THE ECONOMICS OF
ADJUSTMENT

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ABSTRACT

In this paper we argue that many topics in macroeconomics can be viewed as part of the broader theory of the economics of adjustment. We argue that existing approaches to the economics of adjustment take a very narrow view of the role of information. We outline an approach to this topic that stresses the role of learning and information externalities, and discussed through examples how these concerns alter the qualitative nature of the adjustment process. In particular, there appears to be a general bias towards the underprovision of information in a variety of settings which leads to inefficient adjustment.

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1. INTRODUCTION

As consumer tastes and production techniques evolve over time, the economy must adjust to the changing circumstances. It must reallocate its resources away from less desirable goods and less productive technologies towards newly desirable and productive ones. The economics of adjustment takes as its subject matter the analysis of the manner in which these changes occur. It studies how individual economic agents decide to reallocate resources in response to economic disturbances and how markets aggregate these individual adjustment decisions. The importance of the subject arises from the fact that matching resources to their appropriate uses is a very difficult, costly and time-consuming process. As a result it is possible that resources may remain misallocated for some time as the process of adjustment works itself out.

In this paper we focus on the role of information in the adjustment process. In most situations agents make their adjustment decisions under great uncertainty. They need to know the best use for their resources, the best location to adjust to, and the best means of adjustment. They face difficulties, however, in deciding exactly which uses, locations, and means are the best. At each stage of this decision making process they need to gather information in order to make their decisions effectively. Faced with such uncertainty, it is natural that agents will make use of all sources of information at their disposal, including the observed behavior of others who are in similar situations and contemplating similar adjustment decisions. We argue that a careful consideration of the role that information plays, especially the process of learning from others, is crucial to understanding the nature of the adjustment process. A consideration of this role quickly leads to a class of information externalities that have not been incorporated into the adjustment literature.

The economics of adjustment is a broad area that covers a wide variety of different problems. Milton Friedman's original definition of the natural rate places unemployment in this class of economic problems.

"The natural rate of unemployment," he wrote in his presidential address, "... is the level that would be ground out by the Walrasian system of general equilibrium equations, provided there is imbedded in them the actual structural characteristics of the labor and commodity markets, including market imperfections, stochastic variability in demands and supplies, the cost of gathering information about job vacancies and labor availabilities, the costs of mobility, and so on."

Friedman's definition stresses the frictions inherent in labor markets and the difficulty of reallocating labor in response to shocks. The natural rate of unemployment is positive because stochastic supplies and demands make it necessary for labor to adjust, because it is costly to transfer resources from one use to another, and because it takes time to gather information concerning how labor should best be employed.

Labor is not the only factor which faces adjustment problems. Many of the same problems plague markets for other factors such as land and capital. Office buildings frequently remain vacant as owners look for desirable tenants. Home owners often spend months searching for buyers for their homes. Producers must decide when to open and close factories and where to locate new production. In each of these cases the need to adjust to changing economic circumstances causes resources to be temporarily misallocated due to the cost and effort inherent in finding better uses.

At a broader level, there are times when the entire economy faces an adjustment problem. A prime example of this is the situation faced by the nations of Eastern Europe where resources must adapt to an entirely new political, economic, social and legal system. Here the uncertainty surrounding the adjustment process is particularly acute; no-one has a very clear picture of what the ultimate deployment of resources in these economies will look like. Similarly, one may view a developing economy as facing an adjustment problem. Developing nations must cope with many levels of uncertainty in deciding how to concentrate their resources in their development effort. In this sense, the economics of transition, growth and development share much in common with the economics of adjustment.

Returning to the theme of unemployment, much of the Keynesian tradition in macroeconomics builds upon the idea that adjustment problems, including problems of coordination and price stickiness, can cause unemployment to remain suboptimally high for a long period of time. When and how such high levels of unemployment might arise and whether or not government action might ease the adjustment process are all issues that can be included under the general heading of the economics of adjustment.

As the above examples indicate, there is a vast range of economic issues that are all aspects of the economics of adjustment. We begin our discussion of these issues by describing existing approaches that economists use to study adjustment problems. Much of this effort has focused on the question of why

it might be optimal for resources to be temporarily unemployed and on whether or not markets achieve the optimal rate of reallocation. After outlining existing approaches, we argue that this literature has paid inadequate attention to the informational problems that are involved in the adjustment process.

2. CURRENT APPROACHES TO THE ECONOMICS OF ADJUSTMENT

The literature on economic adjustment has taken two general approaches towards examining the problems involved in reallocating resources. The search theoretic approach emphasizes the difficulties involved in locating appropriate uses for resources, whereas the adjustment cost approach highlights the costs inherent in transferring resources from one use to another. In their simplest form, both approaches explain why it is optimal for a certain fraction of the economy's resources to remain in what otherwise might appear to be suboptimal uses.

A benchmark model of labor misallocation due to adjustment costs would begin with a worker who after a shock to the economy is located in state **A** when the worker's optimal state of employment is state **B**. Depending on the focus of the model, these states may represent unemployment and employment, different industries or geographical regions, or some other aspect of the economic environment that might be relevant to the worker's productivity. The model would then posit: (1) an adjustment cost function that specified how costly it would be for the worker to move from **A** to **B** or, if relevant, to some intermediate position; and (2) a loss function that specified how costly it would be for the worker to remain in state **A** or move only part of the way towards state **B**. Given the description of the state space, the adjustment cost function, and the loss function, it is then straightforward to determine the worker's optimal adjustment policy; this policy will simply weigh appropriately the costs and benefits of adjustment.

If the costs of moving all of the way to state **A** exceed the benefits, the worker will optimally remain suboptimally employed. Yet because there is no inherent reason that the privately perceived gains and losses should differ from the social ones, the misallocation that arises out of this benchmark adjustment cost model, however regrettable, is optimal from a social perspective. This basic model has been extended to situations in which the states **A** and **B** change over time, and to situations in which these changes are stochastic. These extensions affect the optimal adjustment policy but not the fact that this policy is socially optimal.

The questions addressed in adjustment cost models are when to adjust and by how much to adjust, not where to adjust. While many extensions of the benchmark model introduce uncertainty about the future state of the economy, adjustment cost models rarely consider uncertainty about the economy's current state. Agents in these models know exactly where resources would move if adjustment were costless. The adjustment costs merely impede this desired reallocation.

Search models introduce a degree of realism by allowing for situations in which workers do not know exactly where the best jobs are located. In the benchmark search model, a worker knows the distribution of wages in the economy, but not the location of any particular wage offer. Meeting a potential employer is equivalent to drawing a wage from this distribution. The question facing the searcher is whether to accept a given wage offer or to continue to search for a better one. The optimal policy involves calculating the wage that makes the searcher indifferent between the two alternatives and accepting all offers in excess of this reservation wage.

Like adjustment cost models, search models explain why workers might choose to remain unemployed. If the gain to finding better employment in the future exceeds the cost of remaining unemployed today, then search is optimal. Also like adjustment cost models, there is no intrinsic reason why search should lead to inefficiency. To the extent that private agents correctly judge the nature of the tradeoffs involved, their decisions should be optimal from both an individual and social perspective.

In reaction to the optimality of the benchmark models described above, several authors have introduced externalities into the adjustment process. Mussa (1986) catalogues the possible distortions that might affect adjustment cost models. He discusses taxes, credit constraints, minimum wage laws, and monopoly power. The exercise, however, does not present a clear picture of the optimality of market based adjustment. Depending on how the distortions affect the relative costs and benefits of adjustment, they may either excessively promote or hinder the process of reallocation. Mussa concludes, "There is no presumption that the pace of adjustment...is too rapid or too slow."

Others have considered the role of externalities in search models. Here two externalities have been emphasized in the literature. First, Mortensen (1982) observes that any match will result in a situation of bilateral monopoly in which the worker and the firm bargain over the surplus of the match. To the extent that this surplus is divided among the two parties, a party that rejects a match

in favor of continued search does not take into account that part of the surplus that would accrue to the other party. In this sense search is inefficient as too few matches are accepted. The second class of externalities concerns the technology by which workers and firms find matches. Tobin (1972) argues that congestion effects will cause the equilibrium rate of search unemployment to be inefficiently high. Gavin (1992) uses similar logic to argue that the unemployment resulting from adjustment in Eastern Europe is inefficient. Diamond (1982), however, argues that thick market externalities may lead to the opposite conclusion: an inefficiently high level of search unemployment. In the Diamond model, higher unemployment thickens the market and improves the quality of matches. Again, as in adjustment cost models, there is no presumption that the pace of adjustment is too slow, rather than too fast.

In broad terms, the existing approaches to the economics of adjustment surveyed above place emphasis on the nature of the costs of adjustment, and the time it takes for individual agents to sample enough information to determine where to move. While both of these issues are undoubtedly important, we feel that current approaches have neglected an important source of external effects on the search process: externalities that arise in the process of gathering and processing information.

We believe that learning is one of the central issues in adjustment. Agents face a tremendous amount of uncertainty in making their adjustment decisions. Their first task is to gather information in order to make informed decisions. The existing literature takes a very narrow view of this learning process. In as much as learning has been studied, it has been viewed as a private affair. An individual searches against a fixed distribution of offers in a manner that does not interact directly with the learning of other market participants. Yet others' actions and behavior may prove to be an important source of knowledge and experience. We believe that the extent to which one agent may learn from observing the behavior of other agents has important implications for the adjustment process.

In the next section we argue by example that there are important lessons that agents learn from watching the behavior of other agents. After presenting these examples, we describe in the following section, how these externalities alter the qualitative nature of the adjustment process.

3. THREE STORIES AND A GENERAL APPROACH

The informational issues involved in adjustment can best be appreciated by considering actual situations. We therefore begin with three cases in which resources are currently known to be in sub-optimal uses, and discuss how the owner of the resource can go about learning the appropriate use of the resource.

The Case of the Vacant Office Buildings

As our first case, consider a world in which there are a large number of currently unoccupied buildings in a given area, each with a separate owner. Owners show potential tenants their vacant office space and entertain offers to take occupancy. Because it is costly to commit the building to any one of its potential uses, owners will not make a commitment easily. They will weigh the current offer against the possibility of receiving a better offer in the future. The situation is similar to the benchmark search model except that we have a group of offices instead of only one.

In the standard search theoretic view, there is a fixed distribution of valuations among the potential tenants, and this makes it a straightforward matter for the owner to decide on the cutoff for accepting an offer. There are many situations, however, in which it is far from straightforward for either the landlord or the potential tenants to work out how they are to value the office space. The reason for this is that uncertainty has many dimensions. For example, owners need to ensure that rent is paid. For this they need to know if this particular tenant is creditworthy, and they need to form expectations regarding the potential success of the tenant's business. Will this tenant be successful in the future and therefore able to pay higher rents, or will the tenant file for bankruptcy leaving the owner in need of a new occupant for the office? Other issues arise from the fact that signing on a particular tenant commits the property to a particular use. This raises questions concerning the appropriate use for the property. What lines of business are likely to thrive in the coming years? What sort of business will occupy neighboring buildings? What sorts of synergies will these businesses create, and what sorts of tenants would be willing to pay higher rents to take advantage of these external economies?

The important point here is not that information is complex or multifaceted. Such complications can be handled within the context of the benchmark search

model by allowing agents to search against a more general class of distributions. The important point is that with potentially so much uncertainty from so many different sources, agents can be expected to use all of the information at their disposal to inform their choices. In particular, when there are several property owners in a similar situation searching for tenants, there is the possibility that each may learn from the others.

The uncertainty surrounding many of the questions raised above can be greatly reduced by such observation. An owner can obtain a guess as to the creditworthiness or reliability of a prospective tenant by observing the behavior of other tenants with similar characteristics. An owner can gain some information on the relative merits of various uses for the property by observing the choices that others make. Similarly, an owner can gain information as to the future character of a neighborhood by watching what other owners do with their property.

What emerges is the picture of a market in which everyone is watching everyone else, deciphering each others every move, attempting to learn what they can about the market. If one owner mothballs a building waiting for business conditions to improve, than all will become slightly more pessimistic about the current situation. If one building is rented for an unexpectedly large amount than all infer that the value of their real estate has risen. If one owner decides to rent to a firm in a particular industry, than all take a close look at the advantages of letting to a similar firm.

These sorts of information spillovers occur all the time. An example, although not from real estate, concerns the sale of the Baltimore Orioles baseball club. Upon hearing that the rival club sold for $170 million, an owner of the Boston Red Sox was quoted as saying that the sale would "have a significant impact on what this teams [sic] sells for and increase the value of all baseball franchises." "Frankly," he continued, "I'm surprised the price was that high. I figured it would be somewhere in the area of $140 [million]."[1] From this reaction, it is clear that the Orioles' sale conveyed positive information that affected the valuation of other clubs.

In another example, Bed, Bath and Beyond, a retailer specializing in linens and bathroom accessories, recently opened a superstore in a vacant building on lower Sixth Avenue in New York and was successful in drawing shoppers to the area. As a result many other buildings were quickly rented to retailers. Rents

[1] Figures and quotes are from McDonough (1993, p. 65).

in the area rose from the low $20's a square foot that Bed, Bath and Beyond is paying to nearly $40 per square in negotiations a year later. Following Bed, Bath and Beyond's success, "the owners of a parking lot on 23rd Street, whose original plans to build an apartment building on the site were quashed by a combination of the depressed market and city red tape, are now wondering whether the space might serve a lucrative commercial use."[2] Again the experience of one searcher appears to have provided valuable information to others trying to make similar decisions.

The Case of the East European Arms Manufacturer

It is clear that there is currently a tremendous mismatch between the actual employment of labor and capital in Eastern Europe and their optimal employment. This has led to a large discussion of the nature of the adjustment mechanism, much of it focussing on the relative costs and benefits of gradual verses accelerated adjustment. The picture that is typically painted in these discussions is that of an economy that is off target, where the main issue is how to adjust to a that ultimate target. Again, we feel that this misses the crucial issue of just how agents actually go about assessing the optimal use for resources that are currently poorly employed.

There are many unanswered questions concerning adjustment in East Europe. Just how much heavy industry will survive the transition to a market economy? What will happen to the science establishment, the arms industry, and the nuclear power industry? To be concrete, consider a plant with a trained work force that is currently manufacturing arms, but knows that it is about to lose its key contract with the state. What should it do? Should the factory close, should it produce arms for export, or should it convert to another use? Once these broad decisions are made a whole set of subsidiary issues must be addressed. If the factory is to be closed, can anything be salvaged for scrap? If new orders are to be sought, which countries are likely to be interested, and how does one tailor products and market them in that country? If the factory is to be converted, what is the best product to produce?

Again with such pervasive uncertainty the factory managers will look anywhere for information. One important source will be the experience of other factories in the local region, and of other arms manufacturers in general. By studying

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[2] Quotes and figures are from Deutsch (1993).

the decisions that others in similar situations have made and are making the managers may indirectly benefit from the information gathered by others prior to their decisions. They will be able to avoid decisions that turned out to be mistaken and to emulate those that succeeded.

The Case of the Redundant Steel Workers

One may regard an unemployed worker as facing many of the same issues. Just as a landlord must find the appropriate tenant and a plant manager must decide on the appropriate product, unemployed workers must find appropriate employment. In general, a worker's performance and pay will depend on the quality of the workers match with a given firm, and this quality will depend in turn on how well a workers skills fit with the needs of the firm, how well these skills mesh with those of other workers, how well the worker's personality fits with those of other workers and so on. Because their pay depends on the quality of the match, unemployed workers are likely to spend some time searching for a good match. The search literature has considered this problem to be a private one, one of a worker searching against a fixed distribution of matches or wage offers and optimally deciding which ones to accept. The literature on external effects has merely added the effect of one worker's search on the arrival rate of matches for others.

The questions facing unemployed workers are of course much broader than whether a given wage is greater than the reservation wage. Workers must decide where even to begin looking for a firm to match with. They must decide whether to remain in their current line of work or search for employment in another field. If switching fields appears to be the best policy, workers must decide which ones offer the best prospects for employment for a worker of their type, and which firms within those particular fields present the best prospects for long and prosperous matches.

It is clear that if any of the characteristics that add to the success of a match between a particular type of firm and a particular type of worker are publicly observable then workers and firms should use this knowledge to improve their chances of making successful matches. By observing the behavior of workers with similar skills and characteristics a worker can learn which types of firms value workers with characteristics similar to his or her own.

Because firms tend to hire workers that match well with the firm, and because workers with the same firm tend to acquire similar skills and knowledge, workers will not have to look far to find other workers with similar characteristics whose behavior they might find informative. An unemployed steel worker will tend to observe the behavior of other unemployed steel workers, since these people are likely to share many of the same skills, educational achievement, and social attitudes. Are these other workers remaining in town waiting to be called back to their jobs? Are they taking other jobs? What type of jobs? Are they happy? Are they moving away? Where are they moving? Are they finding work in their new locations? The answers to these questions will influence where and with what intensity the steel worker searches for new employment.

In all three examples, there is a tremendous amount of missing information. As in the standard search model, individuals will take time to gather and process the information that is relevant to this decision. But unlike the standard search model, information is an incredibly complex multifaceted object, and there are multiple sources of information relevant to the optimal use of the resource. In particular, in all three cases much that is relevant to one individual's decision can be clarified by watching the decision making processes of other actors. In the case of the vacant offices, one of the relevant sources of information is the rental history of neighboring offices. In the case of Eastern European arms manufacturers, one of the sources of information is the decision of similar arms manufacturers on how to convert their factories. In the case of the redundant steel workers, there are the search histories of other workers laid off in steel and allied heavy industries.

4. INFORMATION SPILLOVERS AND OPTIMAL SEARCH

The possibility that agents gain information from the search behavior of other agents raises questions concerning what exactly it is that agents learn and how it is that they learn it. In order to understand how informational spillovers influence the adjustment process, one needs to know what aspects of individual behavior are observable, what the relevance of these observations is to other market participants, and how these observations affect the others' search behavior. At a broader level, one needs to know how these influences on individual behavior affect the operation of the market as a whole. In general the answers to these questions will depend both on the source of the uncertainty and the way in which information

is shared among workers. To get a flavor for the types of interactions that are possible, we discuss several possible cases in detail. To fix ideas we stay with the example of unemployed workers searching for new employment.

We begin with a simple case. Suppose that each worker is unsure about some aspect of the distribution of wage offers, possibly its mean or variance, and that all workers draw their wages from the same distribution. In this case, it is easy to see why the offers received by other workers would prove useful; they provide additional information regarding the unknown aspect of the wage distribution. Suppose further that there are no problems with information sharing. At the end of the day, all workers meet and provide complete accounts of their search activity. In this way, there is a common pool of information that all workers use in determining their reservation wages.

Even in this simple setting a number of informational externalities are present. First, as workers weigh the costs and benefits of increasing their search effort, they will only consider the value to themselves of receiving an additional offer and fail to take into account the value of this offer to others. For this reason, it is very likely that there will be too little search from a social standpoint. Information, as a public good, will be underprovided by the market. Second, the public good aspect of information leads to a free rider problem. If search is costly and requires effort, then each worker has an incentive to conserve energy and allow others to gather information for them. This too will lead to too little search in equilibrium. Finally, if and when workers do accept job offers they may not take account of the fact that by accepting an offer they stop searching and this stops the flow of information to others. Note that this third channel implies that unemployment spells are suboptimally short because workers accept too many offers, whereas the first two imply that spells are suboptimally long due to insufficient search effort. All three, however, imply that there is too little information from a social perspective. Ideally, agents should search more and search harder, but a combination of externalities and free rider problems prevents them from doing so.

One unrealistic aspect of this simple story of information sharing is that the flow of information between workers stops once a worker has accepted a job. In many cases the situation is exactly the opposite. Certain aspects of the match between a worker and a firm are observable only after a worker accepts a job offer and begins to work. We therefore consider what would happen if instead of learning about the distribution of wages, workers were learning about the quality of a match

between their skills and those required by the various types of employment open to them. To be specific, assume that there are many types of employment and that *ex ante* each job has a known and identical distribution of initial wage offers against which all workers searches. Workers differ in that each possesses a certain combination of skills and attributes. The sources of uncertainty is that workers do not know which jobs match well with their particular set of skills, and the quality of this match will determine future wage growth on the job. For simplicity, we assume that the quality of the match between a particular worker and a firm is captured by a single parameter that is observable to the match participants and the public at large only after a job has been taken.

Since the distribution of initial wage offers is known there is nothing that workers can learn from the search experience of other workers. Workers can, however, learn from others' matches. When a worker with certain set of skills discovers a particularly good match, all workers with similar skills will learn something about their match with that profession.

In this case, the information externality manifests itself in too few matches. Workers fail to take account of the value to others of the information that accepting a job offer reveals. For this reason unemployment spells will tend to be too long from a social perspective. As before there is also a free rider problem since agents have an incentive to wait for others to take jobs and reveal the quality of their matches. This free rider problem reinforces the effect of the information externality. It causes searchers to be even more selective in the matches that they accept. Unemployment spells become even longer, and the shortage of information even more acute.

In each of these examples, we have assumed that information sharing was a simple task. In the first case, it was possible to observe the entire search history of other workers. In the second case, it was possible to perfectly observe the quality of other workers' matches. In many situations, such information is neither simple to observe nor easy to convey. Nor is it the case that all information is equally easy to share. It is quite possible that a worker learns more from the fact that a co-worker has taken a job than from the observation that this co-worker is still unemployed. A worker may remain unemployed for a number of reasons. The worker may have received no offers from employers or the worker may have received only poor offers or the worker may not even have searched at all. Unless the channels of communication are very good much of this experience may remain unobservable.

An accepted job is potentially far more informative. One could learn the industry, location, and possibly even the wage of the job that was accepted, all of which may be valuable information to a searcher.

The fact that there is imperfect information sharing among the unemployed workers has further important ramifications for the search process. Consider a case in which the distribution of wage offers is uncertain as in the first case above, but rather than sharing information on wage offers, workers only learn about the wages that are accepted. In this setting, successful matches between workers and firms create information that is useful to other workers attempting to decide how to use their unemployed labor, whereas continued unemployment is an ambiguous signal for the reasons described above.

The limited sharing of information in this example make the information externality and the free rider problem even more clear. To see this it is useful to compare the incentive to accept a match in this market setting to the benchmark search model in which each agent searches in isolation. Because matches in the market setting create information that is valuable to other searchers, social optimality dictates that agents should accept jobs more readily than they would if they were searching in isolation. This is the information externality at work. Due to the free rider problem, however, the result is precisely the opposite; workers become more selective in the market setting in order to learn from others' matches. As a result the market produces individual spells of unemployment that are unambiguously longer than would be socially optimal because each individual delays acceptance in order to learn what others have done.

These examples illustrate possible ways in which the consideration of information spillovers may enrich our understanding of economic adjustment, and therefore of the natural rate of unemployment. One general feature in all of the above cases is a tendency toward the underprovision of information by the private market. This shortage of information affects the efficiency of the search process and provides a possible role for government policy to improve the allocation of resources. Whether this shortage of information leads to a natural rate of unemployment that is above or below its optimal level, however, remains an open question that can only be resolved by analyzing formal models of informational spillovers.

In this paper we have argued that many topics in economics, including the theory of the natural rate of unemployment, can be viewed as part of the broader theory of the economics of adjustment. We have argued that existing approaches

to the economics of adjustment take a very narrow view of the role of information. We have outlined an approach to this topic that stresses the role of learning and information externalities, and discussed through examples how these concerns alter the qualitative nature of the adjustment process. In particular, there appears to be a general bias towards the underprovision of information. The economic significance of this underprovision of information will likely vary from market to market.

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