic hinges on the conditional distribution of engagements $E$, given female and male user counts $(F, M)$. Formally:

$$F(A_0|\psi F_0) = G_{E|F,M}(\psi E_0|\psi F_0, \psi M_0),$$

$$F(\psi A_0|\lambda F_0) = G_{E|F,M}(\psi E_0|\lambda F_0, \psi M_0),$$

where $\psi$ is an arbitrary scalar, and $\lambda$ is a scaling factor. By varying $(\psi, \lambda)$, I trace out $F(A \mid F)$ over the support of $(A, F)$.

In practice, with finite data, I construct a nonparametric estimator of $G_{E|F,M}$. For any evaluation point $(E_\tau, F_\tau, M_\tau)$, I compute the proportion of observations with fewer engagements than $E_\tau$ among those located near $(F_\tau, M_\tau)$ in the $(F, M)$-space. Kernel weights discount the influence of distant points. The estimator is written as:

$$F(\psi A_0|\lambda F_0) = G_{E|F,M}(\psi E_0|\lambda F_0, \psi M_0),$$

$$\hat{F}(\psi A_0|\lambda F_0) = \sum 1(E_t < \psi E_0) \cdot \kappa(F_t, M_t; \lambda F_0, \psi M_0),$$

where $\kappa(\cdot)$ is a bivariate normal kernel function with bandwidth set to 0.01.

Once the distribution $F(A \mid F)$ is recovered, I invert it using observed engagements to retrieve the implied matching efficiency $A_t$ for each time period:

$$A_t = F^{-1}(G(E_t|F_t, M_t) \mid F_t).$$

Using the recovered values of $A_t$, I then invert the matching function:

$$m(A_t F_t, M_t) = G^{-1}(F(A_t \mid F_t) \mid F_t).$$

Finally, I compute local elasticities of the matching function by regressing engagements $E$ on female and male user counts, interacted with the estimated effective search input $AF$. This allows us to estimate the marginal responsiveness of engagements to changes in female and male participation:

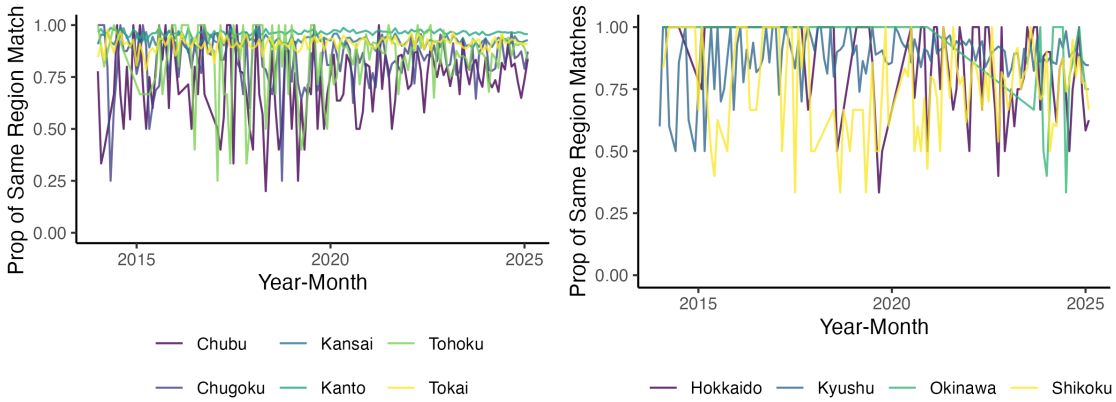
$$\text{Elasticity w.r.t. } F: \quad \frac{d \log m(AF, M)}{d \log F} = \frac{d \log m(AF, M)}{d \log AF},$$

which is obtained by estimating the derivative of the matching function with respect to $AF$, multiplied by the ratio $\frac{AF}{E}$, using the regression coefficient from the empirical specification.

## A.2 Mobility across areas

Figure 4 documents the share of matches formed between users residing in the same geographic area ("within-area matches") over time. Panel (a) shows trends for major regions on the Japanese mainland (Honshu), while Panel (b) displays patterns for island regions. Across all regions, the majority of engagements occur between users residing in the same region, suggesting limited cross-regional mobility in the partner search process. Mainland regions such as Kanto and Kansai consistently exhibit within-region matching rates above 70–80%, while smaller or less dense areas like Chugoku and Tohoku display greater fluctuation, especially in the earlier years of the sample.

In contrast, island regions such as Okinawa and Hokkaido show both higher volatility and a larger share of cross-regional matches, particularly in the early years, potentially reflecting more constrained local partner pools. Over time, the within-region matching rates for island areas also tend to converge toward mainland levels, suggesting an increase in local matching capacity or more geographically filtered search behavior. These patterns indicate that despite the digital nature of the platform, physical geography continues to play a substantial role in shaping match outcomes.




(a) Main Land (Honshu) areas

(b) Island areas

Figure 4: Within-area Marriage Share