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A LAGGED ADJUSTMENT MODEL OF FOREIGN WORKER MIGRATION TO THE FEDERAL REPUBLIC OF GERMANY

by

DAVID H. MALMQUIST

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11 May 1978
date

Elliot Zupnick
Chairman of Examining Committee

May 11, 1978
date

Herbert Guyer
Executive Officer

Professor Elliot Zupnick

Professor Michael Grossman

Professor Harold M. Hochman
Supervisory Committee

The City University of New York

Abstract

A LAGGED ADJUSTMENT MODEL OF FOREIGN WORKER MIGRATION

TO THE FEDERAL REPUBLIC OF GERMANY

by

David H. Malmquist

Advisor: Professor Elliot Zupnick

Much has been written about the phenomenon of temporary labor migration to West Germany. This study takes the position that such migration flows are lagged adjustment responses to observable objective signals in the international market for labor and it attempts to analyze the structures of the functions which determine these migration flows. The paper finds that labor migration to West Germany can be explained very well by logarithmic functions of changes in the observable market criteria. Further, these migration functions are shown to be reasonably stable over time and to be distinctly different between the various nationalities of foreign workers.

ACKNOWLEDGMENTS

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Of course, it is understood that the author's acknowledgment and appreciation of the contributions of other individuals, including those mentioned herein, in no way relieves him of the responsibility for any remaining errors.

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CHAPTER I

INTRODUCTION

There is a fairly long history of the migration of foreign labor into Germany. Prior to World War I there were more than 1 million foreigners employed in Germany. The utter economic chaos that followed World War I in Germany caused most of the foreign worker population to flee. During the Weimar years following the war, the economy improved slightly, but the impact of the terms of the Versailles Treaty, the ensuing inflation, and the stream of German nationals expelled from lost territories retarded the return of the foreign worker population. With the Great Depression, Germany instituted tight regulations designed to discourage foreign workers from coming into the country. Despite these regulations, many foreign workers did come to Germany during the middle and late 1930's because of the relatively early economic recovery there due largely to substantial deficit spending on public works and the manufacture of military hardware. When the war broke out the German economy was reaching the limits of capacity, and more and more workers were required to meet the needs of the expanding economy and to replace those workers conscripted for military service. To meet these needs, many foreigners in occupied lands were "strongly urged" to move to Germany to work for wages. Many others, mostly Slavs, were impressed to work on the farms and in the factories in Germany. This last group was essentially a slave work force. All tolled, there were as many as 5.5 million foreign workers in Germany during World War II.

Rigorous regulations pertaining to foreign workers were again enacted after the conclusion of World War II. During the first several years after World War II, Germany lost most of her wartime foreign worker population, who, with the help of international relief organizations were being relocated in America and elsewhere. And just as after the First World War, there were again large number of German refugees from areas conquered and lost who had to be accommodated. The harsh conditions in Soviet-occupied Germany kept a steady stream of German refugees flowing from East to West Germany. This was reduced to a trickle by the Berlin Wall and stepped-up border security. By the late 1950's, the labor market situation in Germany had reached the point where the foreign workers who wished to move there could be accommodated without too much of a problem. By the middle to the late 1950's Germany had made a rather substantial recovery from the devastating effects of World War II, and there began to emerge in Germany a set of circumstances which made foreign worker immigration attractive. Foremost among these were the substantial relative lack of able-bodied males in the 25 to 45 age bracket (as a result of the enormous number of wartime casualties), the growing trend toward early retirement, and the continuing increase in the average number of years of schooling.

The existence of these conditions, coupled with the signing of the Treaty of Rome, which gave birth to the European Economic Community in 1957, made it necessary to make the laws governing the ability of foreign workers to enter and move about in the German labor market less restrictive. By 1954 there were already seventy thousand foreign workers employed in the Federal Republic; by 1965 there were over a million. The foreign worker phenomenon in West Germany reached a peak by mid-1974 when over two and a half million foreigners were employed there. The vast majority of these were, and still are, Italians, Turks, Greeks, Yugoslavs, and Spaniards. Even with the severe cutbacks of the past two years, there still remain almost two million foreign workers in the Federal Republic.

For the time being, foreign worker migration to West Germany has peaked. No doubt it will pick up again as the economic recovery quickens and unemployment declines. The period which we are focusing on--roughly the mid-1950's to the early 1970's--was not one of continual steady increase in the inflows of workers of each nationality. There was for example a dramatic slackening in the pace of absorption of foreign workers in the 1966-1967 period. The fact is that the foreign worker is now a relatively permanent feature in the German labor market. But as an individual, the official status of the foreign worker is that of a transient. He is called a "Gastarbeiter," or "guest worker." He has permission to stay only for a limited time. If economic conditions slacken, he may be sent home. But as a phenomenon, the foreign worker appears to be in Germany to stay. As long as the socio-political framework which allows the migration to occur remains in place, the relative economic conditions which cause the migration to take place will probably continue to operate in its favor rather than not. It is not likely that Germany will find itself in a state of permanent recession where all foreign workers will ultimately have to be sent home. Nor is it likely that the day is fast approaching when there will be no more countries where the likelihood of finding and keeping a job, as well as the level of real hourly wages, is sufficiently less than in West Germany to provide sufficient encouragement for workers to move there. More likely, if migration to West Germany ceases, or falls off drastically, it will be because the real or imagined social costs to Germany and the German people appear to outweigh the social benefits, with the result being a switch to a legal intolerance toward immigration effected through the political process.

There have already been some hints of this kind of thing both in Germany and in Switzerland. But these periods of grass roots backlash against the foreign worker seem generally to occur when the economy is sagging and a person's failure to find a job is blamed upon the foreign worker. West Germany has fairly strict laws pertaining to migrants. The German laws permit the government, when it wants, to force foreign workers to return home, or to refuse to allow workers' dependents to settle in the country. On the other hand, the German migration laws are rather flexible in that the powers which are granted to the government are discretionary ones which it may or may not choose to apply. Not all of these discretionary powers are on the negative side however. The government can also allow for permanent settlement of workers and families. These discretionary powers, of course, do not apply to Italians who enjoy the "freedom of movement" privileges by virtue of various statutes of the Council of the European Communities.

We see then that the government can, by such intervention, substantially affect the flow of migration. In order to roughly illustrate the importance of the various foreign worker nationalities to the German economy, let us have a look at table 1.1 on the following page. The table shows that in June 1965, foreigners represented 4.9 percent of the German labor force, and in June 1974, 11.1 percent. The table also shows how very tight the labor market was in 1965 relative to 1974. There is

TABLE 1.1

FOREIGN WORKERS IN THE GERMAN LABOR FORCE, JUNE 1965 AND JUNE 1974

Nationality	June 1965				June 1974			
	Labor Force	Employment	Unemployment	% Unemployment	Labor Force	Employment	Unemployment	% Unemployment
Greeks	19,901	19,722	179	0.90	241,190	234,718	6,472	2.68
Italians	360,064	359,773	291	0.08	352,206	340,939	11,267	3.20
Spaniards	6,823	6,729	94	1.38	161,515	158,936	2,579	1.60
Turks	13,630	13,506	124	0.91	632,460	617,531	14,929	2.36
Yugoslavs	64,092	64,060	32	0.05	480,348	473,203	7,145	1.49
All Other Foreign	701,075	700,574	501	0.07	1,503,154	1,494,154	9,000	0.60
Total Foreign	1,165,585	1,164,364	1,221	0.10	2,382,565	2,331,173	51,392	2.16
Non-Foreign	22,689,165	22,594,967	94,198	0.42	19,078,578	18,679,286	399,292	2.09
Total	23,854,750	23,759,331	95,419	0.40	21,461,143	21,010,459	450,684	2.15

SOURCE: Statistisches Bundesamt, Wiesbaden, Federal Republic of Germany very little difference between the unemployment rates of foreigners and those of non-foreigners. This is perhaps a misleading bit of information because, as mentioned earlier, the German government does have the right to refuse entry to non-EEC foreign workers and even to send them home. This tends to keep the unemployment percentages for non-EEC foreigners well below what they would have been if the government did not have such immense power over their inflows and outflows. For reasons already mentioned, Italians cannot be asked to return home merely because there is no work for them. But since they (Italians) no longer constitute the overwhelming majority of foreign workers as they did prior to the mid-1960's, Germany still has very substantial control over the foreign worker population, most of which is now of non-EEC member origin.

As a result of the economic slowdown, Germany instituted a ban on further recruitment in November, 1973, and in April of 1975 placed restrictions upon their movements within Germany in an effort to limit the proportion of foreign workers in any one area to 12 percent of the labor force.[1] These two measures of course could not be applied to Italians since restrictions upon their movement into or about Germany would be illegal. However, labor force data for each employment district are carefully maintained according to worker nationality (including Italians) so that presumably Italians could be counted toward the 12 percent limit. But even though restrictions were imposed, there were still substantial numbers of non-EEC workers entering Germany in 1974 (the last year for which we had collected data at the time of this writing).

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[1]"Slamming the Door on Europe's Guest Worker," Economist, 9 August 1975, pp. 23-27.

Furthermore, Italians can collect unemployment for as long as any German in similar circumstances could and the government cannot send them home as they could with non-EEC nationals. This may provide us with a partial explanation as to why the unemployment rate for Italians is substantially higher than that of all foreign workers. It is possible, therefore, that this higher rate of unemployment for Italians merely reflects their preferred status relative to other foreign workers. But despite their superior status, Italians declined in terms of their absolute number in the German labor force, and especially in terms of their number relative to the total foreign worker labor force. In 1965 Italians represented nearly 31 percent of the foreign worker labor force; in 1974 they represented under 15 percent of the foreign worker labor force.

While Italians were declining in their relative importance, Greeks, Spaniards, Turks, and Yugoslavs were rapidly increasing in number. In 1965 Greeks made up 1.7 percent of the foreign worker labor force; by 1974 they made up slightly more than 10 percent. Spaniards made up less than 0.6 percent of the foreign worker labor force in Germany in 1965, and by 1974 they accounted for 6.8 percent. Meanwhile, the Turkish and Yugoslavian workers' respective shares of the labor force went from 1.1 and 5.5 percent in 1965 to 26.5 and 20.2 percent.

Table 1.2 gives us some indication of to what extent the wives of male foreign workers are living in Germany with their husbands and to what extent they participate in the German economy. With a little bit of calculation we can see that about 26 percent of male Italian foreign workers have their wives participating in the German economy, while the figure is only 19 percent for Turks.

TABLE 1.2

MARITAL STATUS OF MALE FOREIGN WORKERS AND
ECONOMIC ACTIVITY OF THEIR WIVES AS OF SEPTEMBER, 1968

	Employed Males Foreign Workers (1)	Percent			
		Those Under (1) Who Are Married (2)	Those Under (2) Living With Wife in Germany (3)	Those Under (3) With German Wife (4)	Those Under (3) With Economically Active Wife (5)
All Foreigners	768,725	71	51	26	71
Italians	236,825	64	54	22	74
Greeks	83,704	78	78	6	90
Spaniards	75,316	74	60	9	68
Turks	111,648	82	34	7	68
Others	254,232	69	70	53	66

SOURCE: Wolf R. Böhning, "Foreign Workers in Post-War Germany," The New Atlantis 2, no. 1 (1970): p. 18, Table 2; reprint ed., Canterbury: Centre for Research in the Social Sciences, University of Kent, 1972.

NOTE: The data on this table are either taken directly, or derived, from Böhning's table.

From table 1.3 we can get some kind of idea as to where the foreign workers of the various foreign nationalities tend to be employed. We can see for example that there are proportionately fewer Italians than Turks in mining, iron and steel, and manufacturing, and relatively more in transport, commerce, services, and construction. It is interesting to note that those areas in which we tend to find Italians are generally areas that involve a higher degree of public contact and communicative skill in German than the areas in which we tend to find Turks.

There appears to be a pecking order which not only differentiates between the Germans and foreigners, but between different kinds of foreigners as well. Böhning discovered a kind of connection which Germans tend to make between the individual migrant worker and the level of economic development of his native country. An attitude poll run by Böhning himself shows that the Germans tend to regard Americans and Dutch as equal or better than themselves, Italians as equal to themselves, while Turks and Africans are generally regarded as equal or inferior to themselves.[2] But these rankings refer to people of these various nationalities in general. Superimposed upon these rankings is the notion that foreign workers are regarded as "a stratum below the lowest class, that is, as a subproletariat."[3]

In general, there does not appear to be a great deal of racial reaction to the foreign workers in Germany. However, as the nearby sources dry up, there is the possibility that Germany will find itself relying on labor supplied from more distant places. Already we

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[2]Wolf R. Böhning, "Foreign Workers in Post-War Germany," The New Atlantis 2, no. 1 (1970): 12-38; reprint ed., Canterbury: Centre for Research in the Social Sciences, University of Kent, 1972.

[3]Ibid.

TABLE 1.3

EMPLOYED MALE AND FEMALE FOREIGN WORKERS IN
WEST GERMANY BY ECONOMIC SECTOR AS OF THE END OF JANUARY, 1973

	Farming, Gardening, Fishing, etc.	Mining, Stone Masonry, Energy	Iron and Metal Production and Manufacture	Manufacturing Industry Except Iron and Metal Working	Construction and Building Trades	Commerce, Finance and Insurance	Service Trades	Transport	Civil Service
All Foreign Workers	19,030 (2,423)	70,991 (1,612)	836,539 (220,982)	565,865 (246,990)	389,854 (4,767)	147,266 (59,038)	126,811 (75,550)	52,577 (5,735)	137,867 (89,494)
Italians	3,558 (292)	11,202 (304)	137,817 (32,719)	107,942 (46,752)	80,053 (564)	21,642 (6,418)	24,364 (9,422)	10,734 (831)	12,136 (6,026)
Greeks	553 (176)	3,027 (158)	133,061 (54,883)	89,010 (43,527)	11,063 (555)	11,254 (4,670)	8,489 (5,728)	2,423 (659)	9,528 (6,617)
Spaniards	2,036 (269)	3,945 (116)	72,418 (17,775)	54,123 (21,895)	13,851 (238)	8,683 (3,763)	8,036 (5,022)	7,984 (756)	8,081 (5,288)
Turks	4,111 (705)	32,491 (251)	218,808 (45,808)	136,595 (55,873)	75,286 (458)	17,277 (5,729)	14,271 (10,130)	11,748 (625)	17,827 (9,229)
Others	8,772 (981)	20,326 (783)	274,438 (69,797)	178,195 (78,943)	209,601 (2,952)	88,410 (38,458)	71,651 (45,248)	19,688 (2,864)	90,295 (6,233)

SOURCE: Bundesanstalt für Arbeit, Ausländische Arbeitnehmer 1973/73 (Nürnberg: Bundesanstalt für Arbeit, 1974), pp. 84-85, Übersicht 8.

NOTE: Male and female totals; female subtotals in parenthesis.

are seeing relatively fewer Italians and more and more Turks in the German labor force. We even see greater numbers of foreigners showing up in Italy's labor force. Turks are more distinctly foreign in Germany than Italians. It is always possible that if Black Africans and Asians begin showing up in Germany's labor force in greater numbers there will be a greater negative reaction than we now see.

There are, as one could expect, the usual kinds of Marxist/Capitalist polemics surrounding this issue, viz., the question of who gains at the other's expense. Some German officials are of the opinion that the employment of foreign workers constitutes foreign aid given to the labor-sending country by the labor-receiving country.[4] On the other hand, there are those who would have us believe that the foreign worker situation constitutes foreign aid given by the labor-sending country to the labor-receiving country. Consider the following statement for example:

> Labor migration is a form of development aid given by the poor countries to the rich countries. Traditional colonialism took labour (in the form of slaves) as well as natural resources from the countries it dominated. Today, neocolonialism extracts capital from the underdeveloped countries in various ways, the main one being trade on terms fixed by the developed countries. The transfer of human resources in the form of migrant workers is an important part of this transaction. Migration belongs to neocolonialism's system for exploiting the wealth of the Third World. That it is in the interest of the ruling class of some underdeveloped countries does not alter the fact that it helps in the long term to perpetuate the exploitation of the majority of their populations.[5]

Such arguments do not make a great deal of sense and we shall not dwell on them here. It is more reasonable to assume that both sending and

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[4] Suzanne Paine, Exporting Workers: The Turkish Case (London: Cambridge University Press, 1974), p. 2.

[5] S. Castles and G. Kosack, Immigrant Workers and Class Structure in Western Europe (London: Oxford University Press, 1973), p. 428.

receiving countries gain. Certainly the individual migrant workers gain or they would not undertake the move.

Yet another economic problem that is often brought up is the complexity of the social costs to the receiving country associated with using guest workers. Because the question of these social costs is so complex, they are difficult to measure. The private firms will hire these workers as long as the marginal private benefit (value of marginal product) exceeds the marginal private cost (wage). Whether a society should import an additional foreign laborer is a question which is best addressed by first asking whether the marginal social benefit exceeds the marginal social cost. Additions to the population, however brought about, mean that additional fire, police, health, and education services will have to be provided. These things, among other social services, are paid for by the public as a whole and not exclusively by the individual firm doing the hiring. If that were all there was to it, we could say that society at large is subsidizing those private firms using the foreign labor. But there are also social benefits which redound to society at large in excess of the benefit to the private firms hiring the foreign labor. The use of foreign labor enables German laborers to specialize according to their comparative advantage vis-a-vis the foreigners with the likely result that Germans in general are able to enjoy higher standards than they could in the absence of the foreigners, despite the fact that there also are likely to be some specific Germans who are made worse off by the presence of the foreigners.

Having briefly introduced some of the main aspects of the West German "guest worker" problem, we should say something about some of the literature on the subject. There is, of course, a very extensive literature on the human migration. The works of Thomas, Kindleberger, O'Neil, and Sjaastad are well known. Sjaastad's is the seminal work on the theory of human migration from the human capital approach.[6] Kemp has provided us with an excellent treatment of international migration from the general equilibrium point of view.[7] And on the subject of the West German "guest worker" problem, there also exists a very substantial body of literature including the works of Wolf Böhning, Heinz Werner, and Suzanne Paine. Paine's book focuses on the Turkish workers; however, it is a particularly scholarly work which contains an enormous amount of quantitative information on the German labor market and foreign workers in general.[8] An interesting theoretical piece on the question of the "guest workers" in West Germany is that by Krauss which shows how an international exchange of labor services for goods can be effected where gains from trade are realized by both countries with a cosmopolitan Pareto optimal solution.[9]

However, when we talk about meaningful quantitative work on this subject, there is scant little that has been published to date. There is the work of Bain and Pauga which does not examine the forces which affect migration and instead focuses on migration's impact upon the

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[6]Larry A. Sjaastad, "The Costs and Returns of Human Migration," Journal of Political Economy 70, supplement (October 1962): 80-93.

[7]Murray C. Kemp, The Pure Theory of International Trade and Investment (Englewood Cliffs, N. J.: Prentice-Hall, Inc., 1969), pp. 181-212.

[8]Paine, Exporting Workers.

[9]Melvin B. Krauss, "The Economics of the Guest Worker Problem: A Neo Heckscher-Ohlin Approach," Scandinavian Journal of Economics 78, no. 3 (1976): 470-76.

relative growth of money wages in various German industries. Employing time series data, their regression results support the notion that foreign workers tend to have a dampening effect upon money wages in the industry in which they are employed.[10]

More closely related to the work of this paper is that of Drettakis. Drettakis used Koyck transformations and quarterly data in attempting to explain the inflow of migrants by the German index of industrial production, the outflow of migrants, and German unemployment.[11] In a separate work, Drettakis used OLS to explain net migration as a function of last quarter's stock of foreign workers in West Germany and the current level of unfilled vacancies in West Germany.[12] However, in neither work does Drettakis include any "push" factors in the migration model. Nor does he employ in either model any kind of wage variable, nor any variable which measures relative economic conditions between the sending country and West Germany. Both models are relatively successful and indeed represent a significant step forward in the quality of empirical work on this subject.

It was with the hope that a lagged adjustment model, employing "push," as well as "pull," factors, and utilizing Almon lag techniques would further improve the quality of empirical results, as well as the state of knowledge on this subject, that the current work was undertaken.

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[10] Trevor Bain and Alvis Pauga, "Foreign Workers and the Intra-industry Wage Structure in West Germany," Kyklos 25 (1972): 820-24.

[11] E. G. Drettakis, "Distributed Lag Models for the Quarterly Migration Flows of West Germany," Journal of the Royal Statistical Society, ser. A, 129 (July 1976): 365-373.

[12] Idem, "The Employment of Migrant Workers in West Germany 1961-1972: An Econometric Analysis," Applied Economics 8 (August 1976): 11-18.

CHAPTER II

DEVELOPMENT OF THE MODEL

The empirical efforts of this paper focus upon the inflows of "new" entrants to the German labor market. A newly registered worker is either someone who arrives in West Germany without a valid work permit and is granted one at one of the federal labor exchanges, or is someone who arrives in Germany after having been granted a work permit at one of the German recruitment offices in his home country before he departed for the Federal Republic. The data on newly registered foreign workers do not include anyone who is already in Germany and reapplies for, and is granted, permission to stay and work after his current permit expires; they do, however, include someone who had previously worked in Germany and had returned home for whatever reason, and after a time, is granted permission to return and work in Germany.

By and large, however, the new registrants of a given nationality are a fairly homogeneous group. They are typically young and unskilled. This is a fairly important piece of information because it helps to explain why we have chosen to analyze gross in-migration rather than net migration. In-migration is not a relation which is perfectly symmetrical with out-migration; i.e., return migration of foreigners is not determined by the same list of independent variables as the original in-migration. For example, most of the literature suggests that some workers return home after having acquired some skills (by virtue of on-the-job training), and after accumulating some savings which might enable them to open a small business in which they could put the acquired skills to use. Whether or not they are successful in this regard is perhaps beside the point; the point is that it is generally believed that this dream does induce workers to return home. Another example of differences in factors affecting in- vs. out-migration of foreign workers is the effect of unemployment. A worker will leave his homeland only after a protracted period of unemployment at home during which time he may have exhausted his unemployment benefits, his savings, as well as any hopes he may have had of ever finding a job. He will be asked to leave Germany if he happens to be unemployed when his work permit expires, and the unemployment which existed in his homeland a year ago, which may just now be influencing those still affected to leave, would likely have little to do with his decision to return home.

Finally; if the foregoing reasons are not sufficient justification for treating migration into Germany of foreign workers of a particular nationality separately from return migration of workers of the same nationality, there is the question of how much the workers are transformed by their work experience. The fact is that the foreign workers become less homogeneous the longer they stay in Germany. They become more and more specific to the industries to which they are attached. They are waiters, auto workers, etc. with so many years experience. They are now subject to the business cycles and seasonal patterns of the particular industries in which they are employed. Hence, while the new in-migrants might be a fairly homogeneous group of individuals whose inflows are fairly sensitive to changes in the over-all conditions in German labor markets, the out--or return--migration of foreign workers is likely to be more sensitive to the conditions in the specific labor markets in which they find themselves employed in Germany than to those in the over-all labor market.

For these reasons, it is probably not a very good idea to lump in-migration together with out-migration, and we should not examine net migration directly.

The German government is an integral part of the foreign worker recruitment process. The firm in need of a worker of some type, lists the type needed with the Federal Labor Office (Bundesanstalt für Arbeit). The Federal Labor Office then recruits the worker through the local labor exchange. Usually there are more such positions listed with the Labor Office than it can reasonably hope to fill from their local exchanges. Positions are, therefore, listed with its labor exchanges on the home turf of the major foreign suppliers.

The usual argument is that these positions would go unfilled in the absence of the foreign workers. This is, of course, nonsense. If the in-migration of foreign workers were prohibited and all foreign workers were sent home, wages and domestic supplies of labor would adjust so as to yield new equilibria. Over time what happens is that foreign workers come to more or less monopolize those jobs which are most distasteful to the native population. The reason for this is that the downward pressure on wages, resulting from the presence of the foreign workers, prevents wages in the respective job categories from rising along with wages in other low skill areas, and the natives tend gradually to give way to the foreigners.

The usual explanation one finds for the foreign domination of certain job categories implicitly rests upon the assumption that the markets would not work in the absence of the official policy. The evidence they cite is that, with the migration, we find very few young Germans who take positions as waiters, garbage collectors, etc. No such explanation is necessary. All that really happens is that with adjustments being continually made at the margin, and with wages not rising as rapidly in these categories as they otherwise might, we find the foreigners dominating these categories.

But what about the persistence of the vacancies? Does not their failure to disappear over time indicate that the markets are failing to clear--i.e., to work properly--even with the migration? Not at all! These listed vacancies are an expression of anticipated future employment needs which may not necessarily exist at the time they are first listed. The listing of these vacancies is just one of the ways in which employers cooperate with the German federal government to help make the foreign "guest worker" program work. The fact is that not only are the foreign workers, once arrived, an integral part of the German labor market, but so are they before they arrive. In fact, the labor markets of several foreign countries are quite inextricably intertwined with the German labor market. That is, these countries supply Germany with labor; everyone knows this and takes it into account; and while it may be that few, if any, additional German workers will be forthcoming at existing wage levels in the relevant job categories, it is known that foreign workers will be forthcoming, in sufficient numbers, and at existing wages, provided the information regarding the need for such persons is passed through the pipeline. The vacancy listings, therefore, are not an indication of a labor market <u>failing</u> to work, but an indication of one aspect of <u>how</u> it works. Nonetheless, the number of such vacancies listed, at any given time, relative to the number employed, is a useful measure of the degree of tightness in the German labor market.

It is therefore not really necessary to explain the migration to Germany on the basis of disequilibria--the failure of markets to work.

Nor do we necessarily assume that labor markets always achieve their equlibria; that is, they need not necessarily always be cleared. Suppose, for example, that union or state imposed legal minimum wages constrain labor markets to equlibria above the natural, market clearing equilibria. Such constrained equilibria may provide a partial explanation for unemployment but do little to provide us with any plausible explanation for migration. That is, wages which are too high for the markets to clear result in excess supplies--a situation which hardly calls for an inflow of foreign workers. On the other hand--although it would, of course, appear to be a situation conducive to the employment of foreigners--it is difficult to see how wages can be continually maintained at too low a level to clear the markets of their excess demands. Such a condition is untenable in all cases except in the very short run. Wages will inevitably be bid up so as to clear the markets and there is no more case for migration.

In our thinking here we are probably hampered by a static analysis. It is clear that a dynamic analysis is what is required. Imagine a situation developing in the following way: When the barriers to immigration are dropped, some foreign workers appear on the scene. They come because of conditions of chronic unemployment and "underemployment" at home and because of perceived differences in wages. These workers are unskilled and do not know the language. They gravitate towards the only kinds of work which they can get: factory assembly line workers, bus boys, garbage collectors, etc.--anything that requires neither substantial training nor fluency in the local language. Over time, the effect of the foreigners seeking work in these job categories is to keep the wages in these areas at levels below those to which they would have risen in the absence of the foreigners. Gradually, more and more foreigners obtain employment in these areas and their depressant effect upon wages ultimately puts those wages at levels where there would be no additional workers forthcoming at the margin from domestic sources, and if the foreign sources of supply were to be cut off, it would take a quantum jump in wages in order to bring any additional workers forthcoming from domestic sources. By the time this point has been reached, the employers utilizing the foreign labor, probably have begun to realize that the maintenance of existing wage levels for these un- and semi-skilled classes of work is quite dependent upon a continual inflow of foreign workers.

The foregoing scenario is probably not unlike the way in which the post-war Gastarbeiter situation has developed in West Germany. Furthermore, it provides us with a reasonable and coherent theory as an alternative to the usual kinds of explanations which rely upon shortages, surpluses, labor markets which cannot be cleared for some unexplained reason, and upon the conventional (i.e., government statistical office) definition of unemployment which tends to perceive a given fixed number of individuals who will want to work at any particular time and a given fixed number of slots for them to be inserted into at the same time. The conventional view of the German Gastarbeiter situation perceives it as one wherein the workers are <u>not needed</u> in the foreign country but are <u>needed</u> in Germany, and that these differential labor needs would never be adjusted to in the absence of government policy.

It is probably true that, in the situation we are examining, less migration would take place in the absence of the government's policy. But that policy is one which is designed to break down the traditional barriers to labor migration and to promote the flow of information, thus enabling the labor market to function on a broader scale.

Human migration is a natural economic phenomenon which takes place not because of positive government policy, but because government resistance is not strong enough to prevent it. In some cases where the incentive is strong enough, such as in the Berlin wall example, it takes place despite the most formidable barriers. The traditional role of a government with respect to immigration is to retard it. We could, of course, cite a few examples of governments which actually promoted immigration, but these are few, and the encouragement is usually selective--for people from certain countries or of certain ethnic origins only. In the case of the German government, it is a combination of relaxation of restrictions and actual official encouragement. The German government has generally been making it easier to enter the Federal Republic for purposes of working. The government issues permits to work. These permits in themselves constitute a restriction, but they have generally become easier to obtain. The promulgation of the Treaty of Rome made entrance into West Germany from 1957 on less troublesome for migrants from the member countries in the EEC, the bulk of whom were then, as they are now, Italian. Two of the ways in which the German government has actually fostered immigration have been the maintenance of the information stream, and the use of direct recruitment stations in the various major sending countries. In many cases, the worker's transportation is paid for; but this payment, when it is made, is made by the employer. The employer is willing to make this payment because the worker is issued a permit to enter the country and work for that particular employer's firm only.

The role of the government in the sending country is also of importance. The governments of all the major sending countries, in the German case, are more or less permissive. But what is important for the researcher is that the political environment be more or less stable, or he is forced to resort to dummy variables to denote changes in political climate. Political developments in Greece seemed to significantly influence the migration pattern. Another political development which seriously impinges upon any empirical research is the decision that as of January 1, 1970, workers from EEC member countries should not be required to register as foreign workers when they are seeking work in any EEC member country. This development effectively cut off the data flow on new Italian workers in West Germany.

The question is always asked, "If wages and other relative economic conditions are so important, why do substantial differentials remain after migration has taken place?" Sjaastad has pointed out that we should not expect wage differentials to disappear across space as a result of migration.[13] For one thing, one region may have an appealing climate and cultural environment and people may be willing to work there for lower wages. Conversely, it may require unusually high wages to induce people to move to the shores of Hudson's Bay to work. A job driving a bus in San Francisco is a different job from driving a bus in Detroit and will likely command a different wage. This would be true even if North America were one single labor market with complete labor mobility. Rather than expecting migration to eliminate wage differentials, we should expect that after all labor migration has taken place, there should exist an equilibrium vector of wages which will clear all markets --assuming no market interferences and the existence of a general equilibrium solution--and that this equilibrium wage vector will leave some

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[13]Larry A. Sjaastad, "Costs and Returns," pp. 85-87.

substantial wage differentials across space. We should expect even greater wage differentials across international boundaries by reason of

> . . . the natural disinclination which every man has to quit the country of his birth and connections and entrust himself, with all his habits fixed, to a strange government and new laws . . . .[14]

Furthermore, it is important to distinguish as Lianos did, between the total number of persons who would migrate, given sufficient time, and the total number who actually do migrate in any given period.[15] He refers to these two phenomena as stocks and flows. What the stock really is, in his model, is the total amount of labor migration required to reach the new equilibrium, and the "sufficient time" is the total amount of time required to reach the new equilibrium, provided that there are no further changes in the value of the relevant economic variables and no interferences with labor markets or with labor mobility. It follows then that if "sufficient time" is allowed to elapse, with no further changes in economic conditions--except, of course, those resulting from the equilibrating influence of the migration itself--then the new equilibrium will be reached. This in turn, means that each independent variable should have a distributed lag, the length of which should be equal to its respective amount of "sufficient time."

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[14] David Ricardo, The Principles of Political Economy and Taxation, Everyman's Edition (London: J. M. Dent & Sons, 1965), p. 83. These words of Ricardo were actually written to explain the lack of emigration of capital, but are equally applicable to labor migration as well. Actually, they are a fundamental premise of the classical theory of international trade, which rests upon the assumption of the relative immobility of factors of production between countries.

[15] Theodore P. Lianos, "The Migration Process and Time Lags," Journal of Regional Science 12 (December 1972): 425-433.

It is, therefore, one of the basic premises of our model that the inflow of foreign workers is a function of changes in, rather than levels of, the relevant independent variables. So while the level of relative economic conditions determines the equilibrium level of foreigners in the receiving country, changes in those relative economic conditions are required to generate equilibrium changes, and hence adjustments to those equilibrium changes in the form of migration.

This is a fairly strong statement and requires some further amplification before we go into the exact specification of the model in any greater detail. Let us simply postulate that the equilibrium stock of foreign workers in country H at time period t is a function of the real wage differential existing between country H (host) and country F (foreign) at time period t. This is given by equations (2.1) and (2.1.1) below:

(2.1) $r_{F,t} = q_{H,t} - q_{F,t}$, where q_H is the real wage in the host country and q_F is the real wage in the foreign worker's homeland;

(2.1.1) $F^*_t = f(r_{F,t})$, where F^*_t is the equlibrium stock of foreigners in the host country in time period t.

It follows then that any <u>change</u> in the stock of foreign workers at time period t will be a function of the equlibrium stock of foreign workers in country H at time period t less the actual stock in time period t-1. This is expressed by equation (2.1.2) below:

(2.1.2) $\Delta F_t = g(F^*_t - F_{t-1})$, where F_{t-1} is the actual stock of foreign workers in the host country at time period t-1 and ΔF_t is the change in that stock from time period t-1 to time period t.

Now, by definition, the stock of foreign workers in country H in period t-1 is given by:

(2.1.3) $F_{t-1} = \sum_{T=t-\ell}^{t-1} \Delta F + F_{t-\ell}$.

By substituting (2.1.1) and (2.1.3) into (2.1.2), we get:

$$(2.2) \quad \Delta F_t = g \left[f(r_{F,t}) - \sum_{T=t-\ell}^{t-1} \Delta F + F_{t-\ell} \right. ;$$

$$(2.2.1) \quad \Delta F_t = g \left[f(r_{F,t}) - \sum_{T=0}^{t-1} g_T + F_0 \right] ;$$

$$(2.2.2) \quad \Delta F_t = h \left[r_{F,t}, r_{F,t-1}, \ . \ . \ . \right] .$$

Equation (2.2.2) tells us that the change in the number of foreigners in the host country at time period t is some function, h, of past wage differentials. We shall now further postulate that it is the nature of the relationship that changes in the actual stock of foreigners in the host country is a function of the changes in the wage differentials.

Consider the case where there is an equilibrium stock of foreign workers, F_0^*, in country H at the beginning of time period 0. Suppose that under conditions of ceteris paribus, there is a once-and-for-all increase in the inter-country wage differential, which produces a new higher equlibrium level of foreign workers in country H. The actual level of foreign workers will require time to adjust to the new equilibrium level; i.e.: the adjustment will occur gradually. This means that in each succeeding period there will be an increase in the actual number of foreign workers until such time as the actual number of foreign workers equals the new equilibrium level.

This simply means that changes in the actual number of foreign workers is a function of past changes in wage differentials. It obviously follows from our discussion that this must be some kind of distributed lag function. This is so because each successive change in the wage differential will have a corresponding change in the equilibrium number of foreign workers to which the actual number of foreign workers must continually adjust until such time as a new equilibrium is reached. Further, after an increase in the wage differential, if there are no further changes in the wage differential for a sufficiently long period of time, the new equilibrium level would be reached and the given increase would thereafter have no further effect. Therefore, each change in the wage differential has an effect for a while upon the adjustment process and then has no further effect.

Now the net change in the number of foreign workers in any period is equal to the gross inflow of foreign workers less the gross outflow of foreign workers, plus any additional changes due to retirement (where the worker does not leave), death, changes in the size of foreign workers' families in country H, and the rate of labor force participation by family members other than the main wage earner. Possibly, one could reasonably assume that these "additional changes" are too small to worry about, or that they sum to zero.

On the following page we have presented three figures which demonstrate our explanation of the foreign worker supply adjustment process. In figure 2 we have presented the levels of the wage differentials which would be consistent with the change in equilibrium number of foreign workers depicted in figure 1. In figure 3 we have depicted the corresponding change in the wage differential which brought about the adjustment in the number of foreign workers.

We have so far discussed the basic nature of the model as regards migration and inter-country wage differentials. It remains for us to develop the model in more detail in terms of specific functional form and the list of independent variables.

As regards functional form, we have already posited that foreign worker migration is a function of changes in the inter-country wage

Fig. 1. Adjustment of the Supply of Foreign Workers

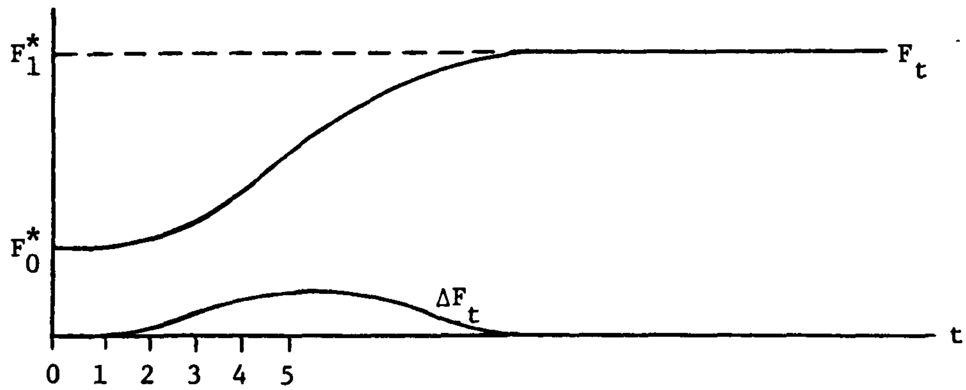


Fig. 2. The Inter-Country Wage Differential

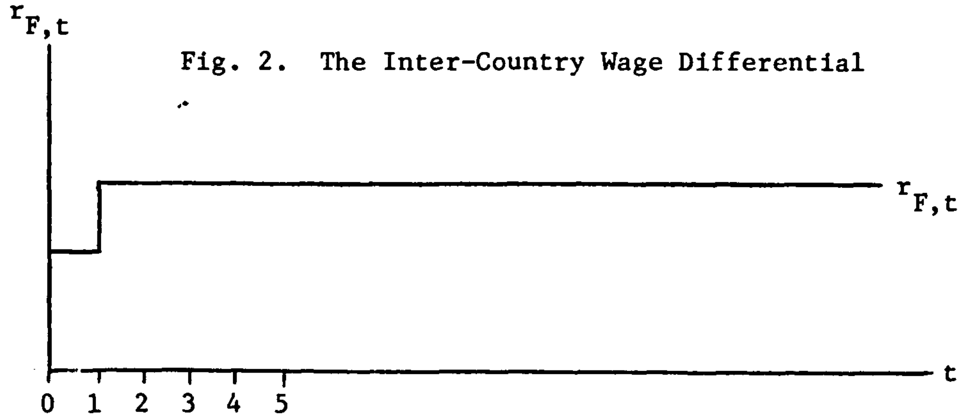
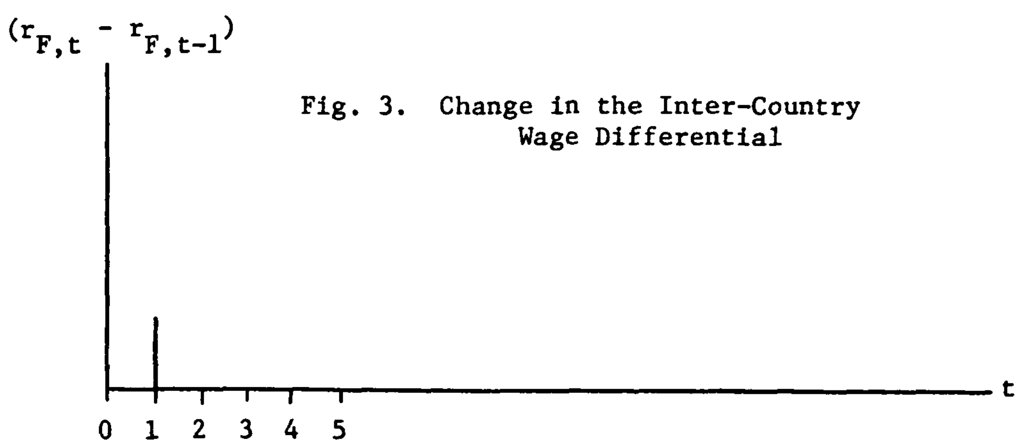


Fig. 3. Change in the Inter-Country Wage Differential



differential. We also tried to estimate migration as a function of levels of the inter-country wage differentials and other independent variables and the results bore out our a priori expectation that the correct specification makes migration a function of changes in the independent variables. (I.e., we were unable to obtain any satisfactory results with the level specification.) In addition, there was the question of whether the model should be estimated in linear or log-linear form. Here again our earliest empirical results gave us a clear indication. The logarithmic specification appeared to be definitely superior to a linear specification.

Let us consider now an equation wherein migration is a linear function of period-to-period changes in the inter-country wage differential:

(2.3) $m_{F,t} = a+b(r_{F,t} - r_{F,t-1})$, where $m_{F,t}$ is the actual number of workers who migrate from the foreign (sending) country to the host (receiving) country during time period t. A logarithmic specification based upon period-to-period differences in the inter-country wage differential could be expressed as follows:

(2.3.1) $\ln m_t = a+b\cdot\ln\left[r_{F,t} - r_{F,t-1}\right]$.[16]

Equation (2.3.1) would not work for negative values of $(r_{F,t} - r_{F,t-1})$. An alternative specification would be to express the change in r from period to period as a ratio, rather than as a difference, as follows:

(2.3.2) $\ln m_{F,t} = a+b\cdot\ln(\frac{r_{F,t}}{r_{F,t-1}})$.

(2.3.2) does not, of course, follow from (2.3) or (2.3.1). It is rather a different specification which makes migration a function of period-

[16] Note here that the logarithmic aspect of this specification is not the only difference between (2.3) and (2.3.1); in level form the parameter 'a' of (2.3.1) would be a multiplicative constant.

to-period changes in the wage differential. A ratio is a different means of measuring the change.[17]

The main other variables going into the model are: the excess of listed vacancies over unemployment in the German labor market, unemployment in the sending country, and the level of real wages in the sending country. This last variable is entered independently from the inter-country wage differential on the theory that such a variable would serve as a proxy for the ability to finance the move from the foreign, or sending, country. In addition to these independent economic variables, dummies were introduced for things such as seasons of the year, the promulgation of the Treaty of Rome, political developments in Greece, and economic recession in West Germany.

The functional form described in (2.3.2) was extended to all the non-dummy independent variables. However, the choice of a log-linear format posed an additional problem as regards the measurement of the market tightness variable. Our index of tightness in the German labor market was at first taken to be the total number of listed vacancies less the total number of registered unemployed; but since total unemployment can be greater than total vacancies, we have the problem of negative values in a logarithmic formulation. Here again the problem was solved by using

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[17] The reader should note that the foregoing discussion relates exclusively to the question of the measurement of temporal changes in the values of the independent variables. It says nothing at all about the question of whether the comparison of real wages between countries should be made as a ratio or as a difference. Those economists with a predominantly internationl trade/general equilibrium background would tend to use an inter-country real wage ratio, while those economists following a human capital approach would tend to use an inter-country real wage difference, the latter measure being a better proxy for the present value of the differential future stream of earnings than is a ratio. The inter-country wage ratio approach was also rejected very early on because of poor econometric results relative to those achieved when an inter-country real wage difference was used.

a ratio rather than a difference. This is shown in (2.4) below:

(2.4) $z_t = \left(\frac{v_H}{u_H} \right)_t$, where z_t is the index of market tightness in the host country at time period t, v_H is the number of listed vacancies in the host country, and u_H is the number of registered unemployed, in the host country. Since this kind of measure for market tightness would tend to understate the importance of those periods where unemployment exceeds vacancies, and because it was believed that it is just in those periods where unemployment exceeded listed vacancies that the government might tend to become restrictive in its immigration policy, it was decided to augment this market tightness variable with a dummy variable signaling those periods where total unemployment exceeds total vacancies.

Before we can present the general migration model which we wish to test in fuller form, we must first introduce some new variables. Let

(2.5) $G_{F,t} = \ln \left(\frac{r_{F,t}}{r_{F,t-1}} \right)$,

(2.6) $X_t = \ln \left(\frac{z_t}{z_{t-1}} \right)$,

(2.7) $n_{F,t}$ = the level of unemployment in the sending country at time period t,

(2.7.1) $U_{F,t} = \ln \left(\frac{n_{F,t}}{n_{F,t-1}} \right)$, and

(2.8) $W_{F,t} = \ln \left(\frac{q_{F,t}}{q_{F,t-1}} \right)$.

We are now in a position to present the general migration model, exclusive of dummy variables and lag structures. This is given below in equation (2.9):

(2.9) $M_{F,t} = \beta_0 + \beta_1 G_{F,t} + \beta_2 X_t + \beta_3 U_{F,t}$

$+ \beta_4 W_{F,t}$, where $M_t = \ln m_{F,t}$, and the β_i are the intercept term and the coefficients on the independent variables. This leaves us only the task of adding the dummy variables where needed and to introduce the specific forms of the lag structures. A recession dummy and the seasonal dummies were common to all the migration equations estimated. In addition, a Treaty of Rome dummy was applied to Italian migration--only in the case of Italy does worker migration data exist both before and after the effective date of the Treaty of Rome--and, as mentioned earlier, there were dummies for political developments in Greece influencing that country's worker migration to West Germany. These dummy variables and lag structures will be dealt with as they are introduced for the specific equations estimated for the four countries--Italy, Greece, Spain, and Turkey in the following chapter.

(2.9) is the basic model with which we are dealing. The specific equations for the various countries differ from (2.9) and from one another in terms of dummies used, lag structures, and time frame. If the reader requires more specific information as to exactly how the dependent and independent variables of equation (2.9) were constructed, he should refer to Appendix A.

CHAPTER III

EMPIRICAL INVESTIGATION

The overall time frame of this study is the first quarter of 1952 to the second quarter of 1975. No equations were actually estimated over this entire range, as data were not available for all the variables belonging in any equation covering that entire range. However, this is the period of time for which we collected the data; each equation was then estimated over the maximum number of time periods which the availability of data would allow. Migration equations were estimated for four countries sending workers to the Federal Republic of Germany: Italy, Greece, Spain, and Turkey. The time frames for the four countries' migration equations do not match when each of those equations is estimated over its respective maximum number of observations. Therefore, in addition to estimating each country's equation over its maximum allowable time frame, data sets were abbreviated so as to provide us with some comparisons between sending countries over identical time frames. However, the only between country comparisons for which the data provided us with a sufficient number of observations were bilateral comparisons between Greece and Turkey and between Italy and Turkey, as well as three country comparisons between Italy, Turkey, and Greece over a fairly short time interval. Because of insufficient data, no decent direct comparisons between Spain and any of the other countries were possible. But even though all the comparisons which we would have liked to have made could not be made, the results are nonetheless interesting. Also, the partitioning of the data sets, for the making of comparisons between countries, provided us with an opportunity to examine the stability over time of the results for any given country.

The model we have tested is essentially (2.9) as defined and developed in Chapter II. (2.9) was modified by dummy variables, which we will define as they are introduced, and by the development of lag structures for certain of the independent variables. On the question of lags, we are following Lianos' analysis, and have posited that the number of persons who will migrate during any period of time is a lagged function of the relevant economic variables.[18] The type of procedure employed was that of Almon polynomial lag structure estimation.[19]

On econometric technique, it should be noted that because of the apparent presence of autocorrelation and the uselessness of the Durbin-Watson statistic when lag structures are employed, each equation presented in this paper constitutes a first order autoregressive scheme to which the Cochrane-Orcutt iterative technique and the Hildreth-Lu scanning method were both applied. The results shown were accomplished with the Cochrane-Orcutt method unless the Hildreth-Lu method is explicitly indicated. Both methods are described in detail in Appendix B.

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[18] Lianos, "Migration Time Lags," pp. 425-433.

[19] S. Almon, "The Distributed Lag Between Capital Appropriations and Expenditures," Econometrica 33 (January 1965): 178-196. In this article, Almon solved for the polynomial parameters by means of the "Lagrangian Interpolation" procedure. For a clear treatment of how to achieve the same result by means of least squares, as we did here, see Jan Kmenta, Elements of Econometrics (New York: The Macmillan Company, 1971), pp. 492-495. Also, for a sample of how the polynomial estimation was handled in our particular case, see Appendix B of this paper. In the present work, all polynomials were estimated in the second degree over three periods--four where possible. If the data could not support a three-period polynomial, the variable was entered independently for two periods, one period, or was dropped altogether.

The first migration equations whose results we shall examine are those for Italy (i.e., equations describing the migration of Italian workers to the Federal Republic of Germany). The primary Italian migration equations were estimated, after making allowances for all observations lost due to lag structures and serial correlation correction, over the period of time beginning with the second quarter of 1955 and ending with the fourth quarter of 1969. (As noted earlier, as of the first quarter of 1970, data on the migration of Italian workers into West Germany are no longer available due to the "freedom of movement" arrangement between all member countries of the EEC.)

The basic form of the Italian migration equation is as follows:

$$(3.1)\quad M_{I,t} = \beta_0 + \beta_1 S + \beta_3 D_2 + \beta_4 D_4 + \beta_5 D_X + \beta_6 W_{I,t-4}$$
$$+ \beta_7(\phi_0 X_t + \phi_1 X_{t-1} + \phi_2 X_{t-2} + \phi_3 X_{t-3})$$
$$+ \beta_8(\mu_0 U_{I,t-3} + \mu_1 U_{I,t-4} + \mu_2 U_{I,t-5})$$
$$+ \beta_9(\nu_0 G_{I,t-3} + \nu_1 G_{I,t-4} + \nu_2 G_{I,t-5}) + \varepsilon_t,$$

where S is an intercept shift term for the inception of the EEC, having 'ones' prior to January 1957 (the effective date of the Treaty of Rome) and 'zeroes' from that time on; D_2 is a dummy variable signifying the second quarter of the year; D_4 is a dummy variable signifying the fourth quarter of the year; D_X is a dummy variable signifying those time periods where the number of persons unemployed is larger than the number of job vacancies; the remaining variables M, W, U, and G are as defined for (2.9); the subscript I signifies that Italy is the sending country; ε, of course, is the residual term.[20] β_0 is the intercept term; β_1 through

[20] See Appendix A for a more detailed explanation of how the variables are actually computed and what their sources are.

β_6 are the coefficients on their respective variables; and β_7 through β_9 are the coefficients on the Almon lag distributions of X, U, and G respectively (β_7 through β_9 are analogous to β_1 in equation (B-7) in Appendix B; they provide no additional information and hence are each set equal to one); the ϕ_i, μ_i, and ν_i are the coefficients on the individual terms within the polynomial lag structures of X, U_I, and G_I, respectively. (The determination of these coefficients is explained in Appendix B.)

Since all of the variables (M_1, W_I, X, U_I, G_I) are expressed in terms of their natural logarithms, and the intercept shift term and other dummies (S, D_2, D_4, and D_x) are expressed in their actual level values, the dummies and the coefficients become exponential in nature when we rewrite equation (3.1) in level form, as is shown below in (3.2):

$$(3.2) \quad m_{I,t} = \exp\left[\beta_0 + \beta_1 S + \beta_3 D_2 + \beta_4 D_4 + \beta_5 D_x\right] w_{I,t-4}^{\beta_6}$$
$$\left(x_t^{\phi_0} \; x_{t-1}^{\phi_1} \; x_{t-2}^{\phi_2} \; x_{t-3}^{\phi_3}\right)^{\beta_7}$$
$$\left(u_{I,t-3}^{\mu_0} \; u_{I,t-4}^{\mu_1} \; u_{I,t-5}^{\mu_2}\right)^{\beta_8}$$
$$\left(g_{I,t-3}^{\nu_0} \; g_{I,t-4}^{\nu_1} \; g_{I,t-5}^{\nu_2}\right)^{\beta_9} \varepsilon_t,$$

where m, w, x, u, and g represent the anti-logarithms of M, W, X, U, and G respectively. This means that the intercept can be interpreted as a multiplicative constant which is modified by the shift term and the seasonal dummies when they are operative.

The Greek, Spanish, and Turkish migration equations all had greater significance attaching to their first quarter dummies; therefore, we are also presenting the results of equation (3.1.1), which includes this dummy for the sake of comparability with the other results. Equation (3.1.1) is given as follows:

$$(3.1.1)\quad M_{I,t} = \beta_0 + \beta_1 S + \beta_2 D_1 + \beta_3 D_2 + \beta_4 D_4 + \beta_5 D_x + \beta_6 W_{I,t-4}$$
$$+ \beta_7(\phi_0 X_t + \phi_1 X_{t-1} + \phi_2 X_{t-2} + \phi_3 X_{t-3})$$
$$+ \beta_8(\mu_0 U_{I,t-3} + \mu_1 U_{I,t-4} + \mu_2 U_{I,t-5})$$
$$+ \beta_9(\nu_0 G_{I,t-3} + \nu_1 G_{I,t-4} + \nu_2 G_{I,t-5}) + \varepsilon_t,$$

where D_1 is the dummy variable for the first quarter of the year and everything else remains as defined above under equation (3.1).

The regression results for (3.1) and (3.1.1) obtained for this time period are presented in table 3.1 on the following pages. The discussion which follows pertains to (3.1). Presenting results for both (3.1) and (3.1.1) demonstates that the first quarter dummy is insignificant, has little or no influence upon the other coefficient estimates, and could, therefore, be left out. However, the results presented for (3.1.1) will facilitate making comparisons with migration equations for other sending countries later on in our discussion.

<u>Interpretation of the Results of (3.1)</u>

In our specification there is an autonomous component of the inflow of new migrant workers from Italy to Germany which is equal to e^{β_0} times everything else on the right hand side of the equation. Our results show that β_0 = 10.383, which translates into autonomous migration (multiplicative constant) of 32,306 Italian workers.

The impact of β_1 is interesting. It clearly demonstates a significant impact of the Treaty of Rome. The way the dummy S was constructed--with ones prior to January 1957, and zeroes thereafter--we are analyzing the impact of not having the Treaty of Rome in effect in

TABLE 3.1

ITALIAN WORKER MIGRATION TO WEST GERMANY
Regression Results of (3.1) and (3.1.1)
Period: 2nd Qtr., 1955 - 4th Qtr., 1969

Variable Name and Summary Statistics	Parameter Name	(3.1) Parameter Estimate (t-Statistic)	(3.1.1) Parameter Estimate (t-Statistic)
Intercept	β_0	10.383 (68.855)	10.416 (61.510)
S	β_1	-1.159 (-5.939)	-1.154 (-5.826)
D_1	β_2		-.081 (-.459)
D_2	β_3	.177 (1.725)	.146 (1.185)
D_4	β_4	-.460 (-5.311)	-.498 (-4.207)
D_x	β_5	-.234 (-1.967)	-.227 (-1.877)
$W_{I,t-4}$	β_6	5.244 (2.765)	5.354 (2.777)
2nd Degree Polynomial Results for X:			
X_t	ϕ_0	.150 (2.373)	.131 (1.717)
X_{t-1}	ϕ_1	.170 (1.915)	.161 (1.750)
X_{t-2}	ϕ_2	.163 (1.795)	.167 (1.818)
X_{t-3}	ϕ_3	.131 (2.257)	.150 (2.094)

TABLE 3.1--Continued

Variable Name and Summary Statistics	Parameter Name	(3.1) Parameter Estimate (t-Statistic)	(3.1.1) Parameter Estimate (t-Statistic)
Mean Lag		1.447	1.551
Mean Lag Standard Error		.156	.282
Sum of Lag Coefficients		.614	.610
Summed Coefficents Standard Error		.269	.272
2nd Degree Polynomial Results for U_I:			
$U_{I,t-3}$	μ_0	.187 (1.692)	.202 (1.743)
$U_{I,t-4}$	μ_1	.367 (2.303)	.392 (2.312)
$U_{I,t-5}$	μ_2	.281 (2.351)	.291 (2.378)
Mean Lag		4.112	4.101
Mean Lag Standard Error		.153	.137
Sum of Lag Coefficients		.835	.885
Summed Coefficients Standard Error		.350	.369

TABLE 3.1--Continued

2nd Degree Polynomial Results for G_I:			
Variable Name and Summary Statistics	Parameter Name	(3.1) Parameter Estimate (t-Statistic)	(3.1.1) Parameter Estimate (t-Statistic)
$G_{I,t-3}$	ν_0	1.170 (2.726)	1.197 (2.739)
$G_{I,t-4}$	ν_1	1.178 (2.550)	1.206 (2.563)
$G_{I,t-5}$	ν_2	.371 (.877)	.394 (.917)
Mean Lag		3.706	3.713
Mean Lag Standard Error		.295	.295
Sum of Lag Coefficients		2.719	2.797
Summed Coefficients Standard Error		1.132	1.156
Value of ρ		.776 (9.445)	.779 (9.530)
$\bar{R}^2$		.972	.972
D-W		2.473	2.457
$F_{14,44}$		109.980	
$F_{14,44;.95}$		1.91	
$F_{15,43}$			100.851
$F_{15,43;.95}$			1.91

the earlier period. The coefficient of -1.159 translates into .314 when we take the antilogarithm. This means that, with all other things in our model being taken into account, Italian migration to West Germany in the pre-Treaty of Rome period was less than 32 percent of what it would have been had the Treaty of Rome been in effect during this period. Alternatively, the model indicates that Italian migration to West Germany from January, 1957 on was more than three times as great as it would have been without the creation of the EEC. This is a fairly startling result, so we should perhaps be wary of too literal an interpretation here; yet there can be little doubt that the treaty did have a profound effect upon labor migration between EEC member countries.

With similar mathematical computation we can derive the impact of the other variables upon Italian worker migration. For example, the coefficients, β_3 and β_4, on the seasonal dummies, D_2 and D_4, tell us that Italian worker migration to West Germany is 19 percent higher in the second quarter and 37 percent lower in the fourth quarter than in the first and third quarters.

Similarly, β_5, the coefficient on the German recession dummy, tells us that even after all other factors are taken into account--including the relative magnitudes of unemployment and job vacancies as measured by the variable X--the amount of Italian worker migration to West Germany was 21 percent less during periods when there was more unemployment than there were job vacancies than there was when the reverse was true. This tells us more than just the influence of the German business cycle, whose influence should largely be reflected in the variable X; it indicates that the German authorities begin to become restrictive in slack periods. It implies a kind of asymmetry in this restrictiveness; i.e., the German authorities are extraordinarily (more than proportionately) restrictive in slack, relative to normal periods.

The interpretation of the rest of the coefficients comes rather more easily because they are coefficients on variables which have undergone natural logarithmic transformation. Therefore, these coefficients are interpreted as elasticities. For example,

$$\frac{\Delta m_{I,t}}{\Delta w_{I,t-4}} \cdot \frac{w_{I,t-4}}{m_{I,t}} = \beta_6.$$

So β_6 is the elasticity of Italian worker migration to Germany in the current quarter with respect to changes in the level of wages in Italy four quarters ago. β_5 has been estimated at 5.244. This means that over the period of time for which the estimation was carried out, a 1 percent increase in the period-to-period ratio of the level of wages in Italy in time period t-4 has the effect of producing a 5.2 percent increase in the amount of Italian worker migration to Germany in the current time period, assuming that all the other independent variables are held constant.

Of the non-polynomial variables, we had a no a priori beliefs as to the direction of the influence of D_2 and D_4, or of the sign of the constant term; therefore, two-tailed tests were applied to β_0, β_3, and β_4. However, the remaining non-polynomial variables, S, and $W_{I,t-4}$ were believed a priori to have positive coefficients, while D_x was believed a priori to have a negative coefficient; therefore, one-tailed tests were applied to β_1, β_5, and β_6. The results show that β_0, β_1, β_4, and β_6 were all significant at the 1 percent α-level, while β_5 was significant at the 5 percent α-level, and β_2 was significant at the 10 percent α-level.[21]

All three of the polynomial variables in (3.1)--X, U, and G--were believed a priori to have positive coefficients (by virtue of rather obvious economic theorizing); therefore, one-tailed t-tests apply to the ϕ_i, μ_i, and ν_i. Since X, U, and G are, like W_I, transformed into their natural logarithms, the coefficients on the individual terms in their lag structures can also be interpreted as elasticities. While such an approach is mathematically correct, and does have a ready economic interpretation, in so doing we are probably being more complex in our interpretation of the results than we have a right to be. The individual coefficients and t-statistics are presented here merely for the purpose of demonstrating how successful, or unsuccessful, we have been in obtaining a good fit and significant results with the polynomial form, and to observe the shape of lag structure on the given variable.

The variable X had a relatively uniform and level distribution. It was estimated over four periods--from t to t-3--and each of the coefficients was significant at the 5 percent α-level. The sum of the lag coefficients is .614 and the standard error of this sum is .269, from which two pieces of information we can produce a t-value of 2.282. Such a t-statistic is significant at the 5 percent α-level. This means that a 1 percent increase in the period-to-period change in the ratio of

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[21]Equation (3.1) was estimated here with 44 degrees of freedom. This provides us with the following critical t-values:

One-tailed tests: $t_{44,.10} = 1.30$; $t_{44,.05} = 1.68$; $t_{44,.01} = 2.42$.

Two-tailed tests: $t_{44,.10/2} = 1.68$; $t_{44,.05/2} = 2.02$; $t_{44,.01/2} = 2.70$.

vacancies to unemployment in the current time period can be expected to produce a .61 percent increase in Italian worker migration to West Germany distributed over the current and succeeding three time periods. This variable is an indicator of the labor market's ability and readiness to accept new foreign laborers. Its coefficients tell us that the greater the ability to absorb foreign workers demonstrated by the German labor market, the greater will be the number of new Italian migrants. This, of course, has components from both the demand and the supply side. The greater the indication of need for foreign workers, the greater will be the recruitment efforts; also the greater the likelihood of finding employment, the greater the number of migrants. This may not necessarily be all that interesting in and of itself, but later we can examine whether there are significant differences in this coefficient across nationalities. The polynomial for this variable, along with the other polynomial variables belonging to this equation, is depicted in diagram C-1 in Appendix C.

The polynomial lag results for the variable U--Italian unemployment--are also interesting. This polynomial runs over three periods, from t-3 to t-5. The fact that t, t-1, and t-2 do not play a role is perhaps due to the average duration of unemployment compensation benefits, but is more likely due to lags in the decision process, bureaucratic delays, and the fact that unemployment experienced at a point in time is painless, while unemployment endured for a protracted period of time can be painful enough to force someone to pick up and leave.

Each of the coefficients μ_i on the variable $\breve{U}_I$ is significant at the 5 percent α-level. The sum of the lag coefficients produces a t-statistic of 2.386, which makes it overall significant at the 5 percent

α-level. These coefficients mean roughly that a 1 percent increase in the period-to-period change in the level of unemployment in Italy in the current time period will produce a .8 percent increase in the number of Italian workers migrating to Germany distributed over the third, fourth, and fifth periods hence. In other words, a 1 percent increase in U_I in the current period, has no impact upon the migration of Italians to Germany in the current period; nor does it have any impact upon migration in the next period, or the period after that. But three periods hence we would expect that there will be a .19 percent increase resulting from the current 1 percent increase in U_I. Similarly, four and five periods hence there will be .37 percent and .28 percent increases, respectively, resulting from this same current 1 percent increase in U_I.

The results for U_I are interesting in that they tend to demonstrate that unemployment has to be endured for a number of periods before it induces the decision to migrate. Note that the nearest coefficient is the smallest and least significant, while the reverse is true for the wage gap variable where the farthest coefficient is the smallest and least significant.

The results for G_I--the inter-country wage gap variable developed in Chapter II--are interesting not only because they support the human capital approach, but also because they support neoclassical economics in general. It is often suggested that wages are unimportant in international migration, and that workers move because of opportunities to get work and training and that measurements of wages and unemployment in their home countries are misleading because of the "dual economy" problem. Our results indicate otherwise. Two of the three coefficients indicate elasticities which are greater than one. And while ν_2 was not significant, ν_0 and the sum of the lag coefficients are significant at the 5 percent α-level by hefty margins and come very close to significance at the 1 percent α-level.

The Durbin-Watson statistic is presented for the sake of those who demand it. First order serial correlation was removed and the value of ρ was found to be .776 with an obviously significant t-statistic of 9.44.

Equation (3.1) performed very well over all, having an F-statistic of 109.98, which is significant at the 0.1 percent level. Also the $\bar{R}^2$ (R^2 corrected for degrees of freedom) is .972, indicating rather tight fitting results. Another bit of evidence indicating how good our fit was for this equation is the plot of actual, fitted, and residual values shown in table D-1 in Appendix D. One final note on equation (3.1): the $\bar{R}^2$ in terms of the ρ-transformed data was .807.

We now turn to our estimates of Turkish migration. The specification for our Turkish migration equation is given by equation (3.3):

$$
\begin{aligned}
(3.3)\quad M_{T,t} \doteq\ & \beta_0 + \beta_1 D_1 + \beta_2 D_2 + \beta_3 D_4 + \beta_4 D_x \\
& + \beta_5 X_{t-1} + \beta_6 X_{t-2} + \beta_7 G_{T,t-1} \\
& + \beta_8 G_{T,t-2} + \beta_9 (\mu_0 U_{T,t-4} + \mu_1 U_{T,t-5} \\
& + \mu_2 U_{T,t-6}) + \varepsilon_t,
\end{aligned}
$$

where M, G, U, and X are again all defined exactly as they were in equation (2.9), and D_1, D_2, D_4, and D_x are all defined exactly the same way as in (3.1.1), with the exception that here the sending country is Turkey, as denoted by the subscript T; and as in (3.1.1) all of the variables (F_T, X, U_T, G_T) are expressed in terms of their natural logarithms, while the dummies (D_1, D_2, D_3, D_x) are expressed in their actual level values.

We can also rewrite (3.3) in level form as follows:

$$(3.4)\quad m_{T,t} = \exp\left[\beta_0 + \beta_1 D_1 + \beta_2 D_2 + \beta_3 D_4 + \beta_4 D_x\right] x_{t-1}^{\beta_5}\; x_{t-2}^{\beta_6}\; g_{T,t-1}^{\beta_7}\; g_{T,t-2}^{\beta_8} \left(u_{T,t-4}^{\mu_0}\; u_{T,t-5}^{\mu_1}\; u_{T,t-6}^{\mu_2}\right)^{\beta_9} \varepsilon_t,$$

where f, x, g, and u again represent the antilogarithms of F, X, G, and U.

Equation (3.3) was estimated for the period beginning in the second quarter of 1963 and ending in the second quarter of 1973. The results of equation (3.3) are presented in table 3.2 on the following pages.

Interpretation of Results of (3.3)

These results are not strictly for the same time period as the Italian migration equation, and again there is no shift term since all of the data observations occur after the inception of the EEC in 1957. Casual observation, however, reveals that the Turkish results are apparently not drastically different from those obtained for Italy. The autonomous term, β_0, for example, has a value of 9.724 here, versus 10.416 in equation (3.1.1).

D_1, which was too small and insignificant to warrant inclusion in the Italian migration equation, remains rather small and insignificant here as well. It was thought best to leave D_1 in the equation so as not to bias our estimates of the other coefficients. The other seasonal

TABLE 3.2

TURKISH WORKER MIGRATION TO WEST GERMANY
Regression Results of (3.3)
Period: 2nd Qtr., 1963 to 2nd Qtr., 1972

Variable Name and Summary Statistics	Parameter Name	Parameter Estimate (t-Statistic)
Intercept	β_0	9.724 (57.776)
D_1	β_1	.159 (.812)
D_2	β_2	.324 (1.825)
D_4	β_3	-.262 (-1.677)
D_x	β_4	-.920 (-4.393)
$G_{T,t-1}$	β_5	.560 (1.716)
$G_{T,t-2}$	β_6	.629 (1.942)
$X_{T,t-1}$	β_7	.100 (1.054)
$X_{T,t-2}$	β_8	.148 (1.637)
2nd Degree Polynomial Results for U_T:		
$U_{T,t-4}$	ϕ_0	1.151 (3.031)
$U_{T,t-5}$	ϕ_1	1.458 (3.149)
$U_{T,t-6}$	ϕ_2	.744 (1.673)

TABLE 3.2--Continued

Variable Name and Summary Statistics	
Mean Lag	4.879
Mean Lag Standard Error	.266
Sum of Lag Coefficients	3.35
Summed Coefficients Standard Error	1.07
Value of ρ	6.78 (5.608)
$\bar{R}^2$	.915
D-W	1.923
$F_{11,25}$	24.411
$F_{11,25;.95}$	2.20

dummies show the same signs as, and magnitudes similar to, those of the Italian equation. Italy being a Christian country, Italians seem to show a greater reluctance than Turks to migrate in the fourth quarter--the Christmas season--as witnessed by the coefficient on D_4 of -.460 as compared to Turkey's -.262.

A very interesting result is the coefficient we obtained on D_4. The estimated coefficient on this variable is -.920. Taking the anti-logarithm of the coefficient on D_x, as we did for equation 3.6, we find that Turkish migration was 60 percent less when there were more unemployed than job vacancies, than there was when the reverse was true, even after all other factors, including the variable X, have been taken into account. This figure of 60 percent less compares to only 21 percent less for Italy. This could mean that there is some evidence that relatively weak economic conditions more adversely affect Turkish migration to Germany than Italian migration to Germany. But we shall have to hold all such judgments in abeyance until later on when we shall make Turkish-Italian comparisons over exactly the same time frame.

The wage gap variable ended up as $G_{T,t-1}$ and $G_{T,t-2}$. The coefficients on the $G_{I,t-i}$ in equation (3.1.1) were 1.170, 1.178, and 0.371 for periods t-3, t-4, and t-5, respectively. So it would appear at this point that wage differentials were slightly less important in determining Turkish migration than in determining Italian migration. However, the equations are slightly different and the time frame is not the same.

There does not appear to be any significant difference between the coefficients on X in (3.3) and those on X in (3.1.1). But there does appear to be a big difference between Italy and Turkey insofar as the level of wages in the sending country is concerned. This variable did not figure in the final Turkish equation, and we may hypothesize that its insignificance results from a greater degree of direct recruitment on location in the sending country and company paid transportation in the case of Turkey.

Student's t-tests performed on the coefficients of our estimation of equation (3.3), as shown in table 3.2, reveal the following: The coefficient on the constant term is significant at the 1 percent α-level. Of the seasonal dummy coefficients, only the one for the second quarter was significant at the 10 percent α-level, while the coefficient on the fourth quarter dummy was almost significant. The coefficient on D_x, β_4, is significant at the 1 percent α-level. The wage differential variable lagged one period was significant at the 5 percent α-level (one-tailed test); the same is true for this variable lagged two periods. The coefficient on the market tightness variable was not quite significant for the one-period lag, but was significant for the two-period lag at the 10 percent α-level (one-tailed test).[22]

By far the most important variable in (3.3) was the only polynomial variable in the equation, $U_{T,t-i}$. The polynomial lag structure of $U_{T,t-i}$ in (3.3) differs rather markedly with its counterpart in (3.1.1), $U_{I,t-i}$. The lag structure for U_T in (3.3) begins one period further back than did U_I in (3.1.1). But the coefficient on the $U_{T,t-i}$ proved to be

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[22]Equation (3.3) was estimated here with 25 degrees of freedom, providing us with the following critical t-values:

One-tailed tests: $t_{25,.10} = 1.316$; $t_{25,.05} = 1.708$; $t_{25,.01} = 2.485$.

Two-tailed tests: $t_{25,.10/2} = 1.708$; $t_{25,.05/2} = 2.060$; $t_{25,.01/2} = 2.787$.

very much larger than those on the $U_{I,t-i}$. The sum of the lag coefficients on $U_{T,t-i}$ is 3.35, while the sum of their standard errors is 1.07, producing a t-statistic of 3.13. This lag structure means that a 1 percent increase in the period-to-period change in the level of unemployment in Turkey in the current quarter will produce a 1.15 percent increase in the level of Turkish migration to West Germany four quarters hence, a 1.49 percent increase five quarters hence, and a 0.74 percent increase six quarters hence.

The summary statistics for the Turkish migration equation as a whole were also quite impressive. The value of $\hat{\rho}$ for this estimate of (3.3) is .678 with a t-value of 5.61. The $\bar{R}^2$ is .915. The calculated value of the F-statistic is 24.41, which, as it turns out, is significant at the 0.01 percent level. Further evidence of the quality of the results obtained for this estimate of (3.3) is demonstrated by the plot of the actual, fitted, and residual values shown in table D-3 in Appendix D.

Spanish worker migration to West Germany was estimated for the time period beginning in the second quarter of 1968 and ending in the fourth quarter of 1973. The equation which was estimated is given by (3.5) below:

$$
\begin{aligned}
(3.5)\quad M_{S,t} &= \beta_0 + \beta_1 D_1 + \beta_2 D_2 + \beta_3 D_4 \\
&+ \beta_5 W_{S,t-1} + \beta_6 U_{S,t-5} \\
&+ \beta_7(\phi_0 X_t + \phi_1 X_{t-1} + \phi_2 X_{t-2}) \\
&+ \beta_8(\nu_0 G_{S,t-1} + \nu_1 G_{S,t-2} + \nu_2 G_{S,t-3}) + \varepsilon_t,
\end{aligned}
$$

where once again the variables are as defined previously, except that here we have the country subscript, S, standing for Spain where we earlier had I and T standing for Italy and Turkey, respectively.

Writing (3.5) in level form we get the following:

$$(3.6)\quad m_{S,t} = \exp\left[\beta_0 + \beta_1 D_1 + \beta_2 D_2 + \beta_3 D_4\right] w_{S,t-1}^{\beta_5}\, u_{S,t-5}^{\beta_6} \left(x_t^{\phi_0}\, x_{t-1}^{\phi_1}\, x_{t-2}^{\phi_2}\right)^{\beta_7} \left(g_{S,t-1}^{\nu_0}\, g_{S,t-2}^{\nu_1}\, g_{S,t-3}^{\nu_2}\right)^{\beta_8} \varepsilon_t .$$

The reader has no doubt noted that the German recession dummy, D_x, has been left out. This is because this particular variable had only one valid observation over the time period for which the Spanish migration equation was estimated. However, we have estimated (3.5.1), given below, which does include this variable, for the sake of comparison with the other results.

$$(3.5.1)\quad M_{S,t} = \beta_0 + \beta_1 D_1 + \beta_2 D_2 + \beta_3 D_4 + \beta_4 D_x + \beta_5 W_{S,t-1} + \beta_6 U_{S,t-5} + \beta_7(\phi_0 X_t + \phi_1 X_{t-1} + \phi_2 X_{t-2}) + \beta_8(\nu_0 G_{S,t-1} + \nu_1 G_{S,t-2} + \nu_2 G_{S,t-3}) + \varepsilon_t .$$

For reasons which are explained, insofar as they are known, in Appendix B, (3.5.1) had to be estimated using the Hildreth-Lu method rather than the more usual Cochrane-Orcutt approach which was applied to (3.5) and every other equation presented in this chapter. The Cochrane-Orcutt results for (3.5) and the Hildreth-Lu results for (3.5.1) are presented in table 3.3 on the following pages. If the reader wishes to compare these with the Hildreth-Lu results for (3.5) and the Cochrane-Orcutt results for (3.5.1), these can be found in table B-1 in Appendix B.

TABLE 3.3

SPANISH WORKER MIGRATION TO WEST GERMANY
Regression Results of (3.5)† and (3.5.1)††
Period: 2nd Qtr., 1968 to 4th Qtr., 1973

Variable Name and Summary Statistics	Parameter Name	(3.5) Parameter Estimate (t-Statistic)	(3.5.1) Parameter Estimate (t-Statistic)
Intercept	β_0	7.768 (31.571)	7.749 (28.139)
D_1	β_1	2.475 (5.412)	2.533 (4.840)
D_2	β_2	2.227 (5.958)	2.263 (5.360)
D_4	β_3	-1.183 (-3.158)	-1.199 (-2.470)
D_x	β_4	--	-.129 (-.472)
$W_{S,t-4}$	β_5	11.325 3.592	11.537 (2.752)
$U_{S,t-5}$	β_6	1.567 (4.075)	1.550 (3.464)
2nd Degree Polynomial Results for X:			
X_t	ϕ_0	.897 (5.132)	.922 (4.647)
X_{t-1}	ϕ_1	1.027 (6.718)	1.044 (6.183)
X_{t-2}	ϕ_2	.772 (4.897)	.786 (4.629)
Mean Lag		.954	.950
Mean Lag Standard Error		.115	.125

TABLE 3.3--Continued

Variable Name and Summary Statistics	Parameter Name	(3.5) Parameter Estimate (t-Statistic)	(3.5.1) Parameter Estimate (t-Statistic)
Sum of Lag Coefficients		2.696	2.752
Summed Coefficients Standard Error		.361	.396
2nd Degree Polynomial Results for G_S:			
$G_{S,t-1}$	ν_0	2.279 (3.790)	2.300 (3.439)
$G_{S,t-2}$	ν_1	3.834 (5.379)	3.879 (4.674)
$G_{S,t-3}$	ν_2	1.776 (3.619)	1.809 (3.477)
Mean Lag		1.936	1.939
Mean Lag Standard Error		.146	.154
Sum of Lag Coefficients		7.890	7.989
Summed Coefficient Standard Error		1.328	1.499
Value of ρ		.533 (3.018)	.570 (3.327)
$\bar{R}^2$		.949	.949
D-W		2.616	2.652
$F_{11,11}$		18.553	--
$F_{11,11;.95}$		2.82	--
$F_{12,10}$		--	15.650
$F_{12,10;.95}$		--	2.91

†Estimated by means of the Cochrane-Orcutt iterative method.

††Estimated by means of the Hildreth-Lu scanning technique.

The results which we shall here discuss will be those of (3.5.1), merely because (3.5.1) does include D_x while (3.5) does not, and having D_x in the equation will facilitate our discussion of comparisons with the results obtained for the other countries of labor emmigration to West Germany. While it is true that there are strong arguments for leaving D_x out, we can take heart in the observation that leaving D_x in or out has virtually no impact upon the remainder of the statistical results. Save for the values of the F-statistics and the values of D_x--it being zero in (3.5)--the results of (3.5) and (3.5.1) are virtually identical.

Interpretation of Results of (3.5.1)

Here again there is no EEC shift term because the series begins too late in time. The value of 7.729 on the multiplicative autonomous term is lower than either the 10.416 for Italy or the 9.724 for Turkey. But this is in part made up for by the larger signs of the first and second quarter dummies. It is useful here to think of the relationship between the seasonal dummies and the autonomous term. Since we estimated first, second, and fourth quarter dummies, the autonomous term is really the autonomous component for the third quarter. It is the intercept term for the third quarter, with the quarterly dummies representing seasonal shifts in the intercept, or autonomous component. Viewed in this sense, the combined intercept term and quarterly dummy will yield the following intercepts for the Spanish migration equation: first quarter, 10.282; second quarter, 10.046; third quarter, 7.724; fourth quarter, 6.527. These are all expressed in natural logarithms and compare with the following values taken from the Italian migration equation (3.1.1), for the period after January 1957: first quarter, 9.610; second quarter, 10.270; third quarter, 10.416; fourth quarter, 9.918. So we can see that autonomous migration of Spanish workers is only vastly different from that of Italian workers for the third and fourth quarters. Nonetheless, (3.5.1) does reveal that Spanish migration to West Germany does tend to exhibit a much larger degree of seasonal variation than any of the other migration equations which we have thus far examined. Not surprisingly, Spanish workers show even greater reluctance to migrate to West Germany during the fourth quarter than do Italian workers. The fourth quarter dummy for Spain of -1.197 translates into .301 when we take the anti-logarithm. This means that autonomous Spanish worker migration to West Germany in the fourth quarter is about 70 percent lower than in the third quarter. This is not surprising, since one tends to think of Spain as a country where Christianity has at least as strong an influence upon peoples lives, if not stronger, than in Italy.

If we were to translate all of the quarterly intercept terms into level form so that we could see just how many Spanish workers we would expect to autonomously migrate to West Germany by quarter, we would find the following: first quarter, 29,202 workers; second quarter, 22,292 workers; third quarter, 2,319 workers; fourth quarter, 699 workers Of course, we do not want to make too literal an interpretation of the intercept terms. Although their economic interpretation is <u>autonomous migration</u>, we do not really wish to say that if there were no period-to-period changes in the values of any of the economic variables, including lagged terms, so that all the period-to-period ratios were equal to one, we would really expect to find migration equaling the intercept value.

Yet another intercept term is the German recession dummy, D_x. However, as we have already noted, there is insufficient data to accurately measure the coefficient on this term. Nonetheless, there it is. And although the coefficient of -.129 is not significant, it is of the correct sign indicating that autonomous migration is reduced by 12 percent when unemployment exceeds vacancies in Germany. This compares to a 20 percent reduction for Italy and a 60 percent reduction for Turkey; so the estimated coefficient here appears to be an entirely reasonable result, based upon what we found in our Turkish and Italian equations as far as this variable is concerned.

The influence of the level of real wages in Spain appears to be quite strong indeed. This coefficient can be interpreted as an elasticity. Its value of 11.537 compares with 5.244 for Italy and it had been left out of the Turkish equation for lack of significance. There is also a slightly shorter time lag on this variable for Spain than for Italy. So it at least appears that Spanish migration to West Germany is more sensitive to prior levels of real wages at home than is Italian migration.

The coefficient on Spanish unemployment (lagged five quarters in this case) is also rather interesting. It indicates that Spanish migration is also influenced by unemployment at home to a greater degree than is Italian migration, although it is perhaps less sensitive to movements in this variable than Turkish migration. The coefficient on $U_{T,t-5}$, estimated in (3.3), was of approximately the same magnitude as the coefficient on $U_{S,t-5}$. However, the coefficient on $U_{T,t-5}$ was estimated in the context of a polynomial and significant coefficients of 1.151 and

.744 were found for U_T,t-4 and $U_{T,t-6}$, respectively, while U_S did not qualify as a polynomial variable and ended up as $U_{S,t-5}$ standing alone.

The polynomial results for X seem to indicate that it too is more important for Spain than for either Italy or Turkey. The coefficient values for X in (3.5.1) range roughly from .8 to .10. For Italy, this polynomial was estimated over four periods, but the values of the coefficients were all less than .2. For Turkey this variable was entered for two consecutive periods, and here too the coefficients were less than .2. This might in part be explained by the differences in the time frame, but the differences in these coefficients are rather large. Unfortunately, there is not sufficient overlap between the Spanish data and the data for other countries to permit comparisons over exactly the same time frame.

Aside from the level of real wages at home in the prior quarter --the migration financing variable--the most important factor influencing Spanish migration to West Germany is the real wage differential between Spain and West Germany. The elasticity for this variable is also much higher than those which we estimated for either Italy or Turkey. The elasticity values for the three periods in the polynomial range roughly from 1.8 to 3.9. One way of looking at the coefficients for G_S is to say that if there is a 1 percent increase in the period-to-period ratio of the real wage differential between Spain and West Germany in the current quarter, the result will be roughly an 8 percent increase in the migration of Spanish workers to West Germany which will be distributed over the following three quarters. Suffice it to say, however, that wages appear to play an important role in influencing the number of Spanish workers migrating to West Germany.

All in all, Spanish migration to West Germany would appear to be relatively less autonomous in nature and affected more both by seasonal influences and economic factors than Italian or Turkish migration. In particular, wages seem to be of more importance, of far greater importance, to Spanish migration than to Italian and Turkish migration. The elasticity of Spanish migration to West Germany with regard to our wage variable is quite high and statistically significant. This is a fairly gratifying result since economists tend to focus upon price as the relevant independent variable, and since the literature on this particular topic tends to downgrade the importance of wages.

Student's t-tests were performed upon our estimates of the coefficients of equation (3.5.1), and all except β_4, the coefficient on D_x, were found to be significant at the 5 percent α-level. β_4, as we mentioned earlier, is insignificant for reasons of insufficient data. Furthermore, all but β_4 and β_5 were found to be significant at the 1 percent α-level.[23] This indicates extremely strong results too for our estimates of Spanish migration to West Germany. The strength of these results is surprising in view of the limited number of observations we had to work with; and it gives further support to the notion that the functional form of the relation which explains each country's migration is unique.

Now we come to our estimates of Greek migration to West Germany. Greek migration was estimated for the period beginning with the fourth

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[23]Equation (3.5.1) was estimated with 10 degrees of freedom, providing us with the following critical t-values:

One-tailed tests: $t_{10,.10} = 1.372$; $t_{10,.05} = 1.812$; $t_{10,.01} = 2.764$.

Two-tailed tests: $t_{10,.10/2} = 1.812$; $t_{10,.05/2} = 2.228$; $t_{10,.01/2} = 3.169$.

quarter of 1964 and ending with the fourth quarter of 1973. In the Greek migration equation, it was found necessary to take into account the radical shifts in the pattern of Greek labor migration to West Germany brought about by the unstable and turbulent nature of Greek politics during a great part of the time frame which we were examining.

Even the most casual observer is aware that Greece has had a rather turbulent political history since the end of World War II. Certainly, of the four sending countries which we have examined--Italy, Turkey, Spain, and Greece--Greece has by far had the most turbulent post-war political history. Dummy variables were therefore constructed which attempt to account for these political changes in Greece.

Greek migration to West Germany was estimated with equation (3.7) given below:

$$(3.7) \quad M_{G,t} = \beta_0 + \beta_1 D_1 + \beta_2 D_2 + \beta_3 D_4 + \beta_4 D_x + \beta_5 D_D + \beta_6 D_T + \beta_7 X_{t-2} + \beta_8 X_{t-3} + \beta_9(\mu_0 U_{G,t-8} + \mu_1 U_{G,t-9} + \mu_2 U_{G,t-10}) + \beta_{10}(\nu_0 G_{G,t-1} + \nu_1 G_{G,t-2} + \nu_2 G_{G,t-3}) + \varepsilon_t,$$

where D_D is a dummy signifying the earlier democratic period in Greece which laste through the first quarter of 1967, D_T is a dummy signifying the turbulent political period in Greece which begins in the second quarter of 1972, and all of the other variables are exactly as defined earlier, with the exception that the country subscript here is G for Greece.

Equation (3.7) can be written in level form as follows:

$$(3.8) \quad m_{G,t} = \exp\left[\beta_0 + \beta_1 D_1 + \beta_2 D_2 + \beta_3 D_4 + \beta_4 D_x + \beta_5 D_D + \beta_6 D_T\right] x_{t-2}^{\beta_7} \; x_{t-3}^{\beta_8} \; (u_{G,t-8}^{\mu_0} \; u_{G,t-9}^{\mu_1} \; u_{G,t-10}^{\mu_2})^{\beta_9} (g_{G,t-1}^{\nu_0} \; g_{G,t-2}^{\nu_1} \; g_{G,t-3}^{\nu_2})^{\beta_{10}} \; \varepsilon_t .$$

With the inclusion of the political dummy variables, the results for Greece turned out to be quite satisfactory. The reader will find these results in table 3.4 on the following pages.

Interpretation of Results of (3.7)

Since our data for Greece begins in 1964, there is no EEC shift term. The estimated value of the autonomous term (9.598) is roughly equal to what we found for Italy and Turkey (10.416 and 9.724 respectively); but it is a bit higher than what we estimated for Spain (7.749) which, as we had earlier mentioned, had unusually large seasonal factors.

Speaking of the seasonal factors, these are rather interesting for Greece. For one thing, they were all found to be negative, which only means that more autonomous migration of Greeks to West Germany occurs during the third quarter. In fact, performing the same manipulations that we had done earlier, we find that estimated autonomous migration of Greek workers to West Germany is 6,204 for the first quarter, 7,151 for the second quarter, 14,735 for the third quarter, and 10,148 for the fourth quarter. The fact that most autonomous migration occurs in the third quarter might be a result of weather. But what is really interesting is that it is the first, rather than the fourth, quarter which shows the lowest amount of autonomous migration. The reader may recall that of the countries for which we estimated migration equations so far, Spain showed by far the severest drop of all for fourth quarter

TABLE 3.4

GREEK WORKER MIGRATION TO WEST GERMANY
Regression Results of (3.7)
Period: 4th Qtr., 1964 to 4th Qtr., 1973

Variable Name and Summary Statistics	Parameter Name	Parameter Estimate (t-Statistic)
Intercept	β_0	9.598 (53.129)
D_1	β_1	-.865 (-2.373)
D_2	β_2	-.723 (-3.092)
D_4	β_3	-.373 (-1.720)
D_x	β_4	-.709 (-4.866)
D_D	β_5	.713 (2.849)
D_T	β_6	-2.256 (-5.676)
X_{t-2}	β_7	.294 (2.714)
X_{t-3}	β_8	.233 (2.861)
2nd Degree Polynomial Results for U_G:		
$U_{G,t-8}$	μ_0	.944 (2.960)
$U_{G,t-9}$	μ_1	1.537 (3.239)
$U_{G,t-10}$	μ_2	1.456 (3.095)
$U_{G,t-11}$	μ_3	.701 (1.702)

TABLE 3.4--Continued

Variable Name and Summary Statistics	Parameter Name	Parameter Estimate (t-Statistic)
Mean Lag		1.413
Mean Lag Standard Error		.440
Sum of Lag Coefficient		4.637
Summed Coefficients Standard Error		1.421
2nd Degree Polynomial Results for G_G:		
$G_{G,t-1}$	ν_0	1.166 (1.808)
$G_{G,t-2}$	ν_1	2.866 (2.907)
$G_{G,t-3}$	ν_2	3.307 (3.075)
$G_{G,t-4}$	ν_3	2.488 (2.523)
Mean Lag		1.724
Mean Lag Standard Error		.499
Sum of Lag Coefficients		9.828
Summed Coefficients Standard Error		2.764
Value of ρ		.573
$\bar{R}^2$		.969
D-W		1.707
$F_{14,22}$		49.046

migration, with autonomous migration being 70 percent less in the fourth than in the third quarter; Italy followed with 39 percent less autonomous migration in the fourth than in the third quarter; then came Turkey with 23 percent less. This seems to follow a pattern. The fourth quarter is probably the least attractive time period in which to migrate northward from the Mediterranean area because of the advent of winter, and our results for the three countries so far discussed--Italy, Spain, and Turkey--seem to bear that out. But bearing in mind that the fourth quarter is also the time period of the Christmas season, it is not surprising that our results show that migrants from Spain, the staunchest Roman Catholic country in the group, seem to show the greatest disinclination of all to migrate in the fourth quarter. Nor is it surprising that migrants from Italy, the second Roman Catholic country in the group, seem to be the second most disinclined to migrate in the fourth quarter. The least disinclined to migrate during the fourth quarter are the Turks, who are predominantly Moslem and hence, by and large, do not celebrate Christmas. But now we have estimated migration to Germany from a fourth country, Greece, and we find that their greatest disinclination to migrate occurs in the first, and not the fourth quarter. This contradicts the results for the other three countries. Yet, the Christmas explanation holds here as well, because Christmas in Greece, as in other Orthodox Christian countries such as Armenia and Russia (the influence of Communism notwithstanding), is celebrated on the 6th of January. So what might appear at first to be an inconsistent result is really quite consistent indeed.

The German recession dummy is quite interesting. It shows that the impact of German recession--as evidenced by an excess of registered unemployed over listed vacancies--seems to fall much heavier upon Greek migration than upon either Italian or Spanish migration. In fact, when we translate these coefficients into percentage declines in autonomous migration, we find a 51 percent decline for Greeks, a 60 percent decline for Turks, a 20 percent decline for Italians, and a 12 percent decline for Spaniards.

Now we come to the special dummies which we had to create to reflect the political changes occurring within Greece. There are actually several distinct periods to post World War II Greek political history. Up to 1967 Greece had a bonafide democracy. But in April of that year, a military coup resulted in a highly repressive dictatorial regime. This regime remained highly repressive for approximately two years. Then, beginning in April of 1969, the military regime began a gradual--though slight at first--easing of repression. This went on until June 1973, when they abolished the monarchy and began to talk of establishing a constitutional republic. This talk brought about a second right wing coup in November of 1973. The second coup brought a return of repression. Then came the Greek misadventure in Cyprus in July and August of 1974 which resulted in the collapse of the military government and the return of democracy. The period beginning with the second quarter of 1972 and ending with the fourth quarter of 1973--the latest period in our time series--can best be described as tense and turbulent. During this period, students, liberals, and intellectuals, with sympathy from the international press, militated for a return to democracy. And every time the government instituted reforms, the people would exercise their greater freedom to become more vocal against the government. This liberalization and the increased demonstrations led to a right wing reaction by a faction within the government. This ultimately resulted in the coup of November, 1973. We have, therefore, bracketed our time series into three parts. First is the period from the fourth quarter of 1964 through the fourth quarter of 1966 when the country was becoming less democratic and more unstable. In the middle we have a stable period of rather repressive dictatorship; this period runs roughly from the first quarter of 1965--just prior to the actual military takeover--through the first quarter of 1972. Finally, we have the third period--the turbulent one--which was to have been a transition back to the democracy; this period runs roughly from the second quarter of 1972 through the fourth quarter of 1973, the end of our time series.

We have created dummy variables for the first and third periods. We are assuming that the situation became less and less relaxed during the third period, and the dummies were constructed accordingly. D_D--the dummy for the democratic period in Greece--was constructed with .9, .8, .7, . . ., .1 for the first nine elements and zeroes thereafter. D_T--the dummy variable for that turbulent period of the government's abortive attempt at a gradual transition back to democracy--was constructed with .7, .6, .5, . . ., .1 for the last seven elements and zeroes prior thereto. As we said, this last period was rather turbulent and it is not clear that it should be a period more, or less, conducive to migration.

The coefficients on the two political dummies were both large and significant. They indicate that there was substantially more autonomous migration during the democratic (first) period than during the dictatorship (second) period, while the turbulent (third) period had substantially less autonomous migration than either of the two earlier periods. However, because of the nature of their construction and the difficulty in quantifying political events, we do not wish to put too literal an interpretation upon these coefficients.

Now the first economic variables which we have in the Greek equation are X_{t-2} and X_{t-3}. Since these variables are in logarithmic form, the coefficients can be interpreted as elasticities. They tell us that a 1 percent increase in the market tightness variable in the current time period will result in an increase in the migration of Greek workers to West Germany of .29 percent two periods hence and an increase of .23 percent three periods hence.

The polynomial results for U_G are also quite interesting. They show that the migration of Greeks to West Germany is rather highly sensitive to changes in the level of unemployment in Greece. These elasticities are high relative to what we found for Italy but not too different from what we found for Turkey. Unemployment at home did not show up as a polynomial variable in the final specification for Spain. Further, the length of the lag between the current period and the first period in the polynomial is considerably longer for Greece than for either Italy or Turkey.

For our wage variable, we found strong results for Greek migration. We see that apparently Greek migration is much more sensitive to changes in the inter-country wage differential than Italian or Turkish migration and is slightly more sensitive than Spanish migration in this regard. For the time period for which we estimated (3.7), our results indicate that a 1 percent increase in the current time period in our wage gap variable, as we defined it earlier, will result, after all other factors are taken into account, in increases of 1.2, 2.9, 3.3, and 2.5 percent, respectively, over the ensuing four quarters. These are very strong results indeed; they indicate that international migration is much more sensitive to wages than is commonly believed.

Student's t-tests performed upon the coefficients of (3.7) reveal that all of the estimated coefficients of (3.7) were significant at the 10 percent α-level. Indeed, most were significant at the 1 percent α-level.[24]

In the foregoing presentation of results, we have endeavored to estimate each equation over as much data as is available. This was done to maximize the quality of the results for each individual equation taken on its own; however, this means that the various equations are not estimated over the same time frame. The result is that the maximization of the quality of each individual equation is achieved at the expense of comparability of results between equations. In what follows we shall present the migration equations for three of the four countries--Italy, Turkey, and Greece--estimated over identical time frames. In the case of Spanish migration, it was not possible to find a time frame in common with any of the other three sending countries' data sets which provided us with a sufficient number of observations with which to do any estimations. Further, the shortened time frames made it necessary to slightly modify two of the equations to eliminate dummies which were not relevant over the shortened periods. The elimination of these country-specific dummies also makes for better comparability between

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[24]Equation (3.7) was estimated with 22 degrees of freedom, providing us with the following critical t-values:

One-tailed tests: $t_{22,.10} = 1.321$; $t_{22,.05} = 1.717$; $t_{22,.01} = 2.508$.

Two-tailed tests: $t_{22,.10/2} = 1.717$; $t_{22,.05/2} = 2.074$; $t_{22,.01/2} = 2.819$.

countries. Let us now introduce two modified migration equations. They are equations (3.1.1') and (3.7') and they are given as follows:

$$(3.1.1')\quad M_{I,t} = \beta_0 + \beta_2 D_1 + \beta_3 D_2 + \beta_4 D_4 + \beta_5 D_x + \beta_6 W_{I,t-4}$$
$$+ \beta_7(\phi_0 X_t + \phi_1 X_{t-1} + \phi_2 X_{t-2} + \phi_3 X_{t-3})$$
$$+ \beta_8(\mu_0 U_{I,t-3} + \mu_1 U_{I,t-4} + \mu_2 U_{I,t-5})$$
$$+ \beta_9(\nu_0 G_{I,t-3} + \nu_1 G_{I,t-4} + \nu_2 G_{I,t-5}) + \varepsilon_t;$$

$$(3.7')\quad M_{G,t} = \beta_0 + \beta_1 D_1 + \beta_2 D_2 + \beta_3 D_4$$
$$+ \beta_4 D_x + \beta_7 X_{t-2} + \beta_8 X_{t-3}$$
$$+ \beta_9(\mu_0 U_{G,t-8} + \mu_1 U_{G,t-9} + \mu_2 U_{G,t-10})$$
$$+ \beta_{10}(\nu_0 G_{G,t-1} + \nu_1 G_{G,t-2} + \nu_2 G_{G,t-3}) + \varepsilon_t.$$

All of the terms in (3.1.1') and (3.7') are as defined earlier.

Using equations (3.1.1'), (3.3), and (3.7') we have made comparisons between Italy, Turkey, and Greece. These comparisons are given in tables 3.5, 3.6, and 3.7 on the following pages. Table 3.5 compares Italian and Turkish migration over the period running from the second quarter, 1963 to the fourth quarter, 1969; table 3.6 compares Greek and Turkish migration over the period fourth quarter, 1964 to second quarter, 1972; table 3.7 compares Italian, Greek, and Turkish migration over the period fourth quarter, 1964 to fourth quarter, 1969. In each of these three comparison tables, each country's own migration equation is estimated on its own data as well as for the data for each other country in the table. These tables then, enable us to examine several different kinds of questions. For one thing, they enable us to examine whether the structures which we have estimated for each of the countries are unique to their respective countries. For another, they enable us to

TABLE 3.5

A COMPARISON OF TURKISH AND ITALIAN MIGRATION TO WEST GERMANY
Regression Results of (3.1.1') and (3.3)
Period: 2nd Qtr., 1963 to 4th Qtr., 1969

Equation (3.1.1')			Equation (3.3)		
Variable Name and Summary Statistics	Coefficient Estimate (t-Statistic) Italy	Coefficient Estimate (t-Statistic) Turkey	Variable Name and Summary Statistics	Coefficient Estimate (t-Statistic) Italy	Coefficient Estimate (t-Statistic) Turkey
Intercept	10.319 (70.782)	9.436 (29.630)	Intercept	10.469 (52.601)	9.440 (38.775)
D_1	-.051 (-.193)	.815 (1.566)	D_1	.061 (.228)	.419 (1.222)
D_2	.171 (.617)	.787 (1.742)	D_2	.449 (1.431)	.459 (1.727)
D_4	-.381 (-1.194)	-.007 (-.027)	D_4	-.276 (-1.078)	-.183 (-.758)
D_x	-.586 (-4.671)	-.537 (-1.510)	D_x	-.562 (-2.808)	-.967 (-3.863)
W_{t-4}	13.102 (3.515)	.911 (.219)	G_{t-1}	-.485 (-.373)	3.068 (1.997)
X^*_t	.169 (2.363)	.274 (1.950)	G_{t-2}	.487 (.368)	2.820 (1.476)
X^*_{t-1}	.055 (1.173)	.437 (2.320)	X_{t-1}	.160 (1.061)	.201 (1.570)
X^*_{t-2}	.026 (.374)	.331 (1.628)	X_{t-2}	.133 (1.124)	.257 (2.101)
X^*_{t-3}	.084 (.829)	-.042 (-.347)	U^*_{t-4}	.284 (1.668)	1.603 (2.307)
U^*_{t-3}	.302 (2.095)	-1.312 (-1.206)	U^*_{t-5}	.346 (1.693)	1.594 (2.193)
U^*_{t-4}	.729 (4.253)	.027 (.035)	U^*_{t-6}	.308 (1.397)	.791 (1.248)
U^*_{t-5}	.439 (3.945)	-.350 (-.438)	Value of ρ	.456 (2.664)	.604 (3.936)

TABLE 3.5--Continued

Equation (3.1.1')			Equation (3.3)		
Variable Name and Summary Statistics	Coefficient Estimate (t-Statistic) Italy	Turkey	Variable Name and Summary Statistics	Coefficient Estimate (t-Statistic) Italy	Turkey
G^*_{t-3}	2.649 (2.545)	-6.191 (-2.481)	$\bar{R}^2$	.837	.900
G^*_{t-4}	3.464 (2.147)	-3.992 (-1.351)	D-W	2.100	1.817
G^*_{t-5}	3.004 (3.056)	-2.555 (-1.369)	$F_{11,15}$	7.011	12.224
Value of ρ	-.734 (-5.616	.515 (3.121)	$F_{11,15;.95}$	2.52	2.52
$\bar{R}^2$	.940	.923			
D-W	2.222	1.756			
$F_{14,12}$	13.348	10.314			
$F_{14,12;.95}$	2.630	2.630			

Chow Test with (3.1.1) Results from Table 3.1:		Chow Test with (3.3) Results from Table 3.2:	
$F_{31,12}$	2.339	$F_{10,15}$	2.493
$F_{31,12;.95}$	2.470	$F_{10,15;.95}$	2.540

*Denotes polynomial variable as previously specified for each question.

TABLE 3.6

A COMPARISON OF GREEK AND TURKISH MIGRATION TO WEST GERMANY
Regression Results of (3.3), (3.7), and (3.7')
Period: 4th Qtr., 1964 to 2nd Qtr., 1972

Variable Name and Summary Statistics	Equation (3.3) Coefficient Estimate (t-Statistic)		Variable Name and Summary Statistics	Equation (3.7) Coefficient Estimate (t-Statistic)	Equation (3.7') Coefficient Estimate (t-Statistic)	
	Greece	Turkey		Greece	Greece	Turkey
Intercept	9.082 (29.101)	9.719 (30.243)	Intercept	9.693 (39.091)	9.272 (27.659)	9.972 (19.817)
D_1	-.052 (-.175)	.066 (.277)	D_1	-1.235 (-2.323)	-.429 (-1.127)	-.207 (-.671)
D_2	.418 (1.286)	.425 (1.655)	D_2	-.915 (-3.024)	-.640 (-2.307)	.107 (.508)
D_4	-.226 (-.926)	-.358 (-2.106)	D_4	.503 (-1.776)	.018 (.102)	-.350 (-1.863)
D_x	-.556 (-2.847)	-.712 (-2.907)	D_x	-.654 (-4.053)	-.757 (-4.888)	-.743 (-3.415)
G_{t-1}	.555 (.575)	.418 (1.254)	D_D	.828 (2.543)	-- --	-- --
G_{t-2}	.478 (.443)	.518 (1.551)	D_T	-.770 (-.334)	-- --	-- --
X_{t-1}	.293 (2.269)	.185 (1.216)	X_{t-2}	.348 (2.610)	.132 (1.327)	-.045 (-.395)
X_{t-2}	.189 (1.912)	.159 (1.355)	X_{t-3}	.225 (2.553)	.164 (1.811)	-.139 (-1.232)
U^*_{t-4}	.318 (.660)	.799 (1.587)	U^*_{t-8}	1.365 (2.414)	1.149 (1.954)	-.358 (-.625)
U^*_{t-5}	-.195 (-.450)	1.039 (2.010)	U^*_{t-9}	1.810 (2.877)	2.024 (2.889)	-.142 (-.182)
U^*_{t-6}	.453 (.807)	.655 (1.214)	U^*_{t-10}	1.532 (2.545)	2.024 (3.162)	-.064 (-.081)

TABLE 3.6--Continued

Variable Name and Summary Statistics	Equation (3.3) Coefficient Estimate (t-Statistic) Greece	Equation (3.3) Coefficient Estimate (t-Statistic) Turkey
value of ρ	.857 (9.278)	.841 (8.659)
$\bar{R}^2$	.934	.918
D-W	1.318	2.318
$F_{11,19}$	24.242	19.279
$F_{11,19;.95}$	2.34	2.34

Variable Name and Summary Statistics	Equation (3.7) Coefficient Estimate (t-Statistic) Greece	Equation (3.7') Coefficient Estimate (t-Statistic) Greece	Equation (3.7') Coefficient Estimate (t-Statistic) Turkey
U^*_{t-11}	.530 (.954)	1.149 (2.469)	-.126 (-.217)
G^*_{t-1}	2.353 (1.793)	1.766 (1.467)	-.035 (-.959)
G^*_{t-2}	3.665 (2.415)	3.814 (2.188)	.162 (.387)
G^*_{t-3}	3.665 (2.397)	4.225 (2.365)	.269 (.640)
G^*_{t-4}	2.354 (1.855)	3.000 (2.274)	.285 (.779)
value of ρ	.705 (5.529)	.881 (10.393)	.897 (11.314)
$\bar{R}^2$	.957	.945	.904
D-W	1.337	1.267	2.219
$F_{14,16}$	25.601	--	--
$F_{14,16;.95}$	2.38		
$F_{12,18}$		25.706	14.182
$F_{12,18;.95}$		2.34	2.34

Chow Test with (3.3) Results from Table 3.2:

	Greece	Turkey
$F_{5,19}$		1.930
$F_{5,19;.95}$		2.74

Chow Test with (3.7) Results from Table 3.4:

	Greece (3.7)	Greece (3.7')	Turkey (3.7')
$F_{6,16}$	1.274		
$F_{6,16;.95}$	2.74		

*Denotes polynomial variable as previously specified for each equation.

TABLE 3.7

A COMPARISON OF ITALIAN, TURKISH, AND GREEK MIGRATION TO WEST GERMANY
Regression Results of (3.1.1'), (3.3), and (3.7')
Period: 4th Qtr., 1964 to 4th Qtr., 1969

Equation (3.1.1')				Equation (3.3)				Equation (3.7')			
Variable Name and Summary Statistics	Coefficient Estimate (t-Statistic)			Variable Name and Summary Statistics	Coefficient Estimate (t-Statistic)			Variable Name and Summary Statistics	Coefficient Estimate (t-Statistic)		
	Italy	Turkey	Greece		Italy	Turkey	Greece		Italy	Turkey	Greece
Intercept	10.365 (45.055)	9.644 (21.425)	7.693 (23.966)	Intercept	10.160 (31.898)	9.248 (25.775)	8.816 (16.082)	Intercept	10.599 (43.750)	10.265 (10.141)	9.550 (35.399)
D_1	-.096 (-.319)	.325 (.378)	2.655 (5.130)	D_1	.227 (.718)	.521 (1.111)	1.080 (1.248)	D_1	.236 (.945)	-.370 (-.878)	-.522 (-.893)
D_2	-.042 (-.086)	.704 (1.052)	.275 (.762)	D_2	.621 (1.747)	.833 (1.907)	1.216 (1.620)	D_2	.259 (.527)	-.038 (-.113)	-.548 (-1.285)
D_4	.033 (.068)	-.171 (-.257)	2.772 (5.388)	D_4	-.079 (-.198)	-.365 (-1.215)	-.057 (-.084)	D_4	-1.178 (-2.200)	-.483 (-1.724)	-.233 (-.896)
D_x	-.827 (-5.332)	-.823 (-2.458)	-1.497 (-9.906)	D_x	-.310 (-1.224)	-.770 (-2.479)	-1.116 (-5.961)	D_x	-.786 (-5.281)	-1.093 (-2.799)	-1.173 (-5.329)
W_{t-4}	10.190 (2.733)	-3.860 (-.663)	19.280 (4.388)	G_{t-1}	.793 (.413)	4.233 (1.932)	1.855 (.505)	X_{t-2}	.528 (2.813)	-.168 (-.943)	-.040 (-.257)
X_t^*	.242 (3.154)	.393 (1.721)	.836 (5.570)	G_{t-2}	-1.529 (-.775)	1.626 (.605)	8.302 (2.422)	X_{t-3}	-.516 (-3.103)	-.303 (-1.499)	.125 (1.107)

TABLE 3.7--Continued

Equation (3.1.1') Variable Name and Summary Statistics	Coefficient Estimate (t-Statistic) Italy	Turkey	Greece
X^*_{t-1}	-.016 (-.338	.353 (2.079)	-.080 (-.991)
X^*_{t-2}	-.091 (-1.168)	.221 (.909)	-.439 (-3.701)
X^*_{t-3}	.019 (.155)	-.002 (-.010)	-.239 (-1.730)
U^*_{t-3}	-.660 (-1.485)	.685 (.465)	-1.665 (-1.753)
U^*_{t-4}	.523 (1.406)	-.536 (-.477)	-2.137 (-2.344)
U^*_{t-5}	.377 (1.266)	1.200 (.999)	-1.935 (-2.624)
G^*_{t-3}	5.056 (3.812)	-1.517 (-.363)	.629 (.227)
G^*_{t-4}	2.325 (1.312)	-6.116 (-1.225)	6.378 (1.472)
G^*_{t-5}	2.604 (2.264)	-7.223 (-2.305)	7.646 (2.130)

Equation (3.3) Variable Name and Summary Statistics	Coefficient Estimate (t-Statistic) Italy	Turkey	Greece
X_{t-1}	.425 (2.290)	.557 (2.092)	.690 (3.361)
X_{t-2}	.042 (.209)	.388 (1.863)	-.008 (-.052)
U^*_{t-4}	.337 (.958)	1.475 (1.504)	-.591 (-.601)
U^*_{t-5}	.690 (1.579)	1.234 (1.410)	-1.381 (-1.212)
U^*_{t-6}	.560 (1.537)	.853 (.993)	-1.050 (-1.019)
Value of ρ	.760 (5.364)	.571 (3.184)	-.278 (-1.324)
$\bar{R}^2$	.892	.915	.932
D-W	2.417	1.705	2.508
$F_{11,9}$	6.770	8.799	11.255
$F_{11,9;.95}$	3.10	3.10	3.10

Equation (3.7') Variable Name and Summary Statistics	Coefficient Estimate (t-Statistic) Italy	Turkey	Greece
U^*_{t-8}	-.433 (-1.786)	-.915 (-.849)	2.171 (2.747)
U^*_{t-9}	.202 (.966)	.019 (.015)	2.216 (2.997)
U^*_{t-10}	.211 (.642)	.632 (.462)	1.983 (3.088)
U^*_{t-11}	-.407 (-1.242)	.992 (.884)	1.474 (2.246)
G^*_{t-1}	2.460 (.874)	1.037 (.360)	3.604 (1.379)
G^*_{t-2}	.181 (.174)	-1.642 (-.418)	8.645 (3.265)
G^*_{t-3}	.850 (.949)	-1.094 (-.295)	10.380 (3.727)
G^*_{t-4}	4.469 (3.209)	2.681 (.915)	8.802 (3.121)
Value of ρ	-.720 (-4.754)	.930 (11.606)	.541 (2.951)

TABLE 3.7--Continued

Equation (3.1.1')

Variable Name and Summary Statistics	Coefficient Estimate (t-Statistic)		
	Italy	Turkey	Greece
Value of ρ	-.862 (-7.788)	-.285 (-1.360)	-.558 (-3.081)
$\bar{R}^2$	.979	.939	.975
D-W	2.496	1.969	1.999
$F_{14,6}$	19.603	6.581	16.663
$F_{14,6;.95}$	3.96	3.96	3.96
Chow Test with (3.1.1) Results from Table 3.1:			
$F_{37,6}$	3.618		
$F_{37,6;.95}$	3.80		
Chow Test with (3.1.1') Results from Table 3.5:			
$F_{6,6}$	2.312		
$F_{6,6;.95}$	4.28		

Equation (3.3)

Variable Name and Summary Statistics	Coefficient Estimate (t-Statistic)		
	Italy	Turkey	Greece
Chow Test with (3.3) Results from Table 3.2:			
$F_{16,9}$		.432	
$F_{16,9;.95}$		3.00	
Chow Test with (3.3) Results from Table 3.5:			
$F_{6,9}$		.605	
$F_{6,9;.95}$		3.37	
Chow Test with (3.3) Results from Table 3.6:			
$F_{10,9}$		.415	
$F_{10,9;.95}$		3.14	

Equation (3.7')

Variable Name and Summary Statistics	Coefficient Estimate (t-Statistic)		
	Italy	Turkey	Greece
$\bar{R}^2$	.924	.906	.972
D-W	2.125	1.840	1.307
$F_{12,8}$	8.108	6.450	22.753
$F_{12,8;.95}$	3.28	3.28	3.28
Chow Test with (3.7) Results from Table 3.4:			
$F_{14,8}$			1.406
$F_{14,8;.95}$			5.55
Chow Test with (3.7') Results from Table 3.6			
$F_{10,8}$			.981
$F_{10,8;.95}$			3.35

*Denotes polynomial variable as previously specified for each equation.

examine the stability of the various equations over time; i.e., over different subsets of their respective time series. For purposes of examining the latter question, Chow tests were performed on the equations belonging to each of the three countries to see whether or not any structural changes took place. Finally, these tables enable us to make comparisons of the coefficients on the individual variables across countries. These comparisons can be made with the identical equation specification for two or three countries as the case may be. They can also be made across countries using the best equation specification for each of the respective countries.

Table 3.5 is a two-country comparison made between Turkey and Italy. The migration equations for these two countries are estimated over the period second quarter, 1963 to fourth quarter, 1969, which is the maximum time length for which we have the data to do the estimates for both countries. Table 3.6 is a two-country comparison between Greece and Turkey. Here again, the time period was the maximum period for which we had the data with which to estimate the migration equations for both countries. Table 3.7 is similar to 3.5 and 3.6 except that it is a three-country comparison made between migration equation results for Greece, Italy, and Turkey; the time period in this case is fourth quarter, 1964 to fourth quarter, 1969.

Looking first at table 3.5, we can see that there is a substantial difference between the functional forms of Turkish and Italian migration. It is clear from the value of the F-statistics alone that (3.1.1') fits much better on Italian migration than on Turkish migration and that (3.3) fits much better on Turkish migration than on Italian.

It also appears that the autonomous component of migration is significantly greater for Italy than it is for Turkey. An intercept term of 10.3 in natural logarithms translates into roughly 29,700 workers per quarter for Italy, while 9.4 translates into roughly 12,000 for Turkey. These are quite significant differences, given the very large values of the t-statistics involved. These differences in autonomous migration seem to hold fairly closely irrespective of whether we use equation (3.1.1') or (3.3). It also appears from our results for either specification that the seasonal dummy values are not sufficiently different to much affect the impact of the larger Italian intercept term in any of the quarters. This means that the level of autonomous migration of Italians is, in every quarter, higher than it is for Turks. Both Turks and Italians exhibit their lowest levels of autonomous migration in the fourth quarter, and their highest levels in the second quarter.

The differences regarding D_x are not entirely unambiguous, but it appears that the impact of recession in Germany has a more severe impact upon Turkish, than upon Italian, migration. The ambiguity comes in when we look at the comparative results for (3.1.1') which shows that the coefficients on D_x are roughly equivalent; but this coefficient for Turkey was insignificant at the 5 percent α-level. The bulk of the evidence suggests that the impact of German recession is greater upon would-be worker immigrants to West Germany from Turkey than upon those from Italy, and further, that any restrictions on worker immigration may be applied during such periods fall more heavily upon Turks than upon Italians.

As we stated earlier, the lagged level of wages, the migration financing variable, did not appear to play any role whatsoever in the

Turkish migration equation. This conclusion is further supported by the fact that table 3.5 reveals that W_{t-4} in (3.1.1') has a t-statistic of .2 for Turkey.

The results for the variable X show that it too plays a more important role for Turks than for Italians. It was estimated as a second degree polynomial running from t to t-3 in (3.1.1') and as X_{t-1} and X_{t-2} as separate independent variables in (3.3). Either way, it showed larger coefficient values for Turkey than for Italy. Looking at the polynomial estimates for X in (3.1.1'), we see that the sum of the lag coefficients is .33 for Italy and 1.0 for Turkey. In (3.3) the coefficient values for X_{t-1} and X_{t-2} are for Italy .16 and .13, respectively, and for Turkey .20 and .26, respectively.

The results for the variable U are interesting, although somewhat mixed. For Turkey in (3.1.1') the results for this variable are insignificant and of the wrong sign, providing further evidence that the functional forms are unique to their respective countries. However, the results for (3.3) are more conclusive. They give a clear indication that the amount of migration in the current time period is affected more by prior levels of unemployment in the home labor market in the case of Turkish migration than in the case of Italian migration.

On the other hand, the evidence suggests that the variable G exerted a slightly greater influence upon Italian, than upon Turkish, migration. The coefficients on the variable G were only significant and of the correct sign for Italy in (3.1.1') and for Turkey in (3.3); i.e., in the equations specific to the two countries in question. If the coefficients were only slightly larger for Italy, they belong to a three-period polynomial lag structure while G applies for only two periods in (3.3) for Turkey.

It has already been pointed out that the F-statistics demonstrate that the functional forms are specific to their respective countries; but now that we have gone through these results, we can see that some of the coefficients are of the wrong sign or have very weak t-statistics for either equation when estimated on the data for the alternate country, providing still further evidence that the functional forms of the migration equations are country-specific.

Further, the results were generally strong for each country's own migration equation, and these results are not very different from those which we presented earlier and which were estimated over different time frames. The Chow tests show that the results for Italy and Turkey, when estimated over the time periods second quarter, 1955 to fourth quarter, 1969 and second quarter, 1968 to fourth quarter, 1973 respectively, are not significantly different from what we found for each of these two countries for the period second quarter, 1963 to fourth quarter, 1969.

Table 3.6 provides us with a comparison between migration equation results for Greece and Turkey over the time period fourth quarter, 1964 to second quarter, 1972. Curiously enough, on the basis of the F-statistics alone, (3.3) fits the Greek data better than the Turkish data. But nonetheless, (3.3) fits the Turkish data better than does (3.7') and (3.7') fits the Greek data better than (3.3) does.

The results in table 3.6 for equation (3.3) appear to be closer to the (3.3) results in table 3.2 than to those found in table 3.5. This is because of the closer identity of the time frames between table 3.6 and table 3.2. In particular, the variable D_x is of greater significance for Turkey in table 3.2 than it is in either table 3.5 or 3.6.

Nonetheless, there are some things we can say with regard to table 3.6. Again, as our earlier tables indicated, there is a smaller autonomous component in Greek migration than in Turkish migration. Also, once again we find that Greeks seem to exhibit a greater reluctance to migrate in the first and second quarters and a lesser reluctance to migrate in the fourth quarter than Turks.

With regard to the German recession dummy, there appears to be no significant difference between the coefficients for Greece or Turkey over this period.

Wages are again shown to be more important for Greece than for Turkey. This is entirely consistent with the results we found earlier for equation (3.7) in table 3.4.

As regards table 3.7 there is very little that contradicts any of our earlier findings. One small change appears to be that the excess demand variable seems to have lost a good deal of its significance for Italy in (3.1.1') when compared to table 3.1 and even a little when compared to table 3.5. The loss of significance for X in equation (3.1.1') is partly made up for by the increased role played by D_x for Italy in that equation.

The level of wages in Italy was more important for (3.1.1') in table 3.7 than in table 3.1, but not as important as in table 3.6. A fascinating result is that wages appeared to be so important when, as in table 3.7, equation (3.1.1') is estimated over the time period fourth quarter, 1964 to fourth quarter, 1969, for Greek migration. As a result of this finding it was thought that it might be wise to try inserting W_{t-4} into equation (3.7') over this time period. Interestingly, it does seem to play an important role over this time period in Greek migration and these results are presented in table 3.8 on the following pages as equation (3.7"). Equation (3.7") is merely (3.7') with $W_{G,t-4}$ added to it.

Continuing with table 3.7, we have already noted the diminished importance of the market tightness variable for Italy in equation (3.1.1'). But there are some other important changes in (3.1.1') which are worth noting. The results for U^* for Italy in (3.1.1') seem to be weaker than in either table 3.1 or 3.5. More importantly, there seems to have been some increase in the importance of the wage differential variable--in their own respective migration equations--for Turkey and Greece in comparison to the results presented in table 3.6, and for Italy in comparison to the results presented in 3.5. Little difference was found in the importance of the wage differential variable for Turkey in comparison to those results obtained in table 3.5.

However, even with all of the changes which we have noted here, there appear to be no significant structural changes occurring over time for the respective equations of any of the three countries presented in table 3.7. This is demonstrated by their Chow test results given at the end of table 3.7. Each of these tests is significant at the 5 percent α-level.

In tables 3.7 and 3.8 we can make comparisons between three countries. The differences between the countries are quite similar to those which we found earlier. These results show once again that the functional forms are specific to the particular countries, and that

TABLE 3.8

GREEK WORKER MIGRATION TO WEST GERMANY
Regression Results of (3.7")
Period: 4th Qtr., 1964 to 4th Qtr., 1969

Variable Name and Summary Statistics	Parameter Name	Parameter Estimate (t-Statistic)
Intercept	β_0	9.540 (37.471)
D_1	β_1	-1.131 (-1.785)
D_2	β_2	-.673 (-1.720)
D_3	β_3	-.295 (-1.062)
D_x	β_4	-1.245 (-7.018)
W_{t-4}	β_5	11.085 (2.009)
X_{t-2}	β_7	.167 (1.064)
X_{t-3}	β_8	.004 (.035)
2nd Degree Polynomial Results for U_G:		
$U_{G,t-8}$	μ_0	2.911 (3.638)
$U_{G,t-9}$	μ_1	2.472 (4.315)
$U_{G,t-10}$	μ_2	1.630 (3.295)
$U_{G,t-11}$	μ_3	.387 (.504)

TABLE 3.8--Continued

Variable Name and Summary Statistics	Parameter Name	Parameter Estimate (t-Statistic)
Mean Lag		8.932
Mean Lag Standard Error		.352
Sum of Lag Coefficients		7.400
Summed Coefficients Standard Error		1.390
2nd Degree Polynomial Results for G_G:		
$G_{G,t-1}$	ν_0	4.288 (1.755)
$G_{G,t-2}$	ν_1	8.200 (3.824)
$G_{G,t-3}$	ν_2	11.180 (5.197)
$G_{G,t-4}$	ν_3	13.220 (4.247)
Mean Lag		2.904
Mean Lag Standard Error		.355
Sum of Lag Coefficients		36.885
Summed Coefficients Standard Error		7.344
Value of ρ		.229 (1.079)
$\bar{R}^2$		.981
D-W		1.355
$F_{13,7}$		27.769
$F_{13,7;.95}$		3.55

comparisons between these countries should only be made using their own equations. For each country, the results tend to be highly irregular and difficult to interpret when estimates are made using another country's equation.

When we look at the results of (3.7") in table 3.8 we find the results are slightly better by virtue of the higher F-statistic. But aside from the inclusion of $W_{G,t-4}$, there is little change in the results for Greece between equation (3.7') and (3.7") as far as the individual coefficients are concerned. Therefore, we could, if we wish, compare the results for Italy using (3.1.1') with those for Turkey using (3.3) and Greece using (3.7") without any real problem. Proceeding on this basis, we see that there is a greater autonomous component in Italian migration than in either Turkish or Greek. Likewise, the seasonal dummies agree with our earlier findings. Once again Greeks display a greater reluctance to migrate in the first than in the fourth quarter. This reluctance of Greeks to migrate in the first quarter is especially evident in the (3.7") results in table 3.8 where, by taking the anti-logarithms, we find that autonomous migration to West Germany is estimated to be 4,487 in the first quarter, 7,093 in the second quarter, 13,905 in the third quarter, and 10,353 in the fourth quarter. So autonomous migration is by far at its lowest level in the first quarter.

Another contrast between the results for Greece and those of the other two countries is the importance of D_x. There is very little difference between the (3.7') and (3.7") results as far as D_x is concerned. The coefficient for Greece on D_x is approximately -1.2 in both cases. This is higher than anything we obtained for Turkey or Italy. In fact, whether we compare across countries for each country's own equation, or compare across countries equation by equation (i.e., making one comparison for (3.1.1'), one for (3.3), and one for (3.7')), the results are the same. A recession in Germany, as indicated by a positive excess of unemployment over listed job vacancies, has a greater effect upon the level of autonomous migration of Greek workers to West Germany than it has upon that of Italian or Turkish workers.

The comparative results for the labor market tightness variable are ambiguous, although it can be said that it does not appear to be terribly important for any of the three countries.

A little less ambiguous is the relative role of the wage level in the sending country. It is of approximately equal importance for Italy and Greece (comparing (3.1.1') for Italy in table 3.7 with (3.7") in table 3.8) and is much less important in the case of Turkey where it does not appear to play any role at all. The Italian and Greek coefficients tell us that a 1 percent increase in the change in the level of wages in the respective home country in the current time period will result in a 10.2 percent increase in Italian migration four periods hence and an 11.2 percent increase in Greek migration four periods hence.

Unemployment in the sending country produced interesting comparative results. The results for this variable for Italy in equation (3.1.1') seem to be slightly diminished from what we presented earlier in tables 3.1 and 3.5. This diminished importance for unemployment in the sending country does not appear to hold for Turkey and Greece.

Of all the results given in table 3.7, the least ambiguous are those for our wage differential variable. The results of tables 3.7 and 3.8 clearly indicate that the inter-country wage differential is the most important economic variable in each country's own migration equation. It is also apparent that the wage differential is more important to Italy than to Turkey and more important to Greece than to Italy. The results for Greece in (3.7") are so strong that an increase of 1 percent in our wage differential variable, as defined earlier, will result in 4.3, 8.2, 11.2, and 13.2 percent increases in the number of new Greek migrants to West Germany in each of the four succeeding quarters.

The Greek results in both table 3.7 and table 3.8 are interesting in their own right. What is especially interesting about them is that since we are working over this shortened time frame, we are no longer in need of our special political dummies.

Our results, especially for (3.7") are strong providing an F-statistic of 27.8. But it is especially heartening to the economist to note such a strong influence for wages, as an incentive variable and as a migration financing variable as well. It is also nice to know that when the time frame is shortened so as to substantially diminish the effects of radical changes in the political climate the nature of the economic relationship which then emerges is one which gives very strong support to economic determination in general and to the human capital model in particular.

Through tables 3.5, 3.6, and 3.7, we have seen that the empirical relationships which we had set forth earlier in this chapter show a substantial amount of stability over time. The Chow tests suggest no significant changes in any of the relationships over time. Also, the comparisons which we made earlier, between the structures of migration equations for the different countries, seem to hold up in the main when they are made over these common time frames. The results also support the view that the structures are indeed unique to the individual countries, since in no case did another country's specification fit as well as that country's own specification. The t-statistics on the individual coefficients (speaking now with regard to each country's own equation only, their opposite members being mere curiosities presented for purposes of comparison only) remained generally good, although there was some weakening in some cases. One strong exception here was Greek migration where most of the t-statistics in table 3.8 are superior to those found in table 3.4. Most of the individual coefficients in these tables remain significant at the 5 percent α-level.[25]

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[25]3.5 (3.1.1')
One-tailed tests: $t_{12,.10} = 1.356$; $t_{12,.05} = 1.782$; $t_{12,.01} = 2.681$;

Two-tailed tests: $t_{12,.10/2} = 1.782$; $t_{12,.05/2} = 2.179$; $t_{12,.01/2} = 3.055$.

3.5 (3.3):
One-tailed tests: $t_{15,.10} = 1.341$; $t_{15,.05} = 1.753$; $t_{15,.01} = 2.602$;

Two-tailed tests: $t_{15,.10/2} = 1.753$; $t_{15,.05/2} = 2.131$; $t_{15,.01/2} = 2.947$.

3.6 (3.3):
One-tailed tests: $t_{19,.10} = 1.328$; $t_{19,.05} = 1.729$; $t_{19,.01} = 2.539$;

Two-tailed tests: $t_{19,.10/2} = 1.729$; $t_{19,.05/2} = 2.093$; $t_{19,.01/2} = 2.861$.

3.6 (3.7'):
One-tailed tests: $t_{18,.10} = 1.330$; $t_{18,.05} = 1.734$; $t_{18,.01} = 2.552$;

Two-tailed tests: $t_{18,.10/2} = 1.734$; $t_{18,.05/2} = 2.101$ $t_{18,.01/2} = 2.878$.

3.7 (3.1.1'):
One-tailed tests: $t_{6,.10} = 1.440$; $t_{6,.05} = 1.943$; $t_{6,.01} = 3.143$;

Two-tailed tests: $t_{6,.10/2} = 1.943$; $t_{6,.05/2} = 2.447$; $t_{6,.01/2} = 3.707$;

3.7 (3.3):
One-tailed tests: $t_{9,.10} = 1.383$; $t_{9,.05} = 1.833$; $t_{9,.01} = 2.821$;

Two-tailed tests: $t_{9,.10/2} = 1.833$; $t_{9,.05/2} = 2.262$; $t_{9,.01/2} = 3.250$.

3.7 (3.7'):
One-tailed tests: $t_{8,.10} = 1.397$; $t_{8,.05} = 1.860$; $t_{8,.01} = 2.896$;

Two-tailed tests: $t_{8,.10/2} = 1.860$; $t_{8,.05/2} = 2.306$; $t_{8,.01/2} = 3.355$.

If there is any possible generalization which can be made regarding changes in the relationships over time--the Chow test results showing no significant overall structural changes in the equations notwithstanding--it would be that apparently for all the countries the market tightness variable became less important as we moved forward through time, while wages (both home country levels and inter-country differentials) and the German recession dummy became more important. This indicates that the system perhaps experienced more or less constant restraint by the German government in the earlier years, while in the later years movement was more or less unrestricted in periods of low unemployment and quite restricted in periods of high unemployment. Also, it appears that movement of each country's workers into Germany had a large autonomous component, indicating that, once the migration process had started, it tended to feed upon itself. There are a number of reasons for this. One is the establishment of information flows back to potential migrants in the sending country. People see the benefits accruing to their friends and neighbors who have migrated and they decide that they might like to try it as well. Another is that we are dealing with the gross flows of new entrants to the German labor market from foreign countries, and as the stock of migrants of a particular national origin grows, there is an increasing need for replacement. The indications of our results are that the latter reason is less important than the former. The basis for this statement is the fact that despite the leveling off of Italian migration, we see very little change in its autonomous component. These and other generalizations with their economic interpretations are discussed in the next chapter.

CHAPTER IV

SUMMARY AND CONCLUSIONS

In this paper we have followed the basic human capital premise that labor migration can be viewed as an investment in location undertaken by the laborer, which is analogous to an investment made by the laborer in his own education. The investment will be made provided it results in a sufficiently large differential future stream of earnings. We have taken the inter-country real wage differential to be the proxy for the perceived differential stream of earnings.

Further, since it is blue-collar worker migration which we have dealt with here, it follows that at least part of this investment in location was probably financed out of prior wage earnings in the sending country. On the basis of this reasoning, a variable measuring a prior level of real wages in the sending country was introduced as a financing variable and in most cases it resulted in a fair amount of success.

Unemployment in the sending country is a variable with both business cycle and demographic aspects. In Turkey for example, where unemployment is to a large extent estimated as a percentage of population, the demographic aspect is by far the most important. No attempt has been made to sort out the demographic from the business cycle aspect of home country unemployment.

All these variables, plus the measure of labor market tightness in Germany, as well as the seasonal and other dummies were shown to be important. Most important of all, wages were shown to be a vital factor influencing the movement of foreign workers into West Germany, despite the fact that the literature on this subject has often suggested otherwise.

The model which we have developed here suggests that the migration of foreign workers into the West German labor market is, at least in part, a dynamic adjustment process. We say "in part" here because our results show that even if the economic variables stopped changing and the period-to-period ratios of the variables we have herein developed were all equal to one, we would still be left with a substantial amount of "autonomous" migration. This large autonomous component could result from the fact that changes in the relevant economic variables do not explain all the migration that these variables could explain. Perhaps their levels are also important. It should be noted, however, that our empirical efforts to incorporate level variables met with no statistical success. Perhaps a better explanation for the large autonomous component can be developed from a variety of factors in the following way: Over time the number of workers of a given nationality working in Germany increases in size due to continuous migration. As the average length of stay increases, so does the need for the replacement of workers who return home. This return stream of migrants increases the flow of information back to the sending country regarding working in Germany. This increased information flow might be expected to change attitudes with respect to working in Germany. Wealth flaunted by returning workers is liable to encourage those at home to seek some of the same for themselves. At the same time, employers who already have a number of workers of a given nationality working for them will try to recruit foreign workers, when they are needed, of the same nationality so as not to complicate the problems of communications and management. What is interesting is that we ended up with a multiplicative constant term while a time variable failed miserably in every case.

What we have then is a model which says that migration is a process of dynamic adjustment to changes in relevant economic variables with strong autonomous and seasonal components. We need not go into the seasonal aspects again since they are discussed at length in Chapter III.

The German recession dummy, however, does merit some discussion. The results for D_x indicate the German government tends to become highly restrictive when recession (as measured by an excess of unemployment over job vacancies) occurs in the Federal Republic. Furthermore, the results suggest that this increased restrictiveness during recessions falls more heavily on Greeks than upon Turks and more heavily upon Turks than upon Italians.

Another important result is that home country unemployment appears to be a relatively more important factor for Italy than for any of the other countries. The wage differential variable seemed to be a more important factor for Greece than for either Italy or Turkey. However, it should be noted that this last result is not as strong as some of the others.

Finally, even though there seemed to be increasing importance for the wage gap variable, there did not appear to be any statistically significant changes in the structure of any of the migration equations as a result of partitioning the data into different time frames. This indicates a remarkable stability for our results; however, whether the recent severe downturn in migration would have been predicted by our model remains, at this point, an empirical question with which, hopefully, we shall deal at some time in the not-too-distant future.

While the kind of micro data which would be required in order to answer a number of other questions pertaining to this matter is simply not available, this paper does go a long way toward demonstrating that there is a market mechanism at work here. The paper shows that worker migration to West Germany can be explained by means of some of the standard tools of economic logic without resorting to the kind of quasi-religious demogoguery which argues that the presence of the foreign workers is prima facie evidence that markets do not work and that without the foreign workers jobs would go perpetually unfilled at any wage.

Perhaps the most interesting aspect of our empirical findings is that labor migration appears to be, in this case at least, a dynamic adjustment process. We have found migration to be a function of period-to-period changes in the independent variables. This gives us the dynamic interpretation. Further, we were not able, nor have we seen any proof that anyone else has been able, to achieve results of this quality when the independent variables are expressed in levels, as opposed to changes, in any model of international migration.

APPENDIX A

DERIVATION OF DATA ELEMENTS[26]

i) $q_H = \frac{\text{Money Wages in West Germany in D.marks}}{\text{Consumer Price Index in West Germany}} \cdot \frac{E_{F,t}}{E_{H,t}}$, where

E_F and E_H are the U.S. dollar exchange rates the foreign country and the host country (West Germany), respectively, expressed in the number of units of national currency per dollar. q_H then becomes the real wage in West Germany, expressed in the given foreign country's national currency.

ii) $q_F = \frac{\text{Money Wages in the Foreign Country in its own National Currency}}{\text{Consumer Price Index in the Foreign Country}}$

iii) $m_{F,t}$ = the total number of official new arrivals of workers (male and female) from the given foreign country during the quarter (I, January to March; II, April to June; III, July to September; IV, October to December).

iv) v_H = the total number of listed vacant positions at the government labor offices in West Germany.

v) u_H = the total number of men and women who are officially listed as seeking employment in West Germany.

[26]Sources: money wages in Greece, Italy, and Spain; unemployment in Greece, Italy, and Spain--International Labor Office; exchange rates and consumer price indexes--International Monetary Fund; unemployment, job vacancies, and new arrivals of foreign workers in Germany--Bundesanstalt für Arbeit; money wages and unemployment in Turkey--Sosyal Sigortalar Kurumu.

vi) u_F = the total number of men and women who are officially listed as seeking employment in the respective foreign country.

The data for wages, consumer prices, exchange rates, job vacancies, and unemployment are those published by the respective sources as representative of the middle month of the quarter (February, May, August, November). The data for wages are for the industrial sector, or the non-agricultural sector where industrial wages are not available.

All the additional manipulations of the data are exactly as described within the text. All the source titles are listed in the List of References of this paper under E., Data Sources.

APPENDIX B

ECONOMETRIC TECHNIQUE

The usual polynomial lag form is given by:

(B-1) $Y_t = \beta_0 + \beta_1 (w_0 X_t + w_1 X_{t-1} + \ . \ . \ . + w_m X_{t-m}) + \varepsilon_t,$

where m is the number of periods in the lag structure. This can be written as follows:

(B-2) $Y_t = \beta_0 + \beta_1 (\sum_{i=0}^{m} w_i X_{t-i}) + \varepsilon_t.$

The coefficients--or weights, as they are called--on the lagged terms are polynomial functions of i as follows:

(B-3) $w_i = \sum_{k=0}^{p} \lambda_k i^k$, where p is the degree of the polynomial determining the weights, and the λ_k are unknown parameters.

In our case we have allowed that the lag structure need not begin in the contemporary time period; however, the weights are functions of the i's which would obtain if the lag structure did begin in the contemporary time period. An alternative way of saying this is that the weights are functions of the number of periods we are removed from the beginning of the lag structure.

Now we can write our polynomial structure as:

(B-4) $Y_t = \beta_0 + \beta_1 (w_0 X_{t-j} + w_1 X_{t-j-1} + \ . \ . \ . + w_m X_{t-j-m}) + \varepsilon_t,$

where j is the number of periods prior to the current period where our lag structure begins. This is computationally the easiest way of handling the problem and we experience no loss of rigor in so doing.

Equation (B-4) can be reduced to

$$\text{(B-5)} \quad Y_t = \beta_0 + \beta_1 \left(\sum_{i=0}^{m} w_i X_{t-j-i} \right) + \varepsilon_t .$$

Each of our economic variables, which ended up in polynomial lag form, was, in the final analysis, estimated as a second degree polynomial over either three or four periods, with generally a different value of j in each case. The weights, however, are still determined by equation (B-3); therefore, if we assume a second order polynomial determining the lag weights over m time periods, we can insert (B-3) into (B-5) and expand it out as follows:

$$\text{(B-6)} \quad Y_t = \beta_0 + \beta_1 \Big[\lambda_0 X_{t-j} + (\lambda_0 + \lambda_1 + \lambda_2) X_{t-j-1} + (\lambda_0 + 2\lambda_1 + 4\lambda_2) X_{t-j-2} + \ldots + (\lambda_0 + m\lambda_1 + m^2\lambda_2) X_{t-j-m} \Big] + \varepsilon_t .$$

At this point we can collect and rearrange terms in relation (B-6) yielding

$$\text{(B-7)} \quad Y_t = \beta_0 + \beta_1 \lambda_0 (X_{t-j} + X_{t-j-1} + \ldots + X_{t-j-m}) + \beta_1 \lambda_1 (X_{t-j-1} + 4X_{t-j-2} + \ldots + mX_{t-j-m}) + \beta_1 \lambda_2 (X_{t-j-1} + 4X_{t-j-2} + \ldots + m^2 X_{t-j-m}) + \varepsilon_t .$$

Here we can see that there are five unknowns, β_0, β_1, λ_0, λ_1, λ_2. But it can be readily seen that β_1 provides us with no additional information; hence the usual convention is to assume, as we have, that it is equal to one. The estimation problem, then is to apply least squares to (B-7) and obtain estimates of β_0, λ_0, λ_1, λ_2. The estimates of these coefficients, once obtained, are inserted back into (B-6). Thus we can see that for each polynomial lag structure, the number of coefficients we are actually directly estimating is equal to p (the degree of the polynomial) plus one; buy by means of the polynomial transformation, these p + 1 coefficients provide us with coefficients for all m periods covered by the lag structure. It is obvious, at this point, that we require that $m \geq p + 1$; i.e., the number of time periods involved in the lag must be greater than or equal to the degree of the polynomial plus one.

Now, when we estimate a polynomial lag structure from t-j to t-m, we are assuming that periods outside of this range do not have a significant impact. But if we wish, we may stipulate that the weights on X_{t-j+1} and $X_{t-j-m-1}$ are, in fact, equal to zero. Such stipulations are called near and far zero restrictions. Since each zero restriction adds an additional constraint, we now need to require that the number of periods less the number of zero restrictions be greater than or equal to the degree of the polynomial plus one.

A problem with polynomial lag distribution is that theoretically it is necessary to specify in advance the degree of the polynomial and the period of time over which the distribution is to be estimated. Inevitably, however, one is forced into a trial and error process, which can be messy when, as we are in our case, dealing with as many as four potential polynomial variables. However, it can be done, as has been demonstrated by Professor Almon.[27] It is necessary to be methodical and to experiment with one polynomial variable at a time while holding the others constant. When the best fit is achieved on that polynomial variable, we move on to the next; and so on, until all have been done. We then go back to the first and repeat the iterative procedure. There are, of course, some theoretical objections to trial and error

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[27] S. Almon, "Lags Between Investment Decisions and Their Causes," Review of Economics and Statistics 50 (April 1968): 193-206.

experimentation with lag structures; for one, the results could possibly be biased by randomly distributed spurious correlations. However, as a practical matter, there is no alternative to trial and error experimentation since the exact nature of the polynomial form is impossible to know a priori. It is also the general practice.[28]

What was actually done in the estimation of the equations described in Chapter III of this paper was to estimate all four of the non-dummy independent variables in the Almon polynomial form simultaneously. Polynomials of the second, third, and fourth degree were tried, and the lag structures were estimated over as many as eight periods. In most cases the lag structures turned out not to begin in the time period concurrent with that of the dependent variable. Taking one variable at a time, we varied the position and length of the lag structure. The position of the beginning, and the length, of the lag structure were determined by varying the values of the parameters j and m in equation B-4. As far as zero restrictions are concerned, all the possible combinations were tried--near end only, far end only, and both ends. In the end, all such zero restrictions were dropped. This is probably well and good because zero restrictions are considered by many to be a bad idea. They overly constrain the system with a priori restrictions, and if the polynomial were to truly conform to such restrictions, it would be revealed by the estimation results without employment of the restrictions. Also, there is the problem of over-

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[28]See Peter Schmidt and Roger N. Waud, "The Almon Lag Technique and the Monetary Versus Fiscal Policy Debate," Journal of the American Statistical Association 68 (March 1973): 11-19. This point is also made made quite clearly in Jan Kmenta, Elements of Econometrics, (New York: Macmillan Publishing Co., 1971), pp. 494-495.

determination. A second degree polynomial estimated over four periods will permit one zero restriction only. Ultimately, all the polynomials we estimated were either three or four periods in length, so that all would have been overdetermined had restrictions been applied to both ends, and some would have been overdetermined with even one zero restriction. Finally, if a variable failed to demonstrate a polynomial lag structure, it was entered as a single period variable or as a separate variable for each of two periods. All the polynomials were estimated, in the final analysis, in the second degree. It was not difficult to determine the length and beginning point of the lag structures; these tended to present themselves rather obviously.

The use of polynomial lags tends to somewhat obscure the existence of serial correlation, and to badly bias the Durbin-Watson statistic, thereby making it impossible to use it as a measure of first order serial correlation. However, examination of the plots of residual values did tend to make it clear that substantial serial correlation existed in the data for all the cases which we estimated. But even if this had not been the case it would have been a good idea to correct for autocorrelation, inasmuch as we are unable to make a sound judgment on the basis of the Durbin-Watson statistic. This means that we really should do the best possible job of removing first order serial correlation; i.e., to obtain the best possible estimate of ρ within a first order autoregressive scheme and to calculate all the coefficients in the equation with all data being transformed by ρ. For this reason Grilliches and others suggest the use of nonlinear estimation techniques to solve for ρ whenever employing polynomial lag distributions.[29]

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[29] Zvi Grilliches, "Distributed Lags: A Survey," Econometrica 35 (January 1967): 46.

The multiplicative relationship existing between coefficients in a first order autoregressive scheme presents us with what is essentially a nonlinear estimation problem. One way of attacking this problem is by means of successive iterations as developed by Cochrane and Orcutt.[30] Briefly, in the Cochrane-Orcutt method, the coefficients on the independent variables and ρ are alternately estimated on data transformed by the previous round's estimates. This process is repeated until there is no significant change in the value of ρ. (We employed the criteria that if ρ did not change by more than .005, no further iterations would be made.)

More precisely, the Cochrane-Orcutt iterative technique is a mehtod of estimating ρ in the following relation:

(B-8) $$Y_t - \rho Y_{t-1} = \beta_0(1-\rho) + \beta_1(X_t - \rho X_{t-1}) + (\varepsilon_t - \rho\varepsilon_{t-1}).$$

Using this method, we obtain first round estimates of the coefficients under the assumption that $\rho = 0$; i.e., we first obtain estimates, $\hat{\beta}_0$ and $\hat{\beta}_1$ of the coefficients, β_0 and β_1, in the relation . . .

(B-9) $$Y_t = \beta_0 + \beta_1 X_t + \varepsilon_t.$$

Using the estimates thus obtained of β_0 and β_1, $\hat{\beta}_0$ and $\hat{\beta}_1$, we can

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[30] D. Cochrane and G. H. Orcutt, "Application of Least Squares Regression to Relationships containing Autocorrelated Error Terms," Journal of the American Statistical Association 44 (March 1949): 32-61. In this article, Cochrane and Orcutt list several possible approaches to ρ estimation--each with reservations. However, as a result of practice and interpretation, the term Cochrane-Orcutt method has come to mean that iterative method described in Kmenta, Elements of Econometrics, p. 288.

calculate the residuals from (B-9) and obtain our first round estimates of . . .

(B-10) $$\hat{\rho} = \frac{\Sigma\hat{\varepsilon}_t \hat{\varepsilon}_{t-1}}{\Sigma\hat{\varepsilon}_t^2} .$$

Having computed this first round estimate of ρ, $\hat{\rho}$, we then transform all the variables by this result and obtain second round estimates of the coefficients of (B-8), $\hat{\hat{\beta}}_0$ and $\hat{\hat{\beta}}_1$, as follows:

(B-11) $$Y_t - \hat{\rho}\, Y_{t-1} = \hat{\hat{\beta}}_0(1-\hat{\rho}) + \hat{\hat{\beta}}(X_t - \hat{\rho}\, X_{t-1}) + u_t^* ,$$

where u_t^* is an estimate of $(\varepsilon_t - \rho\varepsilon_{t-1})$. These new estimates of the coefficients are then plugged into (B-9) and we produce another estimate of ρ, $\hat{\hat{\rho}}$. These steps are repeated successively until the value of the coefficients fail to change by more than the critical .005 already mentioned. While the coefficients are estimated on the transformed data, the ρ estimate is obtained by applying these estimated coefficients to the untransformed data, and using the resulting residuals in relation (B-10) to calculate an estimate of ρ. When no further significant reduction in the sum of squared residuals is possible, the results are said to have converged and we have our final estimates of the coefficients of equation (B-9). The coefficients have been estimated on data transformed by ρ to remove first order serial correlation and the final results are presented in terms of untransformed data. In other words, ρ is used in obtaining the estimates, but is not an integral part of the final results.

But the nonlinearity of this estimation problem can present problems for the Cochrane-Orcutt method as well. If we were to substitute (B-10) into the expression for the residual term found in (B-8),

$(\varepsilon_t - \rho\varepsilon_{t-1})$, it is easy to see that the expression for the sum of squared residuals in a first order autoregressive scheme is a quadratic function. This being the case, the possibility exists of there being several local minima and that the Cochrane-Orcutt method will not converge to that value of ρ which, along with the other coefficients, will coincide with the global minimum of the sum of squared residuals. One way around this is to estimate the parameters β_i for each value of ρ specified in a grid, thus forcing the estimation over a wider range of values than might possibly occur with the Cochrane-Orcutt method. This technique was first prescribed by Sargan[31] and extensive work was done with this method by Hildreth and Lu,[32] whose names are generally used to identify it. With this method, one prescribes a priori a range of values for ρ. For example, we specified .05 to .95 in steps of .05 for equation (3.5.1). In that case we found ρ to be .55. We then set a grid of .45 to .65 with increments of .02. Then .57 was found to be the best value of ρ. In the Hildreth-Lu method, we calculate the coefficients in our estimation equation based on data transformed by each of the values of ρ specified a priori in the grid. Then that equation, and its associated ρ value, is chosen which resulted in the lowest sum of squared residuals based on transformed data. In other words, in an equation of the general form of (B-8), a value of ρ is selected so as to minimize $(\varepsilon_t - \rho\varepsilon_{t-1})^2$. Since in the Cochrane-Orcutt method no further estimates are made if ρ

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[31] J. D. Sargan, "Wages and Prices in the United Kingdom: A Study in Econometric Methodology," in Econometric Analysis for National Economic Planning, ed. P. E. Hart, G. Mills, and J. K. Whitaker (London: Butterworths, 1964), pp. 25-63.

[32] C. Hildreth and J. Y. Lu, "Demand Relations with Autocorrelated Disturbances," Technical Bulletin 276, (Michigan State University Agricultural Experiment Station, 1960), p. 14.

does not change much from one iteration to the next, the possibility exists of choosing a value of ρ in the neighborhood of a local rather than a global minimum of $(\varepsilon_t - \rho\varepsilon_{t-1})^2$.

Only in the case of Spanish migration did it appear that the Hildreth-Lu method produced a superior result, and then only when the German recession dummy, D_x was included. In table 3.3 we presented the Cochrane-Orcutt results for equation (3.5) and the Hildreth-Lu results for equation (3.5.1). For the sake of comparison, we are presenting the Hildreth-Lu results for (3.5) and the Cochrane-Orcutt results for (3.5.1) in table B-1 on the following pages.

TABLE B-1

SPANISH WORKER MIGRATION TO WEST GERMANY
Regression Results of (3.5)† and (3.5.1)††
Period: 2nd Qtr., 1968 to 4th Qtr., 1973

Variable Name and Summary Statistics	Parameter Name	(3.5) Parameter Estimate (t-Statistic)	(3.5.1) Parameter Estimate (t-Statistic)
--	β_0	7.781 (31.494)	7.726 (23.572)
D_1	β_1	2.453 (5.352)	2.489 (4.012)
D_2	β_2	2.205 (5.912)	2.412 (4.112)
D_4	β_3	-1.118 (-3.012)	-1.651 (-2.331)
D_x	β_4	--	4.772 (2.675)
$W_{S,t-1}$	β_5	10.781 (3.445)	14.887 (2.825)
$U_{S,t-5}$	β_6	1.505 (3.981)	2.149 (3.166)
2nd Degree Polynomial Results for X:			
X_t	ϕ_0	.891 (5.092)	.809 (3.332)
X_{t-1}	ϕ_1	1.044 (6.692)	.926 (4.608)
X_{t-2}	ϕ_2	.784 (4.906)	.697 (3.468)
Mean Lag		.960	.954
Mean of Lag Standard Error		.116	.158
Sum of Lag Coefficients		2.719	2.433
Summed Coefficients Standard Error		.370	.365

TABLE B-1--Continued

Variable Name and Summary Statistics	Parameter Name	(3.5) Parameter Estimate (t-Statistic)	(3.5.1) Parameter Estimate (t-Statistic)
2nd Degree Polynomial Results for G_S:			
$G_{S,t-1}$	ν_0	2.238 (3.702)	2.637 (3.289)
$G_{S,t-2}$	ν_1	3.770 (5.275)	4.226 (4.414)
$G_{S,t-3}$	ν_2	1.814 (3.689)	1.169 (1.721)
Mean Lag		1.946	1.817
Mean Lag Standard Error		.149	.171
Sum of Lag Coefficients		7.822	8.032
Summed Coefficients Standard Error		1.343	1.489
Value of ρ		.550 (3.158)	.126 (.610)
$\bar{R}^2$		.949	.904
D-W		2.635	1.859
$F_{11,11}$		18.550	--
$F_{11,11;.95}$		2.82	--
$F_{12,10}$		--	7.822
$F_{12,10;.95}$			2.91

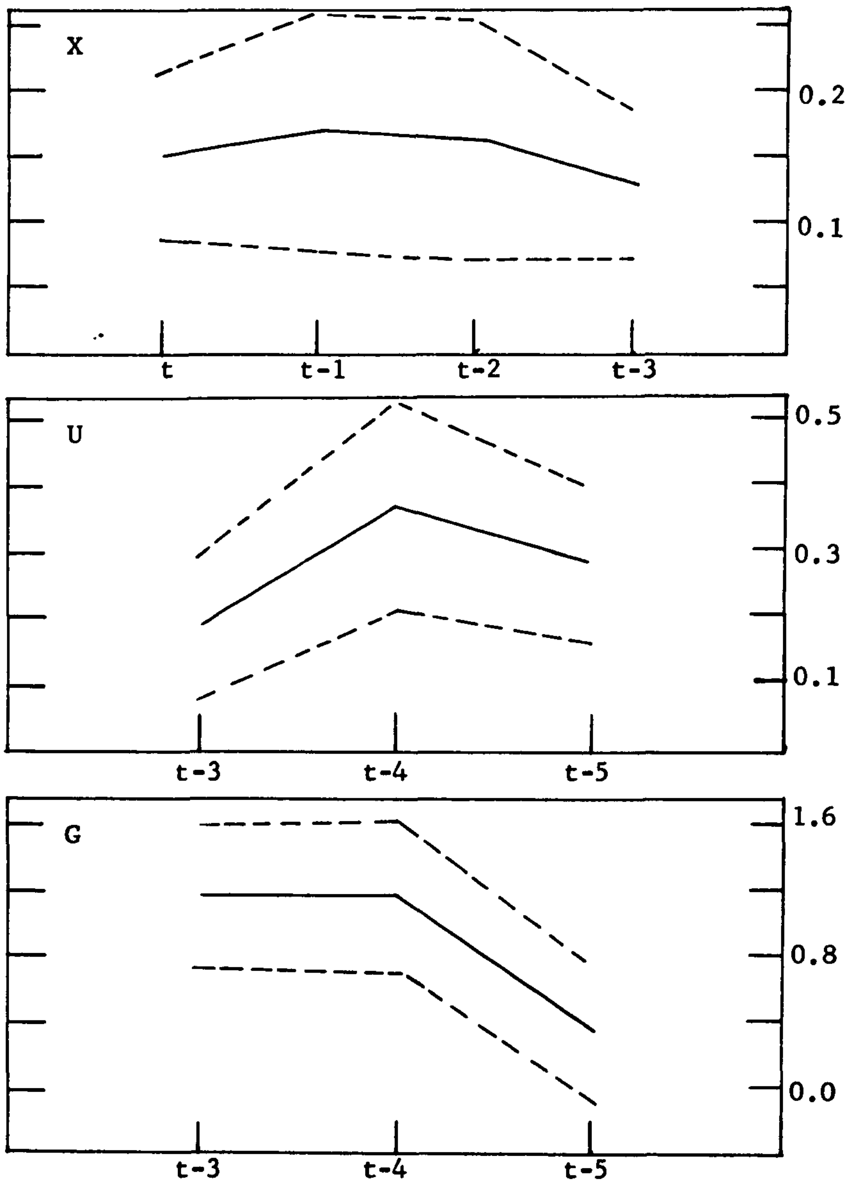
†Estimated by means of the Hildreth-Lu scanning technique.

††Estimated by means of the Cochrane-Orcutt iterative method.

APPENDIX C

APPROXIMATION OF POLYNOMIAL LAG STRUCTURES[33]

Chart C-1. ITALIAN WORKER MIGRATION TO WEST GERMANY
Lag structures from Equation (3.1)
2nd Qtr., 1955 to 4th Qtr., 1969
(Values in natural log scale)



[33]These plots are produced by a computer; the approximation results from connecting the actual points on the polynomial with straight lines rather than plotting the actual polynomial.

Chart C-2. ITALIAN WORKER MIGRATION TO WEST GERMANY
Lag structures from Equation (3.1.1)
2nd Qtr., 1955 to 4th Qtr., 1969
(Values in natural log scale)

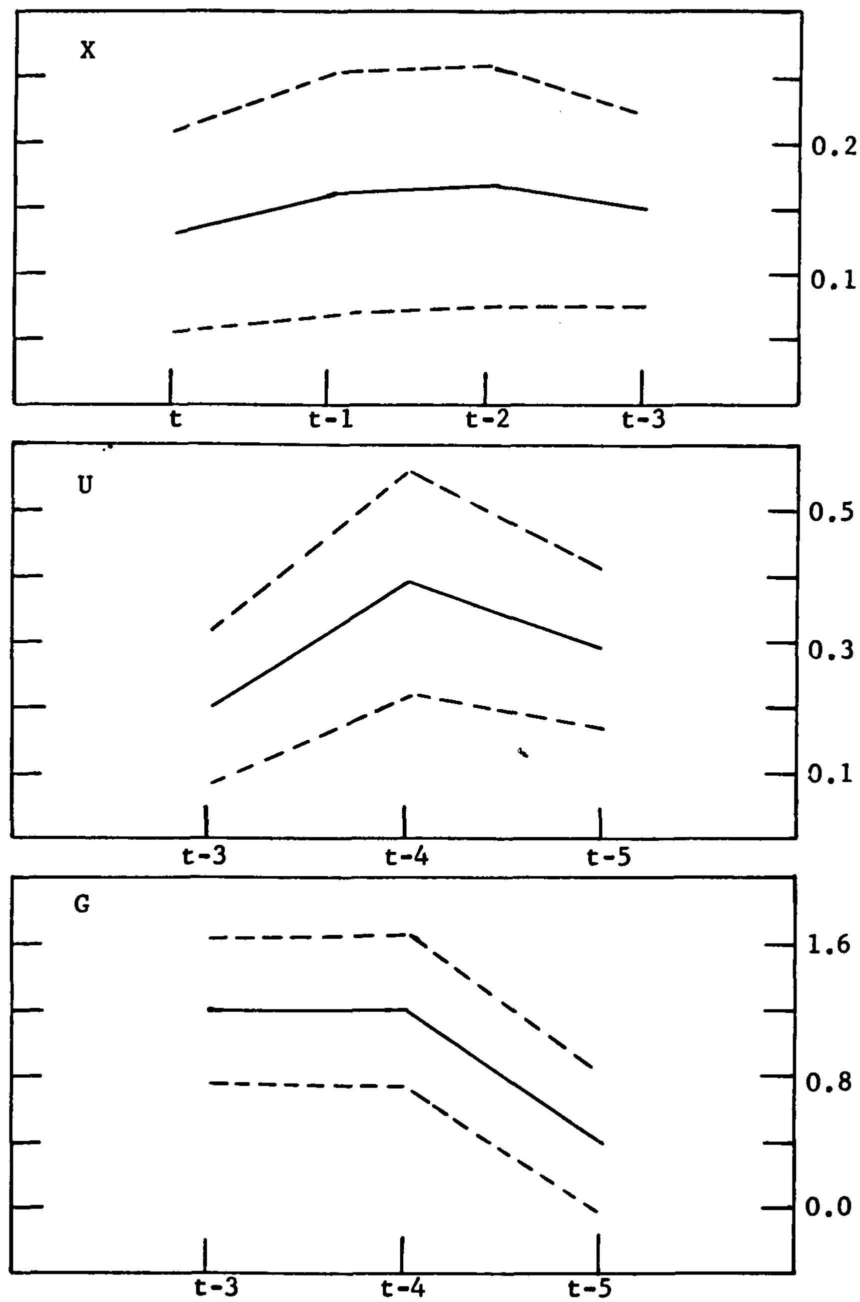


Chart C-3. TURKISH WORKER MIGRATION TO WEST GERMANY
Lag structures from Equation (3.3)
2nd Qtr., 1963 to 2nd Qtr., 1972
(Values in natural log scale)

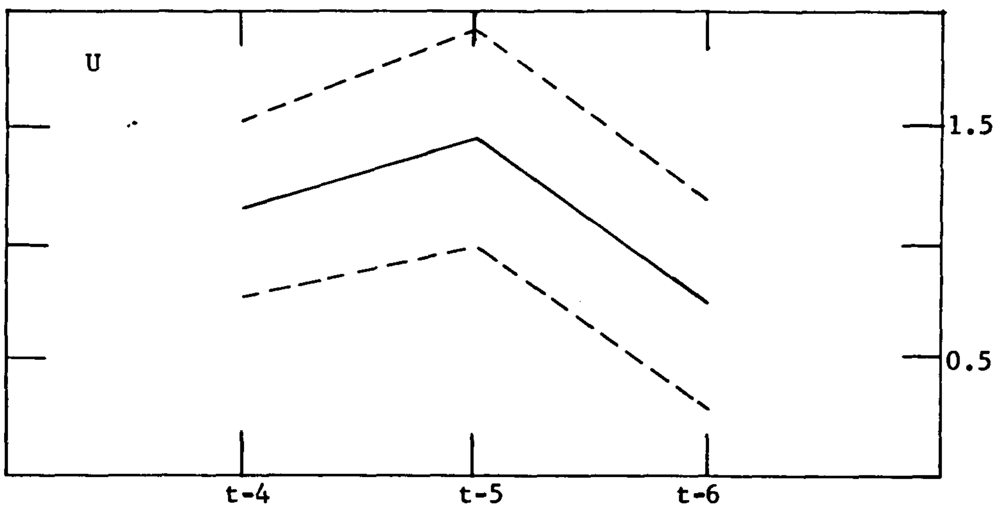


Chart C-4. SPANISH WORKER MIGRATION TO WEST GERMANY
Lag structures from Equation (3.5)
2nd Qtr., 1968 to 4th Qtr., 1973
(Values in natural log scale)

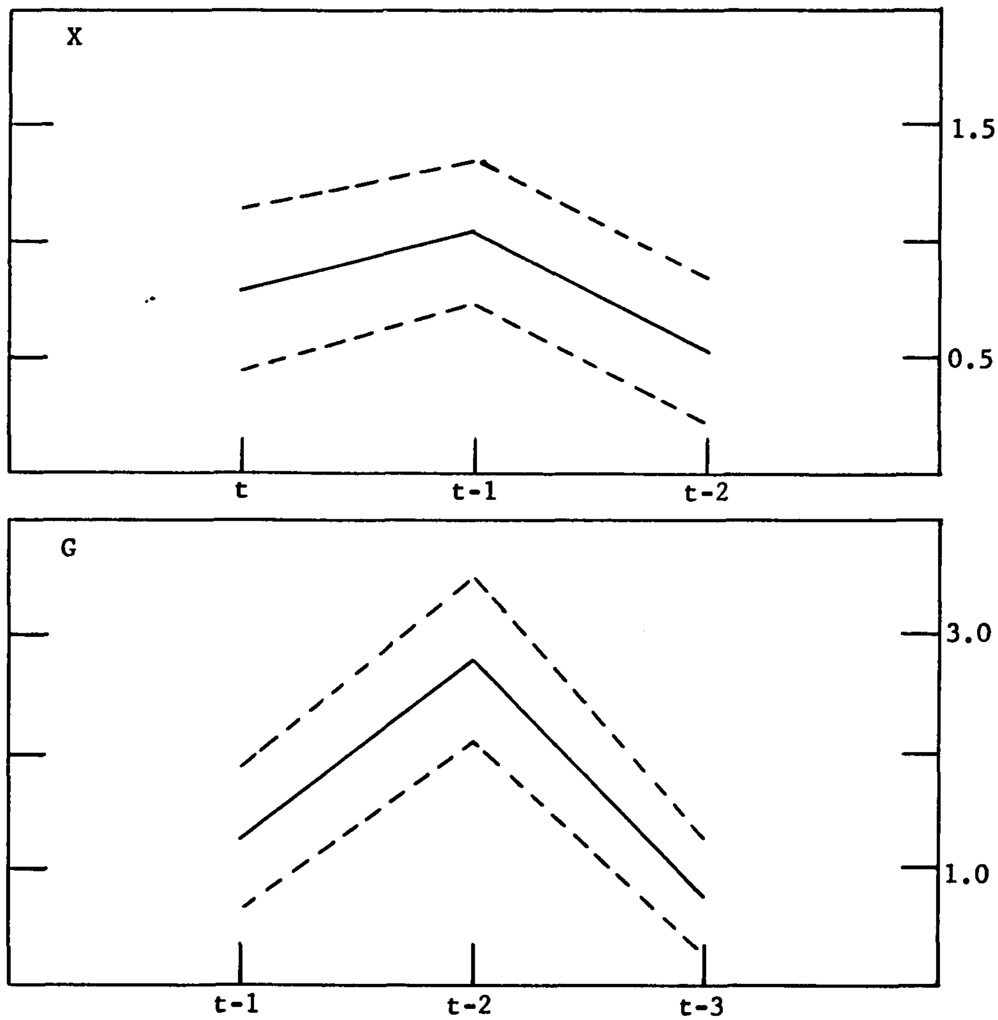


Chart C-5. SPANISH WORKER MIGRATION TO WEST GERMANY
Lag structures from Equation (3.5.1)
2nd Qtr., 1968 to 4th Qtr., 1973
(Values in natural log scale)

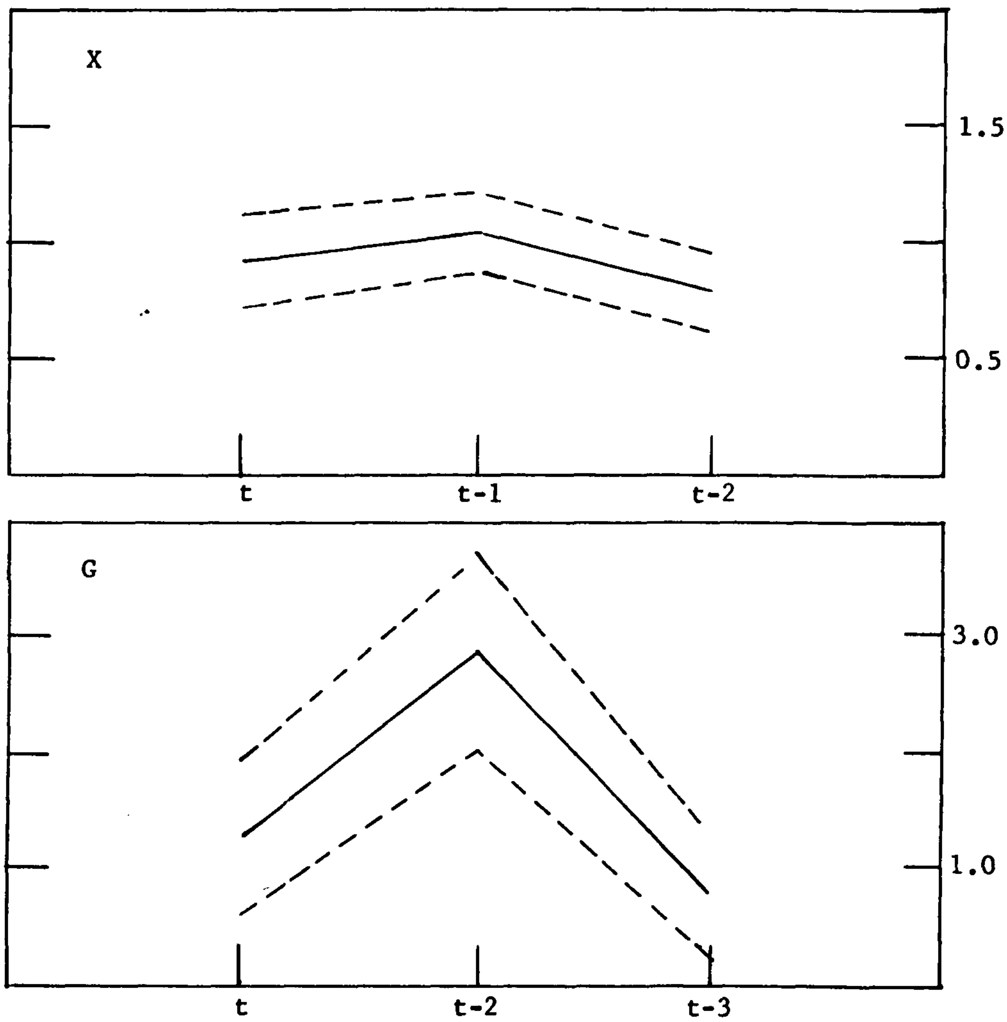


Chart C-6. GREEK WORKER MIGRATION TO WEST GERMANY
Lag structures from Equation (3.7)
4th Qtr., 1964 to 4th Qtr., 1973
(Values in natural log scale)

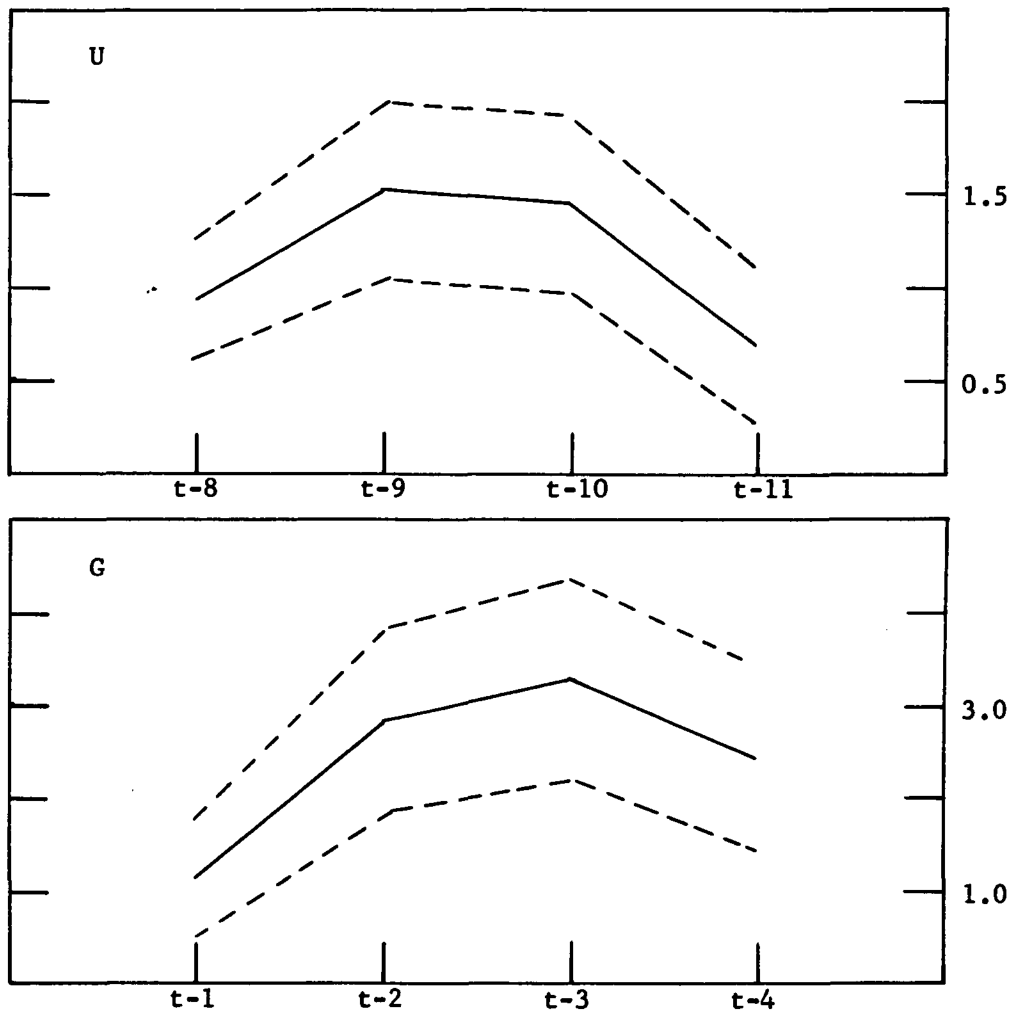


Chart C-7. ITALIAN WORKER MIGRATION TO WEST GERMANY
Lag structures from Equation (3.1.1')
2nd Qtr., 1963 to 4th Qtr., 1969
(Values in natural log scale)

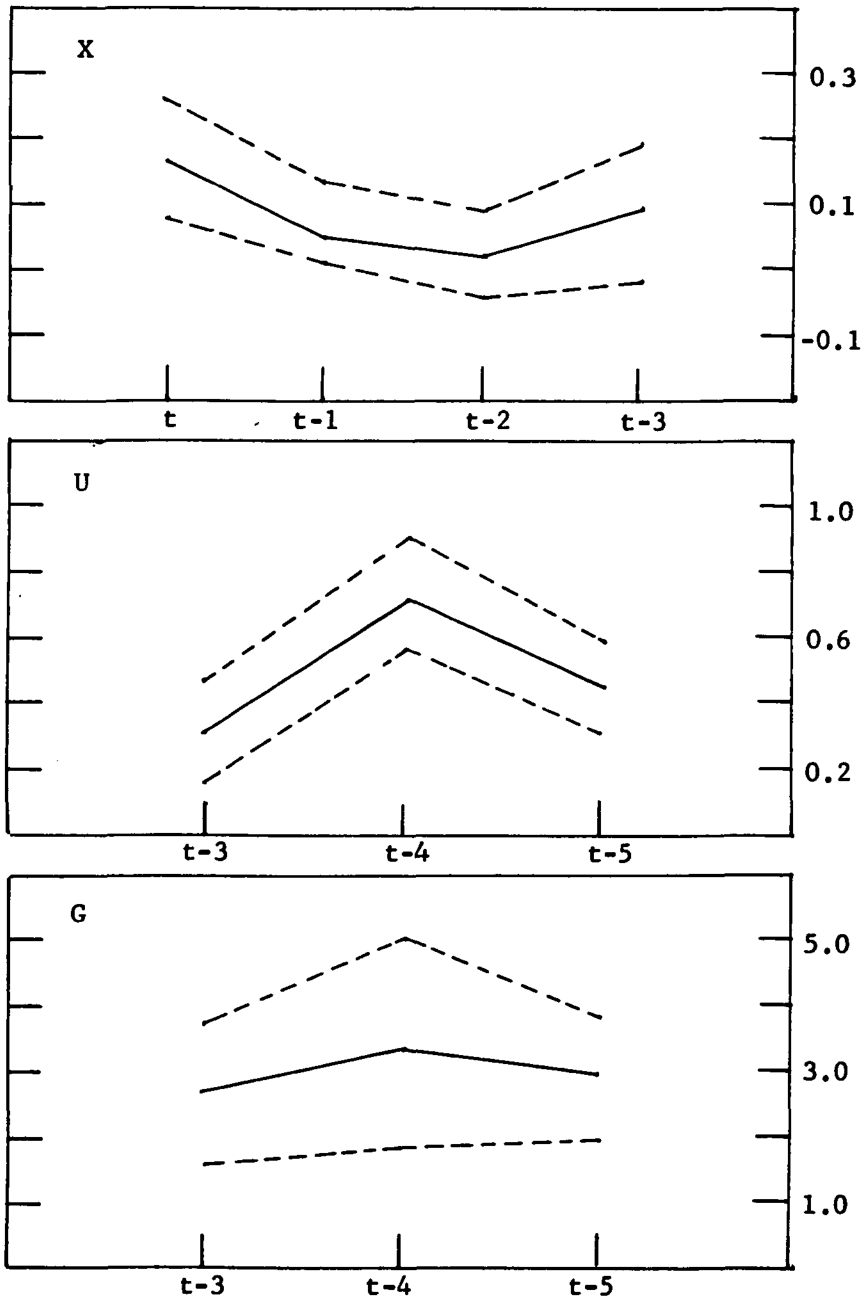


Chart C-8. TURKISH WORKER MIGRATION TO WEST GERMANY
Lag structures from Equation (3.3)
2nd Qtr., 1963 to 4th Qtr., 1969
(Values in natural log scale)

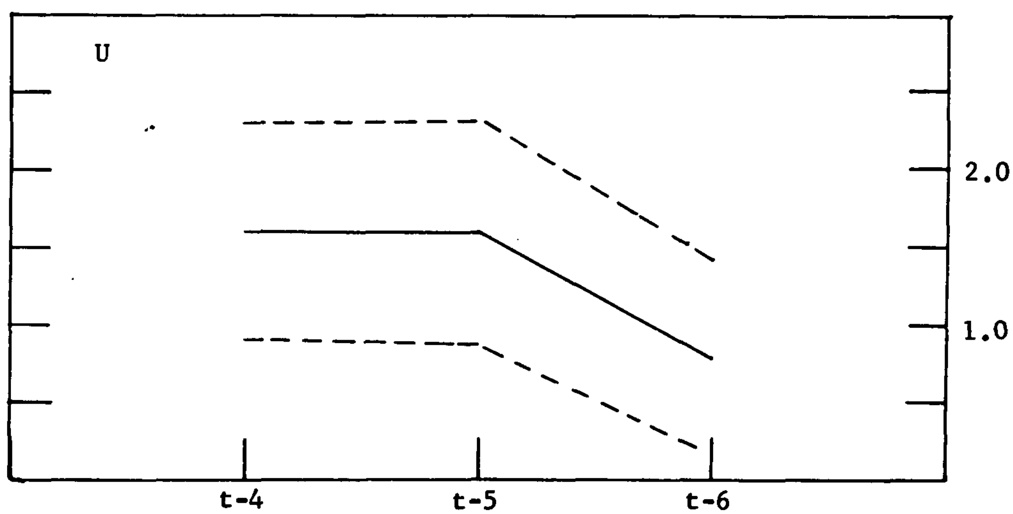


Chart C-9. TURKISH WORKER MIGRATION TO WEST GERMANY
Lag structures from Equation (3.3)
4th Qtr., 1964 to 2nd Qtr., 1972
(Values in natural log scale)

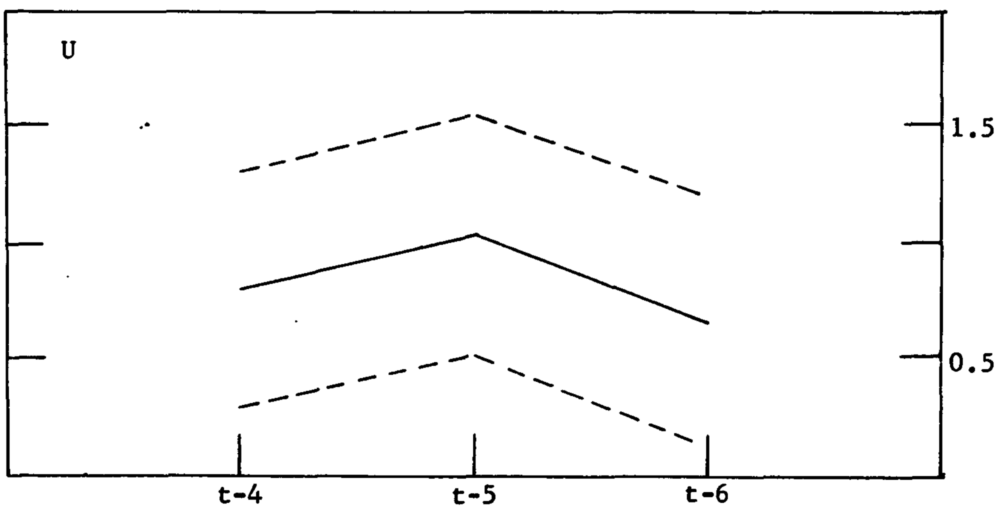


Chart C-10. GREEK WORKER MIGRATION TO WEST GERMANY
Lag structures from Equation (3.7')
4th Qtr., 1964 to 2nd Qtr., 1972
(Values to natural log scale)

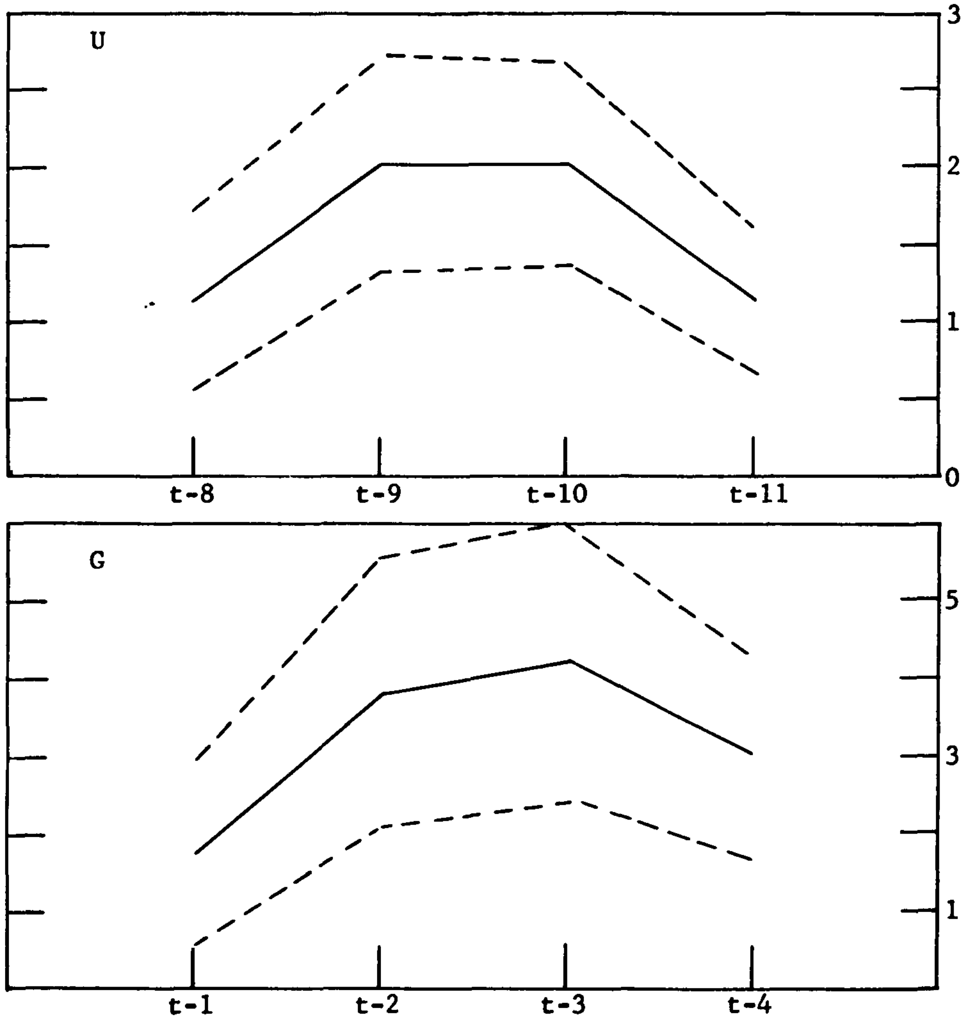


Chart C-11. ITALIAN WORKER MIGRATION TO WEST GERMANY
Lag structures from Equation (3.1.1')
4th Qtr., 1964 to 4th Qtr., 1969
(Values in natural log scale)

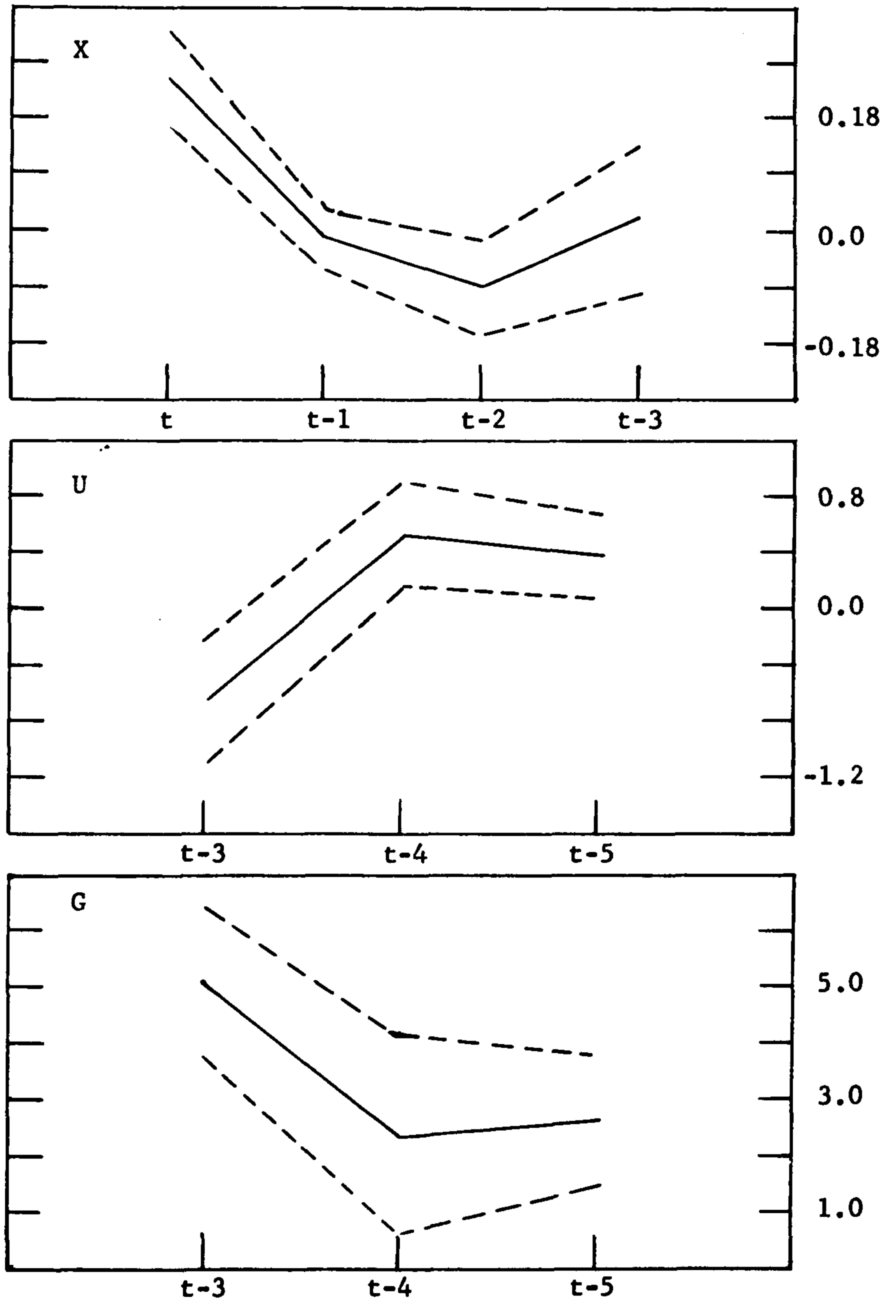


Chart C-12. TURKISH WORKER MIGRATION TO WEST GERMANY
Lag structures from Equation (3.3)
4th Qtr., 1964 to 4th Qtr., 1969
(Values in natural log scale)

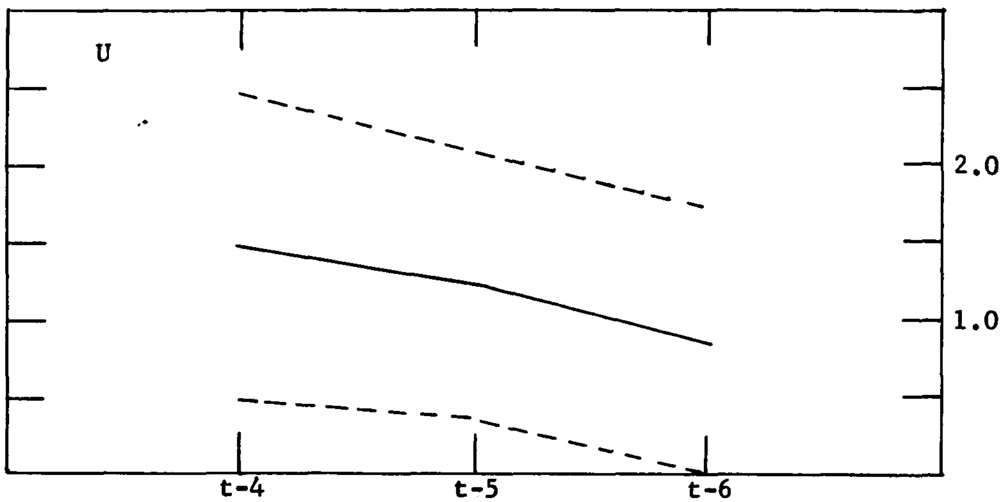


Chart C-13. GREEK WORKER MIGRATION TO WEST GERMANY
Lag structures from Equation (3.7')
4th Qtr., 1964 to 4th Qtr., 1969
(Values in natural log scale)

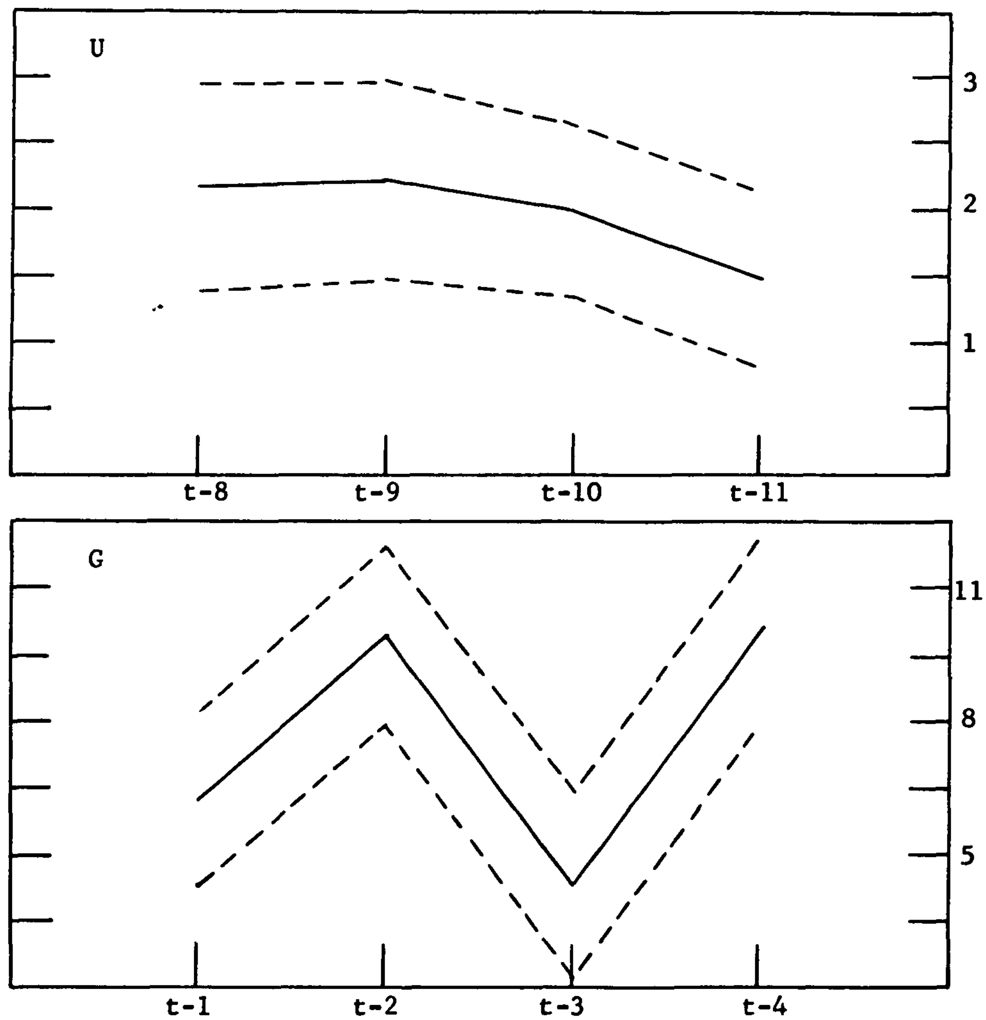
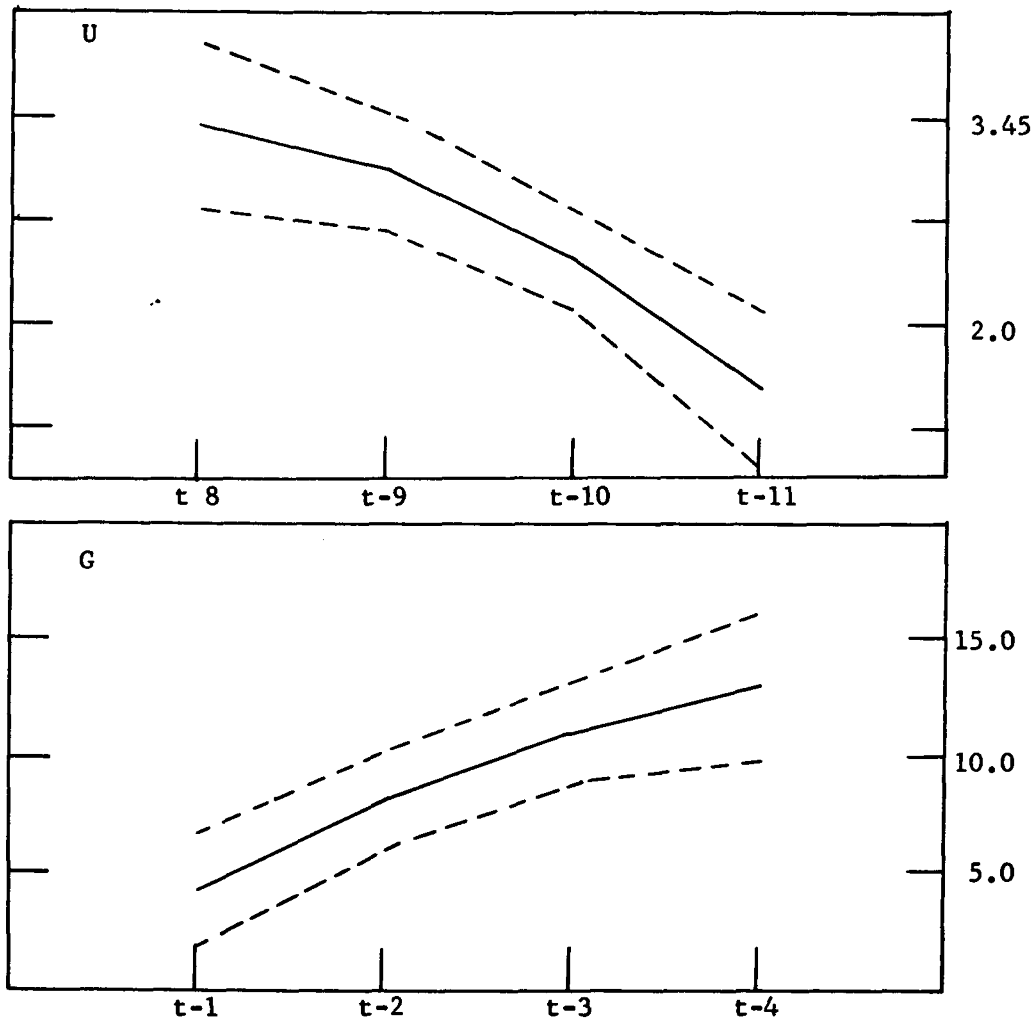


Chart C-14. GREEK WORKER MIGRATION TO WEST GERMANY
Lag structures from Equation (3.7")
4th Qtr., 1964 to 4th Qtr., 1969
(Values in natural log scale)



APPENDIX D

PLOTS OF ACTUAL, FITTED, AND RESIDUAL VALUES

Chart D-1. ITALIAN WORKER MIGRATION TO WEST GERMANY
Plots from Equation (3.1)
(Values in natural log scale)

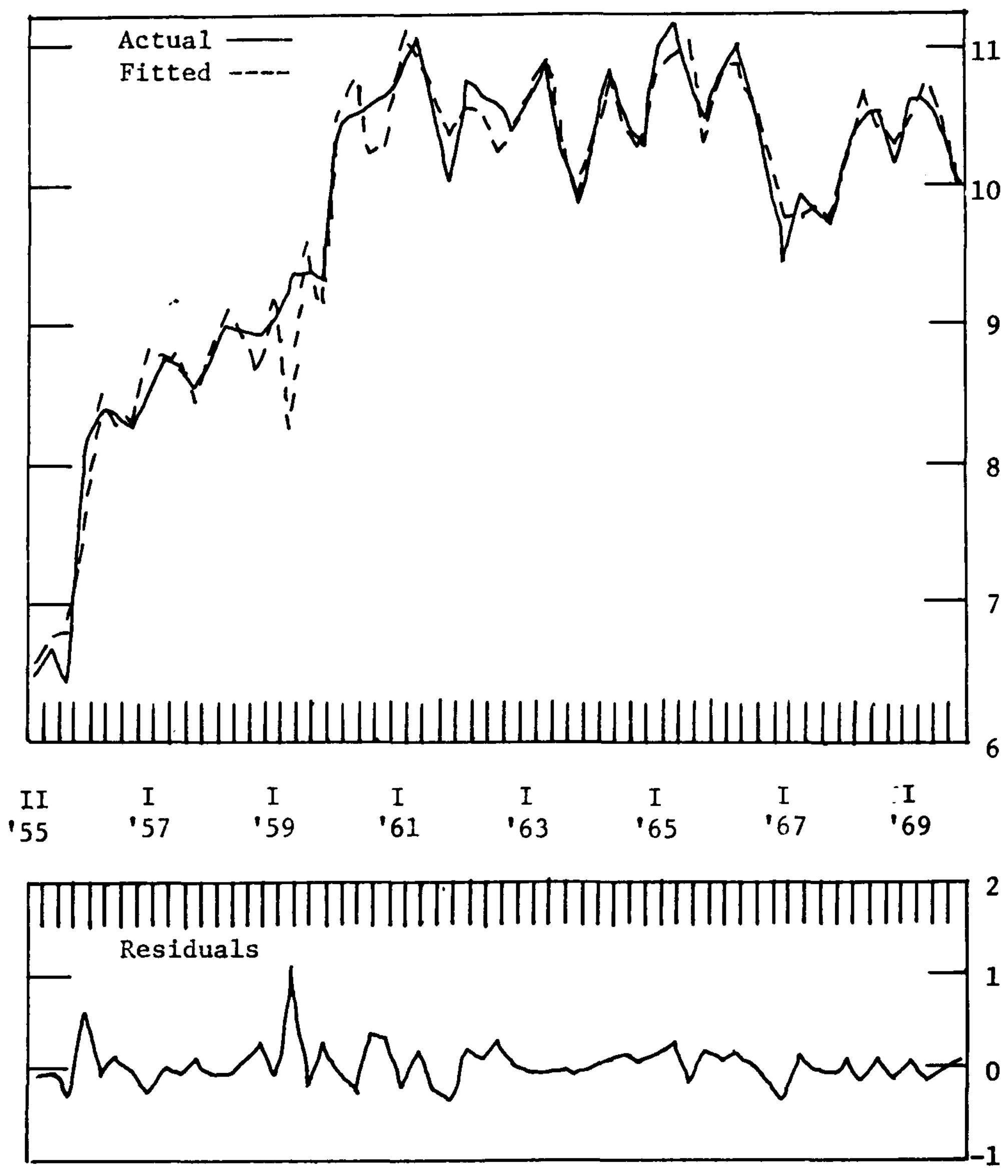


Chart D-2. ITALIAN WORKER MIGRATION TO WEST GERMANY
Plots from Equation (3.1.1)
(Values in natural log scale)

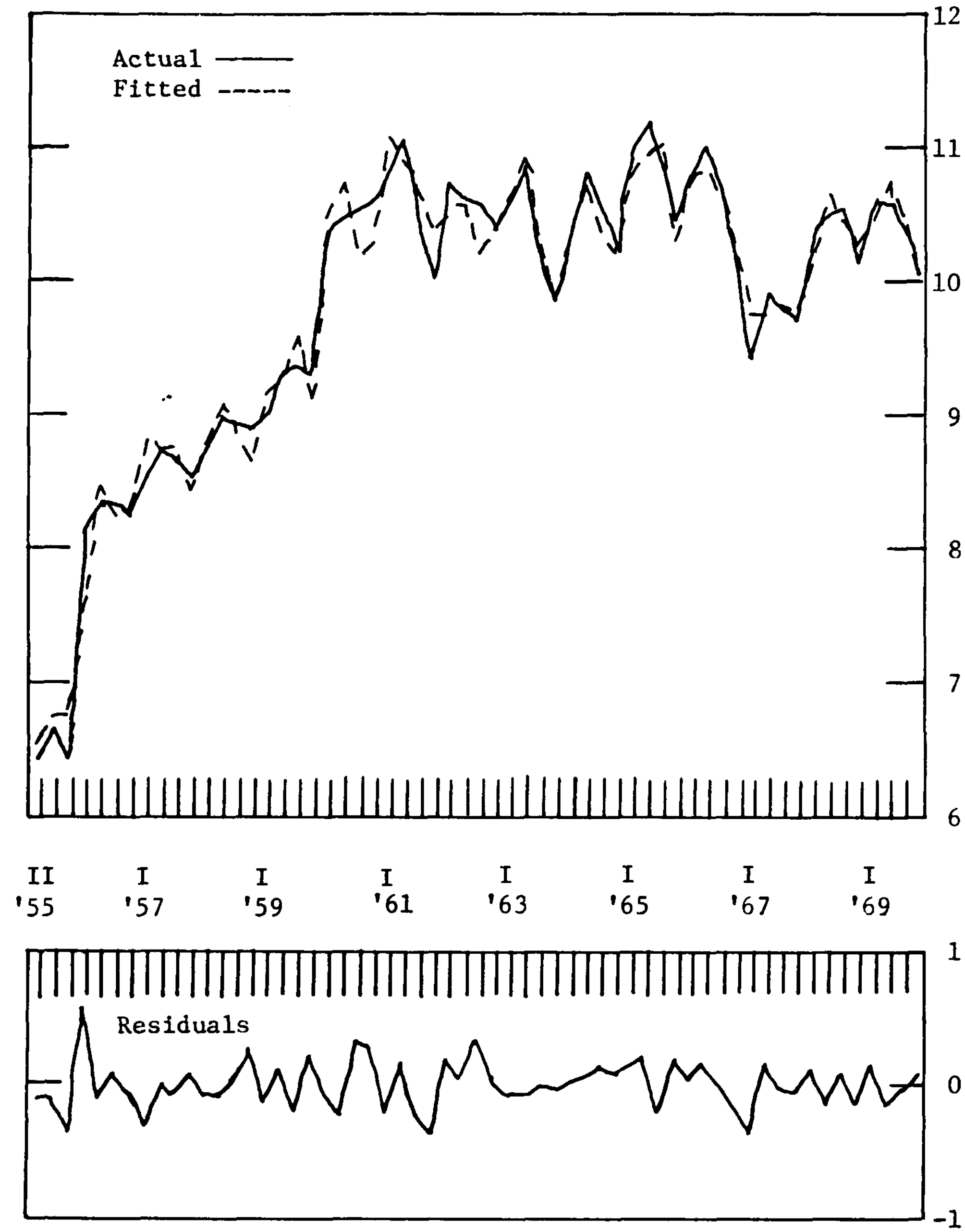


Chart D-3. TURKISH WORKER MIGRATION TO WEST GERMANY
Plots from Equation (3.3)
(Values in natural log scale)

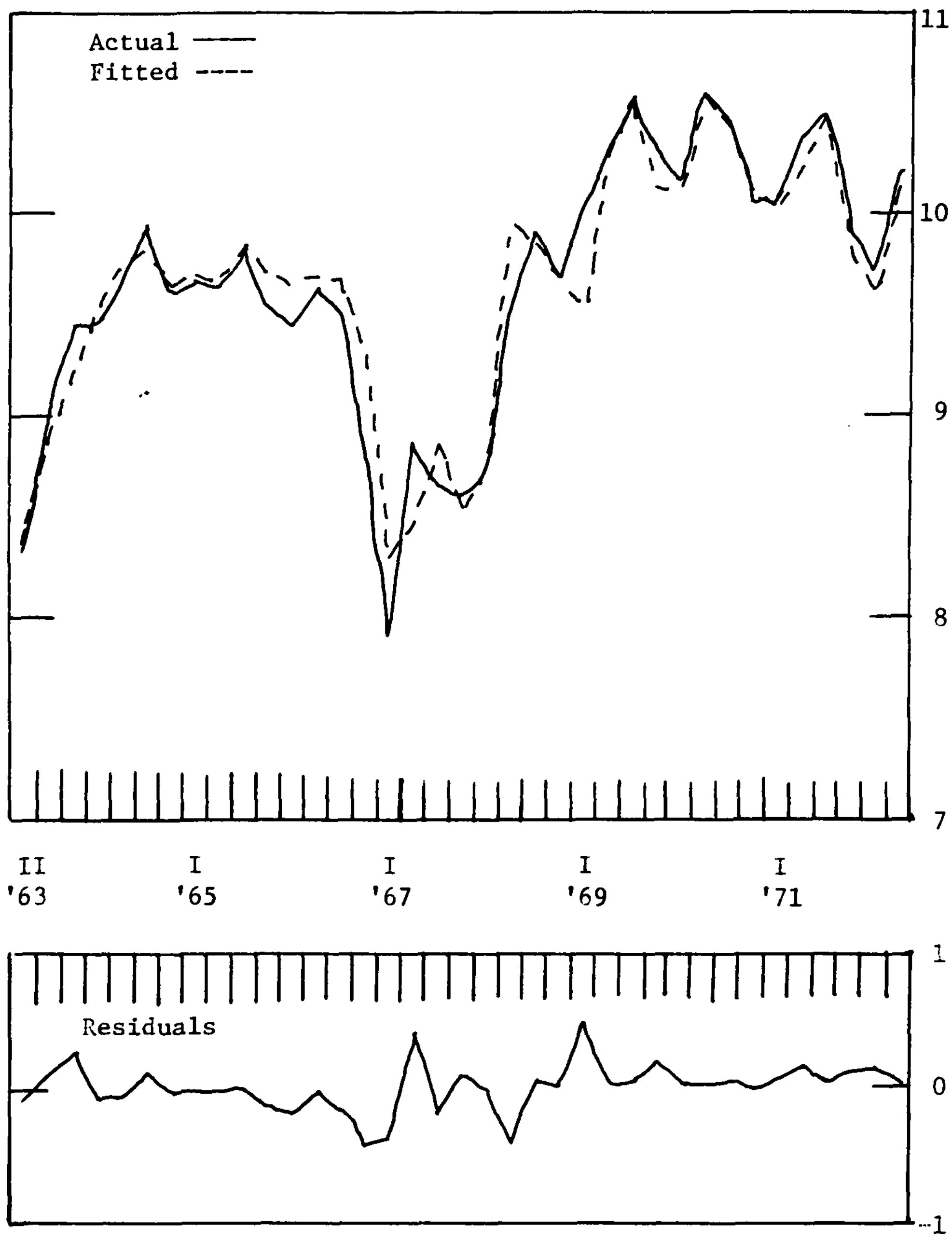


Chart D-4. SPANISH WORKER MIGRATION TO WEST GERMANY
Plots from Equation (3.5)
(Values in natural log scale)

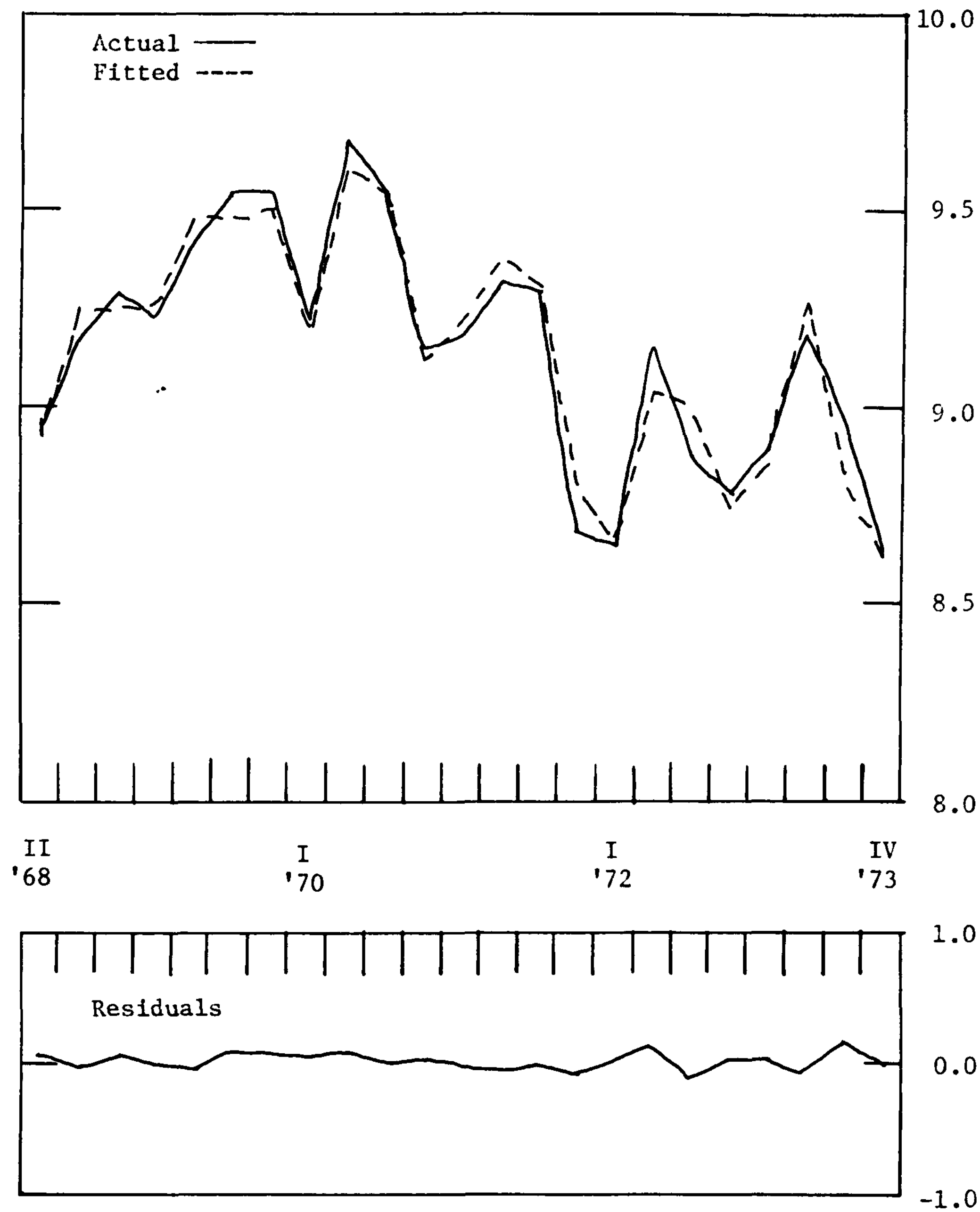


Chart D-5. SPANISH WORKER MIGRATION TO WEST GERMANY
Plots from Equation (3.5.1)
(Values in natural log scale)

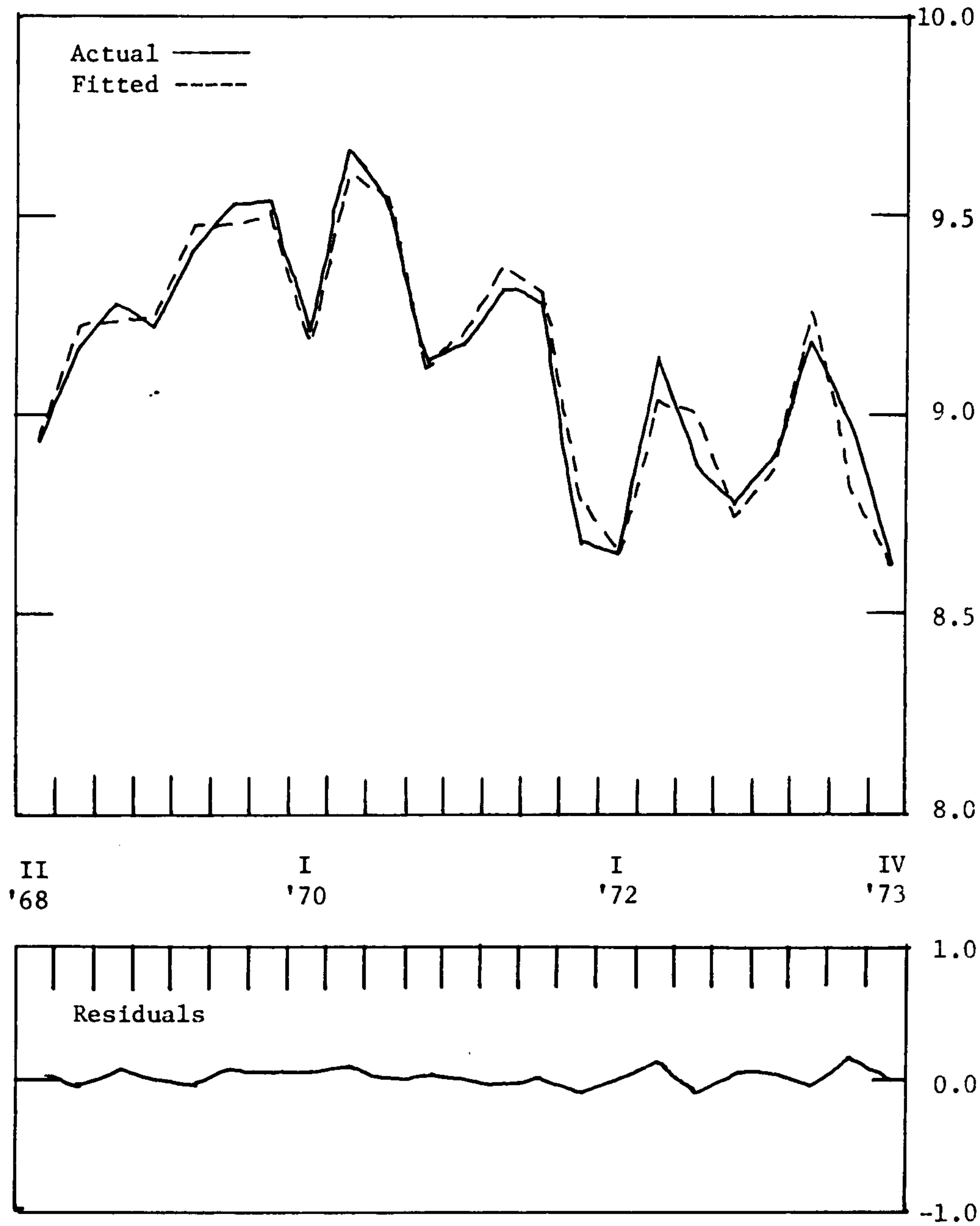


Chart D-6. GREEK WORKER MIGRATION TO WEST GERMANY
Plots from Equation (3.7)
(Values in natural log scale)

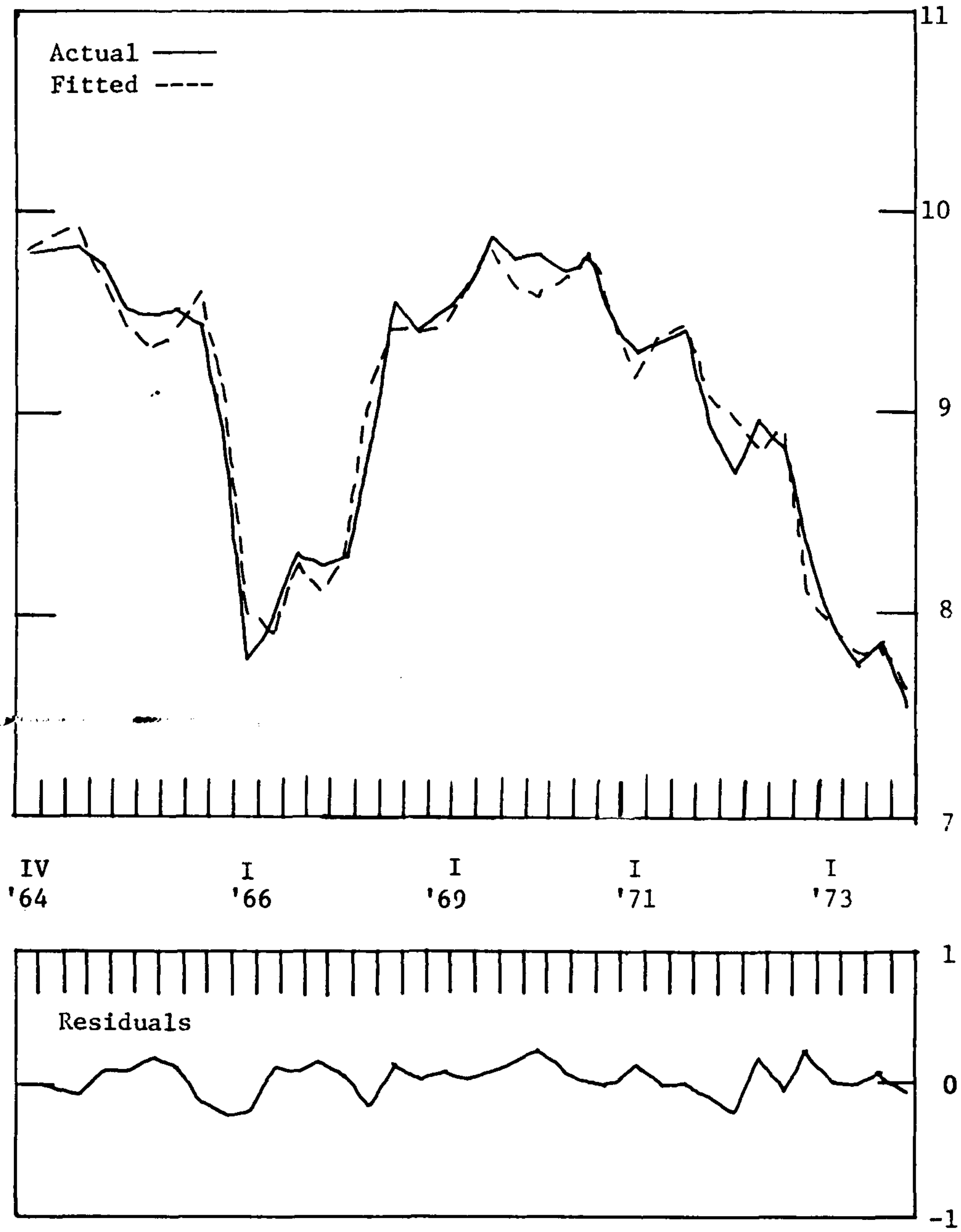


Chart D-7. ITALIAN WORKER MIGRATION TO WEST GERMANY
Plots from Equation (3.1.1')
(Values in natural log scale)

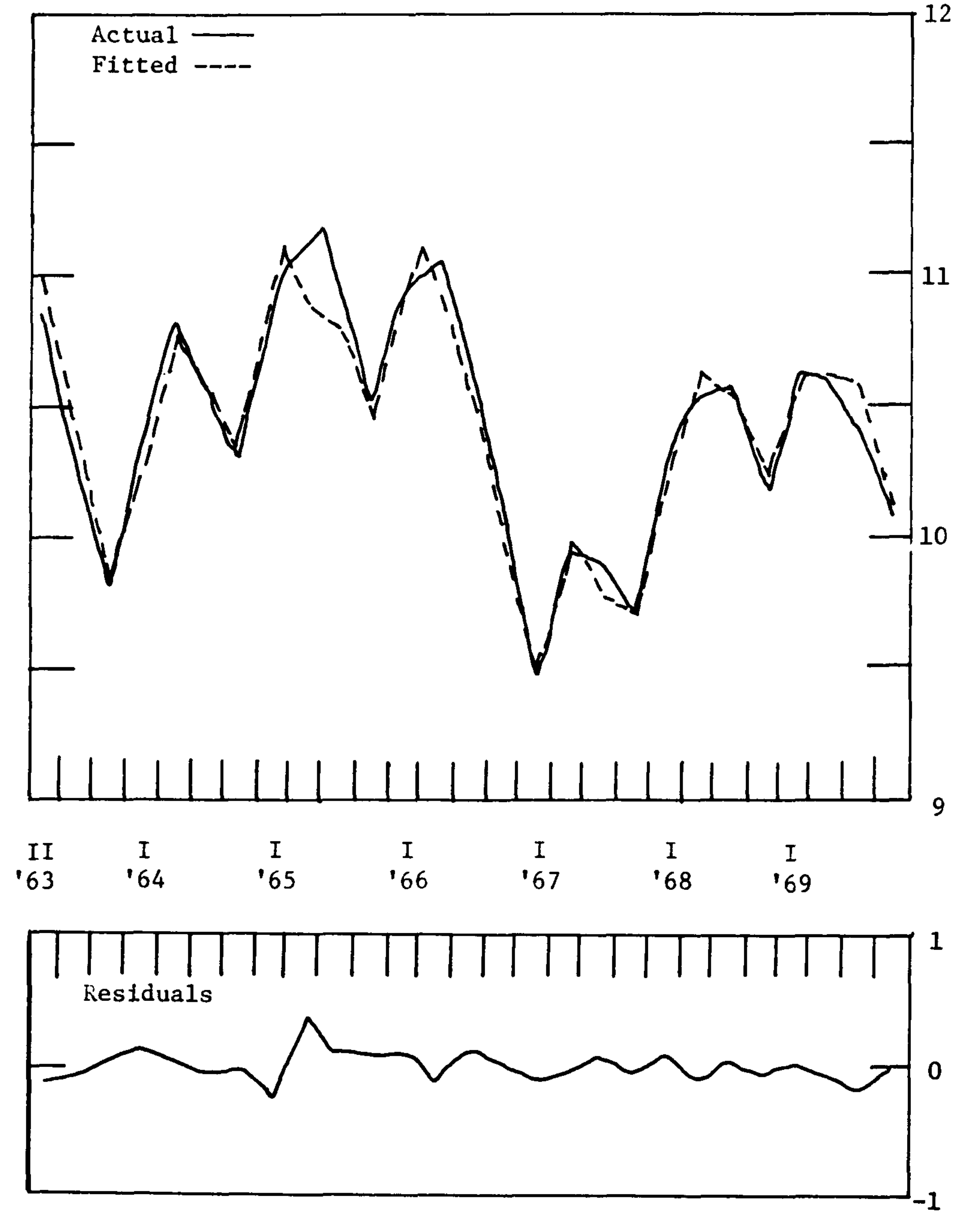


Chart D-8. TURKISH WORKER MIGRATION TO WEST GERMANY
Plots from Equation (3.3)
(Values in natural log scale)

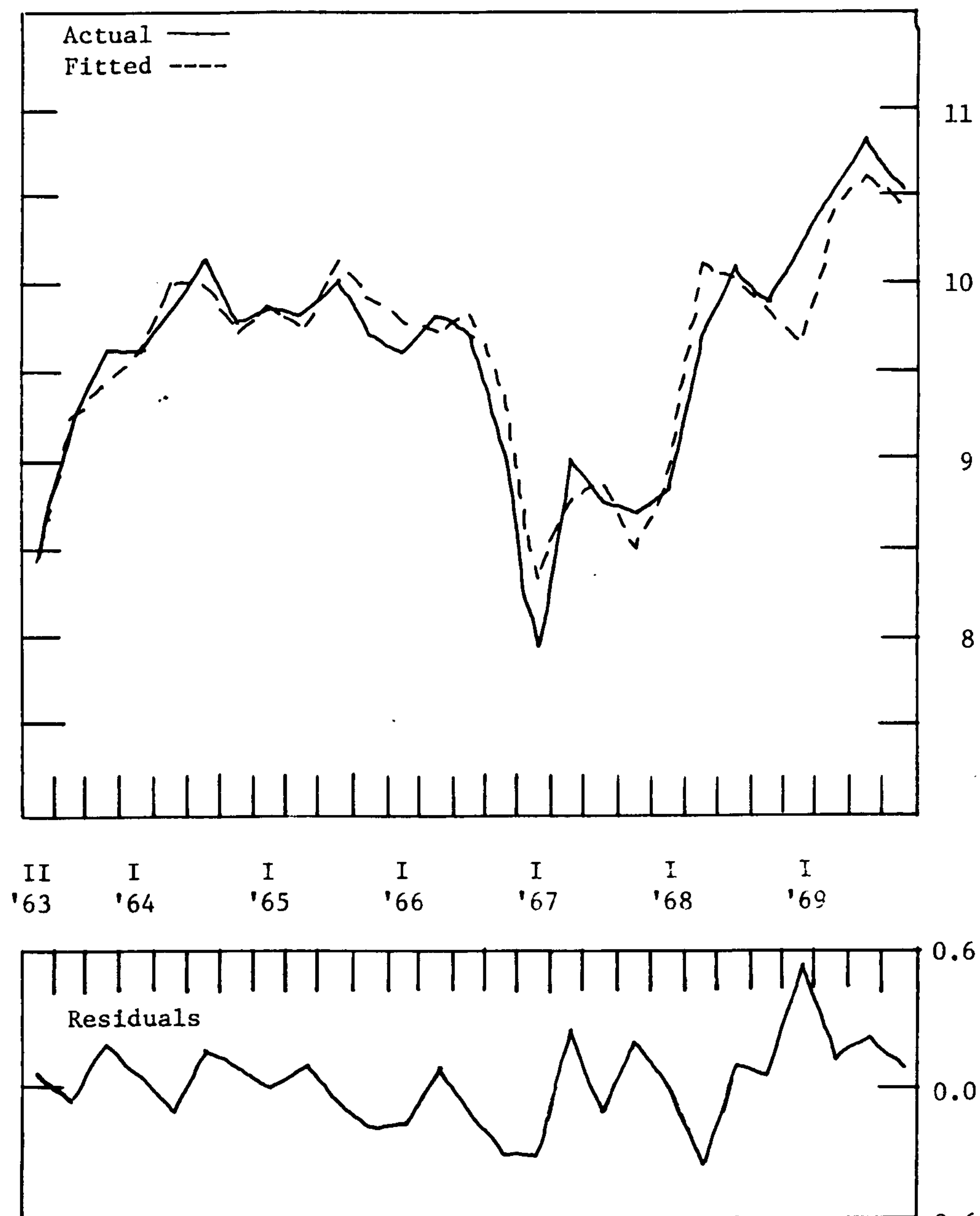


Chart D-9. TURKISH WORKER MIGRATION TO WEST GERMANY
Plots from Equation (3.3)
(Values in natural log scale)

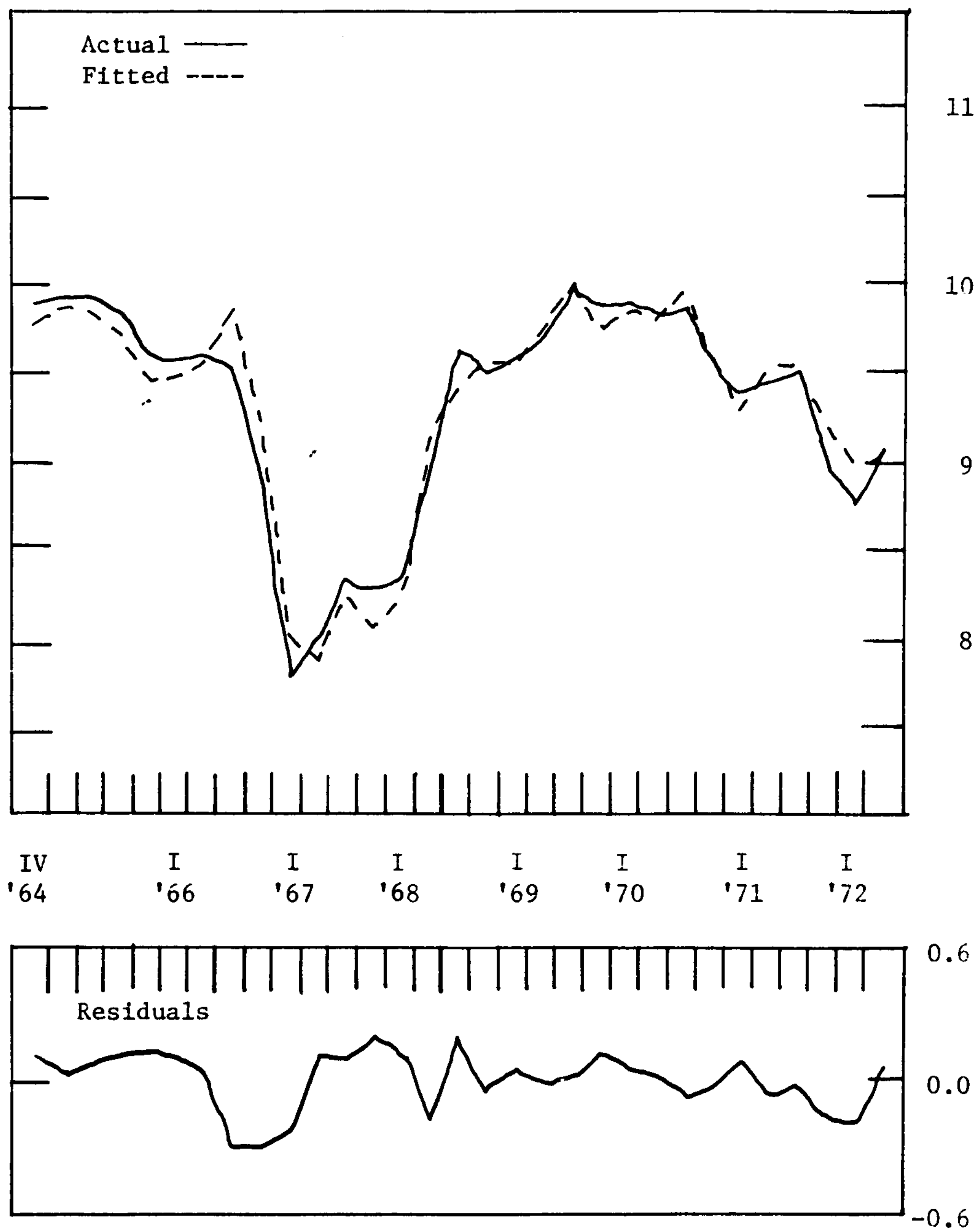


Chart D-10. GREEK WORKER MIGRATION TO WEST GERMANY
Plots from Equation (3.7')
(Values in natural log scale)

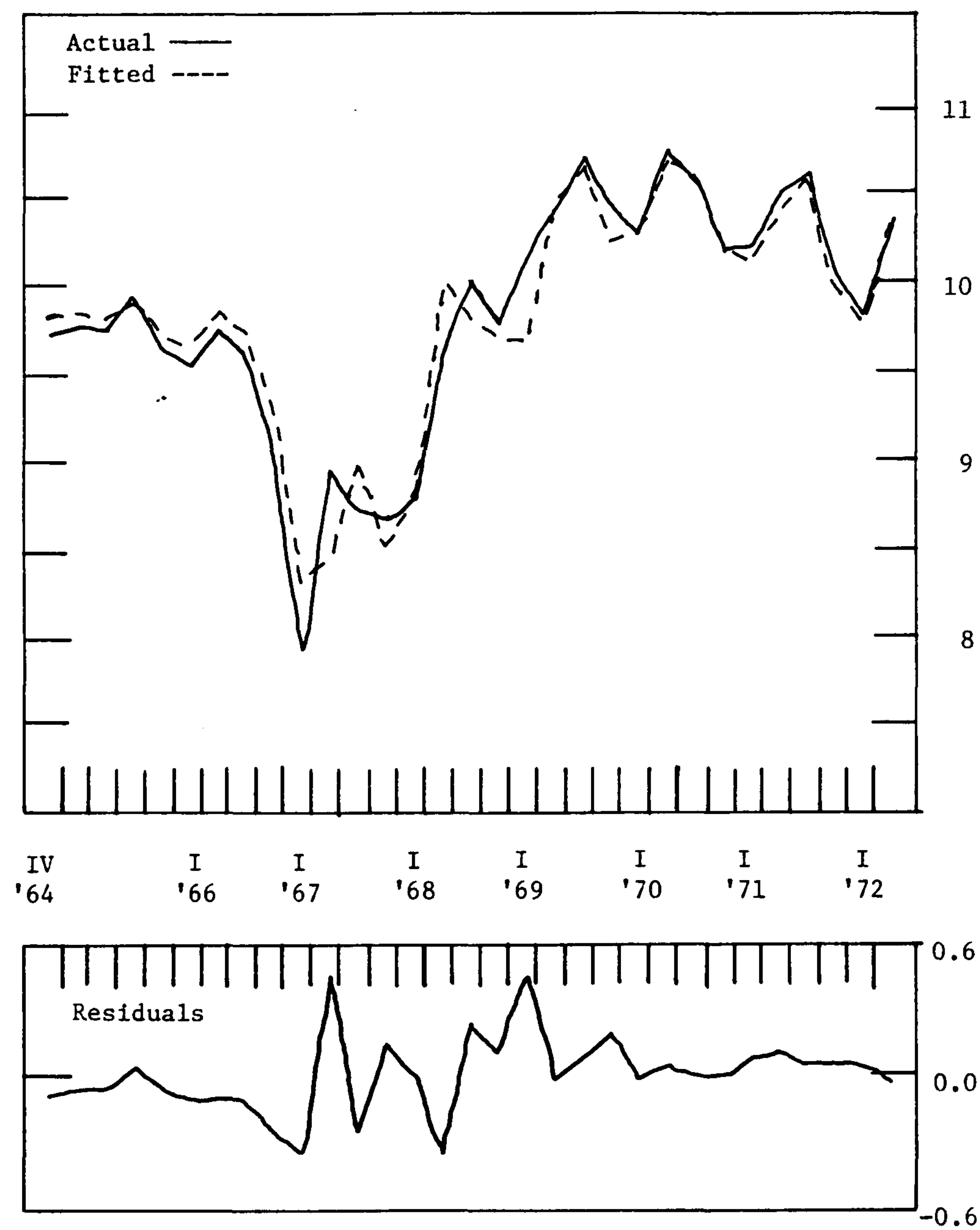


Chart D-11. ITALIAN WORKER MIGRATION TO WEST GERMANY
Plots from Equation (3.1.1')
(Values in natural log scale)

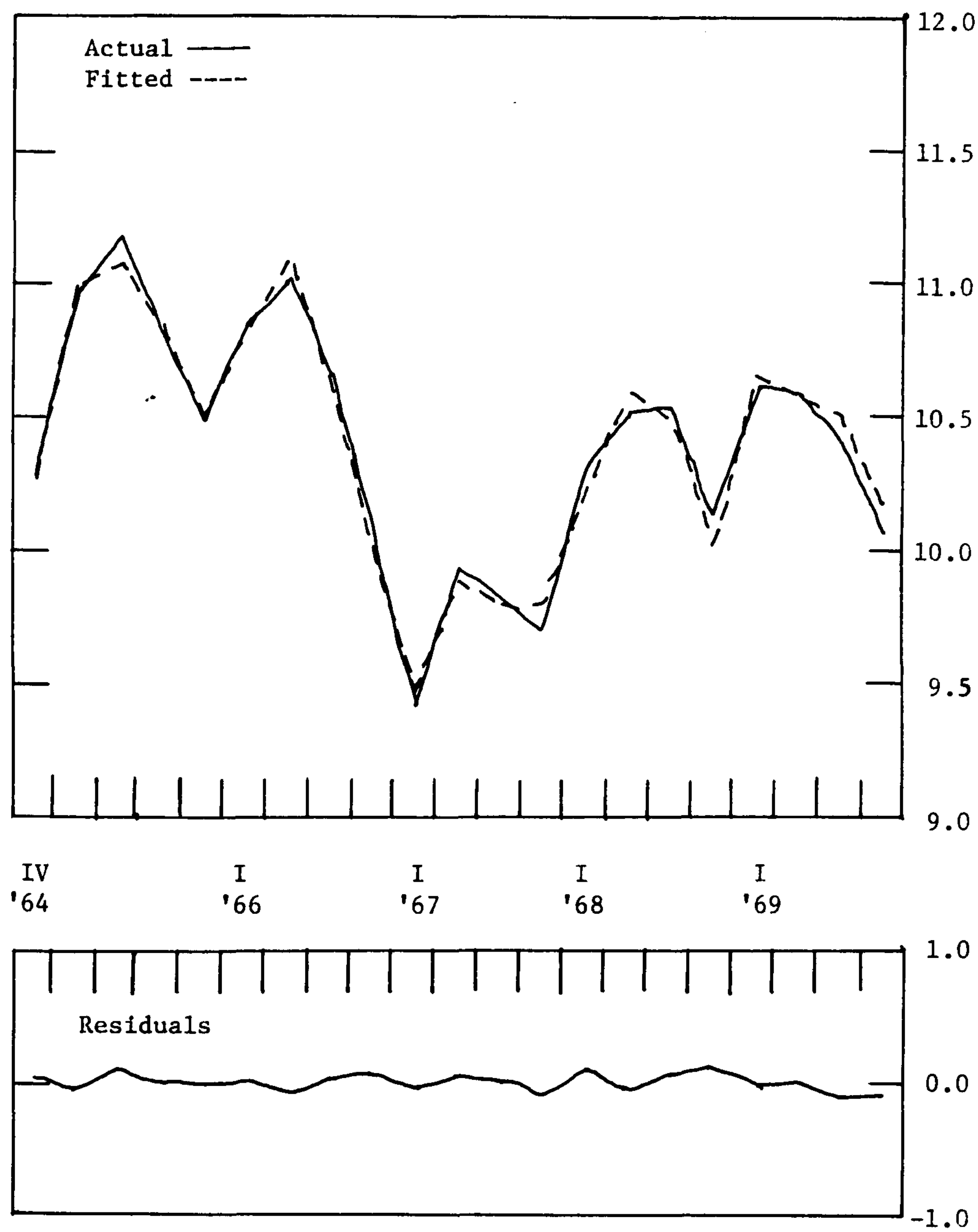


Chart D-12. TURKISH WORKER MIGRATION TO WEST GERMANY
Plots from Equation (3.3)
(Values in natural log scale)

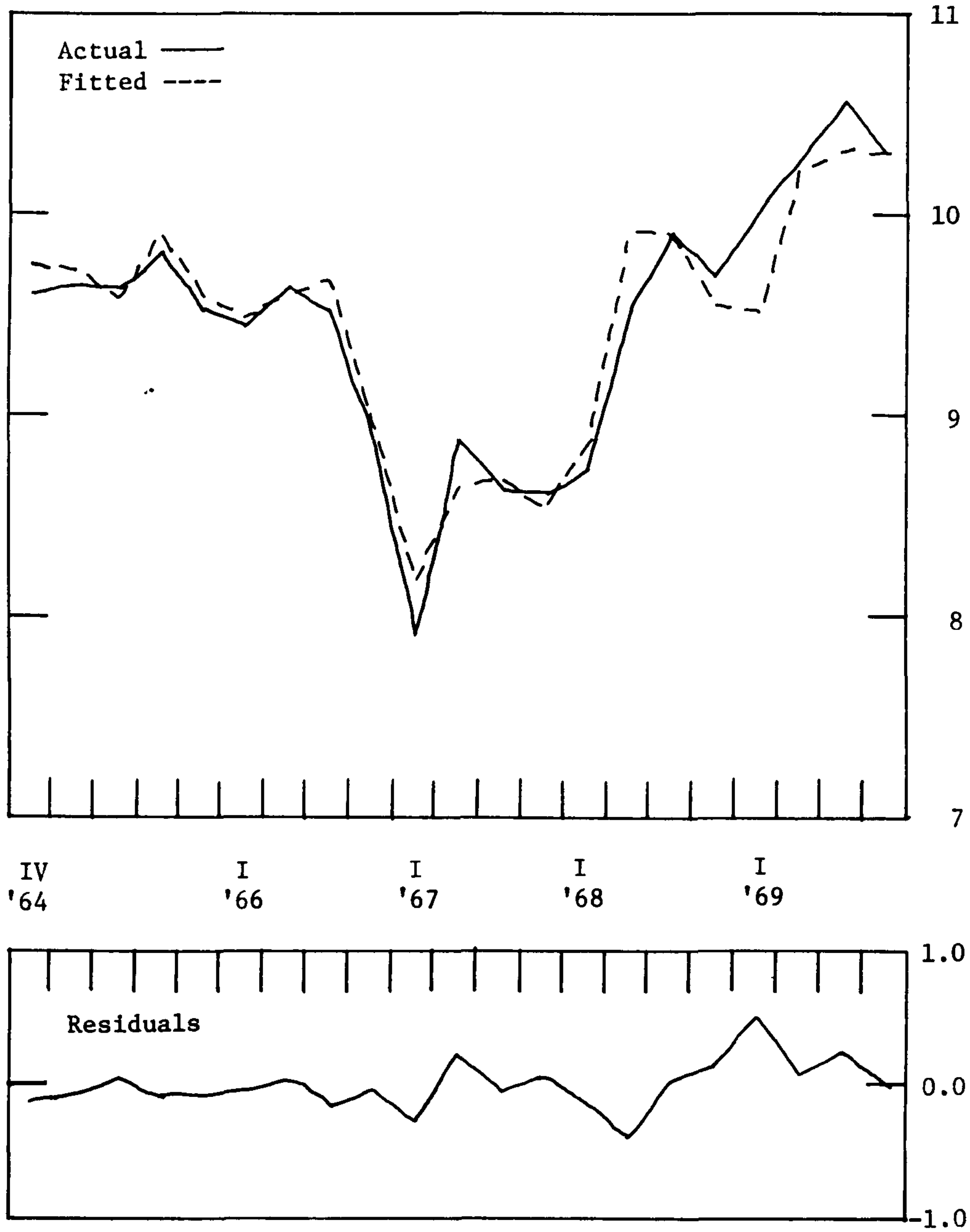


Chart D-13. GREEK WORKER MIGRATION TO WEST GERMANY
Plots from Equation (3.7')
(Values in natural log scale)

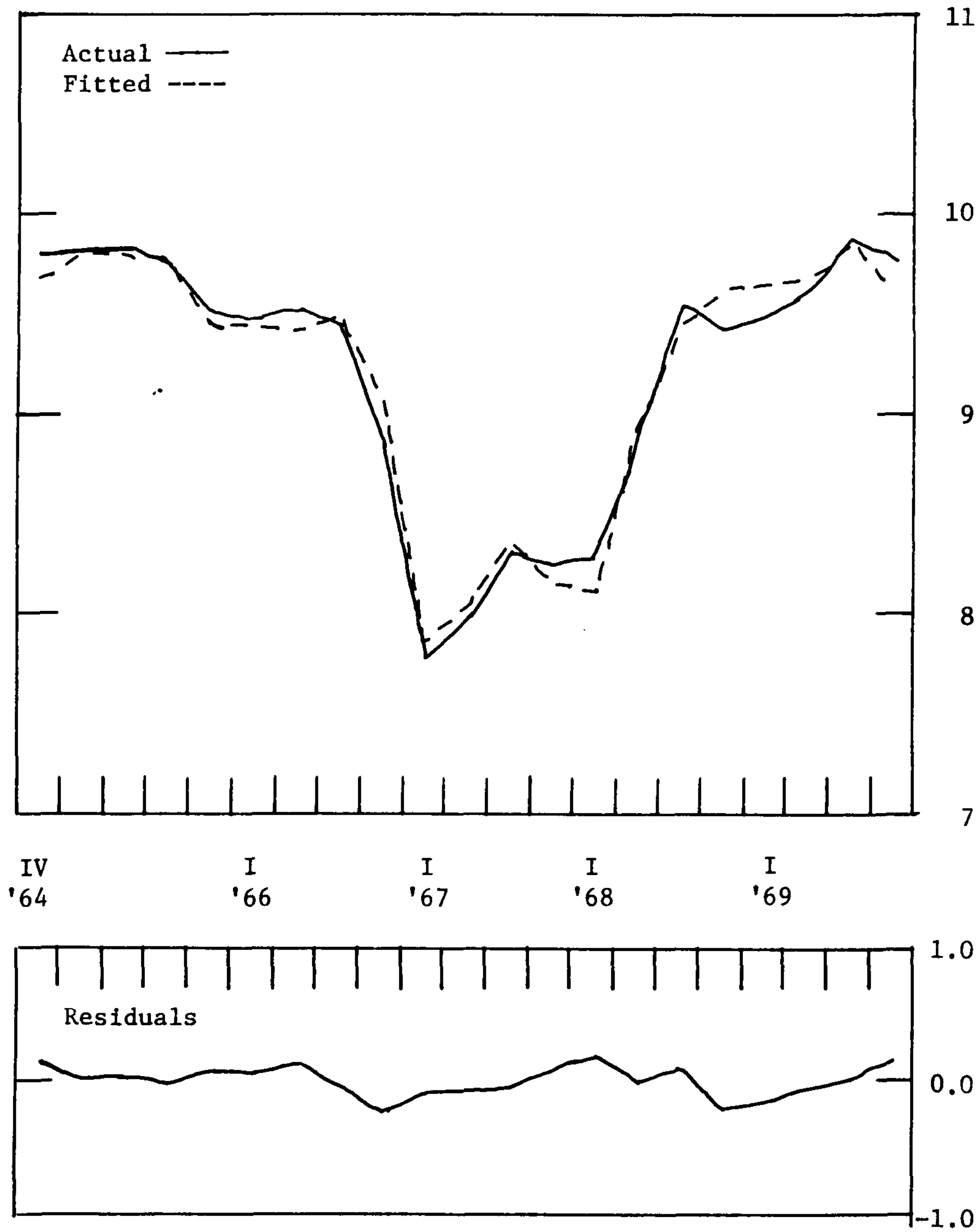
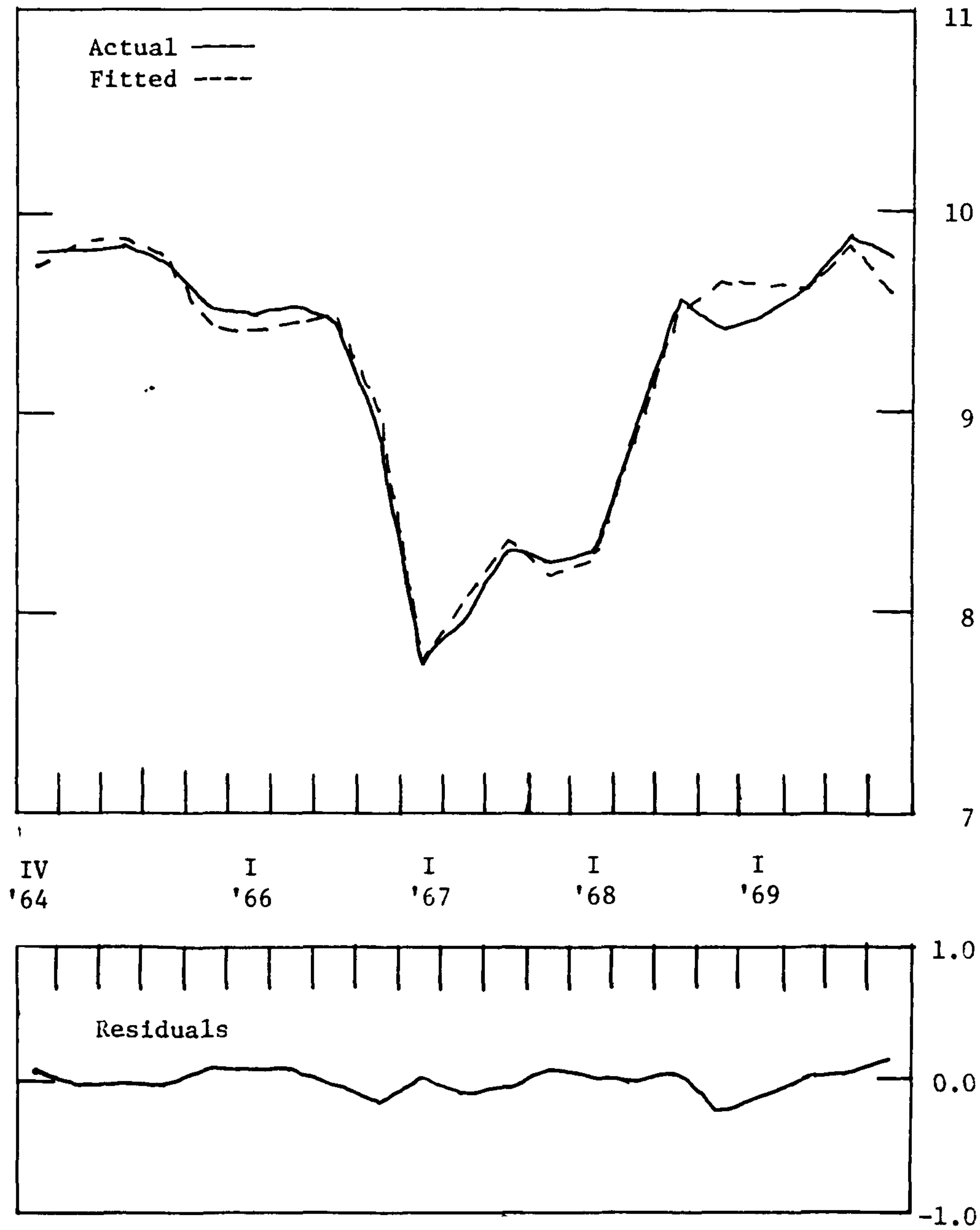


Chart D-14. GREEK WORKER MIGRATION TO WEST GERMANY
Plots from Equation (3.7")
(Values in natural log scale)



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[37]Note: Source material is grouped according to predominant subject matter, and in no case is a reference listed under more than one subject heading.

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[38]Although many more were consulted, only those sources which actually supplied data used in this study are listed here.