The Gastroenterology Fellowship Market: Should There Be a Match?

By Muriel Niederle and Alvin E. Roth*

We are helping a task force of the American Gastroenterology Association to evaluate the current state of the (decentralized) market for gastroenterology fellows, and to assess the prospects of reorganizing it via a suitably designed centralized clearinghouse, a "match." This market used a match from 1986 until the late 1990s. Starting in 1996, participation in the match declined precipitously, and it was formally abandoned after 1999. Consequently, the experience of this market when the match was in place, in comparison to the periods before and since, allows an assessment of the effects of the match. An analysis of how the match failed in the 1990s yields insights into the prospects for success of a new match. These events offer economists a rare window on how decentralized labor markets clear, and on how market clearinghouses succeed and fail.

I. The Rise and Fall of the Gastroenterology Match

A gastroenterologist, after graduating from medical school, completes three years as an internal medicine resident, and then a gastroenterology fellowship. Like many other entry-level labor markets, gastroenterology experienced "unraveling" prior to 1986, as offers were made earlier from year to year, at dispersed times, well over a year before fellowships began. Such early offers are typically also "exploding," they do not leave candidates time to consider many other offers (Roth and Xiaolin Xing, 1994; Niederle and Roth, 2004b).

In 1986, after other attempts to halt unraveling and create a thicker and more orderly market, gastroenterology, and a number of other specialties, were successfully organized through a centralized match, the Medical Specialties Matching Program (MSMP), which operates along the lines of the larger resident match for first-year doctors (cf. Roth, 1984; Roth and Elliott Peranson, 1999). After a period of interviewing, medical residents and gastroenterology program directors ranked each other and submitted these lists to the match. A version of a deferred acceptance algorithm (David Gale and Lloyd Shapley, 1962) produced a *stable* matching (i.e., one in which no resident and program who are not matched together would both prefer to be). But in the late 1990's, the match itself unraveled, as positions were filled before the match was conducted.

Up to 1995, well over 300 fellowship positions were advertised annually through the match, which attracted at least 1.3 applicants per position, with a fill rate of 88 percent and higher. A planned reduction of 25–50 percent in fellowship positions over five years began in 1996, when about 300 positions were advertised. Unexpectedly, there was an even larger reduction in the number of applicants, and in 1996 only 0.9 applicants per position participated in the match, and only about 75 percent of positions were filled through the match. While the number of applicants quickly returned to excess supply, a perceived shortage of "high quality" applicants remained, and it seems that many fellowship programs had lost the confidence to wait for the match and preferred to make offers to candidates when they interviewed them. The next year, 16 percent of the positions initially advertised through the match were withdrawn, leaving only 213 positions in the match. In 1998, 60 percent of advertised positions were withdrawn, leaving only 99 positions in the match, and in 1999, the last year the match was formally conducted, only 14 positions participated.

While we know of about a hundred markets that have been organized by a stable matching mechanism, we know of only a handful that have failed (Niederle and Roth, 2004a), and so

* Niederle: Department of Economics, Stanford University, Stanford, CA 94305, and NBER; Roth: Harvard Business School and Department of Economics, Harvard University, Cambridge, MA 02138. We gratefully acknowledge the support of the NSF and helpful conversations and collaboration with Deborah Proctor.

the cause of the failure of the gastroenterology match is worth investigating. For this, historical field data can only take us so far. However, when we reproduce this market on a small scale in the laboratory (C. Nicholas McKinney et al., 2005) we can subject the market to different kinds of supply and demand shocks, under different information conditions.

Our experimental results confirm that it is hard to unravel a match even through a shock that reverses which side of the market is short. In the lab, when applicants were on the long side of the market, they eagerly accepted early offers, but programs had little incentive to make them. When applicants were on the short side and this was common knowledge, programs made early offers, but applicants preferred to wait for the outcome of the match. The feature of the 1996 market that makes a big difference in the lab is that the sudden shortage of applicants was unanticipated, and hence applicants went into the market thinking that positions would be scarce. So did fellowship programs, but they were more quickly able to discern the true state of affairs, when they did not get their expected number of applications. In this case, in the experiment, programs made early offers, and applicants accepted them. And, of course, once many programs are making early offers, and having them accepted, then many positions are withdrawn, and the attraction of waiting for the match diminishes.

This rare failure of a stable clearinghouse, following a disruption in supply and demand, also gives us an unusually clear way to assess what the clearinghouse accomplished while it was in use.

II. The Effects of a Match

A. *Timing and Market Thickness*

With the demise of the match, the market unraveled once again, and interviews for gastroenterology fellowships moved steadily earlier (Niederle and Roth, 2004a). Compared to internal-medicine subspecialties that continued to use the MSMP, the bulk of gastroenterology interviews had moved two months earlier for positions starting in 2003, and three months earlier for positions starting in 2005 (and 20 months before employment would begin). Interviews also became more dispersed. For example, there are never as many as 70 percent of the gastroenterology programs interviewing at the same time, while the comparably large internal medicine subspecialties that continue to use the MSMP have over 70 percent of programs interviewing at the same time for several months. For gastroenterology, by the time 80 percent of programs have started interviews, more than 50 percent have already finished. These differences between gastroenterology and the subspecialties that continue to use the match are even more consequential than they appear, because, for specialties that use a match, offers do not immediately follow interviews, and candidates can consider in the match all programs for which they have interviewed. We conducted a survey of gastroenterology program directors about the timing of offers, and the replies confirm that offers closely follow interviews.

B. *The Effects on Mobility: Who Matches to Whom?*

When hiring moves increasingly far in advance of employment, it may become more difficult to gather information on candidates, or to secure reliable commitments from them. For these reasons, we suspected that unraveling would be associated with increased reliance on local networks. And when offers are exploding, candidates may be able to more readily secure prompt counteroffers from local programs than from those that would require distant interviews. We therefore examined the mobility of gastroenterologists, as they moved from their internal-medicine residency to a fellowship.

In Niederle and Roth (2003b) we tracked the 9,180 fellows who completed both a residency and a gastroenterology fellowship in the United States after 1977. Before the match, and since its demise, fellows were much more likely to stay at the hospital at which they did their residency, to remain in the same city, and in the same state, than during the match. The fact that mobility declines after the breakdown of the match makes us more confident that the increase in mobility during the match is due to the match and is not simply an increase in mobility over time. The effect of the match is bigger for large (and presumably more prestigious) hospitals, which employ more fellows from a different hospital, city, and state.

The use of a centralized match therefore affects not only the *timing* of the market, but also the outcome, who matches to whom.

III. Does a Match Affect the *Terms* of Employment?

In 2002, 16 law firms filed a class action lawsuit, on behalf of three former residents, seeking to represent the class of all residents and fellows, arguing that the NRMP (the match for medical residents) violated antitrust laws and was a conspiracy to depress wages. The lawsuit was against a class of defendants including the NRMP (which also operates the MSMP), other medical organizations, and the class of all hospitals that employ residents.

One way to investigate whether a match affects wages of medical fellows is to examine comparable medical subspecialties, only some of which use a match. Niederle and Roth (2003a) compare wages of the 1,148 nonmilitary U.S. fellowship programs in all internal-medicine subspecialties that require three years of prior residency. Controlling for the hospital, we find that specialties that use a match have no lower wages than those that do not. Thus it appears that, in these medical labor markets, wages are determined by factors other than whether a centralized clearinghouse is used.

One by-product of the suit is that it brought renewed attention to the fact that many entry-level labor markets have *impersonal* wages that are part of the job description, so that people hired at the same time for the same kind of position by the same firm may all begin at the same salary. Jeremy Bulow and Jonathan Levin (2003) observe that a centralized clearinghouse may promote this tendency, since positions have to be offered in the match to all desirable candidates (i.e., without knowing in advance who will fill them). They note that many labor markets that do not use a match also often have impersonal wages: they mention law, investment banking, and academia. Bulow and Levin (2003) show that a market with nonpersonalized wages tends to lower the average wage and compress the wages of applicants compared to a competitive market (see also Ulrich Kamecke, 1998).

The evidence from medical subspecialties suggests that the absence of a match may promote neither more personalized wages nor a more competitive market. The gastroenterology market became thinner after the demise of the match, since dispersed exploding offers do not allow applicants to compare multiple offers.

Reflecting these considerations, President George W. Bush signed into law, as an addendum to the Pension Funding Equity Act of 2004, legislation that included a Congressional finding that "*Antitrust lawsuits challenging the matching process, regardless of their merit or lack thereof, have the potential to undermine this highly efficient, pro-competitive, and long-standing process ... .*" The legislation goes on to "*confirm that the antitrust laws do not prohibit sponsoring, conducting, or participating in a graduate medical education residency matching program, or agreeing to do so ... .*" Following this legislation, the antitrust suit was dismissed (although legal skirmishing remains).

IV. Reconstituting a Gastroenterology Match

What issues must the American Gastroenterology Association consider, as it contemplates a new match? Whether a match is desirable has the potential to be contentious, because a move to a later, thicker, more competitive market may not be a Pareto improvement. Less competitive programs may, in the present unraveled market, be able to retain their hospital's best medical residents, who would be more mobile in a match (cf. M. N. Ehrinpreis, 2004). However, evidence from the early years of the MSMP suggests that to start a match successfully requires substantial rates of initial participation by programs.

There are also several kinds of gastroenterology fellows, not only clinical fellows, but also basic science research and clinical research fellows. It appears that some programs may wish to hire a few research fellows (but not exclusively research fellows), but would like to fill those research positions with clinical fellows if they cannot. If so, it may be desirable to design the match to allow unfilled research positions to "revert" to clinical positions (Roth and Peranson, 1999; Roth, 2002). For the gastroenterology market, an alternative might be to have the research market operate before the clinical match.

V. Concluding Remarks

To facilitate efficiency, markets need to be thick, and many markets achieve efficiency by aggregating buyers and sellers in time (and sometimes in space). Unraveling works against this: dispersed and exploding offers make the market more like a series of bilateral encounters.

To realize the efficiencies that a thick market allows, the market needs to overcome congestion: having lots of applicants available does not help if employers only have time to consider a few of them. Prior to the start of the gastroenterology match in 1986, attempts were made to organize the market simply via a system of rules about when offers can be made, how long they must remain open, and so forth. Many markets have tried and failed to organize themselves by such rules: the problem is that they experience congestion, so that not enough offers can be processed in the available time. (By the time an offer is rejected, other candidates may no longer be available, and so employers have incentives to start making offers earlier, and to leave them open for less time, which makes the market unravel.)

Clearinghouses solve both problems: they bring participants to the market at the same time, and they overcome congestion.

To more fully understand how a wide variety of labor markets clear, we need to better understand how, and how well, other decentralized as well as centralized market institutions perform these tasks.

Added in proof:

The American Gastroenterology Association announced in June 2005 that it will reinstate a match starting in 2006.

REFERENCES

Bulow, Jeremy and Levin, Jonathan. "Matching and Price Competition." Working paper, Stanford University, December 2003.

Ehrinpreis, M. N. "Con: The Gastroenterology Fellowship Match: R.I.P." *American Journal of Gastroenterology*, 2004, *99*(1), p. 7.

Gale, David and Shapley, Lloyd. "College Admissions and the Stability of Marriage." *American Mathematical Monthly*, 1962, *69*(1), pp. 9–15.

Kamecke, Ulrich. "Wage Formation in a Centralized Matching Market." *International Economic Review*, 1998, *39*(1), pp. 33–53.

McKinney, C. Nicholas; Muriel, Niederle and Roth, Alvin E. "The Collapse of a Medical Labor Clearinghouse (and Why Such Failures Are Rare)." *American Economic Review*, 2005, *95*(3), pp. 878–89.

Niederle, Muriel and Roth, Alvin E. "Relationship Between Wages and Presence of a Match in Medical Fellowships." *Journal of the American Medical Association*, 2003a, *290*(9), pp. 1153–54.

Niederle, Muriel and Roth, Alvin E. "Unraveling Reduces Mobility in a Labor Market: Gastroenterology with and without a Centralized Match." *Journal of Political Economy*, 2003b, *111*(6), pp. 1342–52.

Niederle, Muriel and Roth, Alvin E. "The Gastroenterology Fellowship Match: How It Failed, and Why It Could Succeed Once Again." *Gastroenterology*, 2004a, *127*(2), pp. 658–66.

Niederle, Muriel and Roth, Alvin E. "Market Culture: How Norms Governing Exploding Offers Affect Market Performance." National Bureau of Economic Research (Cambridge, MA) Working Paper No. 10256, 2004b.

Roth, Alvin E. "The Evolution of the Labor Market for Medical Interns and Residents: A Case Study in Game Theory." *Journal of Political Economy*, 1984, *92*(6), pp. 991–1016.

Roth, Alvin E. "The Economist as Engineer: Game Theory, Experimental Economics and Computation as Tools of Design Economics." *Econometrica*, 2002, *70*(4), pp. 1341–78.

Roth, Alvin E. and Peranson, Elliott. "The Redesign of the Matching Market for American Physicians: Some Engineering Aspects of Economic Design." *American Economic Review*, 1999, *89*(4), pp. 748–80.

Roth, Alvin E. and Xing, Xiaolin. "Jumping the Gun: Imperfections and Institutions Related to the Timing of Market Transactions." *American Economic Review*, 1994, *84*(4), pp. 992–1044.