THE FEASIBILITY OF EUROPEAN MONETARY INTEGRATION

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ABSTRACT

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EUROPEAN MONETARY INTEGRATION

By

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In the latter part of the 1960's, the successful completion of the customs union phase of the European Community's development aroused interest in extending the integrative spirit to other domains. This was reflected in the Barre and Werner Reports which established the goal of introducing one common European currency by 1980. The Community would eventually be transformed into one political entity with all of the attendant characteristics.

The purpose of this study is to determine the feasibility of monetary unification among a group of economically-diverse nations. After reviewing the various criteria for an optimum currency area, we focus our attention on the one which seems most relevant at the present time. Namely, are the national trade-off functions relating inflation and unemployment in the Community amenable to the adoption of a common currency and a common monetary policy, given the preferences which policymakers have exhibited between inflation and unemployment in the postwar period?

We begin by specifying a two-equation model of the wage-price-unemployment inter-relationships in the economy. This model is then subjected to a series of statistical tests for structural stability

recently developed by Brown, Durbin and Evans. Such an exercise is relevant in the light of prior research which has indicated that, in some nations, these relations have indeed displayed coefficient instability, notably during periods in which incomes policies were introduced. The analysis in this study differs from previous work, however, in that it searches for breaks in the estimated functions in an objective fashion. There is no need to impose a priori restrictions on the estimating procedure as would be required, for instance, by the Chow test for structural stability.

The results of the stability analysis suggest the appropriate shift and slope dummy variables which should be incorporated into the revised estimates of the wage and price equations. From the latter, we subsequently derive steady-state trade-off functions relating inflation and unemployment for each member of the Community.

Our evaluation of the feasibility of monetary integration involves deriving, from the above long-run target frontiers, the unemployment implications of the adoption of a common monetary policy. The consistency of these results with the stated goals of the various national policymakers finally permits us to evaluate the prospects of the European venture.

The statistical findings of the study indicate that structural instability was indeed exhibited in the postulated economic relationships during the 1960's and the early part of the 1970's, and in every member nation of the Community. Given the situation in the fourth quarter of 1969, just prior to the publication of the Werner Report, we discover that a monetary union would only be feasible for a subgroup of European countries, namely, Belgium, Germany, Italy,

the Netherlands, and the United Kingdom. However, in view of the marked outward movements of some of the trade-off frontiers in the intervening years, we must conclude that, as of the fourth quarter of 1973, the prospects for a successful monetary union had dimmed considerably, with perhaps three nations (Germany, Italy, Netherlands) as potential participants.

These conclusions suggest that complete monetary integration will not be practicable until economic conditions in the member nations of the Community converge to a greater extent. In the interim, it would appear desirable to maintain some flexibility in exchange rate relationships, perhaps through an indefinite extension of the current joint float arrangement. Utilizing the statistical estimates derived in this study, we find that such a scheme would, in fact, be viable over the long-run for Belgium, Denmark, Germany, France, the Netherlands, Ireland, and perhaps Norway, Sweden, Austria and Switzerland (non-members currently adhering to the float); only Italy and the United Kingdom would appear to be marginal participants in the European snake (assuming these nations decide to rejoin). A further key ingredient of the transitional phase should be a broadening of the current system of interregional transfers within the Community. These could play an important role in harmonizing economic conditions to the point where, at some time, monetary integration may be a more viable proposition.

THE FEASIBILITY OF EUROPEAN MONETARY INTEGRATION

By

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CHAPTER I

INTRODUCTION

As the European Economic Community approached completion of the customs union phase of its development, interest appeared in further extending the integrative spirit. Thus, in 1969-70, the Barre and Werner Reports captured this enthusiasm and established the goal of introducing a common European currency by 1980. This scheme would involve the complete loss of national sovereignty over monetary policy; the member nations of the EEC would effectively be transformed into individual states within a politically-unified European entity.

The purpose of this research is to evaluate the feasibility of monetary integration among a group of economically-diverse countries. We estimate a two-equation model of wage and price determination for each nation, each equation of which is then subjected to a series of recently-developed statistical tests to determine whether either has exhibited instability, particularly during periods in which incomes policies were implemented. Our modified estimates, including the appropriate shift and slope dummy variables suggested by the stability analysis, subsequently permit us to compute steady-state inflation-unemployment frontiers for the members of the Community.

The plots of the long-run trade-offs will then suggest the feasibility of a scheme to adopt a common monetary policy along with identical rates of inflation. Thus, by comparing the internal balance

implications of a common currency with the inflation and unemployment objectives voiced by the national authorities, we will be in a position to determine whether or not the European venture will be feasible in the short-run, and stable over the longer term.

The outline of the remainder of the thesis is as follows. Chapter II presents the historical background of the European Economic Community along with the recent proposals for the future implementation of a monetary union. Chapter III examines the various theoretical considerations which are crucial to the evaluation of the desirability of a common currency in a customs union. We also develop the necessary conditions for the successful implementation of such a scheme.

In Chapter IV, we discuss the econometric methodology and statistical techniques to be employed. In particular, we outline the historical development of the inflation-unemployment trade-off concept, followed by a review of previous empirical estimates of such functions for the nations of the EEC.[1] The two-equation model to be estimated is then specified in detail and variable definitions are presented. Finally, the Brown-Durbin-Evans test for structural stability is discussed and the graphical significance tests are explained.

Chapter V discloses our empirical results for both the preliminary equations and those modified to incorporate the appropriate coefficient changes. The preferred estimates are brought together in

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[1]The official name was recently changed to European Community (EC) to reflect the broader aspirations of the member nations.

Chapter VI, in which we compute the national steady-state trade-off functions. These are then utilized to determine the impact of monetary integration on the internal balance of member states, along with the prospects for a successful monetary union in the near future. Chapter VII summarizes the research and outlines our major conclusions.

CHAPTER II

HISTORICAL BACKGROUND

A - THE TREATY OF ROME

In the aftermath of World War II, the nations of Europe were faced with the immediate task of rebuilding their ravaged economies. Though foreign exchange was scarce, cooperative arrangements were established which stimulated the pace of economic activity via the reopening of international trade channels. Early measures, in the form of bilateral clearing agreements, were subsequently replaced by the European Payments Union in 1950. This scheme of multilateral payments clearings proved an important catalyst in the strengthening of European economies and paved the way for the eventual return to full currency convertibility in the latter part of the 1950's.

Concurrently, there were strong pressures on the Continent to foster some semblance of economic integration in the hope that advances on this front would lead Europe to complete political union. The goal of creating a United States of Europe, supported at this early stage by France and the Benelux, found its first expression in the Organization for European Economic Cooperation, established to oversee the orderly reconstruction of European economies.[1] It

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[1] An interesting historical account of the political intrique of

was soon followed by the European Coal and Steel Community (ECSC), a cooperative venture proposed by Jean Monnet and Robert Schuman of France. Their immediate concern was the avoidance of future military conflict between France and Germany.[2] Their long-range plan was that the ECSC would promote the political unification of Europe.

This strong desire to pursue the federation of Europe led, a few years later, to the creation of the European Economic Community. The EEC was officially created on March 25, 1957 when Belgium, France, Germany, Italy, Luxembourg, and the Netherlands signed the Treaty of Rome. Even though the customs union aspect of that Treaty has been highly successful and has received much publicity, there is no doubt that the EEC was visualized by its founding fathers as a major step forward in the process of complete European integration.

On the trade front, the EEC abolished all tariff and non-tariff restrictions to the movement of products within its boundaries and adopted a common external tariff with respect to the importation of non-member products; a ten year period was adopted for the gradual fulfillment of this provision. It was also agreed that all barriers to the free movement of labor and capital should be gradually eliminated.

However special difficulties were encountered in reaching a compromise in the case of agricultural products. The member countries insisted on supporting their own politically powerful

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this period, particularly with respect to the polar views held by France and the United Kingdom on the need for supra-nationalism in Continental affairs can be found in Dennis Swann, The Economics of the Common Market, second edition, Penguin Modern Economics Texts, 1972, particularly Chapter One.

[2] Ibid., pp. 19-20.

agricultural sectors which were not equally efficient. What finally emerged was the Common Agricultural Policy (CAP), a scheme which stabilizes agricultural product prices at some target level. These target prices, expressed in terms of a common unit of account (the U.S. dollar), are then maintained by the imposition of variable levies on agricultural products emanating from outside the Community. More specifically, the target price of any given product is translated into an intervention price after allowance is made for some small margin of variation. After subtracting overland transport costs, the intervention price is then transformed into a threshold price. Finally, the variable levy is determined as the difference between the c.i.f. import price and the threshold price.[3]

The Treaty of Rome also called for cooperation on several other fronts, including the enforcement of competition, the adoption of common transport and energy policies and the introduction of consultation with respect to the appropriate monetary and fiscal policies to be pursued by the individual members.

The provisions of the Treaty dealing with cooperation in the monetary and fiscal spheres are, however, worded somewhat cautiously. In fact, they contain many escape clauses which may be invoked to permit the unilateral implementation of economic policies as the national authorities see fit.[4] The ultimate aim of cooperation, as

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[3] A detailed description of the CAP can be found in M.E. Kreinin, International Economics: A Policy Approach, Second edition, Harcourt, Brace, Jovanovich, Inc., New York, 1975, pp. 349-354.

[4] For a complete account of the provisions of the Treaty of Rome and the history of the monetary integration drive, the reader is referred to A.I. Bloomfield, "European Monetary Integration: The Historical Setting", in L. Krause and W.S. Salant, eds., European Monetary Unification and Its Meaning for the United States, The Brookings Institution, Washington, D.C., 1973, pp. 1-30.

stated in Articles 103-105, is to avoid any serious balance of payments difficulties which might require the imposition of trade barriers, the latter obviously hampering the proper functioning of the Common Market. And so, members "shall consider their policy relating to economic trends as a matter of common interest" and "shall co-ordinate their economic policies ... to the full extent necessary for the functioning of the Common Market". But as Article 108 recognizes, whenever a member experiences a serious balance of payments problem, the Commission can, as a final recourse, authorize the adoption of unilateral measures. With respect to the exchange rate instrument, the Treaty is even more ambiguous. Although Article 107 specifically requests each member to "treat its policy with regard to exchange rates as a matter of common interest", it does not forbid the alteration of exchange rates and, more importantly, it does not present specific guidelines for the determination of that "common interest".

In the years immediately preceding the Treaty of Rome and during the early years of the Community, an important debate emerged as to the desirability of maintaining fixed exchange rates in the Common Market. On the one hand, two arguments were advanced in favor of rigidly fixed rates. First, since the purpose of the customs union was to promote competition, increase economic efficiency, and reap the benefits of the economies of scale which would result, it was felt that variable exchange rates would negate some of these beneficial effects by introducing uncertainty into trading relationships. And second, it was argued that exchange rate variations would destablize the incomes of Community farmers and thus impair

the functioning of the Common Agricultural Policy.

On the other hand, the concensus among economists was that at least some transitional period of flexible exchange rates would be necessary to avoid the severe balance of payments disequilibria that might arise as the result of the opening-up of product markets.

The European Community therefore found itself on the horns of a dilemna. Should it press for absolutely fixed exchange rates to protect the CAP? Or should it seek to maintain some flexibility of rates in order to assure the longer-run success of the customs union? The provisions of the Treaty of Rome embody a compromise solution between these two conflicting objectives. Fixed rates were officially advocated. But the implementation of economic policies remained in the hands of national policymakers. The political will of member nations was not yet strong enough to freely give up all of their options in the quest of European unity. It was hoped that the prospects for full integration would improve with time as the working of the customs union induced convergent economic trends in the member states.

But interest in pursuing the goal of complete union waned seriously during most of the 1960's. These were years of prosperity for the industrial world and particularly for Europe. Economic growth proceeded at a brisk pace, unemployment and price inflation were relatively low, and international trade expanded at an unprecedented rate. The Common Market flourished to such an extent that the deadline for achieving a full customs union was attained earlier than expected. These were also years of growing United States balance of payments deficits and, as a result, the nations of the

European Community were accumulating growing amounts of international reserves. In such a climate, the Community experienced no serious problems in maintaining the fixed exchange rate system and the question of striving toward further economic integration remained dormant. The sole exception to this trend was the Commission of the EEC which relentlessly argued for a much greater degree of coordination of member policies, clearly seeing that the Community economies were becoming increasingly interdependent.

Renewed interest in pursuing the goal of a much closer union was however reawakened by a series of crises which began in 1968. In the summer of that year, France experienced a severe balance of payments problem as the result of a wave of civil unrest. This touched off speculation that the franc would be devalued and that the German mark would be revalued upwards. Stop-gap unilateral measures by both countries in the form of tight exchange controls in France and taxes on exports and rebates on imports in Germany proved inadequate. Speculation continued into 1969 until France devalued the franc by 11.1% on August 8. Germany subsequently set the mark free to float in late September. Shortly thereafter it was re-pegged at a value reflecting an appreciation of slightly more than 9%. The CAP was then effectively suspended as Germany adopted a system of border taxes and rebates on trade in agricultural goods in an attempt to protect the income levels of its farm sector.

And so the years of indifference came to an end just as the customs union phase of economic integration had been fully realized. The time was ripe for a renewed drive toward unification on other fronts and the mood of the times could not have been more propitious.

B - THE BARRE REPORT

It became vividly clear to the members of the EEC that the events of 1968-69 could not be permitted to re-occur in the future, for they severely strained their trading relationships and defeated the purpose of the Common Agricultural Policy. After virtually a decade of seeing its warnings go unheeded, the Commission seized upon this opportunity to reaffirm its belief in the need for coordinated economic policies. Its memorandum dated February 12, 1969 (often referred to as the Barre Report) was to be the basis for the subsequent drive for full monetary and economic union in the Community.

The major recommendations of the Barre Report centered around the complementary notions of cooperation and coordination.[5] Member nations were enjoined to treat the setting of medium-term economic objectives as a matter of common concern such that their individual aspirations would be compatible with one another. To avoid serious external imbalances, it was also recommended that the implementation of short term policies be coordinated via increased prior consultations. To compensate for this loss of freedom, the Report suggested the adoption of a system of short and medium-term financial assistance among all Community members.

For the most part, the Report received favorable reception and, in fact, procedures for the discussion of economic policies were instituted during the summer of 1969. Any country planning to alter its policy in a fashion that could conceivably affect its fellow

[5] The main thrust of the Barre Report as well as the subsequent sequence of events is well documented in H.G. Johnson, "Problems of European Monetary Union", Journal of World Trade Law, July/August 1971, Vol. 5, No. 4, pp. 377-387.

members in an important way was now requested to present its plans to the membership as a whole for discussion and suggestions. The acceptance of such a radical proposal owed much to the events of 1969, namely the exchange crises in both France and Germany and the subsequent suspension of the CAP.

The timing was also appropriate for advances on other fronts as the transitional phase of the Community, as established by the Treaty of Rome, was to be terminated by the end of 1969. Suggestions for means of maintaining the impetus of the Common Market began to be voiced by various groups.[6] The so-called European federalists strove to create a full political union in the hope of regaining international status for Europe not only in the political domain but also in the very important international monetary sphere. The French, reflecting a concern for more immediate problems, particularly the preservation of the CAP, supported the adoption of rigidly fixed exchange rates, at least as a first step in the direction of unification. In contrast, German views were more ambivalent. While they disliked the need to appreciate the value of the mark, they also feared the real possibility that rigidly fixed exchange rates would force them to provide unacceptable amounts of financial support to the nations experiencing chronic balance of payments deficits.

Informal discussions continued throughout the year and culminated in the summit conference of Community heads of state at

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[6] This period of political haggling over vested interests is lucidly presented by P.M. Oppenheimer, "Monetary Union: A Survey of the Main Issues", De Economist, Vol. 122, No. 1, 1974, pp. 23-48.

The Hague on December 1-2, 1969. Not only did recent history convince the delegates of the urgent need for increased cooperation among national policymakers but the success of the customs union phase also instilled in them a desire for some new impetus to maintain the dynamic thrust that the Community had acquired in the preceding decade. Concensus seemed to be that the members should now proclaim their determination to proceed to, and undertake the first steps toward, full economic and monetary union. And indeed, at the end of the conference, it was agreed that, during the subsequent year, the Council of Ministers should submit a plan, drawing on the Barre Report, to establish, by stages, an economic and monetary union. On March 6, 1970 the Council turned this task over to a committee headed by the Prime Minister of Luxembourg, Pierre Werner; the final report was to be submitted by the month of October. In the interim, Community central banks agreed to establish a system of short-term monetary assistance with $2 billion being made available for a period of up to three months to nations experiencing balance of payments difficulties.

C - THE WERNER REPORT

The final report of the Werner group, submitted on October 8, 1970, expressed the firm belief that full economic and monetary union could conceivably be achieved in the EEC by 1980.[7] To support its plan, the committee proposed three stages to approach that final objective and described in detail the components of the first three-year stage. The more important of these were increased prior

[7] Cf. Report to the Council and the Commission on the Realization by Stages of Economic and Monetary Union in the Community, The "Werner Report", Supplement to Bulletin 11-1970 of the European Communities, Luxembourg, Office for Official Publications of the European Communities, October 8, 1970.

consultations and policy coordination, the progressive liberalization of Community capital flows and the fostering of a European capital market, an attempt to standardize the tools of policy, and finally the narrowing of exchange rate fluctuations of EEC currencies vis-à-vis one another. It was also recommended that, at an early stage, a European Fund for Monetary Cooperation be created as a possible predecessor to the eventual Community central bank.

Although none of these provisions can be viewed as extremely radical - in fact many of them had already been achieved to some extent in the past few years - it was felt that they represented a realistic first step. Subsequent steps, involving a greater commitment and loss of sovereignty, would prove much easier to implement upon the successful completion of this first phase. The final objective, of course, would necessitate the complete abdication of national sovereignty; the Community would effectively become one political entity with all the attendant characteristics. Specifically, the Werner Report foresaw the following features of the complete union:[8] a) a single currency or rigid exchange rates with the elimination of margins and the total interconvertibility of currencies; b) the complete liberalization of all capital movements within the area; c) the pooling of external reserves; d) the creation of a common central bank to implement both internal and external monetary policy; e) the institution of a Community center for economic policy decision-making which would be responsible to a European

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[8]These features are presented in Bloomfield, op. cit., pp. 12-13 and in Johnson, op. cit., p. 380.

Parliament; f) and the introduction of regional policies determined at the Community level. Within the decade, the EEC was to be transformed into one "super-nation" similar to the United States in which the member countries would effectively become but member states.

The far-reaching proposals of the Werner group stimulated much active discussion in the ensuing months. And, in particular, they added impetus to the long-standing debate over the precise timing of integration. On the one hand, the French adamantly opposed any form of political unification before the Community economies had been integrated. No doubt wishing to maintain and even solidify their position of influence and fearing their loss of sovereignty, they argued that full monetary and economic union would necessarily force the members to coordinate their economic policies and that the way would thus be cleared for eventual political solidarity. This position was also favored by Belgium and Luxembourg. On the other hand, Germany and the Netherlands viewed the French proposal, in the words of one German official, as putting the bridle on the horse's tail.[9] Their view was that a greater measure of policy coordination and some form of political cooperation were indispensable to the success of a monetary and economic union.

An intermediate position prevailed and the provisions of the Werner Report, for the most part, were accepted by the Council;

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[9]This metaphor is attributed to Ludwig Erhard by Gottfried Haberler in Krause and Salant, op. cit., p. 33. It is similar to the "putting the cart behind the horse" metaphor which has been so popular in the monetary integration literature.

the first stage was to begin on January 1, 1971. The dichotomy of member views was however reflected in the adoption of a precautionary clause whereby the Community would abandon its drive to full union and would discard the provisions of the first stage unless agreement to undertake a second stage could be reached within five years. Under no circumstances would Germany accept greater monetary cooperation without some assurance that the political will really existed to build from there. The prospect of a half-union characterized by rigidly fixed exchange rates and the maintenance of national economic sovereignty stirred the fears of many Germans. They did not cherish the thought of becoming the Community's financier, at every turn supporting those members who would be unwilling, or perhaps incapable, of avoiding balance of payments difficulties.[10]

As a result of these conflicting views, a modest beginning was undertaken. The central banks agreed that, beginning June 15, 1971, they would maintain the value of their currencies within 0.6% of parity as opposed to the prevailing margin of 0.75%. In addition, they established a mutual assistance fund of $2 billion from which members could borrow for periods of two to five years as a supplement to the short-term facility already in existence. They also vowed to further solidify the mechanism of policy coordination; as always though, such pledges continued to be couched in very broad terms such that everyone concerned could, in the end, act unilaterally on any front. To many, the most vociferous being the Germans, this

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[10] German fears over the implications of monetary union are detailed in Bloomfield, op. cit., pp. 13-15.

failure to achieve a clear-cut commitment could only stall and, in all probability, terminate the drive to the monetary unification of Europe; the EEC would be doomed to remain in the customs union phase of its development.

D - INTERNATIONAL MONETARY CRISES

The smooth introduction and progress of the first stage was hampered, in the early summer of 1971, by developments in the international financial system. It was becoming increasingly clear that the United States dollar was overvalued as that country's balance of payments deficit widened significantly; so much so that the U.S. gold stock would only cover approximately one-third of total liabilities to foreign central banks. As large speculative inflows continued to flood into Germany, that nation (with the Netherlands following suit) decided to float its currency on foreign exchange markets. Belgium adopted a two-tier foreign exchange system with the value of the franc permitted to float freely for capital transactions. As was the case during the currency turmoil of 1968-69, the Community effectively suspended the CAP via the introduction of taxes and rebates on its trade in agricultural goods.

The events of the ensuing months are adequately described elsewhere and so will not be recounted here in any detail.[11] Of particular importance for our purposes is the fact that, after the Smithsonian Agreement of December 18, 1971, a renewed thrust was imparted to the movement toward European solidarity. With the new

[11] Cf. Kreinin, op. cit., pp. 168-192.

system of margins permitting exchange rates to fluctuate up to 2.25% on either side of the newly-established central rates, any two European currencies could conceivably vary in value up to 9% vis-à-vis one another.[12] It was then felt that such a development could seriously hamper not only the future prospects for monetary integration but also the proper functioning of the customs union itself. And so new efforts at cooperation emerged, the end result being a clever new arrangement appropriately dubbed the "snake in the tunnel". Beginning on April 24, 1972 the currencies of the EEC would only be permitted to fluctuate vis-à-vis one another within a narrow band of 2.25% whereas the entire Community band could vary within the broader 4.5% band against the dollar. Ireland, Denmark and Great Britain decided to participate in this new system from its inception as they were about to become full members of the Common Market on January 1; however the pound sterling became so weak that in late June it was withdrawn from the snake and permitted to fluctuate freely in response to market conditions, a move that was soon duplicated by Ireland and Denmark.

Meanwhile, upheavals in the international monetary system were beginning to reappear. In January of 1973, after significant speculative pressure, the Italians adopted a two-tier foreign exchange market. In the next month, overwhelming amounts of speculative funds swamped the German exchanges. On February 12, 1973 the dollar

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[12] The demonstration of this point can be found in most international trade textbooks. For instance, see Kreinin, op. cit., pp. 34-35.

was devalued by 10% and shortly thereafter the Italian lira was freed to float for all transactions. Following renewed speculative activity and the closing of foreign exchange markets for a seventeen day period, on March 19 the EEC adopted the so-called "joint float" amounting to retention of the snake but elimination of the tunnel. Participating in this new arrangement were the mark, the krone, the guilder and the French and Belgian commerical francs. Two non-members of the EEC, Sweden and Norway also opted to join in the float. It is interesting to note that Germany had proposed such a joint float on several earlier occasions since the emergence of the various international monetary crises in 1971. Even though it represented a margin of fluctuation much larger than that originally proposed in early 1971, this novel cooperative venture signalled a renewed interest in closer economic ties and thus augured well for the prospects of future economic integration. Further impetus was added by the creation of the proposed European Monetary Cooperation Fund on April 6, 1973 to oversee the proper functioning of the joint float and the system of mutual short-term financing among the central banks.

The degree of economic policy coordination proved far too inadequate in succeeding months and, as a result, some Community currencies strengthened considerably against their joint float counterparts. To restore stability in the arrangement, the German mark was appreciated by 5.5% on June 29, 1973 and the Netherlands and Norway followed suit with an appreciation of their currencies by 5% in the latter part of the year.[13] In January, 1974, with the

[13]Norway was originally scheduled to join the EEC on January 1, 1973 but a national referendum reversed that decision at the eleventh hour.

prospects of growing payments deficits caused by the rapid increase in oil prices, speculative pressure developed on the French commerical franc and finally it was set free to float and thus withdrawn from the European snake; it re-entered the snake on July 9, 1975.

E - THE FUTURE OF MONETARY INTEGRATION

As of the fall of 1975, the EEC is far from representing a unified front with respect to the exchange rates of its members. Some currencies are linked to one another in the joint float, although a considerable margin of flucutuation is still permitted, while other currencies are completely free to fluctuate in response to market conditions.

Faced with such reversals in the first stage of its drive toward full monetary union, the Community experimented with a new approach.[14] In late 1972, it was agreed that the members should accept a common monetary policy; money supplies would be permitted to grow at a rate that would result in price increases of only 4% in each and every member nation. To this date, this venture has proved unsuccessful, owing to its reliance on moral suasion alone. Indeed, in the face of conflict between Community and national objectives, many analysts expected the former to prevail.[15]

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[14]Cf. R.I. McKinnon, "On Securing a Common Monetary Policy in Europe", Banca Nazionale del Lavoro Quarterly Review, No. 104, March 1973, pp. 3-20.

[15]For a theoretical and empirical discussion of the inconsistency of EEC and national objectives, see B. Balassa and S. Resnick, "Monetary Integration and the Consistency of Policy Objectives in the European Common Market", Working Papers in Economics, no. 7, Dept. of Political Economy, The Johns Hopkins University, 1974.

Whether or not such meagre attempts at policy coordination are to be expanded and supervised is yet to be seen. We must nevertheless recognize that the will to achieve full monetary integration remains strong and that it most likely has only been relegated to the back of European minds until current international difficulties are resolved. Longer range thinking is reflected in the Werner Report with its bold and long-term recommendations. The dream of a unified European money has not vanished and thus remains an interesting and worthwhile subject of analysis.

CHAPTER III

THE MEANING AND IMPLICATIONS OF MONETARY UNION

I - THE RATIONALE OF MONETARY INTEGRATION

A - THE MEANING OF MONETARY UNIFICATION

Although monetary unification is quite general in scope, some of its components can be viewed as more important than others. The Werner Report, in prefacing its list of recommendations, opted for as broad a spectrum as possible; the characteristics of monetary union were to include irrevocably fixed exchange rates, gradual elimination of margins of fluctuation, establishment of a single European currency, centralized monetary and fiscal policies and a common external monetary policy, an integrated European capital market, and adoption of regional policies on a Community level. The introduction and supervision of these proposals were to be entrusted to two new organs: a center of decision for economic policy and a system of central banks similar to the U.S. Federal Reserve System.[1] It was felt that such extensive measures would pave the way for, and in all likelihood assure, the Community's accession to full economic and political union.

In a more realistic light, though, the essential ingredients of monetary union are fewer in number than those enunciated by the

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[1] Cf. H.G. Johnson, op. cit, p. 380.

Werner Group. In a recent study, Corden has emphasized the two main components: exchange rate union and full convertibility.[2] With respect to the first component, he further distinguishes between a "pseudo" and a "complete" union. A pseudo exchange rate union is characterized by the adoption of rigidly fixed exchange rates but without any commitment on the part of union members to coordinate their short-term economic policies. Such an arrangement has obvious shortcomings, the more important of which is its probable instability. Faced with inconsistent situations, such as a balance of payments deficit and an unacceptable level of domestic unemployment, or a surplus and unacceptable inflation, some member policymakers are likely to choose an alteration of the rate of exchange of their currencies rather than further impair the attainment of their domestic policy objectives. This absence of a total commitment to integration could also invite destabilizing short-term capital flows as speculators attempt to anticipate (and gain from) future movements in exchange rates.

One possible remedy to this shortcoming would be the creation of a fund for short-term mutual assistance, such as that actually introduced by the EEC in 1970. However, there are reasons to believe that such assistance would fail to rescue the integrative venture of

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[2] Cf. W.M. Corden, Monetary Integration, Essays in International Finance, No. 93, April 1972, International Finance Section, Princeton Univeristy. The same views are expressed in another Corden paper, "The Adjustment Problem", in L. Krause and W. Salant (eds.), European Monetary Unification and Its Meaning for the United States, The Brookings Institution, Washington, D.C., 1973, pp. 159-184.

the Common Market. As indicated in the previous chapter, Germany is firmly opposed to this arrangement because, by delaying its partners' irrevocable pledge to policy coordination, it will likely force it to take on the role of Community financier and will further reduce the possibilities for a successful monetary union. The German position is based on the belief that, in the long run, fundamental disequilibria in the balance of payments must be corrected by real adjustments, such as increases in productivity or cost reductions, rather than by short-term financing.[3]

Policy coordination must then be viewed as a minimum requirement for the success of monetary integration, and only if speculators can be convinced that agreement will be forthcoming on delicate policy issues. As a longer-run measure, full abdication of national autonomy to one centralized decision-making organism will be required. Such a scheme is indeed prominent in the Werner Report and represents what Corden calls a "complete" exchange rate union.[4]

In addition, both kinds of currency convertibility will be essential ingredients of monetary unification. On the one hand, current-account convertibility is crucial for the proper functioning of the customs union. Impediments to transactions in foreign

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[3] On the distinction between the various techniques of adjustment, see F. Machlup, "Adjustment, Compensatory Correction, and Financing of Imbalances in International Payments", in R.E. Baldwin et al., Trade, Growth, and the Balance of Payments, Rand McNally & Co., Chicago, 1965, pp. 185-213.

[4] A recent report prepared by a group of experts came out strongly in favor of internal monetary policy integration as a prerequisite to successful monetary unification. Cf. European Economic Integration and Monetary Unification, Commission of the European Communities, Brussels, October 1973.

exchange would negate the beneficial, trade-expanding effects of free trade. On the other hand, capital-account convertibility (and capital market integration) will foster short and long-term capital movements which will play a vital role in the intra-Community adjustment mechanism. This function of capital movements will be described more fully below in our discussion of the feasibility of a European monetary union.

It will be noted that, in the above analysis, no mention is made of centralized budgetary and regional policies. Several authors have indeed argued that they should remain a matter of national priority.[5] Their claim is that regionally-diversified fiscal policies will provide an important antidote to the domestic employment effects of Community-wide monetary policies.

This discussion leads us to the conclusion that a complete exchange rate union will be minimally necessary, owing to the need to avoid disruptive speculation and also due to the economic and political influence of Germany. Their position, dubbed the "economists' viewpoint" is likely to prevail over the French-supported "monetarists' viewpoint", according to which a "pseudo" exchange rate union would be sufficient to induce convergent policy stances.[6]

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[5] Besides the papers by Corden cited above, this view can also be found in J. Ingram, The Case for European Monetary Integration, Essays in International Finance, No. 98, April 1973, International Finance Section, Princeton University.

[6] This duality of viewpoints which has appeared in both the official and popular literature is clearly explained in Ingram, op. cit., pp. 9-10 and in R.I. McKinnon, op. cit.

The EEC will either embark on a complete union in the Corden sense or it will remain only a customs union for the foreseeable future.

B - THE ECONOMIC BENEFITS

Monetary integration will be costly to the members of the Community, at least in terms of lost sovereignty. This leads us naturally to seek out the motivations of the drive to full economic and monetary union. In this and the subsequent section, we will present the economic and political arguments that seem to be the most significant. Our discussion will then turn to a detailed examination of the various costs associated with the adoption of rigidly fixed exchange rates and the abandonment of monetary policy autonomy.

The basic economic argument in favor of monetary integration is a long-standing argument in favor of fixed exchanges rates, namely that they promote economic efficiency by stimulating international competition. Thus, many economists have argued that, to support the customs union established by the treaty of Rome, the EEC must accept monetary unification.[7] For instance, Ingram writes: "Creation of a single market for goods, services, and financial assets implies the existence of common prices and of a common money, whether a single currency or several currencies linked by rigid

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[7] Cf. T. Scitovsky, "The Theory of the Balance of Payments and the Problem of a Common European Currency", KYKLOS, Vol. X (1957), pp. 18-42; R.I. McKinnon, "The Dual Currency System Revisted", in H.G. Johnson and A.K. Swoboda (eds.), The Economics of Common Currencies, Harvard Univ. Press, Cambridge, Mass., 1973, pp. 85-90; J. Ingram, op. cit.

exchange rates".[8] The ultimate argument in favor of monetary integration is that, since it increases the degree of economic integration and thereby improves the functioning of the common market, it will improve the allocation of economic resources.[9] In addition, by eliminating exchange risks, it will permit capital flows to play their proper corrective role in the short-term payments adjustmetn mechanism.[10]

A second economic motive for monetary solidarity is related to the effectiveness of monetary policy. It is argued that, since most European economies are so closely integrated, they would lose little monetary independence by integrating their monetary policies. But in return they would regain a considerable degree of sovereignty vis-à-vis the policy stance of the United States. That is, in the aggregate, the member nations could pursue whatever economic objectives they deemed important with a single European currency whose value would be flexible vis-à-vis the outside world.

Many have suggested that a further economic argument for monetary union is the preservation of the CAP, although we could reasonably posit that the policical overtones involved actually overshadow the economic factors. Since the Community's target agricultural prices are fixed in terms of a given unit of account,

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[8] Ingram, op. cit., p. 2.

[9] Cf. U. Mosca's comments in Integration Through Monetary Union: A Symposium, Institut für Weltwirtschaft an der Universität Kiel, J.C.B. Mohr, Tübingen, 1971, p. 59.

[10] Cf. B.S. Cohen, "The Euro-dollar, the Common Market, and Currency Unification", Journal of Finance, December 1963, pp. 605-621.

unilateral changes in the value of any EEC currency will disrupt the functioning of the support mechanism. However, the arrangement benefits some members to a much greater extent than others and thereby invites the interplay of political influence on all sides.

The major problem with this motive for monetary union is its inherent economic weakness. It attempts to justify fixed exchange rates as a basis for the stability of the CAP, which itself is an economically unsound institution. And the problem lies in the fundamental inconsistency of Community views. On the one hand, it seeks to increase the economic efficiency of its producers by abolishing all tariffs on intra-EEC trade. On the other hand, it wishes to protect its farmers from international competition. But since subsidies and rebates violate the basic tenets of the customs union, members have been convinced that the CAP is the only solution. The protection of inefficient (though politically powerful) farm sectors cannot be accepted as a valid economic argument in favor of an exchange rate union. Besides, member politicians should attempt to stabilize and shelter the real, rather than nominal, income levels of their farmers.

C - THE POLITICAL MOTIVES

Since the economic debate over monetary union within the Community has been ambiguous and, for the most part, politically oriented, we should perhaps now turn our attention to these political motivations. Fearing the massive destruction of military conflict, European nations have demonstrated, since 1945, a strong desire to avoid any future hostilities and thus have opted for a much greater

degree of integration. The first step in this direction was, of course, the establishment of the EEC through which economic integration was to be achieved. But even the supporters of this early stage foresaw that, eventually, the members would have to proceed to something more embracing, namely political union. And so, with the customs union now complete, increasing emphasis has been placed on this objective; the Community has explicitly vowed to transform itself into a political entity. At that time, continental wars would be precluded and, more significantly, the Europeans would regain super-power status and thereby could have an influential voice in international discussions.

The more realistic participants in this debate, however, realize that this lofty objective will be difficult to implement. Their strategy therefore is to induce member nations into political union. It is hoped that monetary integration will force members to harmonize their economic policies to such an extent that, in the near future, they will readily accept the loss of political autonomy. A common currency is thus seen as a symbol or rallying-point around which political integration can be constructed.

Seen in this light, the rationale for monetary unification is not really economic, but political. In the words of Ugo Mosca: "We should not forget, however, that the political and not the economic return is the essential element. Even without any economic return, we should still fight for European integration."[11] Given this basic motivation, the economist's task must not be to determine

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[11]Cf. U. Mosca, op. cit., p. 21.

whether or not monetary union is appropriate. He should rather seek to present objectively the economic costs of such an arrangement. The motivation of this research is to undertake such a task.

II THEORETICAL FOUNDATIONS OF MONETARY UNIFICATION

A - INTRODUCTION

Having discussed the meaning and rationale of monetary integration, we will now examine the theoretical underpinnings of the arguments for and against the adoption of a common currency by the Common Market countries. The basic issue involved is really whether a group of nations should maintain fixed or flexible exchange rates vis-a-vis are another. In the remainder of this chapter, we will present various aspects of this question, beginning with a review of early opinions on the matter. This will be followed by a summary of the more recent arguments in favor of flexible exchange rates. The discussion will then address itself to the broader question of monetary union and its reliance on the nature of the adjustment mechanism. At that point, it will be particularly relevant to assess the relative costs of adjustment to various balance of payments disequilibria. Finally, the stage will be set for an examination of the criteria for an optimum currency area and an analysis of whether or not these criteria are met by the EEC at the present time.

B - EARLY OPPONENTS OF MONETARY UNION

In the latter part of the 1950's, as the Common Market was slowly becoming a reality, a considerable amount of academic discussion arose as to the desirability of maintaining fixed exchange

rates within an economically integrated area. Since the member nations were giving up a very important tool of economic policy, namely the imposition of tariffs on intra-EEC trade, it was felt that flexible exchange rates all around would prevent serious balance of payments crises. And consequently, widespread credence was given to the notion that permanently fixed exchange rates could conceivably result in the destruction of the customs union itself. Indeed, as early as 1957, it was proposed by R.F. Kahn that "greater recognition is needed of the incompatibility of free trade with the present-day sanctity of exchange rates.".[12]

In effect, these early opponents of monetary union were vocalizing the problems inherent in a pseudo exchange rate union. They argued at length that, as long as each national government maintained autonomy in the implementation of monetary and fiscal policies, the Common Market would be unstable. If members pursued significantly different policies, then differential wage and price movements would result which, in turn, could lead to serious balance of payments disequilibria. With the very real possibility of destabilizing currency speculation, the hands of the nations involved

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[12]Cf. R.F. Kahn, "A Positive Contribution", in "The Free Trade Proposals: A Symposium", Bulletin, Oxford University Institute of Statistics, Vol. 19, 1957, p. 65. For other similar early views, see J.E. Meade, Problems of Economic Union, Univ. of Chicago Press, 1953 and "The Balance of Payments Problems of a European Free Trade Area", Economic Journal, Vol. 67, 1957, pp. 379-396; L.B. Yeager, "Exchange Rates Within a Common Market", Social Research, Winter 1958, Vol. 25, no. 4, pp. 415-438; M.E. Kreinin, "Flexible Exchange Rates in a Common Market, and Suggested Implementation", Social Research, Spring 1960, Vol. 27, No. 1, pp. 105-110.

would be forced. They would be obliged to resort to trade, and perhaps capital, controls to maintain the exchange parity of their currencies. The customs union would ultimately be doomed. The recognition of this fact led one observer to go so far as to argue in favor of retaining quantitative import restrictions as a precautionary measure.[13]

The concensus of opinion at the time seemed to be that, ideally, fixed exchange rates would be desirable to promote the functioning of the customs union and thus to encourage competition and economic efficiency. It was also agreed however, that a transitional period of flexible rates would be necessary until economic integration and policy harmonization were realized to a greater extent. This is basically the integration approach suggested by Meade in his 1957 paper.[14] One notable dissenting view was that of Yeager who argued in favor of retaining flexible rates, even over the longer run. To him, the eventual return to fixed exchange rates and the ultimate creation of a single European currency would be politically infeasible and economically unnecessary. In his words, such a goal reveals "a naive 'scientific' concern for intentions and appearances and an uncritical acceptance of the superficial trappings of economic unity."[15]

Very little support could be mustered in favor of permanently fixed rates in those very early days of the Community.

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[13]Cf. J.R. Sargent, "Stocks and Quantitative Restrictions", "The Free Trade Proposals: A Symposium", op. cit., p. 61.

[14]Cf. J.E. Meade, op. cit.

[15]Cf. L.B. Yeager, op. cit., p. 419.

It is an open question, to be discussed at length below, whether a sufficient degree of policy coordination has been achieved some seventeen years after the Treaty of Rome to make the adoption of rigidly-fixed rates and a common currency a feasible choice. Indeed, it could be that Yeager was right; the EEC could conceivably be locked into a transitional phase for an indefinite period of time.[16]

C - THE REVIVAL OF THE FLEXIBLE EXCHANGE RATE DEBATE

In the latter part of the nineteenth century and in the early decades of the present century, the operations of the international monetary system were governed by the so-called "rules of the game" of the gold standard. Central bankers believed, at least theoretically, that the price-specie flow mechanism was operative.[17] They were to permit the balance of international payments to equilibrate itself almost automatically via gold flows and relative price movements; the level of domestic economic activity was to be subjugated to the needs of an equilibrated payments position. However, with the development of modern industrial society, it soon became obvious that price levels, having acquired a certain degree of downward stickness, were not about to respond favorably to the postulated gold standard

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[16]The transitional phase actually adopted by the EEC, until recently, was the adjustable peg system with exchange rates susceptible to sudden, unilateral changes.

[17]For recent evidence that the rules of the game were not really empirically operational, see A.I. Bloomfield, Monetary Policy Under the Gold Standard: 1880-1914, New York, 1959.

mechanism. In addition, with fresh memories of the massive unemployment of the 1930's in mind, national governments slowly began to demonstrate an increased concern for the pace of economic activity; the rules of the game had lost their appeal. Indeed, in the immediate post World War II period, several nations explicitly established domestic employment levels as goals of economic policy, one of the forerunners being the Employment Act of 1946 in the United States.

With the demise of the gold standard, central bankers were faced with the task of restoring some semblance of stability to the international monetary system. What emerged from their meeting at Bretton Woods was a system of fixed exchange rates pegged to the U.S. dollar. However any nation was now permitted to alter its parity in the face of a fundamental disequilibrium in its balance of payments. Policymakers had thus acquired the task of not only maintaining acceptable rates of unemployment and price inflation, but they were also to avoid serious imbalances in their nation's payments position. And they would soon find that the policy requirements for the simultaneous attainment of all three goals would often clash with one another. In the end, the least painful solution to a conflicting situation of, for example, high unemployment and a deficit in international payments often proved to be a devaluation of the currency.

It was during this period that a debate developed over the desirability of maintaining fixed exhange rates. Some academics, notably Milton Friedman, argued strongly in favor of flexible rates since these would automatically assure equilibrium in the balance of

payments and would thus allow policymakers greater freedom in their pursuit of domestic objectives.[18] A further advantage would be that nations would no longer need to resort to impediments to trade and capital flows such as tariffs and exchange control, except of course for domestic purposes. The opponents of flexible rates, including central bankers and the business community, responded with arguments that such a system would reduce the volume of international trade by increasing the riskiness of such transactions; would invite destabilizing speculation; and would give a free hand to central bankers to create as much paper money as they desired with rampant inflation the result.

While the debate was never resolved, flexible rates have acquired a high measure of respectability. Any new international financial system is likely to include a greater degree of exchange rate flexibility. This wave of opinion is partly responsible for the recent setbacks to the drive toward European monetary integration. Several economists have recently revived the arguments of the early opponents to monetary union and have resolved strongly in favor of flexible exchange rates for Community currencies.[19] As described in

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[18] Cf. M. Friedman, "The Case for Flexible Exchange Rates", Essays in Positive Economics, Univ. of Chicago Press, Chicago, 1953, pp. 157-203.

[19] Cf. in particular F.A. Lutz, "Foreign Exchange Rate Policy and European Economic Integration", in International Monetary Problems, American Enterprise Institute for Public Policy Research, Washington, D.C., 1972, pp. 107-134; P.M. Oppenheimer, op. cit.; W. Kasper, "European Integration and Greater Flexibility of Exchange Rates", in Approaches to Greater Flexibility of Exchange Rates, ed. by G. Halm, Princeton Univ. Press, 1970, pp. 385-387; and G. Haberler's comments in "Round Table on Exchange Rate Policy", American Economic Review, May 1969, pp. 357-360.

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the previous chapter, the trend of the times has not failed to influence official European thinking with several EEC currencies currently floating jointly against the outside world and with a handful of other currencies fluctuating freely vis-à-vis all others. However, such arrangements are believed to be only temporary and strong pressure has already been exerted in favor of renewing the quest for monetary integration.

One important contribution of the revived debate over the desirability of flexible exchange rates is that the level of the discussion has been raised to newer heights. An offshoot of this discussion, the theory of optimum currency areas, has further broadened our conception of the conditions necessary for the efficient fucntioning of fixed parities. As it turns out, the original debate was but a small part of a much more general theory, the foundations of which are embedded in the nature of the adjustment mechanism. Thus, before proceeding to a presentation of the various criteria for an optimum currency area, we will briefly review the adjustment mechanism to balance of payments disequilibria along with its attendant costs to the individual nation. This discussion will then permit us to evaluate the feasibility of European monetary unification and to determine the conditions necessary for the success of such a venture.

D - THE ADJUSTMENT MECHANISM

It has been argued by many of the proponents of monetary integration that Europe can transform itself into one economic entity such that the theory of interregional payments adjustment is a

relevant tool with which to analyze the functioning of the future union. The case of the United States is often proclaimed as proof that the European experiment can be successful. It is thus useful to present the interregional theory of balance of payments adjustment here in order to objectively evaluate the case for monetary union in the Common Market. However, since this theory is nothing but an extension of the international version, a brief discussion of the latter seems appropriate.

In the traditional Keynesian model of income determination, there are automatic forces which tend at least partially to correct any disequilibrium in the balance of international payments. One of the more important of these is the income mechanism. To illustrate it, we assume a hypothetical country which, as a result of a sudden shift in foreign tastes, finds itself with an autonomous deficit position in its international payments. Via the foreign trade multiplier, the decreased volume of exports will dampen the level of domestic activity and income. This reduced income level will consequently lead consumers to curtail their purchases of foreign goods and services according to the domestic marginal propensity to import. And automatically, a portion of the deficit will have been eliminated.

A further improvement in the payments position can be stimulated by a change in relative prices. We can quite reasonably expect that, as economic activity slows down in the deficit nation and speeds up in the other via the opposite reasoning, relative prices will turn in favor of the former. We should note that no absolute fall in prices is necessary, only that prices rise at a slower rate in one nation than in the other.

In addition, the monetary mechanism will come into play at some point in this process. The deficit nation will experience a contracting money supply, the effects of which can be transmitted to the domestic economy through two channels.[20] On the one hand, the Keynesian view is that the reduced supply of money will result in higher interest rates which will discourage investment activity. The subsequent reduction in the level of money income will finally lead to a lower volume of imports. On the other hand, the classical doctrine specified that, according to the equation of exchange, and assuming full employment and a constant velocity of money, the lower supply of money will effectively result in a proportionate change in prices in the same direction. This factor will reinforce the previously mentioned impact of slower economic activity on the price level to improve the competitive position of the deficit nation. Thus the monetary mechanism will automatically contribute to a partial correction of the payments problem.[21]

Under the Bretton Woods system, these automatic forces played a crucial role in maintaining the stability of exchange rate relationships. Each nation maintained some quantity of international reserves which were used to see it through temporary periods of payments difficulties; this buffer stock effectively increased the time

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[20]Of course, the Exchange Stabilization authorities could conceivably neutralize any effects of the payments position on the domestic money supply.

[21]Under modern circumstances, the above discussion would likely be more usefully phrased in terms of rates of price increase rather than price levels. The analysis would be unaffected by the change in phraseology.

span over which the above corrective mechanism could operate. As a consequence, exchange rates were altered more infrequently than might otherwise have been the case in the twenty-five years immediately following World War II. However, as noted previously, with the advent of greater government responsibility for the level of domestic economic activity, the stability of the fixed exchange rate system was often threatened by official action to prevent the full operation of the automatic corrective forces. This was the case whenever a country faced internal and external conditions which were inconsistent with one another. When dealing with both a deficit and unemployment, the politically acceptable course of action usually proved to be a devaluation of the currency rather than the implementation of further employment-damaging contractionary policies.

This discussion suggests that the success of monetary union could greatly be enhanced if the members of the EEC could somehow avoid conflicting situations and if the automatic corrective mechanism were powerful enough to reduce the duration and extent of balance of payments problems. As we shall see, the possibilities for success could also be improved by a set of additional adjusting forces which are common in the process of interregional adjustment.

The question is often posed why the various regions of the United States do not experience serious payments difficulties and, hence, why they can manage without the convenience of a variable rate of exchange vis-à-vis the rest of the nation. The theory that has developed in response to this query has demonstrated that several powerful factors interact to insure the efficient operation

of the interregional adjustment process.[22] One of the more important of these is the existence of centralized monetary and fiscal authorities; no single region can pursue such policies which might be inconsistent with the actions of other regions. Rather, aggregate economic policy is geared to the overall performance of the national economy. The regional effects of such policies, in terms of stagnation and heavy unemployment, are partially alleviated by federally-funded regional policies which attempt to infuse much needed capital and infrastructure investments into depressed areas. The regions themselves have free recourse to the national capital markets in order to induce, via bond sales, a short-term capital inflow which will serve two purposes: to increase the time span over which real adjustment must occur and to perhaps improve the region's productivity through real capital investments.

It is also important to note that private capital flows are highly responsive to interregional yield differentials and profit opportunities. Short-term capital is likely to respond to marginally higher rates of return in a region whose money supply has been depressed by a payments deficit. The response of long-term capital is more ambiguous. Some believe that a stock of unemployed resources in any region will prove particularly attractive to direct, long-

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[22] One of the pioneering works in this field is P. Hartland, "Interregional Payments Compared with International Payments", Quarterly Journal of Economics, Vol. 63, August 1949, pp. 342-407. See also J.C. Ingram, "State and Regional Payments Mechanisms", Quarterly Journal of Economics, Vol. 73, November 1959, pp. 619-632; and M. von Neumann Whitman, International and Interregional Payments Adjustment: A Synthetic View, Princeton Studies in International Finance, no. 19, International Finance Section, Princeton University, 1967.

term investment. Others argue that this type of capital is much more likely to flow into the prospering regions.

A further prime feature of the interregional adjustment process is the movement of labor from depressed into flourishing areas. In a national economy such as the United States, this factor is greatly enhanced by the interregional similarity of people with respect to language and culture. If labor mobility is sufficiently strong in the short-run, then no heavy unemployment need appear in any particular region. And short-term capital inflows will assist this process by permitting more time for labor to relocate. For indeed, in the long run, labor mobility is probably the most important factor in the interregional adjustment process.

The existence and functioning of all of the above mechanisms has, in the past, assured that interregional adjustments in the United States would be relatively smooth and that the regions could accept one single currency. Thus, before any region accepts to join a currency union, it should evaluate the effects on its economic health of giving up an important tool of policy, the option to alter the value of its own currency against the currency of other regions. In the case of the EEC, the member states have opted to retain a significant degree of policy autonomy, at least in the preliminary stages of monetary integration. They should, as a result, carefully weigh the costs of correcting a payments imbalance via exchange rate policy as opposed to the costs associated with monetary and fiscal policies.[23] Such affirmative government action

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[23]Cf. M.E. Kreinin and H.R. Heller, "Adjustment Costs, Optimal Currency Areas, and International Reserves", in Essays in Honor of

would inevitably be required in Europe since the automatic corrective forces have not had the opportunity to develop fully; they should do so in the future as the degree of economic and political integration increases.

The costs of adjustment via an expenditure-changing policy will be lower the higher the marginal propensity to import since any payments imbalance will be eliminated by a smaller change in the level of income and employment. The costs of adjustment via an expenditure-switching policy will be lower the less open the economy and the less dependent it is on foreign trade. For an economy which is not highly open , any exchange rate fluctuation will have only a modest effect on the region's internal price level and there will not occur a significant shift of resources between the domestic and foreign trade sectors of the economy. Thus, the use of the exchange rate instrument would result in very little economic instability.

We are now in a position to evaluate the situation of the individual members of the Community as they begin their drive toward full monetary unification. Each one of them must decide whether or not it can forego the option of altering its exchange rate and thus rely on automatic and policy-induced forces to eliminate balance of

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Jan Tinbergen, ed. by W. Sellekaerts, International Arts and Sciences Press, Inc., White Plains, N.Y., 1974, pp. 127-140. Of course, if the EEC adopts a complete exchange rate union as suggested earlier, then the evaluation of such costs would be unnecessary. Member nations would be required to simultaneously abandon the exchange rate and monetary policy tools.

payments disequilibria.[24] In other words, does the EEC constitute an optimum currency area?

E - CRITERIA FOR AN OPTIMUM CURRENCY AREA

The theory of optimum currency areas emerged some fifteen years ago as economists were debating the pros and cons of fixed exchange rates. Many of the early contributions concentrated on one or another of the various automatic mechanisms of balance of payments adjustment which were outlined above.[25]

The pioneer article, by Robert Mundell, attempted to establish rough limits to the size of an optimum currency area (OCA).[26] The upper bound is determined by the functions of money itself. As numéraire and medium of exchange, money performs best the greater the domain over which it circulates. From this point of view, one world currency (or, at least, a system of rigidly-fixed exchange rates the world over) is appropriate.

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[24] H.G. Grubel has developed a welfare-maximizing approach to this question. The nation's welfare function is seen to include such things as the level of national economic independence, the level and stability of real income, and the avoidance of wars. See his "The Theory of Optimum Currency Areas", Canadian Journal of Economics, May 1970, pp. 318-324; and "The Theory of Optimum Regional Associations", in Johnson and Swoboda (eds.), The Economics of Common Currencies, op. cit., pp. 99-113.

[25] An excellent survey of the literature dealing with optimum currency areas can be found in Y. Ishiyama, "The Theory of Optimum Currency Areas: A Survey", International Monetary Fund Staff Papers, July 1975, pp. 344-383.

[26] Cf. R. Mundell, "A Theory of Optimum Currency Areas", American Economic Review, September 1961, pp. 657-665.

The lower bound to the size of an OCA is defined by the needs of economic stabilization. Economic theory suggests that a reduction in price is necessary to increase the quantity demanded of any economic good. However, the downward inflexibility of wages and prices in modern industrial society invalidates the general applicability of this paradigm in the case of economically-depressed regions. In the wake of the demise of the gold standard, policymakers have found an alteration of the rate of exchange (a devaluation) to be the only effective means of increasing domestic employment via the improved international competitiveness of their industries.[27] According to this argument, it might be possible for the Appalachian region of the United States to stimulate its economy by adopting its own currency. The fallacy in this conjecture is that, since any small region is likely to import a high proportion of its consumption goods from other regions, its inhabitants will be very sensitive to variations in the rate of exchange. The money illusion required for successful expenditure-switching policies is likely to be insignificant as a devaluation will quickly lead to claims for higher money wages.

In addition, the currency of a small area would have little or no liquidity value in the eyes of its citizens. We would expect them to accumulate wealth in assets denominated in terms of some more stable currency as a means of protecting the real purchasing power of their incomes.

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[27] If we extend this argument to its limits, every individual on the globe represents an optimum currency area. This effectively reduces to an argument in favor of flexible wages as a cure for unemployment.

According to Mundell, the optimal currency arrangement lies somewhere between these two extremes. The unemployment which adherence to a common currency inflicts upon certain regions can only be remedied by a high degree of interregional labor mobility.

In the context of the EEC, it has been argued that labor mobility is severely constrained by linguistic and cultural barriers. Some writers have even denounced European monetary union on the grounds that it pays too little attention to human welfare. For instance, Oppenheimer writes: "It is not rational to make thousands of families migrate... simply to avoid altering the price of one currency in terms of others."[28] Perhaps more damaging to the Community's goals is Lanyi's argument that interindustrial as well as interregional mobility is crucial.[29] Achievements in the latter field are unfortunately much more meagre than in the former. A recent study, based on data for the period 1960-68, concludes that a) most migrants to Member States have come from outside the EEC, b) except for Italy, none of the flows between Community

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[28]Cf. Oppenheimer, op. cit., p. 33. Even the medium-term economic program of the Community recognizes this fact and thus is led to argue in favor of establishing new centers of economic activity in the proximity of large masses of employable labor rather than have that labor migrate over large distances. Cf. Premier programme de politique économique à moyen terme, 1966-1970, Communautés européennes, Office des publication officielles des Communautés européennes, Luxembourg, particularly the extract from the Journal Official des Communautés européennes (25-4-67), pp. 1515-1516/67.

[29]Cf. A. Lanyi, The Case for Floating Exchange Rates Reconsidered, Essays in International Finance, no. 72, International Finance Section, Princeton University, February 1969.

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countries have been of any real importance, and c) for the Community as a whole, the mobility of the population did not change substantially. The report concludes that "integration of the Community population and labour forces is still fairly limited."[30]

A second criterion for an OCA is the degree of interregional capital mobility, whose contribution to the adjustment mechanism was outlined above. James Ingram strongly believes that the EEC possesses at the present time all of the institutional requirements to permit the functioning of this mechanism in the form of an emerging Community-wide bond market and the rapid development of the Eurocurrency market.[31] And this factor is stressed as being crucial by Magnifico for the implementation of productive regional policies to assure balanced growth over the entire domain of the Common Market.[32] However, Krause adds that if member nations continue to pursue independent monetary and fiscal policies, which they have done to this point, then the tendency will be very strong to maintain the currency

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[30]Cf. Commission of the European Communities, Regional Development in the Community: Analytical Survey, Office for Official Publications of the European Communities, Luxembourg, 1971. The report cited in footnote 23 argues that interindustrial immobility is one of the prime deterants to accelerated economic growth in the Community. Similar evidence is presented in L.C. Hunter and G.L. Reid, European Economic Integration and the Movement of Labour, Industrial Relations Centre, Queen's University, Kingston, 1970.

[31]Cf. Ingram, op. cit.

[32]Cf. G. Magnifico, European Monetary Unification for Balanced Growth: A New Approach, Essays in International Finance, no. 88, International Finance Section, Princeton University, August 1971; and European Monetary Integration, John Wiley, New York, 1973.

union via the imposition of capital controls.[33] Thus much more will be needed if the nations of the EEC are to maintain their autonomy and still adhere to a system of permanently fixed exchange rates.

In response to this need for a much broader theory of currenty areas, Kenen has suggested that the best candidates for such an arrangement are those nations which are economically highly diversified.[34] Balance of payments disequilibria are much less likely to develop in such countries because industry disturbances can be expected, on average, to cancel one another out. This theory has obvious appeal in most circumstances, yet we can visualize realistic circumstances under which it would not be valid. For example, it is conceivable that the general level of costs and prices is rising more or less simultaneously in all industries, in which case the nation as a whole would experience a deficit payments position. The option to alter the exchange rate in such circumstances might not be given up very easily by any government particularly sensitive to the political costs of rising unemployment. The United

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[33] Cf. L.B. Krause, "Implications for Private Capital Markets", in Krause and Salant, op. cit., pp. 114-141. Krause's suspicion is documented as actually occurring in: European Communities, Monetary Committee, Fourteenth Report on the Activities of the Monetary Committee, Office for Official Publications of the European Communities, April 1973. The Monetary Committee concludes: "There can be no complete and lasting integration of the Community's securities markets before disparities in business trends in the member countries, and therefore in the economic and monetary policies, have been narrowed down". (p. 52).

[34] Cf. P.B. Kenen, "The Theory of Optimum Currency Areas: An Eclectic View", in R.A. Mundell and A.K. Swoloda (eds.), Monetary Problems of the International Economy, University of Chicago Press, Chicago, 1969, pp. 41-60.

Kingdom is an excellent example of such a country which has needed to rely heavily on the variability of the pound sterling to compensate for a general stagnation of labor productivity relative to that abroad, coupled with the drive for significant wage increases by very powerful labor unions. As far as the Community as a whole is concerned, we would doubt that the Kenen argument would apply since some of the member states are quite small and not all that industrially diversified.

This argument about the size of an OCA's constituent members is very closely related to the McKinnon criterion, namely that the more open an economy and the more dependent it is on foreign trade, the more will it benefit from maintaining fixed exchange rate relationships with its major trading partners.[35] This is reinforced by the fact that an open economy is much less likely to exhibit any significant degree of money illusion such that alterations in the value of the currency would prove ineffective in any case. However, as Corden has pointed out, this claim is only valid if a nation can expect most disturbances to originate at home. Flexible exchange rates would prove much more attractive as an insulator against price instability generated by inflationary tendencies originating abroad.

The weakness of single-criterion theories of OCA's is again apparent here since the nations of the EEC are not all dependent on trade to the same extent. In a recent empirical study based on

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[35]Cf. R.I. McKinnon, "Optimum Currency Areas", American Economic Review, vol. 53, September 1963, pp. 717-725; reprinted in R.N. Cooper (ed.), International Finance: Selected Readings, Penguin Modern Economics, Penguin Books, 1969, pp. 223-234.

1968 data on the share of imports from partner countries in the consumption of manufactured goods, Balassa concludes that France, Germany, and Italy are sufficiently independent that the case for their joining in a European currency union is not convincing based on McKinnon's criterion.[36]

Two other subsidiary and, in realistic terms, rather minor arguments which have cropped up in some of the literature on OCA's can be rejected very rapidly. The first of these is that alterations of the exchange rate are unnecessary since wages and prices can be counted on to be flexible enough in a downward direction to correct, at least in the long run, any payments imbalance. As we saw above, this argument is strengthened by the fact that what is really needed is only relative downward flexibility, a condition that can often be satisfied in a dynamic international environment. However these adjustments are usually so time-consuming that most nations, when faced with heavy reserve losses, prefer to implement some affirmative and more direct corrective policy measure , namely a devaluation of the currency. The second argument is based on the existence of money illusion to assist exchange rate variations in improving the competitive position of a trading nation. As we saw, since some of the nations of the EEC are relatively small, open economies highly dependent on foreign trade, a strong case for a European currency union must be founded on other, more valid arguments.[37]

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[36]Cf. B. Balassa, "Monetary Integration in the European Common Market", in Europe and the Evolution of the International Monetary System, ed. by A.K. Swoboda , Graduate Institute of International Studies, Geneva, 1974.

[37]These criteria, along with the more important of the others, are

Many of the currency area criteria are based on the adjustment mechanism outlined earlier. To avoid the human hardship caused by the necessary flow of labor and capital out of depressed areas, Sohmen introduced a substitute criterion for the feasibility of an OCA.[38] A currency area should, from its inception, be endowed with a unified tax system which would provide compensating income transfers from one region to the other. As in the United States, such a system would maintain the income levels of depressed areas and thus would soften the impact of the necessary real adjustments and, in addition, would increase the length of time over which such adjustments could take place. Though such a system is highly desirable in theory, it could not realistically be expected to be instituted by the Common Market, since its members seem to want to retain as much political autonomy as possible, at least in the near future. Indeed the plans for a European currency union rely heavily on fiscal policies administered at the regional level to alleviate much of the burden of adjustment which will result from the abandonment of the exchange rate tool and from the implementation of a Community-wide monetary policy.

F - THE INTEGRATED APPROACH TO MONETARY UNIFICATION

The failure of the EEC to satisfy most of the above criteria has, in recent years, shifted the focus of the debate to the formulation of more comprehensive and complete theories of OCA's. This

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lucidly presented in J.M. Fleming, "On Exchange Rate Unification", Economic Journal, September 1971, pp. 467-488.

[38] Cf. E. Sohmen, Flexible Exchange Rates, Revised edition, University of Chicago Press, Chicago, 1969, pp. 181-187.

development has been stimulated by the European commitment to the creation of a complete exchange rate union (in the Corden sense) at the insistence of Germany. But this approach is likely to give rise to severe adjustment burdens for some of the participating nations. Common and coordinated monetary policies, to ensure the stability of rigidly-fixed exchange rates, will necessarily be devised to serve some average or even majority need in Europe. The obvious consequence is that this will result in perhaps serious sacrifices in terms of national economic objectives. Some areas will experience more inflation than they deem desirable while others will be forced to tolerate more unemployment than might otherwise be acceptable.[39] In the very short run, when regional policies and factor mobility are inadequate, this problem could prove disastrous for the future of European unity. Any individual nation which judges that it is bearing too great a share of the burden of adjustment is likely to sabotage the enterprise by re-appropriating for itself the right to alter the value of its currency vis-à-vis the rest of the world.

The very real possibility of such an occurrence has given rise to a new criterion for an optimum currency area, namely, that

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[39]The perceived importance of this consequence of monetary union can be seen in: Corden, op. cit.; F. Machlup, "Nationalism, Provincialism, Fixed Exchange Rates and Monetary Union", in Schmitz (ed.), Convertibility Multilateralism and Freedom, pp. 265-273, quoted in Krause, op. cit.; R.Z. Aliber, "Uncertainty, Currency Areas and the Exchange Rate System", Economica, November, 1972; B. Balassa, "Monetary Integration in the European Common Market", op. cit.; M.J. Fleming, op. cit.; H.G. Johnson, "Problems of European Monetary Union", op. cit.; A. Lanyi, op. cit.; F. Lutz, op. cit.; B. Balassa, "Comment" on R.A. Mundell, "A Plan for a European Currency", op. cit., pp. 173-177; European Economic Integration and Monetary Unification, op. cit.; W. Kasper, op. cit.; and W. Kasper and H.M. Stahl's comments in Integration Through Monetary Union: A Symposium, op. cit.

the OCA is the domain over which the implementation of area-wide economic policies will result in acceptable burdens of adjustment for the constituent regions.[40] The necessary conditions which go along with this criterion are straightforward. The member nations of the monetary union should exhibit very similar Phillips' curves along which they can feasibly trade off more inflation for less unemployment. And they should also possess very similar preference functions with respect to the various objectives of policy such that the optimum configuration of objectives in each nation will be consistent with a Community-wide policy stance. No doubt the ideal way to solve any problem is simply to avoid it from the very beginning.

If these conditions were satisfied by the nations of the EEC, then monetary integration would have very good prospects for success. In an unpublished study, Balassa and Resnick performed a preliminary and rather crude test for the existence of such conditions.[41] Using an econometric model of the European economy developed by Resnick, they inserted the policy target values published by the EEC and then simulated the model to determine the resulting values for the policy objectives of each individual member nation. They then compared these values with the announced objectives of these nations and determined that a coordinated policy stance would force all

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[40]This criterion is very prominent in the recent literature cited in the preceding footnote.

[41]Cf. B. Balassa and S. Resnick, op. cit.

members to depart significantly from their preferred positions. They concluded that, at least in the transitional phase of European union, some flexibility of exchange rates would be essential.

It is the purpose of the succeeding chapters of this study to perform more extensive empirical tests for the existence of these criteria for European monetary unification. We will first estimate the objective trade-off or Phillips curves that have confronted national policymakers in the past, along with their various characteristics, such as their stability over time. This will permit us to determine if the various target configurations available to the national authorities are converging over time as the process of economic integration advances. That is, if the EEC does not constitute an OCA at this time, is it slowly becoming one? We will then examine the preferences that these policymakers have revealed in the past with respect to the dual targets of unemployment and inflation. This will finally permit us to determine, utilizing our estimated relationships, the impact on individual member nations of accepting a centralized monetary policy. A comparison of this projected outcome with their announced targets should provide strong evidence on the chances for success of European integration.

The organization of the remaining chapters is as follows. In Chapter IV, we present the econometric methodology of the analysis, including the specification of the estimated equations and the statistical properties of the tests for structural stability of the coefficients over time. Chapter V then presents our empirical findings for each nation of the Community. In Chapter VI, we utilize these results to derive steady-state trade-off curves. We then

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discuss the common monetary policy of the EEC and its impact on the internal balance of its members as compared to their desired combination of inflation and unemployment. Finally, Chapter VII presents the conclusions of the study and assesses the probable outcome of the drive toward full monetary integration.

CHAPTER IV

ECONOMETRIC METHODOLOGY AND STATISTICAL TECHNIQUES

A - INTRODUCTION

In this chapter, we develop the model to be estimated along with the various statistical techniques which are utilized. We begin with a brief historical background of the trade-off relationship which links inflation to the rate of unemployment. This is followed by an extensive review of some of the previous empirical estimates of this relationship for the individual members of the EEC; such a review will provide the direction for much of the research in this study. We then present in detail the specification of the equations estimated in the next chapter, including an explanation of: the variables examined, the construction of these variables, and the data sources and estimating technique employed. The final section of the chapter outlines the rationale and theoretical underpinnings of the tests for the structural stability of the estimated trade-offs over time.

B - THE DEVELOPMENT OF THE TRADE-OFF CONCEPT

Though several writers have recently disputed the claim that A.W. Phillips was the originator of the idea of an inverse relationship between the rate of increase of money wages and the rate of unemployment, there can be no question that his name is the one most

often associated with this concept.[1,2] His 1958 paper established the existence of such a relationship in the United Kingdom for the period 1861-1957.[3] And in the intervening years, the macro-econometric literature has literally been swamped by empirical verifications of the so-called Phillips curve for different nations, covering various historical periods, and including several theoretical extensions of the original concept.

The basic hypothesis of the Phillips theory represents an application of economic price theory to the labor market. Namely, an excess demand for labor services should lead directly to an increase in the money wage rate (the price of such services), and conversely. For the sake of convenience, the rate of unemployment is used as a proxy variable for the state of excess demand or supply in this market. And the relationship is postulated to be nonlinear due, for the most part, to the downward rigidity of money wages. Even in

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[1]Cf. E. Amid-Hozour, D.T. Dick and R.L. Lucier, "Sultan Schedule and Phillips Curve: An Historical Note", Economica, August 1971, pp. 319-320; A. Donner and J.F. McCollum, "The Phillips Curve: An Historical Note", Economica, August 1972, pp. 323-324; A.P. Thirlwall, "The Phillips Curve: An Historical Note", Economica, August 1972, p. 325.

[2]An extensive survey of the historical development of the trade-off relationship can be found in M. Goldstein, "The Trade-Off Between Inflation and Unemployment: A Survey of the Econometric Evidence for Selected Countries", International Monetary Fund Staff Papers, November 1972, pp. 647-695.

[3]Cf. A.W. Phillips, "The Relation Between Unemployment and the Rate of Change of Money Wage Rates in the United Kingdom, 1861-1957", Economica, New Series, Vol. XXV, 1958, pp. 283-299.

the face of high unemployment, workers are reluctant to lower their wage demands.[4]

In addition, the change in the rate of unemployment is suggested as a significant variable, since it is viewed as a plausible indicator of future labor market conditions. When the unemployment rate declines, employers would be expected to offer higher wages in order to avoid future recruiting difficulties in a tighter labor market. The reverse reasoning would apply with respect to a rise in unemployment.

The effect of the rate of price increase on wage demands is straightforward. Phillips, and Lipsey in a subsequent paper, proposed that workers would, at least partially, protect the real value of their earnings by bargaining for compensation for increases in the general level of prices.[5] Indeed Lipsey found that, during the period of analysis, British workers were only partly sheltered from rising prices, with wages increasing, on average, 0.2 percentage points for every percentage point increase in prices. This could be attributed either to the lack of worker bargaining power or to the existence of money illusion on the part of employees.

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[4]Recently, several theories have been developed to explain the job search behavior of unemployed workers and their unwillingness to accept wage reductions. Cf. in particular, E.S. Phelps et al., Microeconomic Foundations of Employment and Inflation Theory, W.W. Norton and Co., Inc., New York, 1970.

[5]Cf. R.G.Lipsey, "The Relation Between Unemployment and the Rate of Change of Money Wage Rates in the United Kingdom, 1862-1957: A Further Analysis", Economica, New Series, Vol. XXVII, 1960, pp. 1-31.

One of the more important contributions of the Lipsey work was to document the temporal instability of the Phillips relationship. By examining various subperiods of the historical record, he concluded that the estimated coefficients were significantly different in the period after World War II than in the years preceding World War I. And particularly significant for the empirical analysis of the next chapter, he found "evidence of a more rapid increase in wages in response to demand and prices" in the latter period.[6] The instability of Phillips curves has figured prominently in the recent literature, especially as a potent argument against the use of such trade-offs in the formulation of economic policy. A detailed review of this debate will be presented in a subsequent section of this chapter.

Subsequent modifications of the basic relationship appeared in various forms. First, new explanatory variables were added, the more prominent of which were: a) profits as an indicator of employers' ability to concede to higher wage demands; b) labor productivity as a basic influence on wage rates according to neoclassical economic theory; and c) trade union membership as a proxy for worker aggressiveness. Second, new measures of excess demand in the labor market were introduced to account for the interaction of both unemployment and vacancies. Third, the validity of ordinary least squares as an estimation technique was brought into question by several authors who pointed to the feed-back effect of wage increases on the price level.

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[1]Cf. Lipsey, op. cit., p. 30.

This latter criticism was associated with efforts to transform the trade-off concept into one relating the rate of price increase to the rate of unemployment. This notion was originally presented by Samuelson and Solow and has, at least in the popular literature and to some extent in government circles, come to be known as "the Phillips curve".[7] The mapping of the trade-off relationship from wage-unemployment to price-unemployment space has, in ensuing research, usually been accomplished by expanding the original model to one containing two equations. To the wage equation has been added an equation relating changes in the price level to changes in wages, among other things. This model has been subjected to a great deal of empirical testing in recent years since it refers directly to two of the more prominent goals of economic policy.

This process of extending and embellishing the Phillips thesis was recently reversed by the theoretical rejection of the trade-off as a long-run phenomenon. Headed by Friedman and Phelps, several analysts have suggested that only in the short-run will workers be fooled into accepting employment at lower real wages.[8] As they become aware of price increases and as enough time elapses for them to adjust to these new prices, the unemployment rate will gradually rise again to its original level. In the long-run, the rate of inflation will be independent of the rate of unemployment,

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[7]Cf. P.A. Samuelson and R.M. Solow, "Analytical Aspects of Anti-Inflation Policy", American Economic Review, May 1960, pp. 177-194.

[8]Cf. M. Friedman, "The Role of Monetary Policy", American Economic Review, March 1968, pp. 1-17 and E.S. Phelps, "Money-Wage Dynamics and Labor-Market Equilibrium", Journal of Political Economy, July/August 1968, Part II, pp. 678-711.

which will settle at its so-called "natural" level determined by the structural characteristics of the economy.

Although this expectations hypothesis is theoretically appealing, its practical relevance has been criticized. For instance, Albert Rees has argued that adjustments to new circumstances are so costly and time-consuming that, even in the long-run, policy-makers can expect to confront a negatively-sloped, though steeper, trade-off between inflation and unemployment.[9] A great deal of the empirical research on the matter tends to support this view. For the United States, Turnovsky and Wachter discovered that the average response of wage changes to expectations of price increases was of the order of 35 per cent, as opposed to the 100 per cent response indicated by the expectations theory.[10] Solow concludes that, in both the United States and the United Kingdom, the process of adjustment is so slow that it "makes no dent at all in the practical significance of the trade-off surface for economic policy".[11]

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[9]Cf. A. Rees, "The Phillips Curve as a Menu for Policy Choice", Economica, New Series, Vol. XXXVII, 1970, pp. 227-238.

[10]Cf. S.J. Turnovsky and M.L. Wachter, "A Test of the 'Expectations Hypothesis' Using Directly Observed Wage and Price Expectations", Review of Economics and Statistics, February 1972, pp. 47-54. Although others have corroborated this finding, the expectations thesis has been found to be valid in Canada. Cf. S.J. Turnovsky, "The Expectations Hypothesis and the Aggregate Wage Equation: Some Empirical Evidence for Canada", Economica, New Series, Vol. XXXIX, 1972, pp. 1-17 and J. Vanderkamp, "Wage Adjustment, Productivity and Price Change Expectations", Review of Economic Studies, January 1972, pp. 61-72.

[11]Cf. R.M. Solow, Price Expectations and the Behavior of the Price Level, Manchester University Press, 1969, p. 15. His findings indicate an adjustment process well in excess of twenty years. We should note that the lack of money illusion postulated by the expectations theory would destroy the effectiveness of a devaluation of the currency and thus would strengthen the case for a common currency.

This more or less represents the current state of the arts with respect to objective trade-off relationships, with empirical research still being conducted. It is appropriate then to turn our attention to the various statistical estimates of the Phillips curve which have been derived for the individual nations of the Common Market.

C - PREVIOUS EMPIRICAL ESTIMATES OF EUROPEAN TRADE-OFF CURVES

Given the proliferation of empirical trade-off curves in the last fifteen years, we must, for the sake of conciseness, be selective in our review of such research dealing with the nations of Europe.[12] In addition, some variables are more important than others for the purpose of short-term economic policy. Therefore, in this section, we will mostly concentrate on the impact of the rate of unemployment on the rate of change of wages and on the two-way interaction of prices and wages. With other factors held constant, this will permit us to determine the position and general characteristics of the objective target frontier confronting policymakers.

BELGIUM[13]

One of the earliest studies relating to Belgium was undertaken by Klein and Bodkin as part of a multi-country project. Their

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[12]Luxembourg is not considered in this review nor will we estimate equations for it. The two most important reasons for this exclusion are the fact that Luxembourg has been a member of an economic and monetary union with Belgium and the lack of adequate data on many of the variables of interest to this study.

[13]Empirical works dealing with Belgium which are cited in the text are (in order of appearance): L.R. Klein and R.G. Bodkin, "Empirical Aspects of the Trade-Offs Among Three Goals: High Level Employment,

primary findings were that, over the period 1952-59, the wage-unemployment curve was relatively steep and linear (with a slope of -2.39), that workers were only partially compensated for the rate of inflation (with a price coefficient of 0.70), and that the curve was continuously shifting downwards over time. In striking contrast, a United Nations report covering the years 1954-65 categorized Belgium as a country with high unemployment but exhibiting a relatively low sensitivity of earnings and wage rates to unemployment. In addition, the price coefficient now fell in the range of 1.3-1.5, indicating an over-adjustment of wages to price changes.

With respect to the temporal stability of the aggregate wage function, Koshal and Galloway confirm, despite data problems and poor statistical fits, the Klein/Bodkin result that the relationship is gradually sliding downwards from 1952 to 1967. Similarly, Spitäller documents the instability of the price-unemployment mapping and, by examining two separate subperiods, concludes that, since 1959, it has shifted outwards and become much steeper. His work

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Price Stability, and Economic Growth", in Inflation, Growth, and Employment, Commission on Money and Credit, Prentice-Hall, Inc., Englewood Cliffs, N.J., 1964, pp. 367-428; United Nations Economic Commission for Europe, Incomes in Post-War Europe: A Study of Policies, Growth, and Distribution, Geneva, 1967, especially Chapter 3; R.K. Koshal and L.E. Galloway, "The Phillips Curve for Belgium", Tijdschrift Voor Economie, 1970, no. 3, pp. 263-271; E. Spitäller, "Prices and Unemployment in Selected Industrial Countries", International Monetary Fund Staff Papers, November 1971, pp. 528-567; H. Glejser, "Un modèle trimestriel partiel des prix, des salaires et de l'emploi en Belgique", Cahiers economiques de Bruxelles, vol. XXXVII, 1967, pp. 299-319; R. Boelart, Wage-Price Dynamics in EEC Countries: An Analysis of the Unemployment-Inflation Trade-Offs in the Common Market, Ph.D. dissertation, University of Wisconsin, 1972 and "Unemployment-Inflation Trade-Offs in EEC Countries", Weltwirtschaftliches Archiv, Band 109, 1973, pp. 418-451.

also suggests that it might be more appropriate to include unemployment in a nonlinear fashion.

To disentangle some of the feed-back effects between wages and prices, some researchers have estimated a two-equation model. For the years 1957-65, Glejser discovers a nonsignificant influence of prices on wages, only a moderate influence of wages on prices and a highly nonlinear reaction of wages to unemployment. However, Boelart's probings of the period 1955-69 disclose a highly significant over-compensation of wages for inflation, with a coefficient of 1.68 and a somewhat lower degree of nonlinearity in the relationship. In addition, the feed-back effect of wages on prices is found to be slightly higher than in other studies as, on average, prices rise by 43% of the increase in wages.

DENMARK[14]

Only a small number of studies could be found that deal specifically with the Danish trade-off function. For the years 1953-65, the U.N. report cited earlier presents an aggregate wage equation with a very large constant term and a relatively small slope. This indicates that wage increases are normally quite high and independent of the rate of unemployment. With a price coefficient of 0.30, workers have failed, in large measure, to receive compensation for the rate of inflation. This latter result is confirmed by

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[14]The Danish studies referred to are: U.N. Economic Commission for Europe, op. cit.; L. Ulman and R.J. Flanagan, Wage Restraint: A Study of Incomes Policies in Western Europe, University of California Press, Berkeley, 1971, pp. 116-146; Spitäller, op. cit.

Ulman and Flanagan who obtained a coefficient of 0.35 for 1948-68. However, these writers suggest a nonlinear effect of unemployment on wages. Looking at the price-unemployment relation directly, Spitäller also discloses nonlinearity, but one which increases in degree after 1959.

FRANCE[15]

The various empirical estimates of wage and price equations for the French economy are very interesting since they all appear to contradict one another. This phenomenon can partially be explained by the diversity of functional forms and explanatory variables utilized in different studies. For instance, four different specifications have been introduced to represent the effect of unemployment on wages: a) the absolute change in the difference between unemployment and vacancies (Evans); b) the unemployment rate in a linear fashion (Klein/Bodkin and U.N.); c) the unemployment rate inverted to the first power (Boelart) and to the second power (Bodkin et al. and OECD). But even for any given specification, the results are strikingly different. In the U.N. study for 1952-65, the linear unemployment coefficient is statistically insignificant whereas in Klein and Bodkin, for 1952-59, it is significant. More interesting is the

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[15]French empirical studies which are cited are: M.K. Evans, An Econometric Model of the French Economy, Economic Studies Series, OECD, March 1969; Klein and Bodkin, op. cit.; U.N. Economic Commission for Europe, op. cit.; Boelart, op. cit.; R.G. Bodkin et al., Price Stability and High Employment: The Options for Canadian Economic Policy, Economic Council of Canada, Queen's Printer, Ottawa, 1967; and Organization for Economic Cooperation and Development, Inflation: The Present Problem, Paris, December 1970.

fact that the coefficient on u^{-2} in Bodkin et al. is 13.56 as compared to 0.30 in the OECD study.

With respect to the effect of prices on wages, the coefficient estimates are also quite diverse. Evans reports full compensation for price increases lagged six months, with short and long-run coefficients of 1.29 and 1.04 respectively. All other studies disclose significant under-compensation with estimates of 0.36 in Boelart and OECD, 0.30 in U.N., and 0.12 in Klein and Bodkin. Bodkin et al. were unable to obtain a significant effect of inflation on wages, but discovered an important dampening impact for the incomes policy implemented in the Fall of 1963 (by including a dummy variable).

Finally, the feed-back influence of wages on prices is determined to be quite important, at least in terms of magnitude. The coefficients presented are of the order of 0.76 (OECD), 1.02 (Boelart), and 0.19 and 0.62 in the short and long-run respectively (Bodkin et al.). Additionally, both Evans and Boelart conclude that the trade-off in France is only a short-run phenomenon for which no long-run, steady-state counterpart exists.

GERMANY[16]

The German aggregate wage function has also been estimated with several unemployment specifications which also lead to somewhat

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[16]Research dealing with Germany which is mentioned in the text is: U.N. Economic Commission for Europe, op. cit.; Klein and Bodkin, op. cit.; R.K. Koshal and L.E. Galloway, "The Phillips Curve for West Germany", Kyklos, Vol. XXIV, 1971, Fasc. 2, pp. 346-349; Boelart, op cit.; Bodkin et al., op. cit.; Organization for Economic Cooperation and Development, op. cit.; W.G. Hoffman "Die 'Phillips-Kurve' In Deutschland", Kyklos, Vol. XXII, 1969, Fasc. 2, pp. 219-231; Spitäller, op. cit.

contradictory results. For the period 1952-65, the U.N. presents a linear coefficient of -.004, indicating very little influence of unemployment on wages. But for the subperiod 1952-59, Klein and Bodkin report a much greater impact with a coefficient of -3.12 and a steadily decreasing constant term. In contrast, Koshal and Galloway found an intermediate value for the long-run slope (-1.47) but conclude that the function has not been shifting in the post-war period. Two studies include the inverse of the rate of unemployment (Boelart and Bodkin et al.) with long-run slopes of 0.40 and 1.64 respectively. The latter group of researchers also discovered that the wage equation was both gradually shifting upwards over time and significantly dampened beginning in 1962, a year which saw many nations adopt incomes policies (though Germany did not).

On the question of compensation for price rises, the record is again mixed. At one extreme are the findings of the U.N. and of Koshal and Galloway that price effects are either perverse (a negative coefficient) or completely non-existent. Then come the Klein/Bodkin and Boelart estimates of a 50% offset for inflation. And at the other extreme is the independent discovery by the OECD and by Bodkin et al. that workers in Germany have been effectively fully sheltered from rising prices. The respective short-run price coefficients were 1.02 and 1.23, with a long-run estimate of 0.93 in the latter study.

In the few price equations which have been tested empirically, the range of estimates of the reaction of prices to wages is also rather broad. Boelart's coefficients fall in the area of 0.10 and the OECD's 0.50. Bodkin et al. show a much greater responsiveness

with short and long-run coefficients of 0.86 and 1.39. Combining the price and wage functions, Boelart derives a virtually horizontal price-unemployment curve, with the rate of inflation hovering very close to the figure of 2%, regardless of demand conditions in the economy. This finding is corroborated by Bodkin et al. although they express scepticism over the relatively poor fit of their price equations. Direct estimates of the reduced form relating inflation to unemployment are somewhat mixed. Hoffman was unable to obtain any significant correlation for the postwar period but Spitäller's equation indicates a relatively steep, but linear, trade-off curve.

IRELAND[17]

The evidence for Ireland is rather sparse as only two estimates of the aggregate wage equation could be found, one by the U.N. and the other by OHerlihy. Both utilize the linear form of the unemployment rate but their findings are markedly different. The former deduce that a 1% drop in unemployment would result in a wage increase of 1.1% whereas the comparable figure in the latter study is 2.5%. Their price coefficients are however consistent with one another, being 0.63 and 0.70 respectively. The primary difference then is that one wage-unemployment relation is much steeper than the other.

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[17]The two works on Ireland referred to are: U.N. Economic Commission for Europe, op. cit.; and C. St.J. OHerlihy, A Statistical Study of Wages, Prices and Employment in the Irish Manufacturing Sector, Economic Research Institute, Dublin, Paper No. 29, 1966, cited in U.N. Economic Commission for Europe, op. cit.

ITALY[18]

Very few researchers have been able to obtain acceptable empirical estimates of the wage-price-unemployment link in the Italian economy. Klein and Bodkin obtained a positive coefficient for the effect of unemployment on aggregate wage changes though the existence of a significant time trend in their equation casts doubt on the stability of their coefficients. Two subsequent papers discovered unemployment coefficients with the theoretically correct sign, though significantly different in magnitude: 18.90 in Sylos-Labini; 44.0 (short-run) and 5.8 (long-run) in Boelart. The price effects in all three are similar though and indicate that Italian workers were over-compensated for the inflation rate, with coefficients ranging from 1.10 to 1.55. The latter two writers also estimated price equations which indicate that, on average, price variations reflected 30% of every wage change.

Boelart utilized his two-equation model to derive a steady-state price-unemployment relationship. It exhibits a high degree of curvature at rates of unemployment below 3-4%; otherwise the curve is relatively flat with the rate of price increase fairly constant between 2-3%. Spitäller estimated a reduced-form trade-off directly and found it to be linear throughout and quite steep.

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[18]Italian empirical evidence is drawn from: Klein and Bodkin, op. cit.; P. Sylos-Labini, "Prices, Distribution and Investment in Italy, 1951-1966: an Interpretion", Banca Nazionale del Lavoro Quarterly Review, December 1967, pp. 316-375; Boelart, op. cit., Spitäller, op. cit.

NETHERLANDS[19]

The statistical documentation for the Dutch economy is, but for one or two exceptions, fairly consistent. The concensus is that the wage-unemployment function is curvilinear (U^{-1}), indicating that wage changes are highly responsive to the rate of unemployment, at least when the latter is low. This finding is supported by the U.N., by Ulman and Flanagan and by Boelart. Verdoorn and Post, in simulating the Central Planning Bureau model of the economy, also detect a nonlinear effect, though less pronounced.

However, the price impact on wages gives rise to more diverse results with coefficients of 0.44 (Verdoorn and Post), 0.59 (Boelart), 0.79 (U.N.), and 1.39 (Ulman and Flanagan). Whether Dutch workers have received under- or over-compensation for inflation remains an unsettled question. On the other hand, the feed-back effect of wages on prices is determined to be rather moderate: 0.40% in Verdoorn and Post and 0.45% in Boelart for every 1% change in wages.

Finally, the steady-state trade-off is seen to be quite steep with prices exhibiting a high sensitivity to unemployment

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[19]The Dutch statistical evidence is drawn from: U.N. Economic Commission for Europe, op. cit.; Ulman and Flanagan, op. cit., pp. 48-87; Boelart, op. cit.; P.J. Verdoorn and J.J. Post, "Capacity and Short-Term Multipliers", in P.E. Hart, G. Mills and J.K. Whitaker, (eds.), Econometric Analysis for National Economic Planning, Colston Research Society, Butterworth's, London, 1964; Spitäller, op. cit.

conditions. Nonetheless, the unemployment coefficient obtained by Spitäller is twice as large as that derived by Boelart.

UNITED KINGDOM[20]

Since the original work of Phillips, the statistical evidence on wage-price-unemployment interactions in the United Kingdom has been abundant. For the purposes of this study, it will be sufficient to restrict our review to the more recent findings which have been reported, particularly those dealing explicitly with the stability of the estimated equations over time.

Recent postwar history in Britain has been characterized by various attempts to moderate the rates of increase of both wages and prices via the imposition of incomes policies. The earliest documented attempt to determine the effect of such policies on wage behavior was undertaken by Brechling. He concluded that incomes policies were indeed effective as they reduced, on average, the rate of wage increase by 1-2%. The unemployment rate entered his equation in a nonlinear fashion (U^{-1}) with short and long-run coefficients of

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[20]Research dealing with the U.K. which we cite is found in: F.P.R. Brechling, "Some Empirical Evidence on the Effectiveness of Prices and Incomes Policies", in M. Parkin and M.T. Sumner, Incomes Policy and Inflation, Manchester University Press, Manchester, England, 1972, pp. 30-47; Bodkin et al., op. cit.; U.N. Economic Commission for Europe, op. cit., D.C. Smith, "Incomes Policy", in Parkin and Sumner, op. cit., pp. 48-84; OECD, op. cit.; R.G. Lipsey and M. Parkin, "Incomes Policy: A Reappriasal", Economica, May 1970, pp. 115-138, reprinted in Parkin and Sumner, op. cit., pp. 85-111; M.T. Sumner, "Aggregate Demand, Price Expectations and the Phillips Curve", in Parkin and Sumner, op. cit., pp. 163-181; R.J. Flanagan, "The U.S. Phillips Curve and International Unemployment Rate Differentials", American Economic Review, March 1973, pp. 114-131.

0.07 and 0.05, respectively. Bodkin et al. followed up with an equation which also allowed for a shift in the intercept during incomes policy periods (1961-62 and 1964-65); they discovered a significant dampening effect on the order of 1%. The impact of unemployment was deemed to be nonlinear with a relatively steep slope, at least for unemployment rates below 4%. This finding supports the earlier classification of the U.K., by a U.N. report, as a nation exhibiting a high sensitivity of wage changes to conditions in the labor market.

A subsequent study by D.C. Smith on the effects of incomes policies disclosed that their effectiveness was likely most noticeable from mid-1966 to mid-1967, the period of the statutory freeze on wages and prices. To account for this factor, the OECD arbitrarily adjusted the wage series utilized in their wage equation upward by 2% for the period of the freeze.

Research interest then turned to the possible effect of incomes policies not only on the constant term in the aggregate wage function but also on the other coefficients. In particular, some analysts suspected that the effect of unemployment conditions might be significantly different between so-called "policy-on" and "policy-off" years. The work of Lipsey and Parkin represents one of the first published contributions to this debate and their results are rather provocative. During policy-off periods, the Phillips curve is found to be statistically confirmed and very steep, implying the possibility of marked reductions in wage inflation by moderate reductions in aggregate demand. However, when incomes policies are implemented, the Phillips curve effectively breaks

down with unemployment becoming statistically insignificant. The authors also suggest that, because incomes policies effectively rotate the wage function in a counter-clockwise direction, they lead to perverse results. Whenever the rate of unemployment exceeds 1.8%, any further efforts to lower inflation will require a greater reduction of aggregate demand than if incomes restraint were not actually in effect. Finally, Sumner recently discovered that the Lipsey-Parkin coefficient estimates were not even stable during the policy-off period; in particular, inflation lost much of its influence on wage changes between 1957 and 1961.

With respect to statistical evidence dealing with the price equation, the record is mixed. The short-run impact of wages on prices is found to be moderate by Bodkin et al. and by the OECD with coefficients of 0.29 and 0.24, respectively. Their long-run coefficients (0.50 and 0.31) are, however, closer to the estimates of Lipsey and Parkin (0.56) and Flanagan (0.58), but much smaller than Smith's estimate of 1.04. The validity of some of these coefficients is suspect, though, since their stability remains in doubt. For instance, Bodkin et al. deduce that incomes policies have increased the rate of inflation by an additional 1.5% in the short-run and 2.6% in the long-run. Smith also documents similar perverse effects for some periods during which statutory restraint policies were imposed. Lipsey and Parkin examined the possibility that the "slope" coefficients had been influenced by incomes policies. Their wage coefficient dropped from 0.85 for policy-off periods to 0.01 for policy-on periods, suggesting an additional break in the wage-price interactive link.

D - IMPLICATIONS FOR RESEARCH

This lengthy review of previous statistical evidence suggests several conclusions which provide the motivation and direction for the empirical research of this study. First, no published work has examined the experience of the last three or four years, yet this period is particularly crucial to an evaluation of the feasibility of monetary unification. It is quite possible that changes in the policy trade-offs confronting policymakers during these years can explain, to a large extent, the recent foundering of the integration drive.

Second, the inconsistency of some of the results of past statistical research, particularly for different sample periods, suggests that extensive tests should be performed to examine the stability of the price-wage-unemployment relationships in the member nations of the EEC. However, in contrast to prior ventures in this direction, we will utilize a recently-developed statistical technique which, via data analysis, objectively searches for possible structural breaks in a relationship and for coefficinet instability over time.

E - MODEL SPECIFICATION AND RESEARCH METHODOLOGY

This study revolves around a two-equation model which depicts the price-wage-unemployment interrelationships in the economy.[21] We begin by presenting the specification of the wage and price equations, followed by an exposition of the statistical techniques to be utilized.

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[21]Others have derived steady-state target frontiers from full-scale econometric models of the economy. Cf. J.F. Helliwell, L.H. Officer, H.T. Shapiro, and I.A. Stewart, "Econometric Analysis of Policy Choices for an Open Economy", Review of Economics and Statistics, November 1969, pp. 383-398.

THE WAGE EQUATION

The specification of the wage adjustment relationship includes the conventional variables which have been found to be significant in prior research. The rate of unemployment, which serves as a proxy for the excess demand for labor services, will appear in three different functional forms, namely linearly and inverted to the first and second power. Though theoretical considerations suggest a nonlinear form due to the downward rigidity of money wages and to the presence of bottlenecks at low levels of unemployment, some empirical research has discovered that the linear form is more suitable. This is particularly true in countries which exhibit a small range of variations in the unemployment rate. Rather than make an arbitrary choice at the outset, we will experiment with all three forms in order to determine the one which is appropriate for each individual nation.

The change in the rate of unemployment is also included, as a measure of expectations of future labor market conditions. Following Bowen and Berry, the absolute (DU) rather than the percentage change in this variable is employed.[22] The primary reason for this definition is to avoid extremely large fluctuations in DU as a result of only moderate changes in U, given the relative magnitudes of both the variation and the base. A second motive is that, since wage changes are presumably more sensitive to cyclical

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[22] Cf. W.G. Bowen and R.A. Berry, "Unemployment Conditions and Movements of the Money Wage Level", Review of Economics and Statistics, May 1963, pp. 163-172.

rather than structural unemployment, DU is preferable since it reflects, for the most part, changes in the former component of unemployment.

In addition, the rate of change of the consumer price index figures prominently as an influence on money wage variations. This variable is especially important since it represents one of the crucial links in the model and since it relates directly to the Friedman-Phelps contention that long-run trade-offs do not exist. To allow for inertia and for the costs of rapid adjustment to changing circumstances , we will introduce both current and lagged values of the inflation rate. If the sum of these coefficients can be shown to be significantly smaller than unity, then workers are not fully compensated for increases in the cost of living and the long-run trade-off, though perhaps steeper than its short-run counterpart, can be judged to be a feasible policy frontier.

The sluggish reaction of wages to prices can also be incorporated into the equation by inclusion of the lagged value of the dependent variable itself. For instance, let us assume that the desired change in wages ($\dot{\omega}^*$) is a function of some vector of explanatory variables (X):

$$\dot{\omega}_t^* = g(X_t) \tag{1}$$

and that actual wage changes adjust to that desired value according to some finite speed of adjustment (λ):

$$\dot{\omega}_t = \lambda(\dot{\omega}_t^* - \dot{\omega}_{t-1}). \tag{2}$$

Combining (1) and (2) we derive the wage adjustment relationship:

(3) $$\dot{\omega}_t = \lambda g(X_t) - \lambda \dot{\omega}_{t-1} .$$

Wherever appropriate, $\dot{\omega}_{t-1}$ will appear in the wage equations estimated below.

Another variable with which we will experiment is the percentage change in labor productivity. Kuh has shown that, according to neoclassical employment theory, this variable should exert a significant influence on the rate of wage change. The theory postulates that labor services will be purchased until the marginal value product of labor just equals the money wage. Holding product prices constant, a rise in the marginal physical productivity of labor will shift the demand for labor curve outwards and, as equilibrium is reestablished, nominal wages will increase.

Finally, since the data we will be using to estimate the model is not adjusted for seasonal influences, quarterly dummy variables will be included directly in each equation to permit us to more correctly identify the underlying economic forces at work. The role of profits and of union aggressiveness will not be examined due to the lack of adequate data on these variables for all the countries of the Common Market. In sum then, the wage equation to be estimated will be of the form (omitting the quarterly dummies and $\dot{\omega}_{t-1}$):

(4) $$\dot{\omega} = \beta_0 + \beta_1 U + \beta_2 DU + \beta_3 \dot{P} + \beta_4 \dot{P}_{-1} + \ldots + \beta_k \dot{P}_{-k} + \beta_{k+1} \cdot \dot{L}$$

where U will take on one of the three forms outlined above, DU will be defined as the absolute change in unemployment, $\dot{L}$ will represent the percentage change in labor productivity, and $\dot{P}$ will stand for the percentage change in consumer prices.

THE PRICE EQUATION

The conventional practice in trade-off analysis is to restrict demand pressures in the economy to the wage equation. As we saw above, these are usually represented by the rate of unemployment. The price equation is then considered solely from the cost side, the more simplistic version explaining the rate of price change as the difference between the rates of change of wages and labor productivity.

Most specifications now found in the literature are somewhat more realistic and are derived from one of two alternative theories about price formation.[23] Since both of these lead to the same estimating equation, we will concentrate on the marginal cost pricing version in the succeeding discussion. The mark-up theory and its comparison to the marginal cost theory is adequately presented in Bodkin et al.

To illustrate the marginal cost theory of pricing, let us assume a production process which utilizes two inputs: labor services (N) and imports (M), as a proxy for raw materials. The total costs of production are given by:

$$TC = \omega N + P_m M \tag{5}$$

where ω is the wage per unit of labor services and P_m is the price of imported goods. Differentiating this equation with respect to

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[23]The derivations of the price equation are extensively discussed in Bodkin et al., op. cit., pp. 13-16, and in Boelart, op. cit.

output (Q), we obtain the formula for marginal cost:

$$MC = \omega/\frac{\partial Q}{\partial N} + P_m/\frac{\partial Q}{\partial M} \tag{6}$$

However, assuming a Cobb-Douglas type of aggregate production function, the marginal physical productivities (MPP) of both labor $(\partial Q/\partial N)$ and imports $(\partial Q/\partial M)$ are known to be a constant multiple of the respective average physical productivities (APP). That is, assuming output elasticities of α and β for labor and imports, respectively, we have:

$$MPP_L = \alpha \cdot APP_L \quad \text{and} \quad MPP_M = \beta \cdot APP_M \tag{7}$$

Thus equation (6) can be rewritten as:

$$MC = \frac{\omega}{\alpha \cdot APP_L} + \frac{P_m}{\beta \cdot APP_M} \tag{8}$$

On the other hand, total revenue is simply the product of the price and volume of output, and thus marginal revenue (MR) can be derived as:

$$MR = P\left(1 - \frac{1}{\eta}\right) = P\left(\frac{\eta - 1}{\eta}\right) \tag{9}$$

where η is the price elasticity of demand.

The marginal cost theory of pricing postulates that, to maximize profits, firms will extend production up to the point at which marginal revenue just equals marginal cost. Given (8) and (9) above, this implies that:

$$P\left(\frac{\eta - 1}{\eta}\right) = \frac{\omega}{\alpha \cdot APP_L} + \frac{P_m}{\beta \cdot APP_M} \tag{10}$$

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Solving (10) for P and logarithmically differentiating with respect to time we finally obtain:

$$(11) \qquad \dot{P} = \gamma\dot{\omega} - \gamma A\dot{P}P_L + \varepsilon\dot{P}_m - \varepsilon A\dot{P}P_M$$

where:

$$\gamma = \frac{\eta}{\eta - 1}\left(\frac{1}{\alpha}\right) \quad \text{and} \quad \varepsilon = \frac{\eta}{\eta - 1}\left(\frac{1}{\beta}\right) .$$

Equation (11) is then transformed into its estimating form by assuming: that the elasticity of demand (η) is constant; that the average productivity of imports is constant, such that $A\dot{P}P_M = 0$; and that the coefficients on $\dot{\omega}$ and $A\dot{P}P_L$ need not be absolutely equal, since APP_L is likely to vary widely over the business cycle, whereas firms are actually concerned with the expected value of APP_L over the longer-run.[24] Including a constant term to account for the influence of omitted variables, the price equation thus appears as:

$$(12) \qquad \dot{P} = \alpha_0 + \alpha_1\dot{\omega} - \alpha_2 A\dot{P}P_L + \alpha_3\dot{P}_m$$

In estimating equation (12), we will also incorporate the seasonal dummies discussed earlier and we will experiment with the lagged value of the dependent variable as a potential indicator of lags in the adjustment of prices to altered circumstances.

NOTES ON DATA TRANSFORMATIONS

An extensive discussion of the various data sources employed and the techniques utilized to construct the variables of the model

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[24]This rationale is presented in Bodkin et al., op. cit.

is presented below in Appendix A. However, it seems appropriate to mention, at this point, two aspects of the transformation of the data which have been judged to be particularly important. On one hand, we note that many previous researchers, in reporting estimated wage equations, disclose extremely low values of the Durban-Watson statistic, pointing to the presence of serial correlation.[25] Recently, several economists have delved into the possible reasons for this phenomenon and the concensus seems to be that it results primarily from the differencing procedure utilized to construct the dependent variable. In particular, Rowley and Wilton and Kelejian and Black have demonstrated that the four-quarter overlapping change technique (FQOC) employed by Bodkin et al. and by Lipsey and Parkin actually generates autocorrelated residuals, which then lead to biased coefficient standard errors and invalid Student's t-statistics.[26] In addition, Rowley/Wilton and Wallis have indicated that the autoregressive process produced is of the fourth (and possibly fifth)

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[25]Examples of reported Durbin-Watson statistics below the appropriate critical value are: 0.742 in Lipsey and Parkin, op. cit., p. 128, and 0.42 in Bodkin et al., op. cit., p. 244. This latter result is particularly disturbing since the equation contains the lagged value of the dependent variable. Such a specification has been shown to bias the DW statistic toward acceptance of the null hypothesis of no serial correlation. Cf. M. Nerlove and K.F. Wallis, "Use of the Durbin-Watson Statistic in Inappropriate Situations", Econometrica, January 1966, pp. 235-238.

[26]Cf. J.C.R. Rowley and D.A. Wilton, "Quarterly Models of Wage Determination: Some New Efficient Estimates", American Economic Review, June 1973, pp. 380-389 and "The Empirical Sensitivity of the Phillips Curve", American Economist, Fall 1973, pp. 90-112; S.W. Black and H.H. Kelejian, "The Formulation of the Dependent Variable in the Wage Equation", Review of Economic Studies, January 1972 pp. 55-59.

order such that the traditional methods invoked to remedy the problem, such as those developed by Cochrane and Orcutt and by Hildreth and Lu , are insufficient since they are designed to remove first order serial correlation.[27]

In a related vein, Rowley and Wilton have also decried the use of the FQOC method on the basis of the highly unrealistic assumptions required to support its validity.[28] In particular, the method assumes such things as the grouping of workers into four distinct groups depending on the quarter of the year in which their contracts are renegotiated, that such agreements are then rigidly fixed until the same quarter of the subsequent year, and that each seasonal bargaining group should be given an equal weight in determining the aggregate wage change. Rowley and Wilton point out the weakness of such assumptions in the face of multiyear contracts, seasonal bunching of wage negotiations, and front-end loading clauses.

Given data limitations, the present study will only deal with the problem of induced serial correlation mentioned above. To do this, we will utilize a simple quarter-to-quarter percentage change for the variables which enter the model in a rate of change form, namely, wages, consumer prices, import prices and labor productivity.

The second aspect of data transformations relates to the alignment of the various variables. Bowen and Berry analyzed this

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[27]Rowley and Wilton, op. cit.; K.F. Wallis, "Wages, Prices, and Incomes Policies: Some Comments", Economica, August 1971, pp. 304-310.

[28]Rowley and Wilton, "The Sensitivity of Quarterly Models of Wage Determination to Aggregation Assumptions", Quarterly Journal of Economics, November 1974, pp. 671-680.

problem and argued against using the original Phillips first central difference method of creating the rates of change for wages since this implicitly introduces a lead and a lag into the influence of U on $\dot{\omega}$.[29] Instead, they favored the average unemployment method whereby U and $\dot{\omega}$ are defined as:

$$(13) \qquad U_T = \frac{U_t + U_{t-1}}{2} \quad \text{and} \quad \dot{\omega}_T = \frac{W_t - W_{t-1}}{W_t}$$

It can be seen that both variables are now centered at the end of period $(t - 1)$. In the research below, we will employ this technique in order to avoid any a priori specification of the timing of the relationship between unemployment and wages.

THE BASIC ESTIMATION TECHNIQUE

As outlined earlier in our discussion of the historical development of the Phillips curve, several writers have pointed to the inconsistency of the ordinary least squares technique when applied to the wage equation, owing to the presence of two jointly-determined variables: wages and prices.[30] Their suggestion was simply to apply two-stage least squares to the equation and several such estimates were presented. However, the bias inherent in the OLS method turned out to be very small, as evidenced by the work of Klein and Ball, Dicks-Mireaux, Brechling, Boelart, Bodkin et al.,

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[29] Cf. Bowen and Berry, op. cit.

[30] Cf. Section B above. The econometric theory dealing with the inconsistency of OLS estimators in such situations can be found in any good econometrics text. See, for instance, H. Theil, Principles of Econometrics, John Wiley & Sons, Inc., New York, 1971, Chapter 9.

Smith, and Lipsey and Parkin.[31] Based on this testimony and, since the primary purpose of this research is to examine the temporal stability of the wage and price relationships, we will employ the OLS technique in deriving the various coefficient estimates.

F - TESTS FOR STRUCTURAL STABILITY

The stability of trade-off curves has long been a major argument against their use, particularly for the purposes of orienting economic policy. As indicated earlier, Friedman and Phelps were some of the early advocates of removing the Phillips-type of analysis from the policymaking domain. Once people's expectations had fully adjusted, the wage-unemployment relation would lose all practical significance. This point of view subsequently stirred up a debate among economists. Reuber, for one, cited evidence that the Canadian Phillips curve had indeed been quite stable in the post-1930 period and that the small shift that it had exhibited was exactly in the opposite direction as that predicted by the Friedman-Phelps thesis — it had become slightly flatter.[32]

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[31] Cf. L.R. Klein and R.J. Ball, "Some Econometrics of the Determination of Absolute Prices and Wages", Economic Journal, Vol. LXIX, 1959, pp. 465-482; L.A. Dicks-Mireaux, "The Interrelationship Between Cost and Price Changes, 1946-1959", Oxford Economic Papers. New Series, Vol. XIII, 1961, pp. 267-292; Brechling, op. cit.; Boelart, op. cit.; Bodkin et al., op. cit.; Smith, op. cit.; Lipsey and Parkin, op. cit.

[32] Cf. G.L. Reuber, "Comment: The Specification and Stability of Estimated Price-Wage-Unemployment Adjustment Relationships", Journal of Political Economy, July/August 1968, pp. 750-754.

Recent research into the empirical stability of trade-off functions has relied almost exclusively on a statistical test developed by Chow.[33] In a few words, this test involves estimating a relationship over an entire sample period and over two predetermined subperiods separately. Then, utilizing an F statistic, one can determine whether the estimated coefficients are significantly different from one period to the next. Examples of the use of this technique can be found in Bodkin et al. and in Lipsey and Parkin. In particular, the latter two researchers concluded that the wage equation in the U.K. was significantly different between periods when incomes policies were in effect and periods when such policies were not implemented.[34]

However, the major drawback of the Chow technique is that it requires advance knowledge of approximately when a structural break in a relationship has occurred. Moreover, it would seem to be a rather poor indicator of gradual rather than abrupt changes in a function over time. In the words of Holt: "... there is need of improving our conceptualization, data, and estimation of these relationships" to determine whether, in fact, they really deserve the Rees and Hamilton label of being "conspicuously unstable".[35]

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[33] Cf. G.C. Chow, "Tests of Equality Between Sets of Coefficients in Two Linear Regressions", Econometrica, July 1960, pp. 591-605 and F.M. Fisher, "Test of Equality Between Sets of Coefficients in Two Linear Regressions: An Expository Note", Econometrica, March 1970, pp. 361-366.

[34] Cf. Lipsey and Parkin, op. cit., particularly p. 133.

[35] C.C. Holt, "Job Search, Phillips' Wage Relation, and Union Influence: Theory and Evidence", in Phelps et al., Microeconomic Foundations of Employment and Inflation Theory, op. cit., pp. 118-119; A. Rees and M. Hamilton, "The Wage-Price-Productivity Perplex", Journal of Political Economy, February 1967, pp. 63-70.

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A new technique has recently been developed by Brown, Durbin and Evans (BDE) which does not require a priori information about the timing of structural breaks. It also appears to be an effective tool for detecting gradual alterations in a relationship.[36] In this section, we provide a verbal discussion of the BDE method; its technical characteristics are presented in Appendix B.

The test of stability proposed by BDE revolves around the concept of the cumulative sum (cusum) of recursive residuals. An equation containing k explanatory variables is first estimated over the first k observations and then employed to predict the value of the dependent variable in the $(k + 1)^{th}$ period which, when compared to the actual value of that variable, leads to a prediction error or residual. This procedure is then repeated, each time adding one additional observation, until the entire sample period has been employed. At each pass, we calculate the cusum of squared residuals and, dividing this value by the cusum of squared residuals over the entire sample period, we obtain a statistic denoted Sr. Given the definition of Sr, it is obvious that it will always lie between zero and unity (a value which it attains at the last recursion) and that it will increase monotonically between these two extreme values.

It will be shown in Appendix B that, if the null hypothesis that the relationship is stable over time is valid, then Sr should equal its mean value for every iteration. This implies that the plot of Sr over time should lie on the diagonal connecting

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[36]Cf. R.L. Brown, J. Durbin and J.M. Evans, "Techniques for Testing the Constancy of Regression Relationships Over Time", Journal of the Royal Statistical Society, forthcoming.

points (k,0) and (T,1). Appropriate confidence bands for various levels of significance can then also be graphed, for a two-tailed test, on either side of and parallel to the mean value line.[37]

Thus the cusum of squares test is graphical in nature in that it involves examining the plot of Sr over time and, if it crosses either significance line, concluding that a structural break in the relationship has occurred. The point of crossing also provides evidence as to the observation at which the break has occurred. The computer program (TIMVAR) which is utilized in this study also performs all of the above calculations in reverse order, that is, beginning with the end of the sample and working its way forward. In some instances, examining both the forward and backward plots of Sr is necessary to determine the point of instability more precisely. In addition, the program calculates Quandt's log likelihood ratio (QLLR) as a supplementary piece of evidence as to the proximate point at which instability has occurred.[38] In essence, this test splits the sample in two, beginning at observation k + 1, and calculates the ratio of the likelihood that the observations would be observed under H_0 (the relation identical in both subperiods) to the likeli-

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[37] The BDE cusum of squares test was recently utilized to examine the stability of wage equations for the United Kingdom. Cf. M. Goldstein and M.S. Khan, "The Relative Stability of Selected Wage Inflation Models for the United Kingdom", unpublished manuscript.

[38] Cf. R.E. Quandt, "The Estimation of the Parameters of a Linear Regression System Obeying Two Separate Regimes", Journal of the American Statistical Association, 53, 1958, pp. 873-880 and "Tests of the Hypothesis that a Linear Regression System Obeys Two Separate Regimes", Journal of the American Statistical Association, 55, 1960, pp. 324-330.

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hood under H_1. This calculation is also performed recursively by moving the hypothesized break point over the range $(k + 1,\ldots,T)$ one observation at a time. The observation at which the QLLR is at a minimum is then assumed to be the most likely point of instability.

In the next chapter, we will perform the BDE cusum of squares test on both the wage and the price equation for each member of the Common Market. This will permit us to resolve whether these functions have been stable over the postwar period. If not, we will then examine the potential causes of instability and their effects on the model. In particular, we will analyze the plot of the recursive coefficients over time to give us some indication of which coefficients have changed and at which point in time. Given this information, we will then re-estimate the unstable equations with various shift and slope dummy variables in order to better capture the nature of the postwar trade-off relationships.

CHAPTER V

EMPIRICAL RESULTS

A - INTRODUCTION

In this chapter, we present the statistical findings of the study. We examine the wage and the price equation, in turn, for each member of the Common Market. The basic ordinary least squares estimates are reported first, followed by the results of the stability tests. We then delve into the potential causes for any detected instability and this subsequently leads us to re-estimate those equations deemed to be unstable. This is accomplished by modifying the specification of the equations to include the appropriate combination of shift and slope dummy variables.

B - BELGIUM

THE WAGE EQUATION

We estimated the conventional Phillips relationship for Belgium over the period from the first quarter of 1961 to the first quarter of 1974. In all preliminary tests, the linear specification for the unemployment rate performed best in terms of the t-statistic and the square of the multiple correlation coefficient for the overall regression (R^2). For instance, we obtained:

$$(B1) \quad \dot{\omega}_t = \underset{(3.75)}{2.760} - \underset{(1.10)}{0.187}\, U_t - \underset{(0.10)}{0.048}\, DU_t + \underset{(6.09)}{1.120}\, \dot{P}_t - \underset{(2.23)}{1.186}Q2 - \underset{(3.21)}{1.334}Q3 - \underset{(4.32)}{1.490}Q4 \qquad R^2 = 0.62,\ D.W. = 2.05,\ S.E.E. = 0.855$$

and

$$(B2)\quad \dot{\omega}_t = \underset{(4.89)}{1.925} + \underset{(0.54)}{1.421}U_t^{-2} + \underset{(0.02)}{0.010}DU_t + \underset{(6.16)}{1.139}\dot{P}_t - \underset{(2.09)}{1.110}Q2 - \underset{(3.00)}{1.246}Q3 - \underset{(4.17)}{1.440}Q4$$

$R^2 = 0.61$
D.W. = 2.03
S.E.E. = 0.864

where the number in parentheses below each coefficient is its t-statistic.

The stability tests for the various specifications were very similar, so we present only those dealing with equation (B1). As can be seen in Figure 1, the forward cusum of squared residuals (CSR) indicates instability beginning in the middle of the sample, sometime after observation 27. Quandt's log likelihood ratio (LLR) attains a minimum at observation 31, which suggests that the structural break is most likely to have occurred at that point. The reasons for this phenomenon are unclear, at least based on any available historical record of developments in Belgium over this time period. One plausible conjecture is that wage developments after the third quarter of 1968 (observation 31) were altered by the increased militancy of labor, which was reflected in massive social unrest and widespread strikes in France earlier in that year.

In view of these results, we re-estimated equation (B1) including various combinations of: a shift dummy, a slope dummy for the unemployment rate, the lagged change in the inflation rate and the percentage change in labor productivity. These findings are reported in Table 1.

Of the estimates presented in Table 1, the preferred equation would seem to be equation (B7). All the coefficients

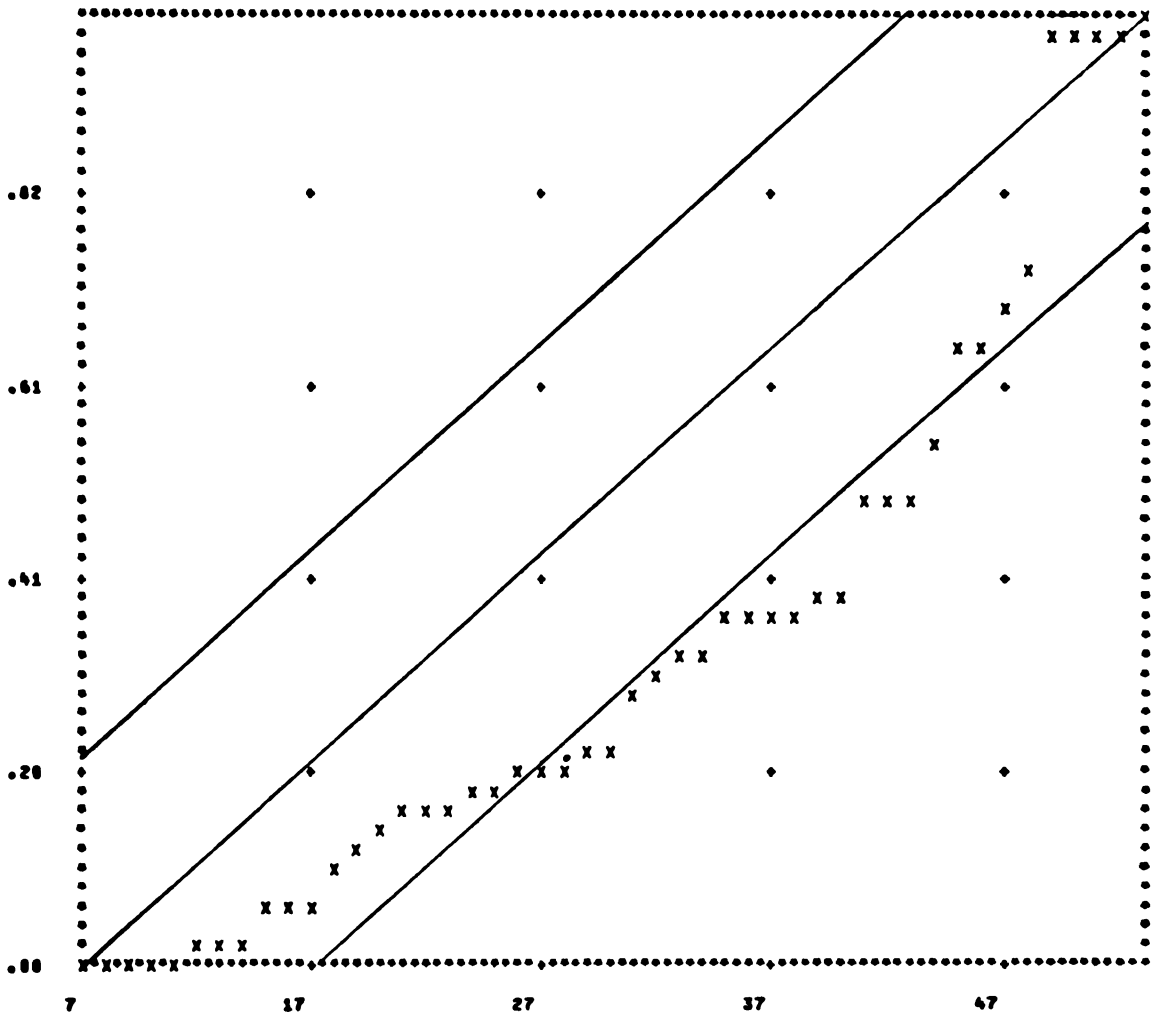

FIGURE 1

THE WAGE EQUATION FOR BELGIUM:
FORWARD CUSUM OF SQUARED RESIDUALS NORMALIZED

TABLE 1. WAGE EQUATIONS FOR BELGIUM (1961-I TO 1974-I)

Equation Number	Constant Term	Coefficients of Explanatory Variables[a]												
		U	U*D31	$\dot{P}_t$	$\dot{P}_{t-1}$	$L\dot{P}_t$	Q2	Q3	Q4	D31	R^2	D.W.	S.E.E.	d.f.
B3	3.512	-.420	+.465	0.666	0.325	0.055	-1.610	-1.729	-1.603	-.878				
	(4.58)[b]	(2.32)	(1.31)	(3.41)	(1.51)	(1.66)	(4.26)	(5.23)	(5.24)	(0.75)	0.73[c]	2.19	0.744	43
B4	3.940	-.490	+.540	0.706		0.058	-1.593	-1.729	-1.642	-.989				
	(5.45)	(2.75)	(1.52)	(3.60)		(1.73)	(4.15)	(5.15)	(5.31)	(0.83)	0.72	2.12	0.755	44
B5	3.751	-.460	+.562	0.743			-1.168	-1.540	-1.688	-1.069				
	(5.14)	(2.54)	(1.55)	(3.73)			(3.88)	(4.75)	(5.36)	(0.88)	0.70	2.24	0.771	45
B6	3.245	-.321		0.824			-1.190	-1.517	-1.657	+0.767				
	(4.90)	(2.02)		(4.23)			(3.90)	(4.62)	(5.20)	(2.99)	0.68	2.21	0.783	46
B7	3.054	-.300		0.726	0.365	0.056	-1.641	-1.715	-1.572	+0.626				
	(4.44)	(1.90)		(3.80)	(1.70)	(1.68)	(4.31)	(5.15)	(5.11)	(2.39)	0.72	2.16	0.750	44
B8	2.827	-.262		0.760	0.389		-1.234	-1.532	-1.612	+0.609				
	(4.11)	(1.65)		(3.92)	(1.78)		(4.12)	(4.77)	(5.16)	(2.28)	0.70	2.29	0.765	45
B9	3.460	-.357		0.783		0.060	-1.627	-1.713	-1.611	+0.775				
	(5.25)	(2.27)		(4.08)		(1.76)	(4.19)	(5.04)	(5.15)	(3.09)	0.70	2.08	0.766	45

[a]The variables are defined as:

U = the unemployment rate

U*D31 = an interactive variable where D31 is defined as below

$\dot{P}_t$, $\dot{P}_{t-1}$ = the rate of changes of consumer prices, current and lagged one period

$L\dot{P}_t$ = the rate of change of labor productivity

Q2, Q3, Q4 = dummy variables for the second, third and fourth quarters

D31 = a shift dummy taking on the value of 1.0 from observation 31 on, 0.0 otherwise

[b]The number in parentheses below each coefficient is its t-statistic (absolute value).

[c]The summary statistics are defined as: R^2 = coefficient of multiple correlation; D.W. = Durbin-Watson statistic; S.E.E. = standard error of estimate; d.f. = degrees of freedom.

are statistically significant, at least at the 10% level, whereas, in equation (B3), the coefficients of the slope dummy, U * D31, the inflation rate lagged one period, and the shift dummy, D31, are not significantly different from zero. The values of the Durbin-Watson statistic are all such that we cannot reject, at the 1% level of significance, the null hypothesis that the residuals are serially uncorrelated.

Turning to the coefficient estimates in equation (B7), we note that the intercept is quite large and that wage changes are relatively insensitive to the rate of unemployment. However, the sum of the price coefficients (1.09) indicates that Belgian workers have been fully compensated for changes in the cost of living.[1] Moreover, since the third quarter of 1968, wages have risen almost two-thirds of a percentage point per quarter, independently of other factors. In addition, changes in labor productivity have exerted a moderate influence on wages. The three quarterly dummies are also significant and reflect a marked seasonal pattern, with the largest wage changes occurring in the first quarter of the year.

THE PRICE EQUATION

We estimated the price equation over the same 53 quarters as were utilized in the wage equation. The basic form, which was employed in the stability tests, resulted in the following OLS estimates:

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[1] In Belgium, the incomes of civil servants are linked to the consumer price index, as are the wages and salaries of almost all workers in the private sector. Cf. J. Finet, "Monetary Policy in Belgium", in K. Holbik, Monetary Policy in Twelve Industrial Countries, Federal Reserve Bank of Boston, 1973, p. 42.

$$(B10)\quad \dot{P}_t = \underset{(0.89)}{-0.194} + \underset{(5.67)}{0.322}\dot{W}_t + \underset{(4.65)}{0.117}\dot{P}_{mt} - \underset{(0.95)}{0.018}\dot{LP}_t$$

$$+ \underset{(2.53)}{0.594}Q2 + \underset{(2.61)}{0.523}Q3 + \underset{(2.41)}{0.446}Q4 \qquad R^2 = 0.64$$
$$D.W. = 2.33$$
$$S.E.E. = 0.421$$

The plot of the forward CSR, appearing in Figure 2, suggests marked instability very early in the sample. Indeed, Quandt's LLR points to observations 11-12 as the apparent starting point of instability; this finding is corroborated by the plots of the recursive coefficients which show a sharp shift around these points and are thereafter relatively constant.

Given this information, we re-estimated equation (B10), dropping the first 11 observations and experimenting with lags on some of the explanatory variables. These estimates, reported in Table 2, indicate that one period lags on wages, import prices, and the dependent variable itself, and the current value of the labor productivity variable are not statistically significant. As a result, equation (B14) is the one preferred; we note that wages and import prices have a somewhat moderate influence on prices and that the pattern of price variations is, as in the wage equation, highly seasonal. The Durbin-Watson statistic reveals that the residuals are free of autocorrelation.

Finally, we also subjected this preferred price equation to the stability tests. From the plot of the forward CSR, in Figure 3, we note that there are no signs of structural instability, at least at the 10% level of significance. The price function is thus accepted, in its form in equation (B14), without further modifications.

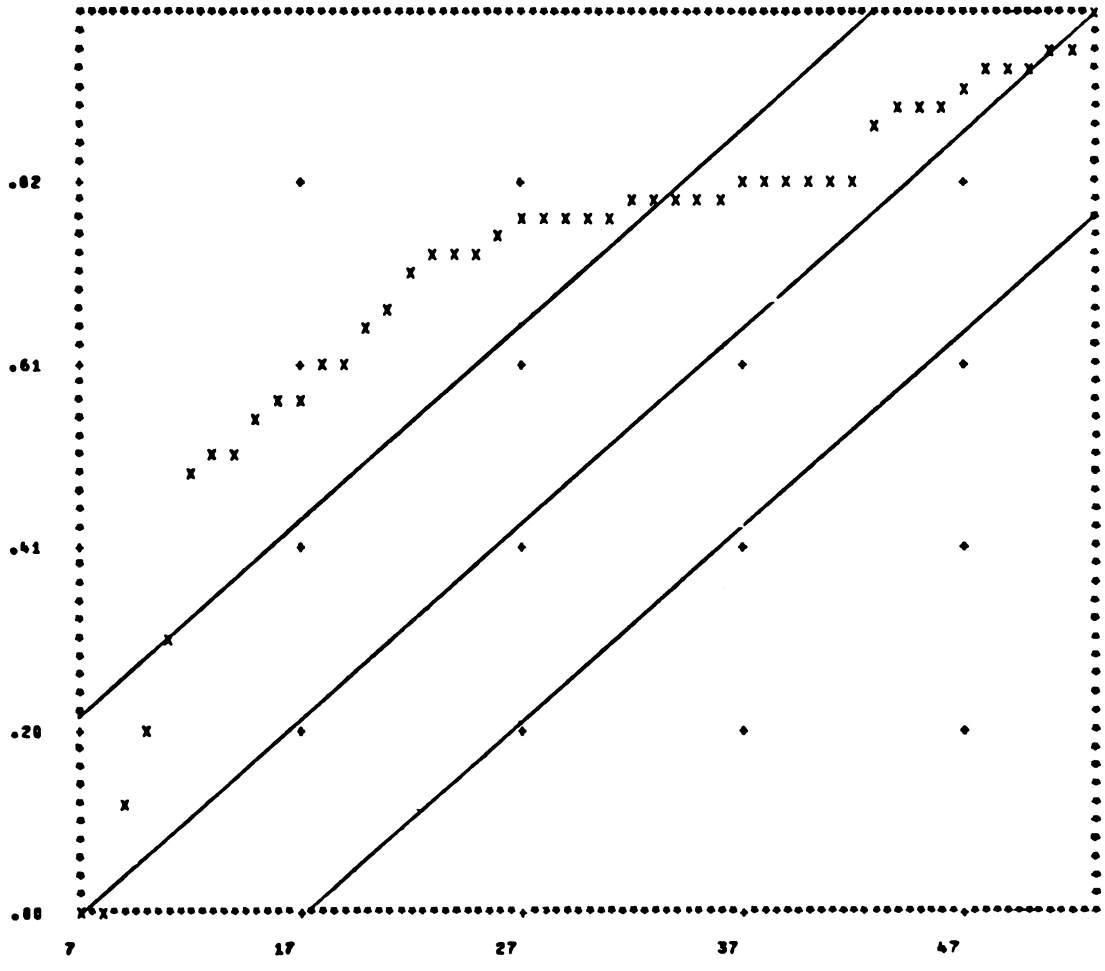

FIGURE 2

THE PRICE EQUATION FOR BELGIUM:
FORWARD CUSUM OF SQUARED RESIDUALS NORMALIZED
(1961-I to 1974-I)

TABLE 2. PRICE EQUATIONS FOR BELGIUM (1963-IV to 1974-I)

Equation Number	Constant Term	Coefficients of Explanatory Variables[b]									R^2	D.W.[c]	S.E.E.	d.f.
		$\dot{W}_t$	$\dot{W}_{t-1}$	$\dot{P}_{mt}$	$\dot{P}_{mt-1}$	$L\dot{P}_t$	Q2	Q3	Q4	$\dot{P}_{t-1}$				
B11	-.065	0.296		0.109	0.026	0.005	0.444	0.407	0.553		0.80	2.00	0.289	45
	(0.35)[a]	(6.52)		(5.50)	(0.94)	(0.21)	(2.24)	(2.36)	(3.64)					
B12	-0.078	0.304	-.014	0.118			0.550	0.456	0.563		0.80	2.10	0.289	46
	(0.42)	(6.23)	(0.30)	(6.62)			(2.82)	(2.94)	(3.55)					
B13	-.082	0.299		0.118			0.511	0.441	0.547	0.002	0.80	-0.42[c]	0.289	46
	(0.43)	(6.03)		(6.54)			(3.27)	(2.88)	(3.57)	(0.02)				
B14	-.081	0.299		0.118			0.512	0.441	0.548		0.80	2.09	0.285	47
	(0.44)	(6.70)		(6.72)			(3.51)	(3.03)	(3.70)					

[a]The number in parentheses below each coefficient is its t-statistic (absolute value).

[b]The variables are as defined previously in Table 1 and in the text.

[c]The Durbin-Watson test is inappropriate in the presence of the lagged dependent variable and therefore. in (B13), we computed the Durbin h-statistic. Cf. J. Durbin, "Testing for Serial Correlation in Least-Squares Regression When Some of the Regressions are Lagged Dependent Variables", Econometrica, May 1970, pp. 410-421.

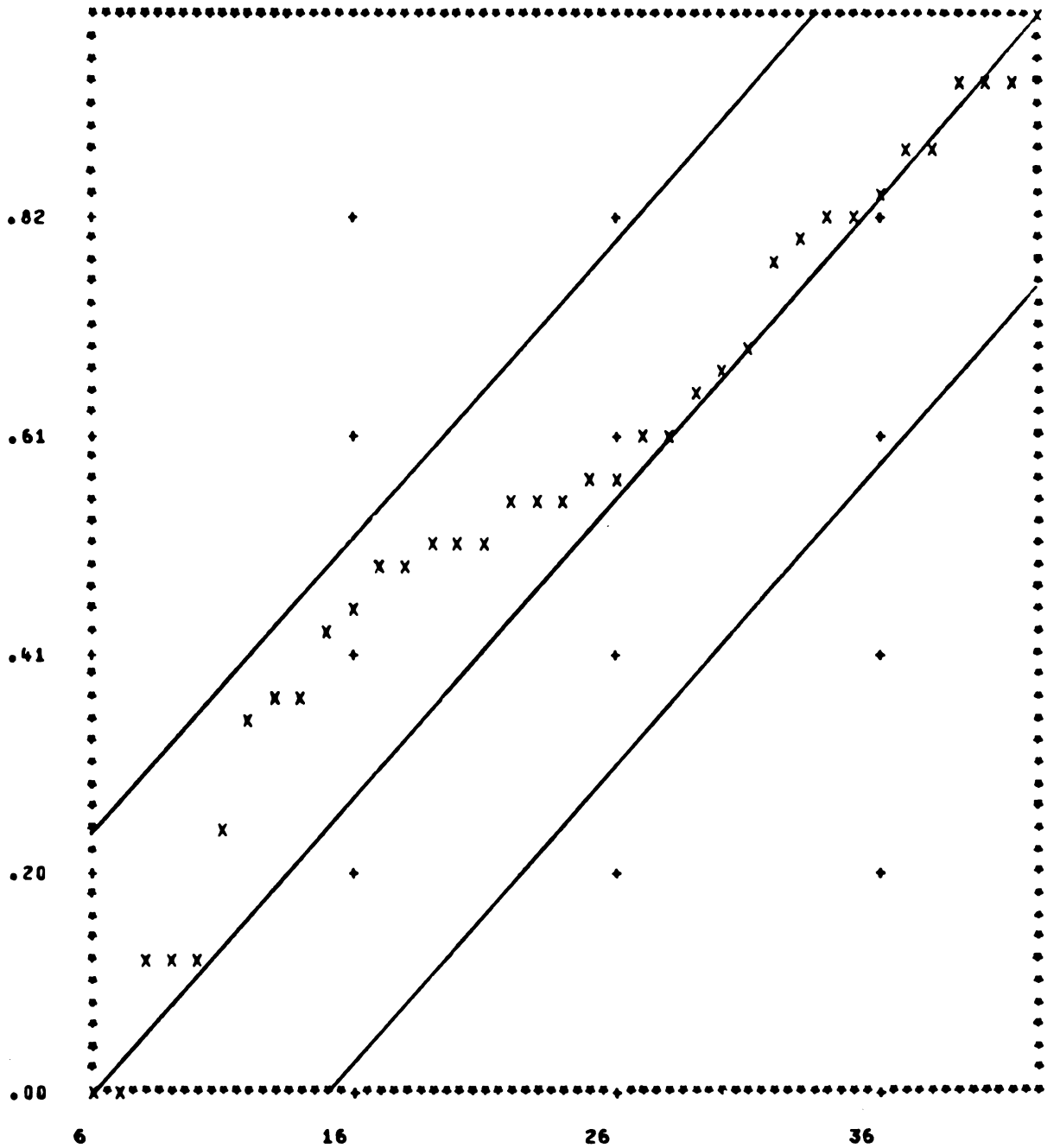

FIGURE 3

THE PRICE EQUATION FOR BELGIUM:
FORWARD CUSUM OF SQUARED RESIDUALS NORMALIZED
(1963-IV to 1974-I)

C - DENMARK

THE WAGE EQUATION

In all of our preliminary estimates of the Danish aggregate wage relation over the period 1959(I) to 1973(IV), the coefficient on the unemployment variable was either of the wrong sign or statistically insignificant. The linear specification of U thus seemed "superior" since it at least produced a coefficient with the correct sign, as shown in:

$$(D1) \quad \dot{\omega}_t = \underset{(0.81)}{0.930} - \underset{(0.06)}{0.010}U_t - \underset{(0.53)}{0.102}DU_t + \underset{(1.48)}{0.284}\dot{P}_t$$

$$+ \underset{(3.21)}{4.623}Q2 - \underset{(1.46)}{1.496}Q3 + \underset{(3.66)}{2.674}Q4 \qquad R^2 = 0.75$$

$$D.W. = 2.17$$

$$S.E.E. = 1.601$$

This equation reveals a marked seasonal pattern in wage variations, though none of the other explanatory variables are significant.

Looking at the forward CSR in Figure 4, we discover that equation (D1) displays instability, at the 10% level of significance, approximately in the middle of the sample. More precise information is provided by Quandt's LLR which attains a minimum value at observations 37 and 38. The exact causes for this instability are difficult to ascertain, but we might mention some events which could have triggered the shift. The year 1967 was characterized by continuing current account deficits and rapidly rising wages and prices, the latter partially induced by a recently-introduced value-added tax.[2] With unemployment at a relatively high level, the authorities

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[2] Cf. Ulman and Flanagan, op. cit., p. 141.

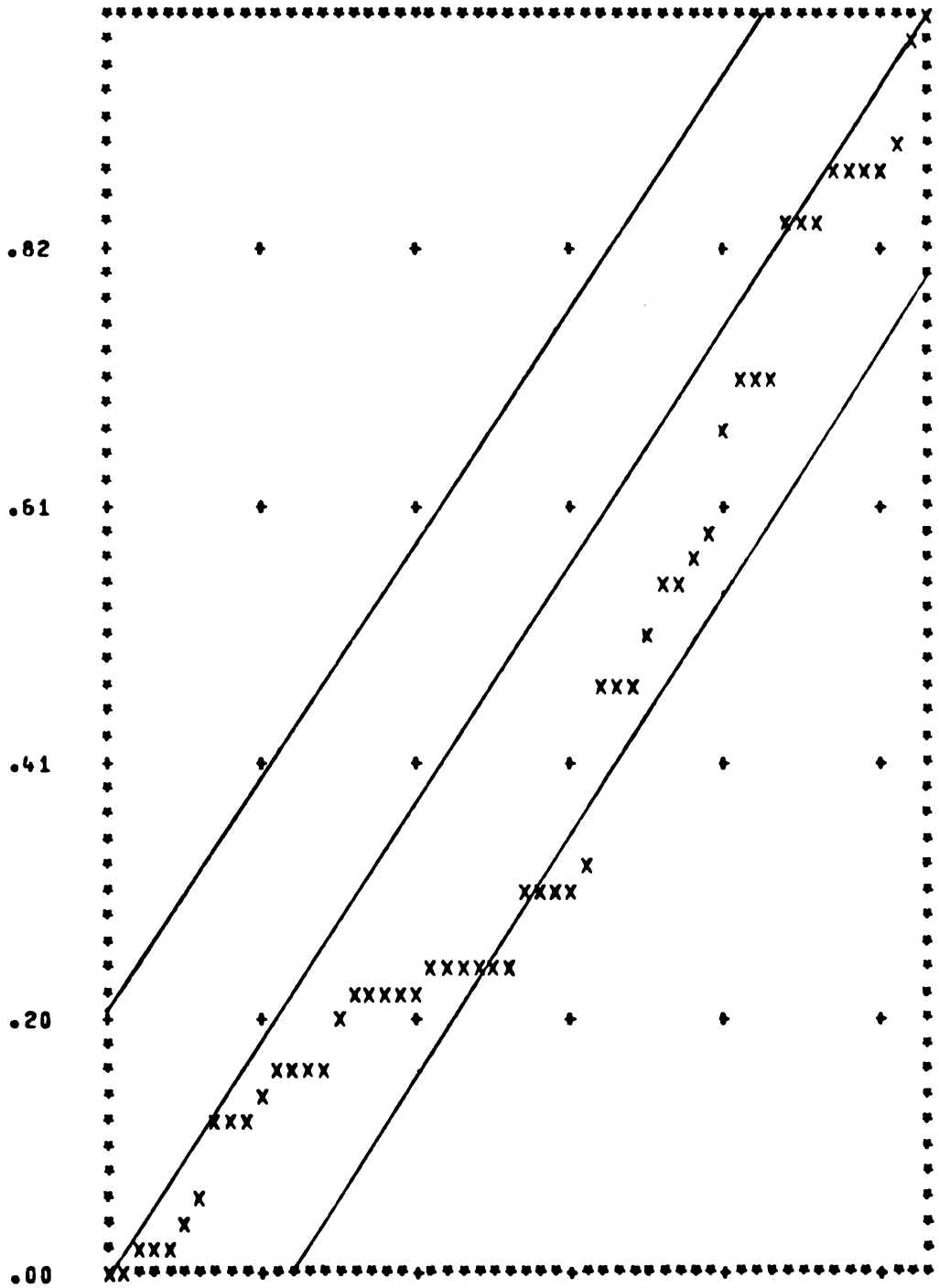

FIGURE 4

THE WAGE EQUATION FOR DENMARK:
FORWARD CUSUM OF SQUARED RESIDUALS NORMALIZED

responded to the situation by devaluing the krone in November. And, given the existence of extensive cost of living escalator clauses in most labor contracts, one of the primary issues in the upcoming election proved to be the imposition of a program of wage restraint in order to assure the effectiveness of the devaluation. However, the newly-elected conservative government was unable to obtain the support of labor groups and therefore resorted to a system of direct price controls which have been in effect virtually ever since.[3] Thus this vigorous, renewed interest in statutory restraint, along with labor's increased opposition (owing somewhat to the defeat of the labor-supported Social Democrats), could provide part of the explanation for the modification of economic behavior which is reflected in the post-1968 trade-off relationships.

With respect to the incomes policy implemented in 1963, Figure 4 provides no evidence for its effectiveness in restricting wage increases. Figure 5 though, showing the plot of the backward CSR, does reveal some instability beginning in the second quarter of 1961 (observation 10). The reasons for this phenomenon are again uncertain, but the following scenario is plausible. Faced with growing inflation and a balance of payments deficit, the authorities began to give increasing attention to statutory incomes policy as a viable policy alternative. And, in view of the British pay pause of 1961 and the publicity being given to the need for a stricter

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[3]Cf. A.R. Braun, "The Role of Incomes Policy in Industrial Countries Since World War II", International Monetary Fund Staff Papers, March 1975, especially p. 11.

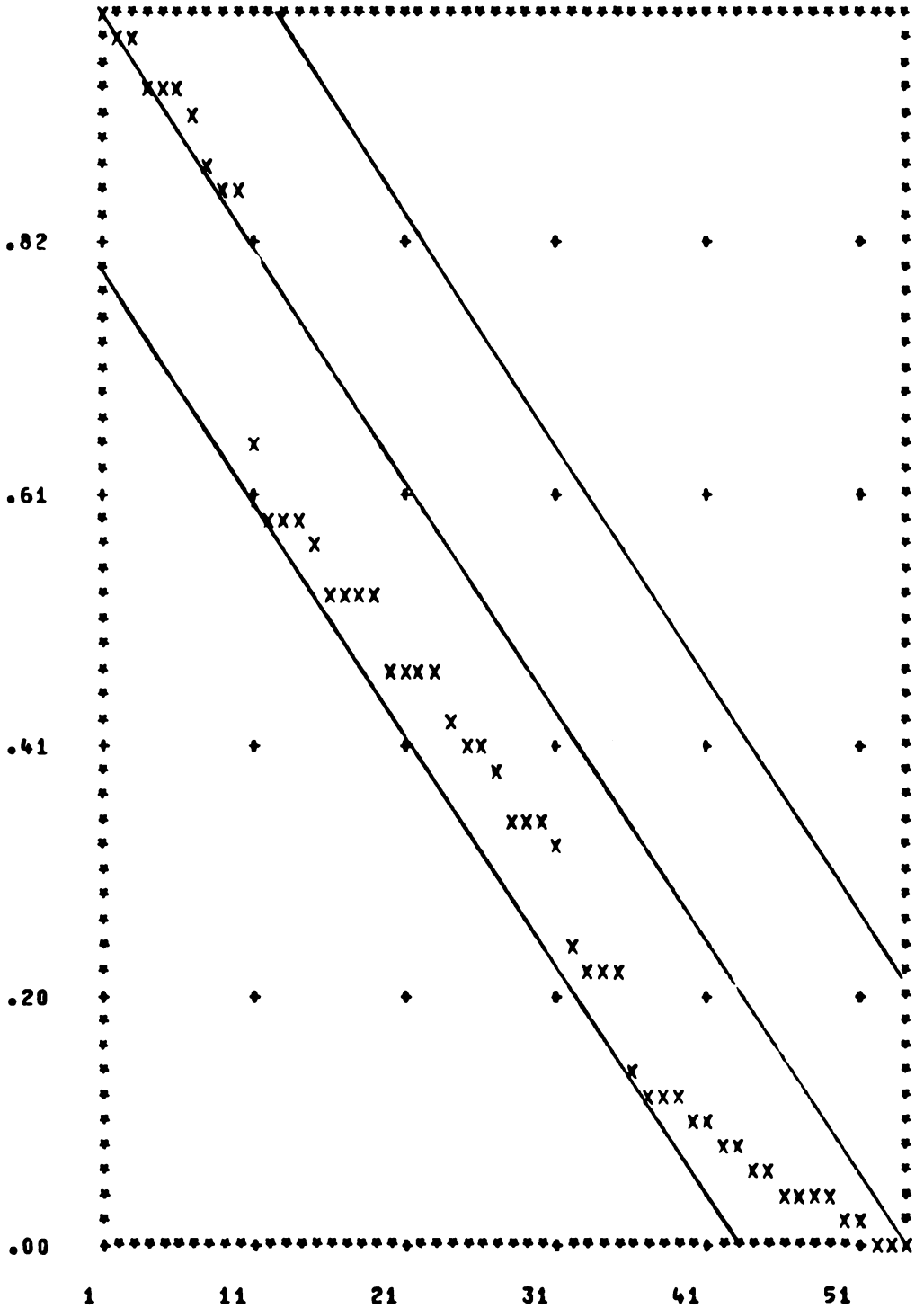

FIGURE 5

THE WAGE EQUATION FOR DENMARK:
BACKWARD CUSUM OF SQUARED RESIDUALS NORMALIZED

scheme than the U.S. guideposts, it is possible that many wage increases at the time were simply anticipating the forthcoming freeze.[4] Our conclusion that the wage equation was stable after that period, and particularly through the incomes policy phase, is reinforced by the arguments of Ulman and Flanagan that the purported effectiveness of the incomes policy was grossly over-exaggerated.[5] Wage increases were indeed lower in 1963 and 1964 than the wage explosion of 1961 but were no lower than might be expected, given current economic conditions.

Based on the stability results outlined above, we then proceeded to re-estimate the wage equation, deleting observation 10 to avoid biased R^2's and D.W. statistics.[6] For the post-1968 period, we experimented with different combinations of shift and slope dummy variables. The more significant results are reported in Table 3.

In all of the equations estimated, most of the explanatory variables are statistically significant, at least at the 10% level. The exceptions are: the current value of the percentage change in labor productivity, the dummy for the fourth quarter, and the post-1968 intercept dummy. It would thus appear that our earlier conjecture about altered economic behavior after 1968 is verified, especially by the appearance of the current and lagged values of the labor productivity variable and, more importantly, by the introduction of the lagged rate of inflation. Since 1968, Danish workers

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[4]The historical record of this period is presented in greater detail in Ulman and Flanagan, op. cit., pp. 127-136.

[5]Cf. Ulman and Flanagan, op. cit., pp. 131-134.

[6]Cf. C. Swan and H.J. Cassidy, "One-Time Dummies: Zero-One Dummy Variables Which Take On Only One Non-Zero Value", Journal of Economics and Business, Spring 1975, pp. 268-271.

TABLE 3. WAGE EQUATIONS FOR DENMARK (1959-I to 1973-IV)

Equation Number	Constant Term	Coefficients of Explanatory Variables[c,d]																
		U_t	U_t*D37	$\dot{P}_t$	$\dot{P}_{t-1}$*D37	$L\dot{P}_t$	$L\dot{P}_t$*D37	$L\dot{P}_{t-1}$*D37	Q2	Q3	Q4	D37	DU_t	$\dot{W}_{t-1}$	R^2	D.W.[b]	S.E.E.	d.f.
D2	2.795	-.136	-.042	.161	1.131		.121	.157	3.306	-2.980	.627	-.743	-.159	-.218	0.93	2.89	0.842	46
	(3.90)[a]	(1.37)	(0.21)	(1.55)	(4.41)		(3.29)	(4.80)	(3.88)	(4.17)	(1.10)	(0.70)	(1.47)	(2.54)				
D3	2.763	-.122	-.174	.155	1.001		.107	.149	3.304	-2.885	.574		-.153	-.230	0.93	2.05	0.837	47
	(3.89)	(1.26)	(2.18)	(1.50)	(5.75)		(3.46)	(4.91)	(3.89)	(4.13)	(1.02)		(1.42)	(2.74)				
D4	2.800	-.141	-.040	.156	1.131	-.007	.124	.159	3.377	-2.910	.620	-.753	-.156	-.221	0.93	2.22	0.851	45
	(3.87)	(1.37)	(0.19)	(1.46)	(4.37)	(0.24)	(3.14)	(4.74)	(3.70)	(3.72)	(1.08)	(0.76)	(1.41)	(2.53)				
D5	2.767	-.127	-.173	.150	0.999	-.006	.110	.150	3.367	-2.821	.566		-.150	-.232	0.93	2.13	0.846	46
	(3.85)	(1.27)	(2.14)	(1.42)	(5.68)	(0.21)	(3.25)	(4.84)	(3.71)	(3.68)	(1.00)		(1.37)	(2.72)				
D6	2.445	-.136	-.074	.117	1.158	-.011	.110	.157	4.490	-2.214	.656	-.[illegible]37		-.241	0.93	1.56	0.860	46
	(3.56)	(1.31)	(0.35)	(1.12)	(4.44)	(0.40)	(2.86)	(4.65)	(9.64)	(3.60)	(1.13)	(0.59)		(2.76)				
D7	2.411	-.116	-.189	.120	1.049		.094	.148	4.369	-2.253	.623			-.246	0.92	1.41	0.846	48
	(3.58)	(1.19)	(2.35)	(1.19)	(6.09)		(3.15)	(4.84)	(10.84)	(4.14)	(1.10)			(2.94)				

[a]The number in parentheses below each coefficient is its t-statistic (absolute value).

[b]The Durbin-Watson test is inappropriate in the presence of the lagged dependent variable; therefore we computed the Durbin h-statistic.

[c]The variables are as defined previously except for:

D37 = a dummy variable taking on the value of 1.0 for observations 37 to 60, 0.0 otherwise.

[d]Observation 10 was deleted in these equations, for reasons outlined in the text. The D.W. Statistic was adjusted accordingly.

have been receiving full compensation for increases in the cost of living. Moreover, we note the significant shift in the wage-unemployment relation in the post-1968 period with a slope more than twice as steep as in the past. Therefore, based on overall goodness of fit and on the significance of the coefficients, equation (D3) would seem to be our preferred aggregate wage function for Denmark.

THE PRICE EQUATION

The basic price equation, estimated over the same period as the wage function, was very poor with respect to fit and coefficient significance, as shown below:

$$(D8)\quad \dot{P}_t = \underset{(1.11)}{0.435} + \underset{(1.50)}{0.164}\dot{W}_t + \underset{(0.59)}{0.055}\dot{P}_{mt} - \underset{(1.03)}{0.035}L\dot{P}_t$$

$$+ \underset{(0.50)}{0.382}Q2 + \underset{(1.86)}{1.256}Q3 + \underset{(1.07)}{0.578}Q4 \qquad R^2 = 0.16$$

$$D.W. = 1.77$$

$$S.E.E. = 1.204$$

The stability test however, depicted by the plot of the forward CSR in Figure 6, suggests that structural instability of the relation occurred in the vicinity of observation 35. Quandt's LLR is not very helpful in this case since it cycles widely over the sample period; however, further support for observation 35 as the breaking point is provided by the backward CSR in Figure 7. Thus, it appears that the various price freezes introduced between 1963 and 1973 did not significantly alter the price relationship. A possible explanation for the break in the third quarter of 1967 (observation 35) could be the adoption of a valued-added tax scheme which resulted in a general rise in prices.[7] In addition, the looming

[7] Cf. Ulman and Flanagan, op. cit., p. 141.

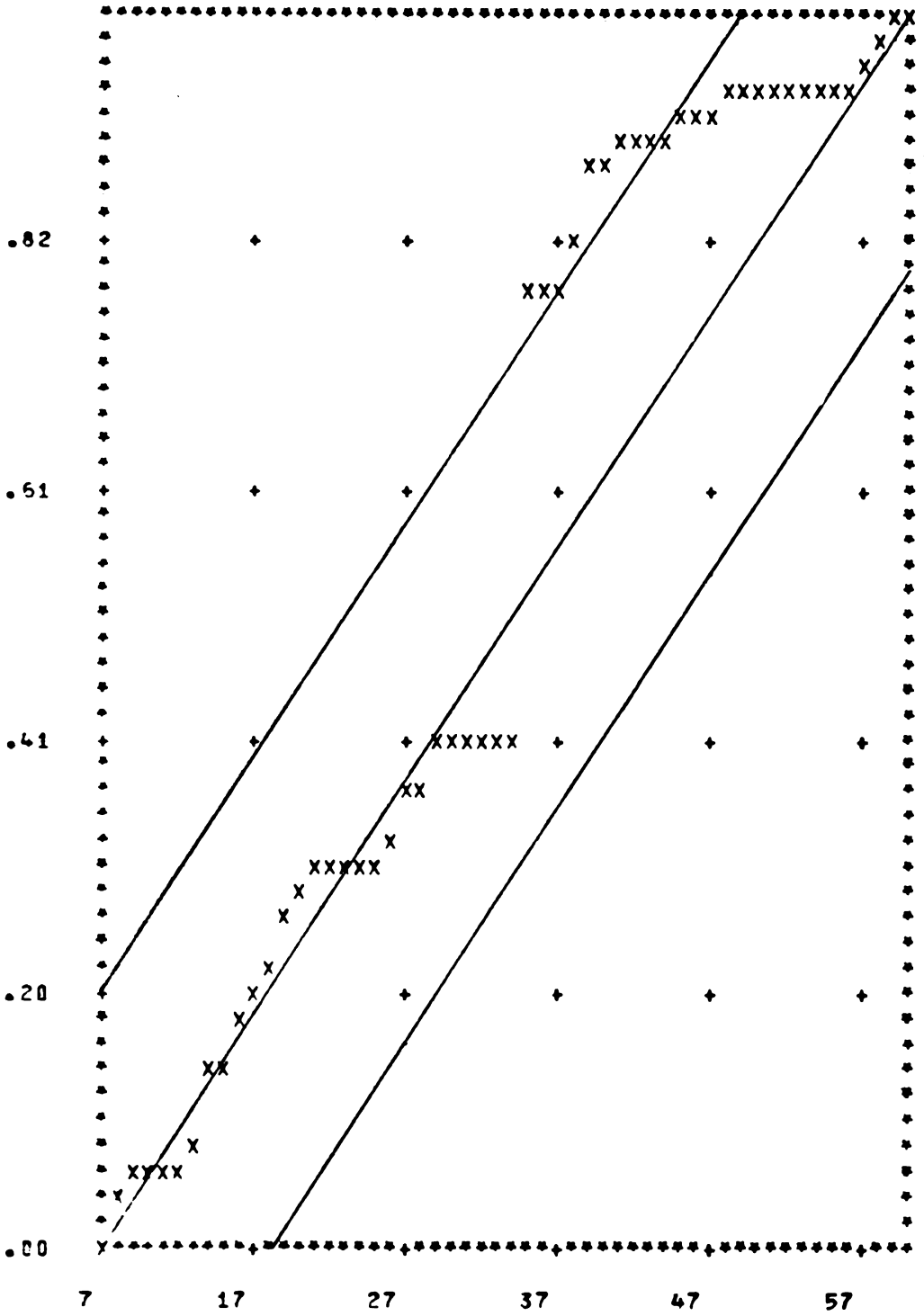

FIGURE 6
THE PRICE EQUATION FOR DENMARK:
FORWARD CUSUM OF SQUARED RESIDUALS NORMALIZED

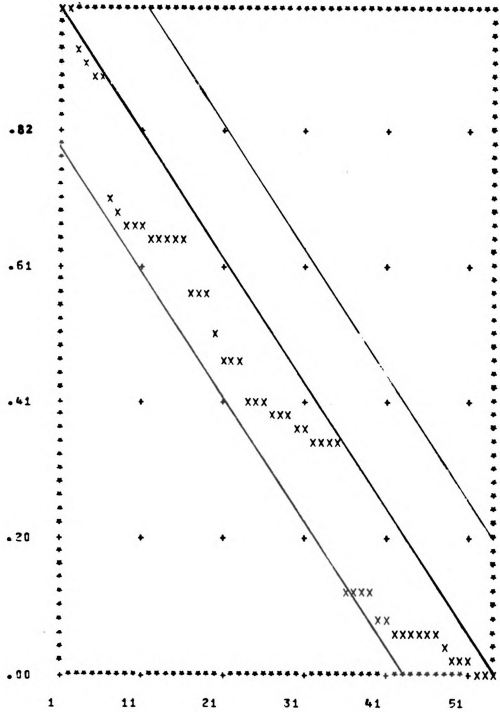

FIGURE 7

THE PRICE EQUATION FOR DENMARK:
BACKWARD CUSUM OF SQUARED RESIDUALS NORMALIZED

threat of a forthcoming program of price control (as explained above for the wage equation) could plausibly have induced some anticipatory price rises.

We therefore experimented with shift and slope dummies for the post-1967(III) period but none of these proved to be significant. Rather, simply omitting the thirty-fifth observation provided the best estimates; these results are set out in Table 4 below.[8] We note that the price equation reflects sluggish adjustment to changing circumstances with only the lagged values of $\dot{P}_m$ and $L\dot{P}$ entering significantly; both the current and lagged values of the wage variable are important. The lagged value of the dependent variable was not significant in any of the estimates. In conclusion, we decided to choose equation (D11) as that one which best represented price behavior in Denmark over this period. It provided one of the lowest standard errors of estimate and the test for serial correlation was inconclusive (based on the value of the Durbin-Watson statistic).

D - FRANCE

THE WAGE EQUATION

Our preliminary estimates of the aggregate wage equation for France, over the period 1957(V) to 1973(IV), were quite interesting in that they all produced a highly significant coefficient on the unemployment variable, but with the wrong sign. Examples with two different specifications are:

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[8] In preliminary estimates, the coefficient of a one-time dummy for quarter 35 was roughly 6.5, indicating an abnormally high $\dot{W}$ for that period. We deleted that observation above to avoid the problems spelled out by Swan and Cassidy.

TABLE 4. PRICE EQUATIONS FOR DENMARK (1959-I to 1973-IV)

Equation Number	Constant Term	Coefficients of Explanatory Variables[c,d]													
		$\dot{W}_t$	$\dot{W}_{t-1}$	$\dot{P}_{mt}$	$\dot{P}_{mt-1}$	$L\dot{P}_t$	$L\dot{P}_{t-1}$	Q2	Q3	Q4	$\dot{P}_{t-1}$	R^2	D.W.[b]	S.E.E.	d.f.
D9	-.085	0.232	0.138	-.085	0.206	-.015	-.053	-.157	0.616	1.245					
	(0.19)[a]	(2.67)	(1.55)	(1.09)	(2.36)	(0.59)	(1.91)	(0.26)	(1.01)	(2.07)		0.38	1.54	0.906	49
D10	-.195	0.223	0.117	-.106	0.213	-.020	-.048	-.006	0.686	1.173	0.118				
	(0.42)	(2.55)	(1.28)	(1.33)	(2.44)	(0.76)	(1.70)	(0.01)	(1.12)	(1.94)	(1.07)	0.39	1.63[b]	0.905	48
D11	+.053	0.192	0.123		0.182		-.048	-.107	0.369	1.221					
	(0.12)	(2.40)	(1.45)		(2.17)		(1.76)	(0.19)	(0.86)	(2.04)		0.36	1.61	0.902	51
D12	-.068	0.190	0.096		0.181	-.016	-.044	.098	0.633	1.147	0.062				
	(0.15)	(2.25)	(1.06)		(2.14)	(0.61)	(1.54)	(0.16)	(1.03)	(1.88)	(0.75)	0.37	1.64[b]	0.912	49
D13	-.005	0.202	0.115		0.181	-.013	-.048	-.029	0.588	1.204					
	(0.01)	(2.44)	(1.33)		(2.14)	(0.51)	(1.75)	(0.05)	(0.96)	(2.00)		0.36	1.60	0.908	50
D14	-.094	0.209	0.130	-.099	0.213		-.048	-.130	0.357	1.204	0.105				
	(0.21)	(2.46)	(1.45)	(1.25)	(2.44)		(1.72)	(0.22)	(0.83)	(2.00)	(0.96)	0.39	1.69[b]	0.901	49
D15	+.008	0.180	0.108		0.183		-.044	-.009	0.367	1.173	0.073				
	(0.02)	(2.19)	(1.23)		(2.17)		(1.57)	(0.01)	(0.85)	(1.94)	(0.69)	0.37	1.65[b]	0.906	50

[a]The number in parentheses below each coefficient is its t-statistic (absolute value).

[b]The Durbin-Watson test is inappropriate in the presence of the lagged dependent variable; therefore, in some equations, we computed the Durbin h-statistic.

[c]The variables are as defined previously.

[d]Observation 35 was deleted in these equations. The D.W. statistic was adjusted accordingly.

$$(F1)\quad \dot{W}_t = \underset{(0.72)}{0.375} + \underset{(3.02)}{0.686}U_t^{-1} - \underset{(0.99)}{0.925}DU_t + \underset{(3.00)}{0.393}\dot{P}_t$$

$$+ \underset{(0.22)}{0.122}Q2 + \underset{(1.68)}{0.737}Q3 + \underset{(0.40)}{0.172}Q4 \qquad R^2 = 0.27,\ D.W. = 2.11,\ S.E.E. = 1.153$$

$$(F2)\quad \dot{W}_t = \underset{(4.64)}{1.860} - \underset{(2.36)}{0.796}U_t^{-2} - \underset{(1.16)}{1.124}DU_t + \underset{(3.38)}{0.462}\dot{P}_t$$

$$+ \underset{(0.13)}{0.074}Q2 + \underset{(1.67)}{0.757}Q3 + \underset{(0.56)}{0.254}Q4 \qquad R^2 = 0.23,\ D.W. = 2.02,\ S.E.E. = 1.184$$

The stability tests for both (F1) and (F2) yielded the same results, so we will restrict our discussion to those related to the former. The plot of the forward CSR, in Figure 8, is highly irregular with a significant break appearing early in the sample, followed by a marked, erratic movement at observation 47. This latter quarter also completely dominated Quandt's LLR test. An examination of the historical record reveals that this was the third quarter of 1968, during which our wage series increased by 10.6% on a quarterly basis. This unusual rise stemmed directly from the massive civil unrest and widespread strikes of May 1968.

With respect to the earlier instability, we deduced, after examining the plots of some of the recursive coefficients, that the break could quite likely have occurred in the fourth quarter of 1963 (observation 28). The French authorities have, throughout the postwar period, avoided any overt scheme of wage restraint, but rather have relied on direct price controls as an alternative.[9] However, in the face of increasing inflation and, hoping to avoid another

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[9] Cf. Ulman and Flanagan, op. cit., pp. 147-170.

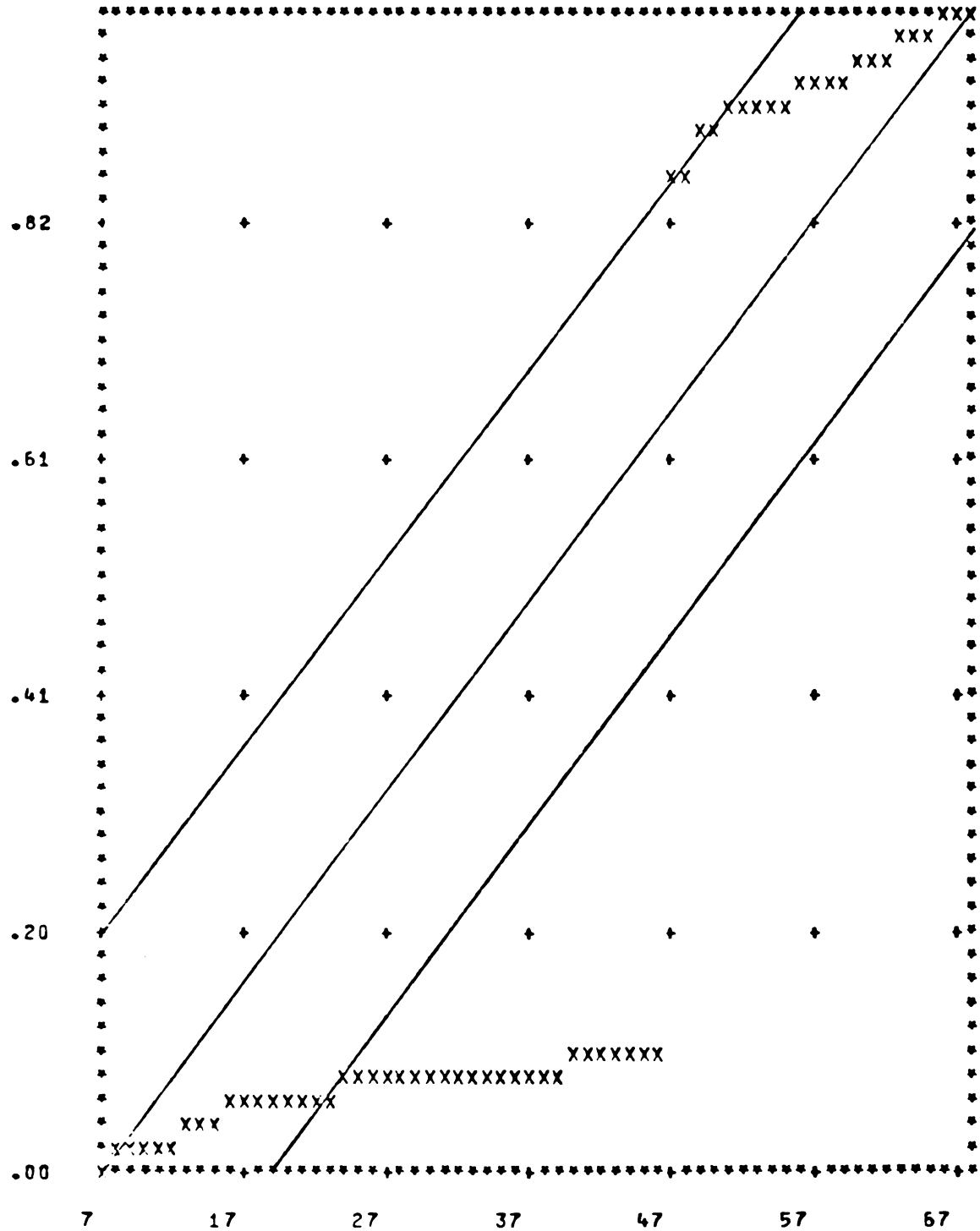

FIGURE 8

THE WAGE EQUATION FOR FRANCE:
FORWARD CUSUM OF SQUARED RESIDUALS NORMALIZED

devaluation of the franc (which had proved necessary in 1957 and 1958), policymakers began to show interest in some means of restricting the rise of incomes. Future guidelines for such increases, to be coordinated with other elements of medium-term economic planning, were established by a national Conference on Incomes which was held in the latter part of 1963. In subsequent years though, labor unions continuously refused to adhere to such guidelines.[10] It is possible, therefore, that wage movements were affected by the guideline scheme, but the duration of its effect remains open to examination.

In order to test these various hypotheses, we estimated the wage equation without the observation for 1968(III) but with an intercept dummy and various slope dummies for the post-1963 (IV) period. Table 5 reports our more significant results. The wage relation has exhibited significantly different characteristics after 1963 (IV), particularly with respect to the influence of the change in unemployment, which has gotten weaker. With respect to the impact of the unemployment variable itself, the evidence is mixed. The linear specification of U has been stable whereas the inverted and squared version has revealed some signs of becoming slightly more influential. Moreover, the intercept of the equation, reduced in 1963 (IV), has gradually been increasing in value ever since, as

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[10] Cf. D.C. Smith, Incomes Policies: Some Foreign Experiences and their Relevance for Canada, Special Study No. 4, Economic Council of Canada, Ottawa, October 1966, pp. 175-182.

TABLE 5. WAGE EQUATIONS FOR FRANCE (1957-I to 1973-IV)

Equation Number	Constant Term	Coefficients of Explanatory Variables[c,d]													$\bar{R}^2$	D.W.[b]	S.E.E.	d.f.
		U_t	U_t^{-2}	U_t^{-2}*D28	DU_t	DU_t*D28	$\dot{P}_t$	$\dot{P}_{t-1}$	$\Delta\dot{P}_t$	D28	T*D28	Q2	Q3	Q4	$\dot{W}_{t-1}$				
F3	2.530	-.883			-.827	+.711	0.148	0.201	0.012	-3.028	.082	-.076	.047	-.535	.033				
	(6.60)[a]	(3.47)			(1.58)	(1.41)	(2.29)	(3.41)	(0.54)	(6.02)	(5.99)	(037)	(0.10)	(0.7)	(0.69)	0.77	0.79[b]	0.412	54
F4	2.506	-.857			-.935	+.859	0.155	0.198		-2.975	.081	-.090	-.199	-.252	.037				
	(6.62)	(3.45)			(1.94)	(1.97)	(2.45)	(3.40)		(6.07)	(6.04)	(0.44)	(1.07)	(1.47)	(0.80)	0.76	0.63[b]	0.409	55
F5	2.175	-.682			-.930	+.735	0.160	0.219	-.001	-2.695	.073				.022				
	(7.20)	(3.09)			(2.46)	(1.75)	(2.55)	(3.97)	(0.31)	(5.89)	(5.90)				(0.47)	0.75	0.71[b]	0.410	57
F6	2.196	-.697			-.964	+.728	0.161	0.217		-2.723	.073				.019				
	(7.51)	(3.24)			(2.68)	(1.75)	(2.59)	(3.99)		(6.12)	(6.16)				(0.43)	0.75	0.64[b]	0.407	58
F7	2.234	-.705			-.979	+.749	0.164	0.220		-2.762	.074								
	(8.09)	(3.32)			(2.76)	(1.82)	(2.67)	(4.12)		(6.38)	(6.46)					0.75	1.85	0.404	59
F8	0.949		.645	.508	-.485	+.573	0.120	0.198	0.014	-3.109	.071	.055	.167	-.028	.034				
	(4.13)		(2.72)	(1.54)	(0.93)	(1.16)	(1.77)	(3.49)	(0.66)	(5.40)	(7.39)	(0.28)	(0.35)	(1.13)	(0.74)	0.79	0.80[b]	0.393	53
F9	0.983		.612	.583	-.626	+.743	0.130	0.194		-3.087	.070	.035	-.124	-.298	.039				
	(4.41)		(2.65)	(1.59)	(1.32)	(1.78)	(1.97)	(3.46)		(5.40)	(7.40)	(0.18)	(0.75)	(1.80)	(0.87)	0.79	0.56[b]	0.391	54
F10	1.005		.483	.547	-.840	+.695	0.139	0.220	-.002	-2.907	.066				.019				
	(4.78)		(2.19)	(1.48)	(2.26)	(1.70)	(2.10)	(4.11)	(0.60)	(5.13)	(7.14)				(0.43)	0.78	0.40[b]	0.395	56
F11	1.016		.504	.542	-.912	+.698	0.142	0.219		-2.948	.067								
	(5.02)		(2.34)	(1.49)	(2.60)	(1.74)	(2.20)	(4.21)		(5.32)	(7.61)					0.77	1.93	0.389	58
F12	1.028		.615	.575	-.703	+.775	0.135	0.204		-3.124	.072	.020	-.115	-.256					
	(4.75)		(2.67)	(1.57)	(1.52)	(1.87)	(2.08)	(3.70)		(5.50)	(7.64)	(0.11)	(0.70)	(1.62)		0.79	1.89	0.390	55

[a]The number in parentheses below each coefficient is its t-statistic (absolute value).

[b]The Durbin-Watson test is inappropriate in the presence of the lagged dependent variable; therefore, in some equations, we computed the Durbin h-statistic.

[c]The variables are as defined previously except for:

D28 = a dummy variable taking on the value of 1.0 for observations 28 to 68, 0.0 otherwise.
T*D28 = an interaction variable between the D28 dummy and a time trend.

[d]Observation 47 was deleted in these equations. The D.W. statistic was adjusted accordingly.

shown by the signs of the D28 and T*D28 dummies. This would seem to indicate that the incomes guidelines proposed by the Conference on Incomes had a significant dampening impact on wage increases at first, but that this impact progressively lost force. Indeed, we can compute from our coefficients that the guidelines' effect had completely vanished by the first quarter of 1968.[11] Finally, we note that the only other consistently significant variables were the current and lagged values of the rate of increase of consumer prices.

In sum, the superior equation, based on overall fit and coefficient significance, appears to be (F12); again serial correlation did not present a problem.

THE PRICE EQUATION

The basic price equation, estimated over the same period as the wage function, was as follows:

$$(F13) \quad \dot{P}_t = \underset{(2.69)}{0.855} + \underset{(3.18)}{0.332}\dot{W}_t + \underset{(2.58)}{0.119}\dot{P}_{mt} - \underset{(1.31)}{0.058}L\dot{P}_t$$

$$- \underset{(1.83)}{0.644}Q2 - \underset{(1.78)}{1.684}Q3 + \underset{(1.19)}{1.335}Q4 \qquad R^2 = 0.28, \quad D.W. = 1.26, \quad S.E.E. = 1.002$$

Though the fit of the equation is quite poor, all of the economic variables have the correct sign and are statistically significant, at least at the 10% level (except for $L\dot{P}_t$). Two of the three quarterly dummies are also significant.

Turning to the forward CSR for this equation, in Figure 9, we note only one departure from stability, namely during the third

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[11] This finding was also reported by Bodkin et al., op. cit., p. 244.

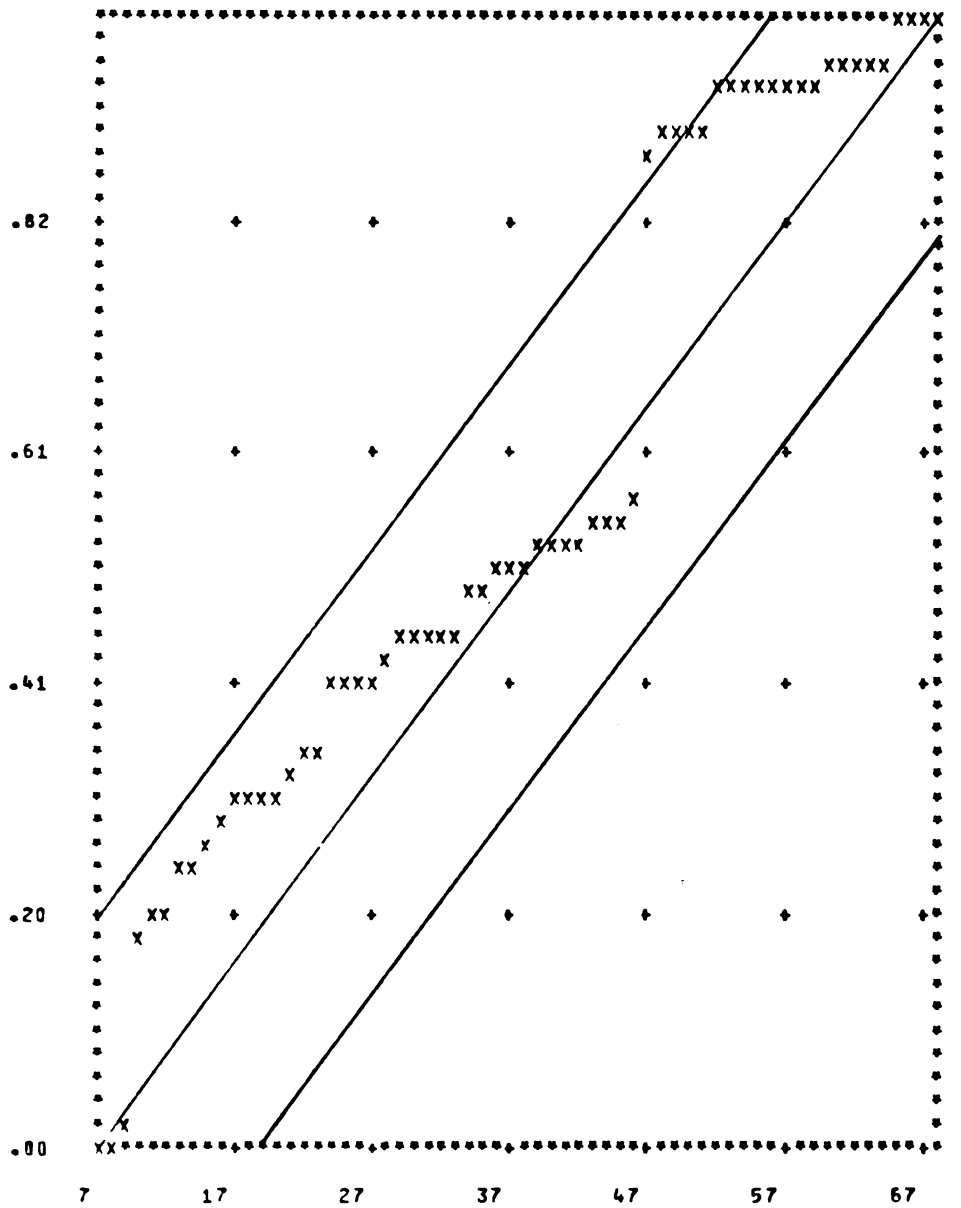

FIGURE 9

THE PRICE EQUATION FOR FRANCE:
FORWARD CUSUM OF SQUARED RESIDUALS NORMALIZED

quarter of 1968 (observation 47)[12]. Quandt's LLR also records a marked break for that period. This finding is not surprising since we noted earlier that this quarter immediately followed a period of severe social unrest. Therefore, to avoid the biases outlined above, we deleted the observation for the third quarter of 1968 in our modified price equations; these appear in Table 6.

These estimates reflect a significant improvement in explanatory power over (F13), though the coefficient of multiple correlation (R^2) is still relatively low. The important, significant variables are the rate of change of both wages and import prices. In preliminary estimates including observation 35, we found that prices rise by 3% (on a quarterly basis) less than might have been expected during that quarter, no doubt reflecting the special measures introduced at that time: the abolition of the payroll tax and the provision of subsidies to public enterprises and industrial exports.[13]

On the basis of the information provided in Table 6, we chose the retain equation (F18) for future reference. Though its R^2 is low compared to the other equations, it still provided the lowest standard error of estimate; and all of the coefficients were statistically significant.

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[12] This finding confirms the Bodkin et al. contention that the price freezes introduced by the French authorities were not significant in restraining the rate of increase of consumer prices. Cf. Bodkin et al., op. cit., p. 247.

[13] Cf. OECD, Economic Surveys: France, April 1969.

TABLE 6. PRICE EQUATIONS FOR FRANCE (1957-I to 1973-IV)

Equation Number	Constant Term	Coefficients of Explanatory Variables[c, d]											
		$\dot{W}_t$	$\dot{W}_{t-1}$	$\dot{P}_{mt}$	$L\dot{P}_t$	$L\dot{P}_{t-1}$	Q2	Q3	Q4	$\dot{P}_{t-1}$	R^2	D.W.[b]	S.E.E.	d.f.
F14	1.137	.415	.087	.096	-.038	-.045	-1.808	-2.038	-1.035	.348				
	(1.04)[a]	(2.23)	(0.82)	(2.33)	(0.94)	(1.05)	(1.70)	(1.41)	(0.53)	(2.87)	0.51	12.34[b]	0.860	57
F15	0.827	.463		.094	-.030	-.031	-1.475	-1.527	-.547	.361				
	(0.81)	(2.64)		(2.28)	(0.77)	(0.79)	(1.50)	(1.17)	(0.30)	(3.00)	0.50	5.47	0.857	58
F16	0.937	.409	.064	.097		-.037	-1.617	-1.100	-1.596	.358				
	(0.88)	(2.20)	(0.62)	(2.34)		(0.89)	(1.55)	(1.05)	(0.87)	(2.96)	0.50	8.95	0.859	58
F17	0.729	.447		.095		-.028	-1.389	-.851	-1.131	.366				
	(0.72)	(2.57)		(2.31)		(0.72)	(1.43)	(0.89)	(0.67)	(3.06)	0.50	5.23	0.854	59
F18	0.047	.432		.100			-.724	-.198	.056	.373				
	(0.13)	(2.52)		(2.50)			(2.42)	(0.64)	(0.19)	(3.14)	0.49	3.72	0.851	60

[a]The number in parentheses below each coefficient is its t-statistic (absolute value).

[b]The Durbin-Watson test is inappropriate in the presence of the lagged dependent variable and therefore; therefore we computed the Durbin h-statistic.

[c]The variables are as defined previously.

[d]Observation 47 was deleted in these equations. The D.W.-statistic was adjusted accordingly

E - GERMANY

THE WAGE EQUATION

Our preliminary research dealing with the aggregate wage equation in Germany over the period 1958 (I) to 1973 (IV) was rather discouraging. We were only able to explain a very small proportion of the variation of wage changes and many of the coefficients turned out to be statistically insignificant. We present one of our estimated equations to illustrate these findings:

$$(G1)\quad \dot{W}_t = \underset{(2.43)}{0.974} + \underset{(2.40)}{0.671}U_t^{-1} - \underset{(0.44)}{0.083}DU_t + \underset{(1.79)}{0.376}\dot{P}_t + \underset{(0.33)}{0.076}\dot{P}_{t-1} + \underset{(0.18)}{0.004}L\dot{P}_t$$

$$R^2 = 0.15$$
$$D.W. = 1.81$$
$$S.E.E. = 1.132$$

The unemployment rate was most significant when entered in a simple inverted fashion. The only other explanatory variable which proved significant was the rate of increase of consumer prices, but with a remarkably small coefficient. No seasonal pattern in wage changes could be detected.

Such unsatisfactory results tend to support the hypothesis that some other important (and perhaps non-economic) factors are likely to have been central to postwar wage negotiations in Germany. As discussed in the previous chapter, Bodkin et al. obtained very poor results until they introduced a time trend and a dummy variable into their wage function to permit the constant term to shift upwards over time.[14] Some writers, such as Hoffman and Boelart, have even reported that no meaningful Phillips curve could be estimated

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[14] Cf. Bodkin et al., op. cit., p. 249.

over the powtwar period.[15] Ulman and Flanagan, however, propose that wages are negotiated under a system of bilateral monopoly such that "wages appear to have increased more rapidly than one would have predicted on the basis of past relations between wage inflation, price inflation, and the unemployment rate".[16]

To shed additional light on these questions, we begin by examining the forward CSR, in Figure 10, which reveals that wage equation (G1) was not significantly unstable over the sample period. This conflicts directly with the Bodkin et al. findings referred to above. However, the plot in Figure 10 does disclose erratic movements and breaks at some isolated points; these are even more evident in the backward CSR in Figure 11. The jump at point 33 is interesting since it corresponds to the beginning of 1966, the year following the creation of the Council of Economic Advisers (CEA) which subsequently published wage norms and advocated restraint in wage negotiations. We will experiment with both shift and slope dummies to determine whether the guidelines of the CEA had any impact on the wage function in the post-1966 period. We also delete from our estimates those quarters judged to be abnormal, based on Figures 10 and 11. Our major findings are set forth in Table 7.

We first note that the intercept dummy for the post-1966 period is significant and indicates that wage increases have indeed been dampened since the introduction of the CEA's guidelines. The slope dummies for this period are also significant for the change in

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[15]Cf. Hoffman, op. cit., and R. Boelart, "The Phillips Relationship in West Germany: Some Comments on the Study by Enke and Maneval", Jahrbücher Für Nationalökonomie Und Statistik, December 1971, pp. 149-152.

[16]Cf. Ulman and Flanagan, op. cit., pp. 171-199.

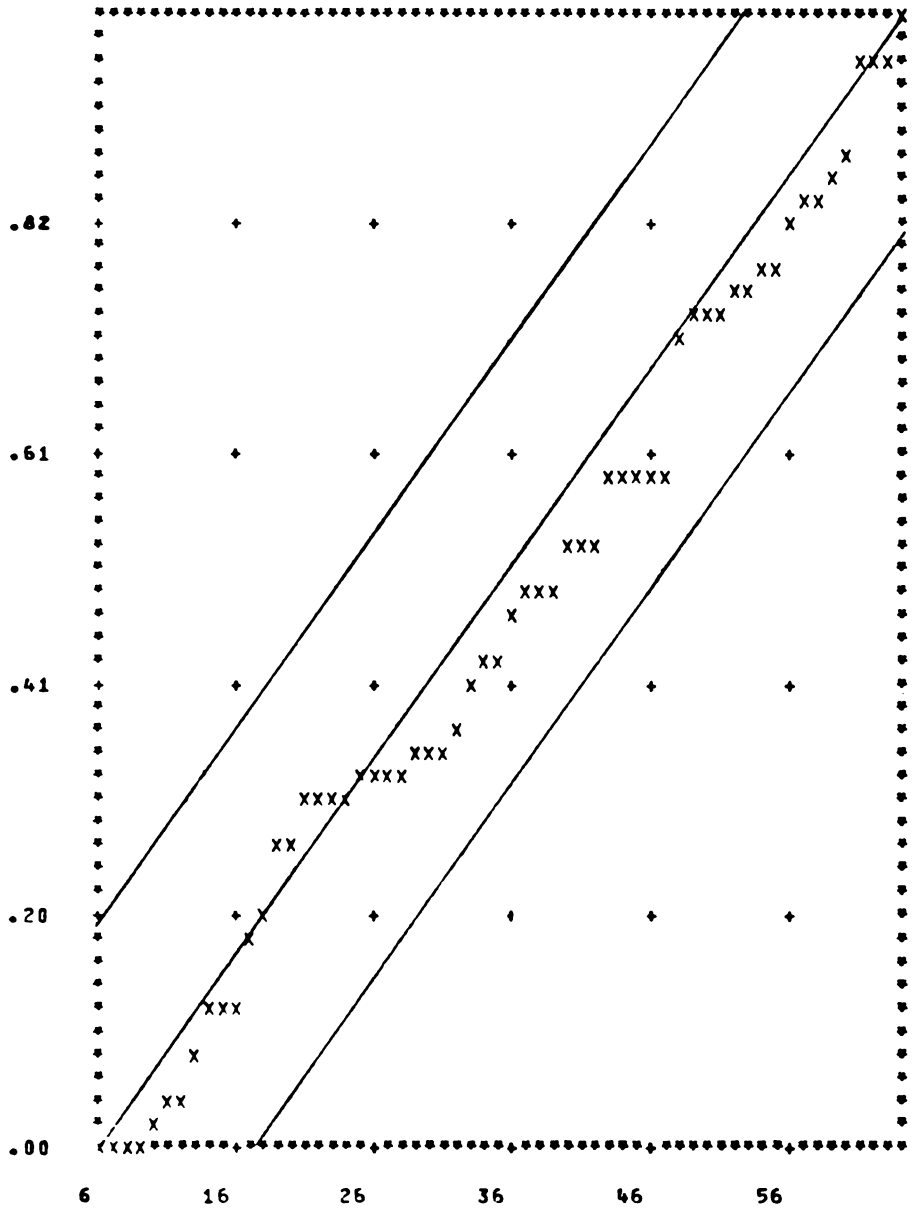

FIGURE 10

THE WAGE EQUATION FOR GERMANY:
FORWARD CUSUM OF SQUARED RESIDUALS NORMALIZED

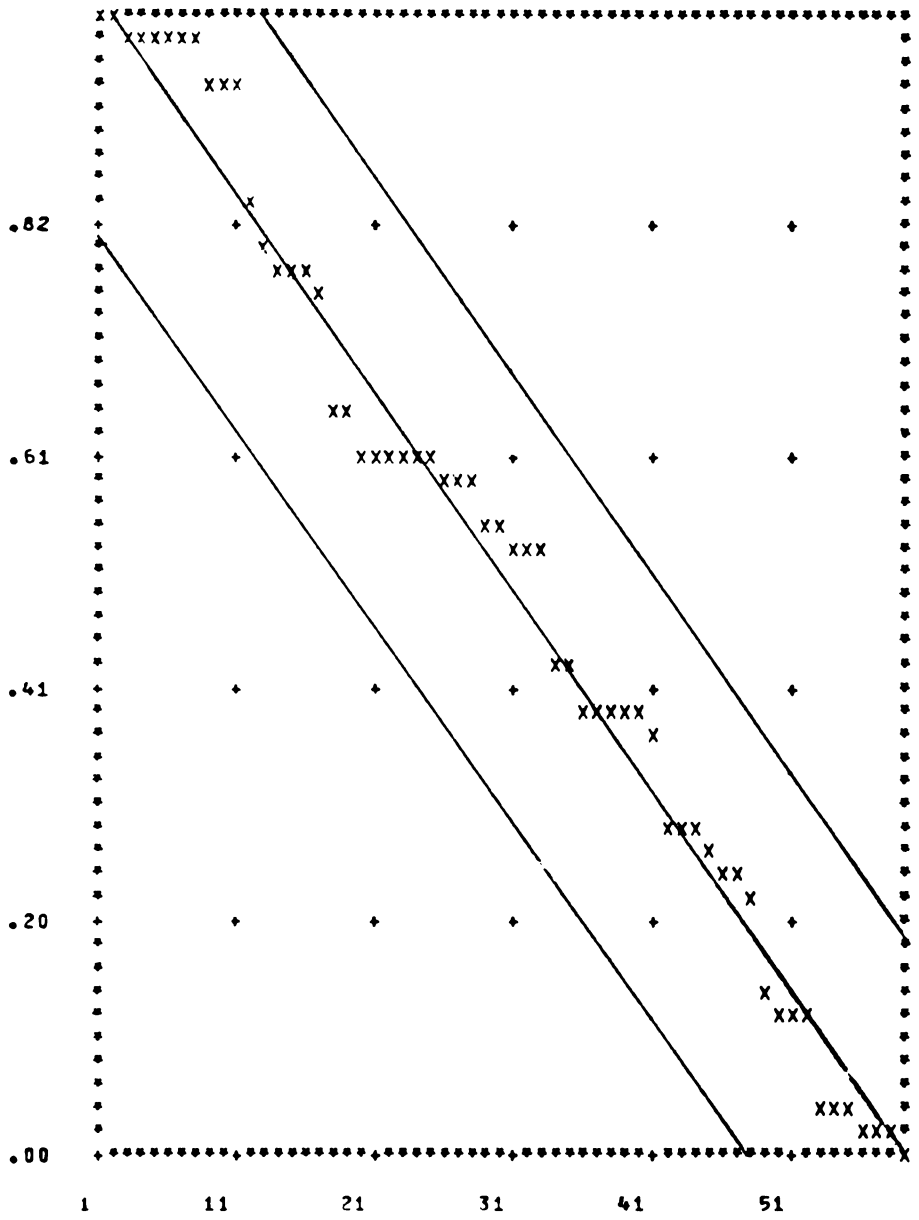

FIGURE 11

THE WAGE EQUATION FOR GERMANY:
BACKWARD CUSUM OF SQUARED RESIDUALS NORMALIZED

TABLE 7. WAGE EQUATIONS FOR GERMANY (1958-I to 1973-IV)

Equation Number	Constant Term	Coefficients of Explanatory Variables[b,d]											
		U_t^{-1}	U_t^{-1}*D33	DU_t*D33	$\dot{P}_t$	$\dot{P}_{t-1}$	$L\dot{P}_t$	$L\dot{P}_{t-1}$*D33	D33	R^2	D.W.[c]	S.E.E.	d.f.
G2	1.252	.347	.794	-.610	.401		.035	.053	-1.292				
	(4.02)[a]	(1.61)	(2.22)	(2.28)	(2.69)		(1.87)	(2.15)	(2.80)	0.42	2.22	0.746	49
G3	0.965	.610		-.652	.374		.028	.050	-.377				
	(3.28)	(3.25)		(2.35)	(2.43)		(1.47)	(1.97)	(1.74)	0.36	2.01	0.775	50
G4	1.346	.165	.720	-.490	.409	.297			-1.261				
	(4.41)	(0.75)	(2.04)	(1.72)	(2.72)	(1.78)			(2.73)	0.40	2.70	0.752	50
G5	1.050	.428		-.538	.382	.295			-.431				
	(3.80)	(2.31)		(1.84)	(2.47)	(1.72)			(1.92)	0.35	2.47	0.775	51
G6	0.947	.483		-.403	.300	.358	.028	.058	-.527				
	(3.33)	(2.52)		(1.37)	(1.96)	(2.11)	(1.53)	(2.35)	(2.39)	0.42	2.14	0.749	49
G7	1.232	.223	.787	-.364	.328	.355	.035	.061	-1.433				
	(4.11)	(1.03)	(2.29)	(1.29)	(2.22)	(2.18)	(1.96)	(2.55)	(3.19)	0.47	2.38	0.719	48

[a]The number in parentheses below each coefficient is its t-statistic (absolute value).

[b]The variables are as defined previously except for:

D33 = a dummy variable taking on the value of 1.0 for quarters 33 to 64, 0.0 otherwise.

[c]The Durbin-Watson statistic was adjusted for the missing observations.

[d]Observations 11, 17, 28, 43, 48, 52, 61 were deleted in these equations.

unemployment and the lagged value of the labor productivity variable. With respect to the unemployment variable itself, the evidence is mixed. The slope dummy on U^{-1} became highly significant only after we removed those quarters in which we found erratic movements in the wage variable. However, the regular unemployment variable now lost significance, which may partly explain the earlier findings of Hoffman and Boelart for the pre-1966 period. Both the current and lagged values of the rate of price inflation are important explanatory variables and their sum suggests that German workers have received roughly 70% compensation for increases in the cost of living. We also note that none of the equations exhibit significant serial correlation.

Thus we will retain equation (G7) for the subsequent analysis, though with important reservations. As our results suggest, wages in Germany have displayed several unexpected and autonomous upward movements which reduce the usefulness of any Phillips-type analysis for forecasting purposes.

THE PRICE EQUATION

The preliminary price function for Germany, over the period 1958 (I) to 1973 (IV) was estimated to be:

$$(G8) \qquad \dot{P}_t = \underset{(4.24)}{0.892} + \underset{(2.37)}{0.143}\dot{W}_t + \underset{(3.31)}{0.156}\dot{P}_{mt} - \underset{(1.01)}{0.034}L\dot{P}_t$$

$$- \underset{(0.35)}{0.128}Q2 - \underset{(3.99)}{1.034}Q3 - \underset{(0.39)}{0.194}Q4 \qquad R^2 = 0.46$$

$$D.W. = 1.38$$

$$S.E.E. = 0.558$$

Figure 12 below shows the plot of the forward CSR and reveals that equation (G8) displayed instability beginning between observations

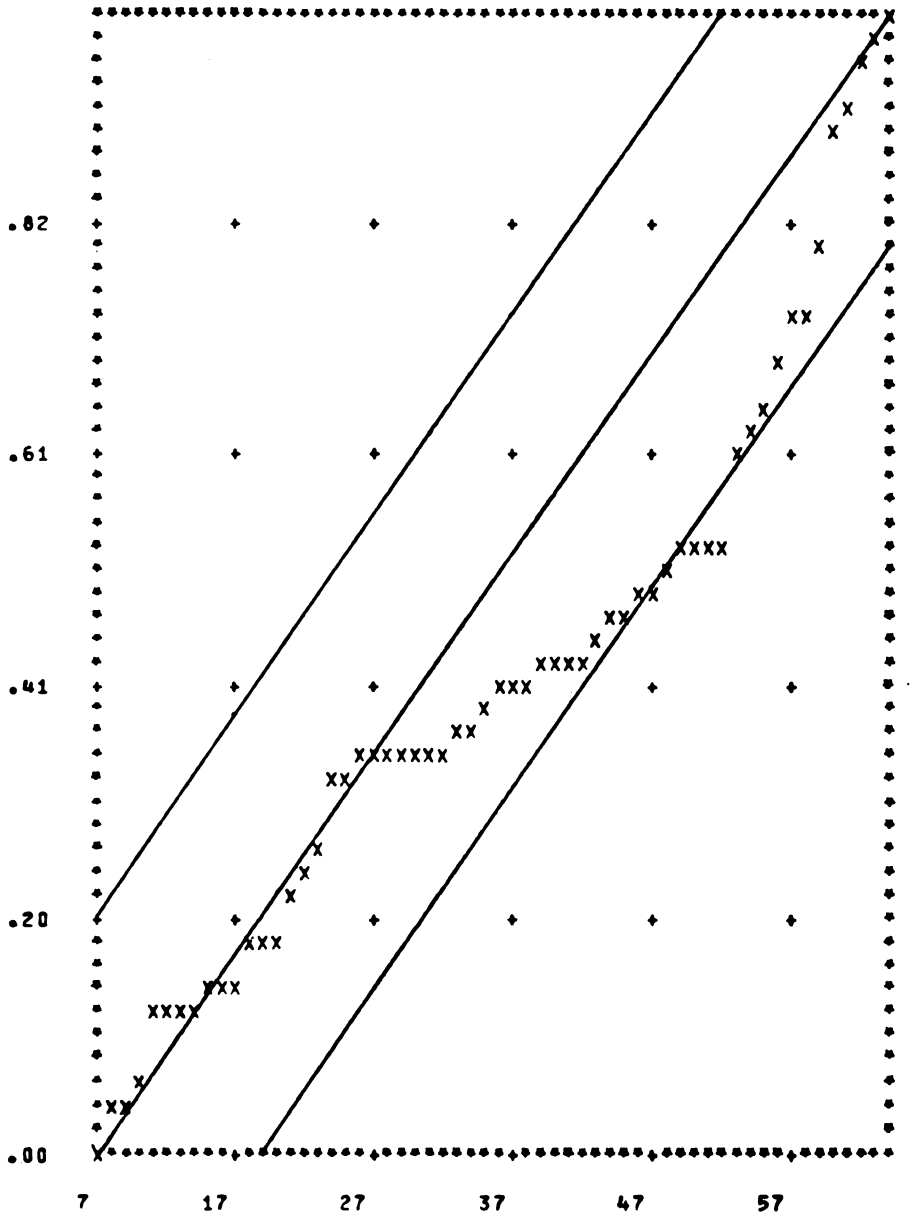

FIGURE 12

THE PRICE EQUATION FOR GERMANY:
FORWARD CUSUM OF SQUARED RESIDUALS NORMALIZED

47 and 53. Quandt's LLR supports observation 52 as the likely point of rupture. We could not find any obvious explanation for this phenomenon but can only note that it roughly corresponds to the recent period of turmoil in the international monetary system and the simultaneous surge of world-wide inflation. To determine the effect of this factor, we re-estimated the price equation with different combinations of shift and slope dummies for the period following the fourth quarter of 1970 (observation 52). The more pertinent of these results are outlined in Table 8.

It is apparent that the period after the fourth quarter of 1970 has indeed witnessed an upward shift in the intercept of the price function. Consumer prices have been rising by eight-tenths of a percentage point (on a quarterly basis) more than previously would have been the case, given the values of the explanatory variables in the equation. Also noteworthy is the fact that wages and import prices have only had a moderate impact on prices. In addition, no significant lagged effects were uncovered, indicating that prices adjust quickly (though only partially) to changing circumstances. Overall then, equation (G13) seems to best represent the determination of consumer prices in the German economy. Again we could not reject the null hypothesis of serially uncorrelated residuals.

F - IRELAND

THE WAGE EQUATION

In our estimates of the aggregate wage function for the Irish economy, for the period 1956 (I) to 1974 (I), none of the specifications of the unemployment variable proved statistically significant. The linear version of U, however, displayed the

TABLE 8. PRICE EQUATIONS FOR GERMANY (1958-I to 1973-IV)

Equation Number	Constant Term	Coefficients of Explanatory Variables[c]													R^2	D.W.[b]	S.E.E.	d.f.
		$\dot{W}_t$	$\dot{W}_t$*D52	$\dot{P}_{mt}$	$\dot{P}_{mt}$*D52	$\dot{P}_{mt-1}$	$\dot{P}_{mt-1}$*D52	$L\dot{P}_t$	$L\dot{P}_{t-1}$	D52	Q2	Q3	Q4	$\dot{P}_{t-1}$				
G9	1.089	0.150	-.145	0.109	0.039	-.057	0.111	-.044	-.030	1.208	-.442	-1.310	-.768	-.067				
	(2.97)[a]	(2.53	(1.10)	(1.91)	(0.49)	(1.13)	(1.03)	(1.49)	(0.97)	(3.29)	(0.95)	(4.87)	(1.18)	(0.48)	0.69	-	0.450	50
G10	1.066	0.142	-.140	0.106			0.060	-.042	-.026	1.148	-.497	-1.324	-.674					
	(3.08)	(2.51)	(1.08)	(2.65)			(0.62)	(1.49)	(0.87)	(3.43)	(1.09)	(5.12)	(1.13)		0.67	2.17	0.448	53
G11	1.034	0.143	-.138	0.102	0.046	-.058	0.097	-.047	-.027	1.141	-.427	-1.328	-.661					
	(2.99)	(2.50)	(1.06)	(1.87)	(0.59)	(1.17)	(0.94)	(1.59)	(0.90)	(3.38)	(0.92)	(5.02)	(1.09)		0.69	2.13	0.447	51
G12	1.167	0.108		0.078	0.074		0.048	-.053	-.036	0.807	-.482	-1.375	-.643					
	(3.55)	(2.18)		(1.55)	(0.99)		(0.50)	(1.85)	(1.26)	(5.54)	(1.04)	(5.23)	(1.07)		0.67	2.13	0.449	53
G13	0.825	0.105		0.105				-.039		0.825	-.105	-1.135	-.183					
	(4.88)	(2.16)		(2.69)				(1.45)		(5.72)	(0.36)	(5.44)	(0.45)		0.66	2.13	0.447	56

[a] The number in parentheses below each coefficient is its t-statistic (absolute value).

[b] The Durbin-Watson test is inappropriate in the presence of the lagged dependent variable. For (G9), the computation of the Durbin h-statistic was impossible.

[c] The variables are as defined previously except for:

D52 = a dummy variable taking on the value of 1.0 for quarters 52 to 64, 0.0 otherwise.

highest t-value and thus was employed in subsequent estimations. The basic results were:

$$(IR1)\quad \dot{W}_t = \underset{(1.23)}{1.926} - \underset{(0.96)}{0.180U_t} + \underset{(0.15)}{0.059DU_t} + \underset{(3.45)}{0.590\dot{P}_t}$$

$$+ \underset{(1.39)}{1.604Q2} + \underset{(0.31)}{0.355Q3} + \underset{(1.76)}{1.236Q4} \qquad R^2 = 0.27,\ D.W. = 1.72,\ S.E.E. = 1.729$$

The temporal stability of equation (IR1) was then scrutined through the use of both the forward and backward CSR's, in Figures 13 and 14, respectively. Both plots reveal significant departures from constancy, at the 10% level, in the vicinity of observations 31-35. In addition, the backward plot exhibits a sharp, though non-significant, break at observation 24, suggesting that a one-period erratic movement might have occurred. The forward plot indicates such short-lived phenomena at observations 59 and 70. Quandt's LLR test suggests that the most likely point of instability was in the vicinity of the earliest quarter mentioned above (24), namely the fourth quarter of 1961. It also behaves erratically after point 59 and a scanning of the plots of the recursive coefficients discloses that some of these were indeed subject to marked changes beginning roughly in the first quarter of 1971 (observation 61). These various hypotheses were tested in our subsequent estimates with dummy variables similar to those employed previously; we also deleted those observations where $\dot{W}$ was erratic. Our findings are presented in Table 9.

One of the more important results is that the coefficient on the unemployment variable has not significantly changed over the sample period. However, the intercept has shifted upwards since 1971, indicating that wage increases have averaged roughly one

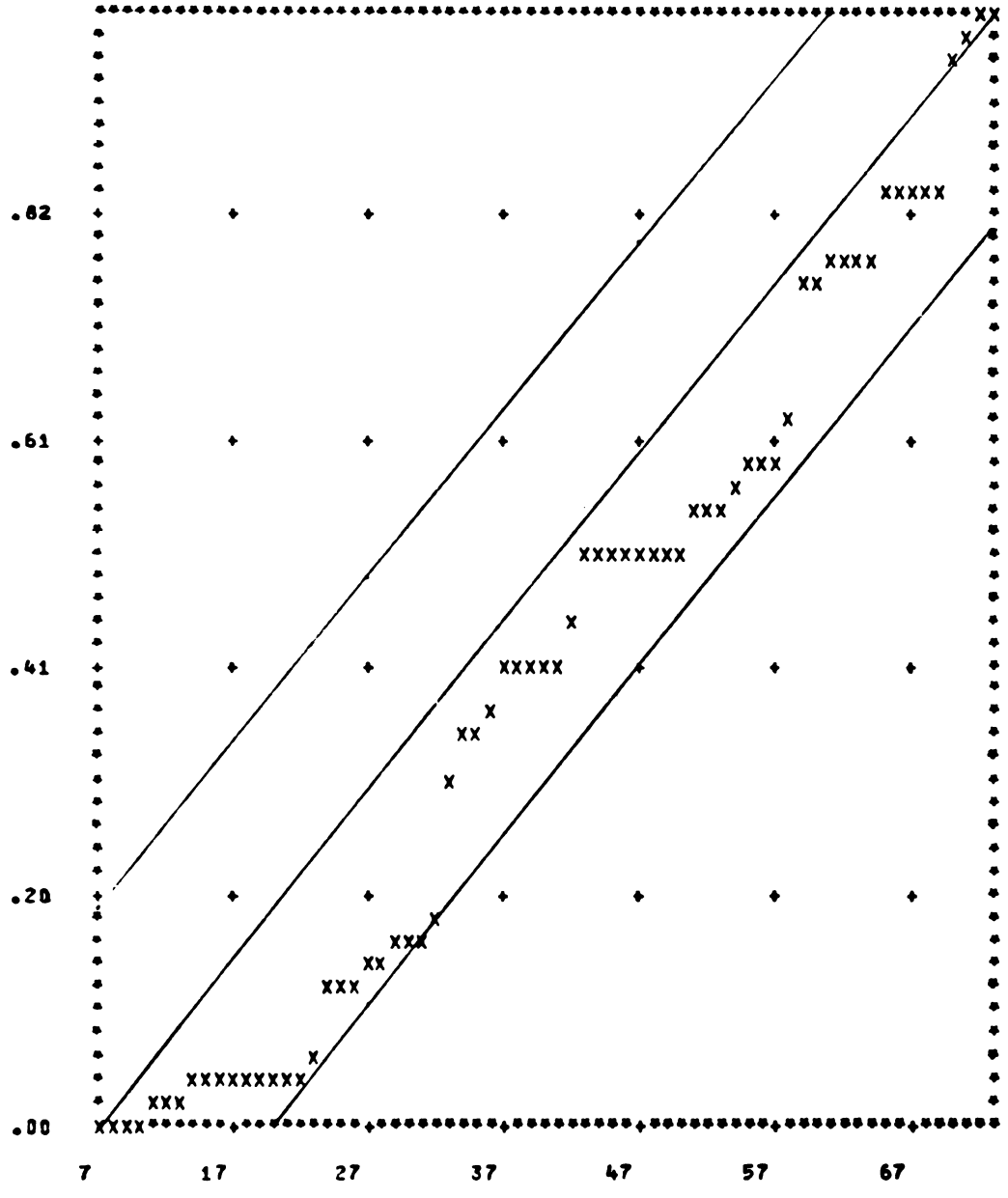

FIGURE 13

THE WAGE EQUATION FOR IRELAND:
FORWARD CUSUM OF SQUARED RESIDUALS NORMALIZED

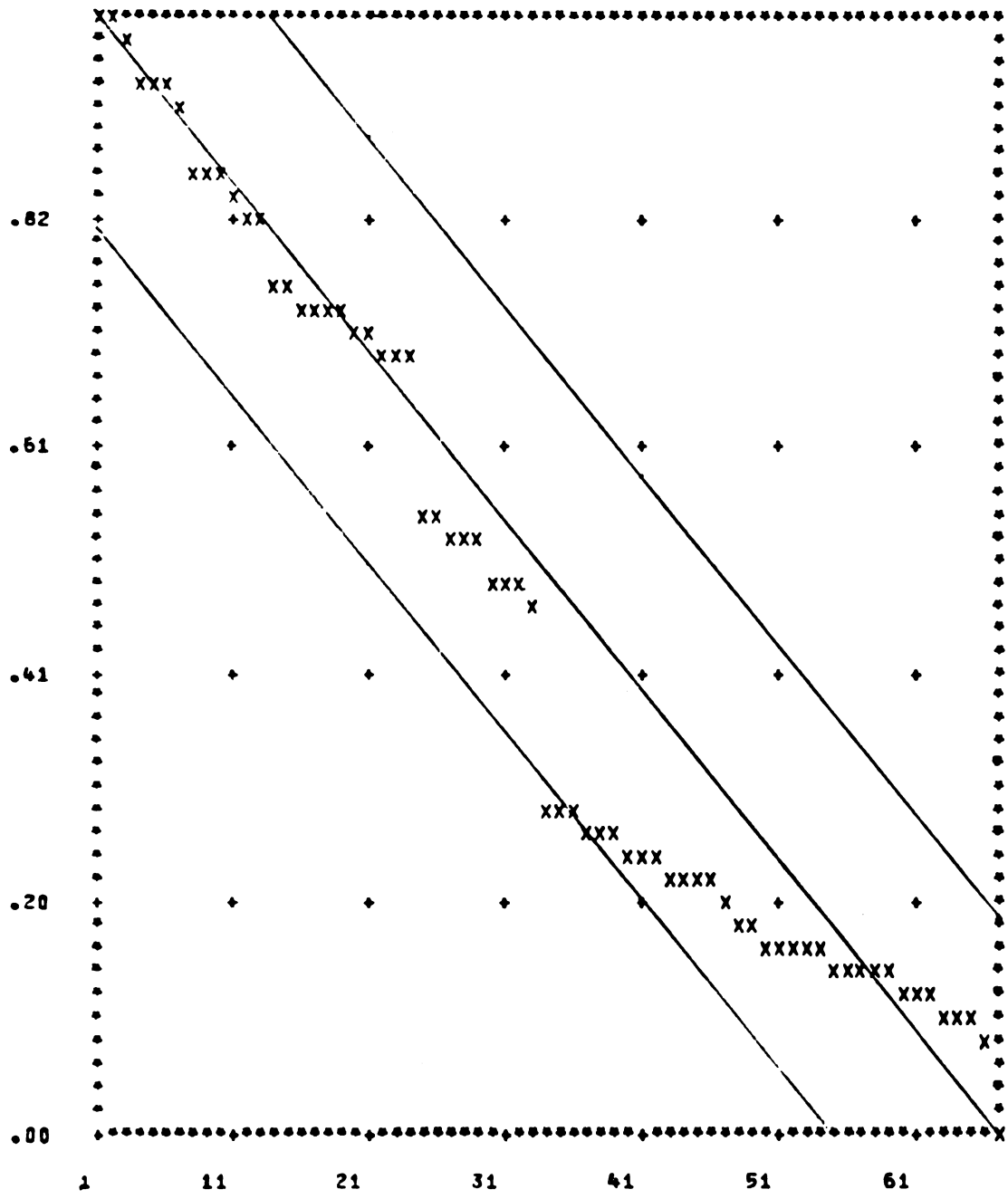

FIGURE 14

THE WAGE EQUATION FOR IRELAND:
BACKWARD CUSUM OF SQUARED RESIDUALS NORMALIZED

TABLE 9. WAGE EQUATIONS FOR IRELAND (1956-I to 1974-I)

Equation Number	Constant Term	Coefficients of Explanatory Variables[b,d]													
		U_t	U_t*D61	$\dot{P}_t$	$L\dot{P}_t$	$L\dot{P}_{t-1}$*D61	D61	T^{-1}*D61	Q2	Q3	Q4	$\dot{W}_{t-1}$	R^2	D.W.[c]	S.E.E.	d.f.
IR2	0.868	-.122	+.622	0.223	0.016	0.201	-3.806		2.061	0.029	1.628	0.223				
	(0.81)[a]	(0.93)	(1.05)	(1.60)	(0.37)	(3.12)	(0.85)		(2.84)	(0.06)	(3.15)	(2.54)	0.58	2.75[c]	1.108	58
IR3	1.857	-.195	+.554	0.345	0.033	0.177	-3.000		1.506	0.174	1.221					
	(1.79)	(1.46)	(0.90)	(2.53)	(0.72)	(2.65)	(0.65)		(2.08)	(0.38)	(2.37)		0.54	1.37	1.158	59
IR4	0.816	-.108		0.213	0.013	0.194	0.853		2.088	-.032	1.577	0.218				
	(0.76)	(0.83)		(1.53)	(0.30)	(3.03)	(1.93)		(2.87)	(0.07)	(3.06)	(2.49)	0.57	2.82[c]	1.108	59
IR5	1.794	-.181		0.334	0.030	0.171	1.146		1.539	0.118	1.182					
	(1.73)	(1.37)		(2.47)	(0.66)	(2.58)	(2.58)		(2.13)	(0.26)	(2.31)		0.53	1.36	1.156	60
IR6	0.873	-.117	+.234	0.208	0.014	0.196		-57.623	2.094	-.018	1.586	0.218				
	(0.81)	(0.88)	(0.49)	(1.49)	(0.31)	(3.03)		(0.24)	(2.86)	(0.04)	(3.06)	(2.48)	0.58	2.85[c]	1.114	58
IR7	1.839	-.189	+.219	0.332	0.031	0.173		-30.842	1.538	0.133	1.193					
	(1.76)	(1.41)	(0.44)	(2.45)	(0.67)	(2.58)		(0.13)	(2.12)	(0.29)	(2.32)		0.53	1.36	1.161	59
IR8	0.814	-.108		0.216	0.014	0.193		57.399	2.076	-.027	1.577	0.218				
	(0.77)	(0.83)		(1.57)	(0.31)	(3.01)		(1.98)	(2.86)	(0.06)	(3.07)	(2.49)	0.58	2.79[c]	1.107	59
IR9	1.782	-.181		0.339	0.031	0.170		76.449	1.524	0.125	1.185					
	(1.73)	(1.37)		(2.53)	(0.67)	(2.57)		(2.63)	(2.11)	(0.28)	(2.32)		0.53	1.37	1.154	60

[a]The number in parentheses below each coefficient is its t-statistic (absolute value).

[b]The variables are defined as previously except for:

D61 = a dummy variable taking on the value of 1.0 for quarters 61 to 73, 0.0 otherwise.

T^{-1}*D61 = the inverse of the time trend multiplied by dummy D61.

[c]The Durbin-Watson test is inappropriate in the presence of the lagged dependent variable; therefore, in some equations, we computed the Durbin h-statistic.

[d]Observations 24, 33, 59, 70 were deleted in these equations. The D.W. Statistic was adjusted accordingly.

percent per quarter in excess of what they would have been prior to 1971, other things equal. The lagged value of the productivity variable has had a significant positive influence on wages, but only for the latter part of the sample. A marked seasonal pattern is also detected, with wages rising more rapidly in the second and fourth quarters. Some preliminary estimates confirmed the one-period erratic movememts. This suggests that wages in Ireland have, at times, risen by much more than could be explained by the economic factors examined here. The sharp increase in the third quarter of 1970 (observation 59) could be attributed to fears that an incomes policy might be imposed. And, in fact, some form of wage restraint was incorporated into the First National Wage Agreement of December 21, 1970.[17] However, no obvious explanations could be found for the other autonomous increases.

The two intercept dummies for the post-1971 period are equally significant; one reflects a constant upward shift in the wage function (D61) while the other depicts a more pronounced, but gradually self-reversing, outward movement (T^{-1}*D61). The equation with the former specification (IR4) will be retained, only because a constant relation is preferably for our present purposes.

THE PRICE EQUATION

In our preliminary work on the Irish price function, for the same sample period as above, the superior specification turned out to be:

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[17] Cf. D. Robinson, Incomes Policy and Capital Sharing in Europe, Harper and Row, Inc., New York, 1973, pp. 33-37.

$$(IR10)\quad \dot{P}_t = \underset{(1.19)}{2.540} + \underset{(1.37)}{0.089}\dot{W}_t + \underset{(4.04)}{0.247}\dot{W}_{t-1} + \underset{(4.50)}{0.185}\dot{P}_{mt}$$

$$- \underset{(1.49)}{0.044}L\dot{P}_t + \underset{(3.47)}{1.337}Q2 - \underset{(2.45)}{0.786}Q3 \qquad R^2 = 0.52$$

$$D.W. = 1.93$$

$$S.E.E. = 0.920$$

This equation is interesting in two respects: the highly significant lagged effect of wages and the relatively high impact of import prices (compared to estimates for other nations).

With respect to the structural stability of the equation, the plot of the forward CSR, in Figure 15, reveals a break in the vicinity of observations 32, 33, and 34, and an erratic movement at quarter 58. Quandt's LLR supports the latter point as the most likely to have exhibited instability. The backward CSR, in Figure 16, suggests additional significant unstable quarters, namely 7 and 16 (approximately). Finally, some of the plots of the recursive coefficients point to observation 61 as a potential time of inconstancy; we recall that this quarter figured prominently in the wage equation. And so, we proceeded to re-estimate the Irish price equation, again deleting abnormal observations; the results are reported in Table 10.

As can be seen quite readily the rate of inflation has also been roughly one-half of a percentage point (on a quarterly basis) higher in the post-1971 period, a phenomenon very similar to that encountered in the German price equation. We also note a marked seasonal pattern in price movements with increases higher in the second quarter and lower in the third (relative to the first quarter). The other coefficients are very similar to those reported earlier in equation (IR10). The lowest standard error of estimate is provided by equation (IR15); again, the Durbin-Watson statistic supports the null

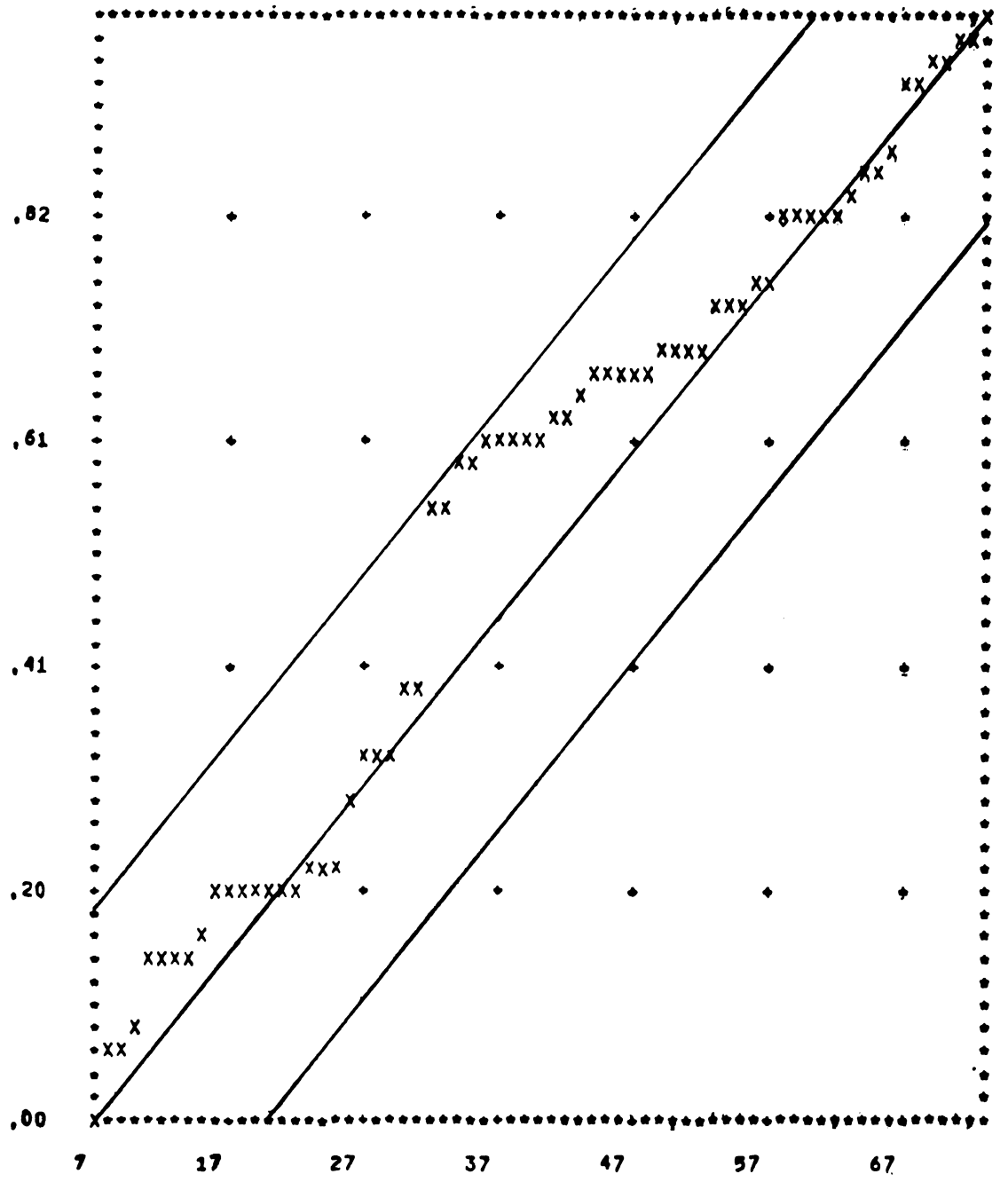

FIGURE 15

THE PRICE EQUATION FOR IRELAND:
FORWARD CUSUM OF SQUARED RESIDUALS NORMALIZED

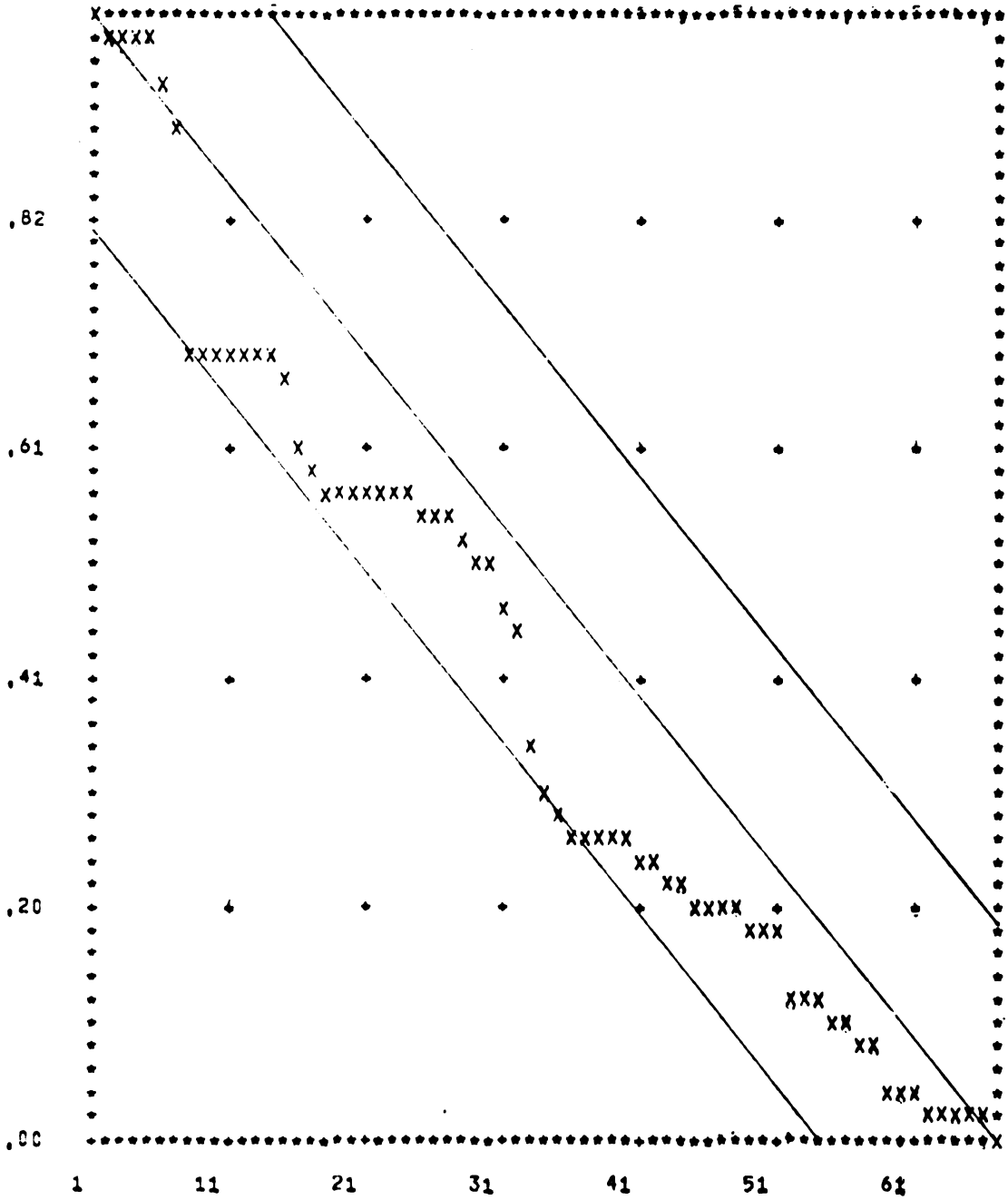

FIGURE 16

THE PRICE EQUATION FOR IRELAND:
BACKWARD CUSUM OF SQUARED RESIDUALS NORMALIZED

TABLE 10. PRICE EQUATIONS FOR IRELAND (1956-I to 1974-I)

Equation Number	Constant Term	Coefficients of Explanatory Variables[b,d]											R^2	D.W.[c]	S.E.E.	d.f.
		$\dot{W}_t$	$\dot{W}_{t-1}$	$\dot{P}_{mt}$	$\dot{P}_{mt-1}$	$L\dot{P}_t$	$L\dot{P}_{t-1}$	D61	Q2	Q3	Q4	$\dot{P}_{t-1}$				
IR11	0.325	0.107	0.182	0.157	-.013	-.041	0.007	0.521	0.998	-1.027	-.134	0.040				
	(1.23)[a]	(1.61)	(2.75)	(3.87)	(0.23)	(1.25)	(0.22)	(1.65)	(1.95)	(2.94)	(0.32)	(0.37)	0.66	0.244[c]	0.739	55
IR12	0.327	0.109	0.191	0.157	-.009	-.041	0.005	0.544	1.024	-.974	-.134					
	(1.24)	(1.67)	(3.10)	(3.93)	(0.16)	(1.27)	(0.16)	(1.76)	(2.03)	(3.09)	(0.32)		0.66	1.92	0.733	56
IR13	0.328	0.105	0.181	0.154		-.042	0.007	0.512	1.010	-1.024	-.136	0.035				
	(1.25)	(1.61)	(2.76)	(4.02)		(1.33)	(0.21)	(1.65)	(1.99)	(2.96)	(0.33)	(0.33)	0.66	0.199[c]	0.733	56
IR14	0.338	0.108	0.184	0.157	-.012	-.043		0.521	0.990	-.983	-.182	0.036				
	(1.32)	(1.65)	(2.84)	(3.90)	(0.22)	(1.41)		(1.67)	(1.95)	(3.43)	(0.52)	(0.33)	0.66	0.141[c]	0.733	56
IR15	0.338	0.109	0.190	0.155		-.044		0.534	1.022	-.950	-.170					
	(1.35)	(1.70)	(3.19)	(4.15)		(1.49)		(1.80)	(2.08)	(3.65)	(0.49)		0.66	1.94	0.721	58

[a]The number in parentheses below each coefficient is its t-statistic (absolute value).

[b]The variables are as defined previously except for:

D61 = a dummy variable taking on the value of 1.0 for observations 61 to 73, 0.0 otherwise.

[c]The Durbin-Watson test is inappropriate in the presence of the lagged dependent variable; therefore, in some equations, we computed the Durbin h-statistic.

[d]Observations 7, 16, 32, 33, 34, 58 were deleted in these equations. The D.W. statistic was adjusted accordingly.

hypothesis of no serial correlation. On these grounds, we will retain this equation for future reference, though with the same caution as prescribed earlier. The traditional economic variables isolated here have succeeded in explaining only a portion of past price variations; at times, prices have behaved quite erratically.

G - ITALY

THE WAGE EQUATION

The review of previous empirical research, in the last chapter, pointed out the difficulties encountered in estimating a wage-unemployment relationship for the Italian economy. Similar problems appeared in our preliminary work. In particular, all three specifications of the unemployment rate proved to be statistically insignificant over the period extending from the fourth quarter of 1959 to the third quarter of 1973. The linear version of U consistently recorded the highest t-value; an example of such a specification is:

$$(IT1) \quad \dot{W}_t = \underset{(1.75)}{3.334} - \underset{(0.79)}{0.350U_t} - \underset{(2.10)}{0.993DU_t} + \underset{(5.97)}{1.97\dot{P}_t}$$

$$- \underset{(2.00)}{2.500Q2} - \underset{(2.02)}{1.859Q3} - \underset{(3.29)}{2.695Q4} \qquad R^2 = 0.51$$

$$D.W. = 1.97$$

$$S.E.E. = 1.682$$

According to this equation, wages are virtually unresponsive to the rate of unemployment but do react somewhat to changes in that rate. More importantly, we note that Italian workers have more than adequately protected the real value of their wages which, on average, have increased twice as fast as prices. A very marked

seasonal pattern in wage movements is also detected with first quarter increases far outstripping those in the rest of the year.

However, this equation is shown, in the plot of the forward CSR in Figure 17, to have been significantly unstable beginning between observations 25 and 42. Quandt's LLR points to the last point in that range, namely the first quarter of 1970, as the most likely origin of inconstancy. This finding is not surprising since the last quarter of 1969 witnessed several major strikes in Italy which involved over one million workers.[18] This factor was incorporated into our subsequent estimates in the usual fashion; some of these results appear in Table 11.

Our modified estimates are quite interesting in that they show that the prime source of instability in the post-1970 period rests with the cost of living variable, whose impact on wages effectively doubled after 1969. In addition, once this phenomenon is accounted for, the unemployment variable becomes significant over the entire sample period. There are also indications that the influence of the labor productivity variable might have been reduced somewhat beginning in 1970. However, it would appear that the intercept of the equation has remained relatively constant. We might therefore conclude that the labor unrest of 1969 did not impart an autonomous upward bias to wage changes but, rather made these more responsive to changes in the cost of living. In effect, it appears that real wages have risen significantly over the latter part of our sample.

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[18] Cf. Ulman and Flanagan, op. cit., p. 213.

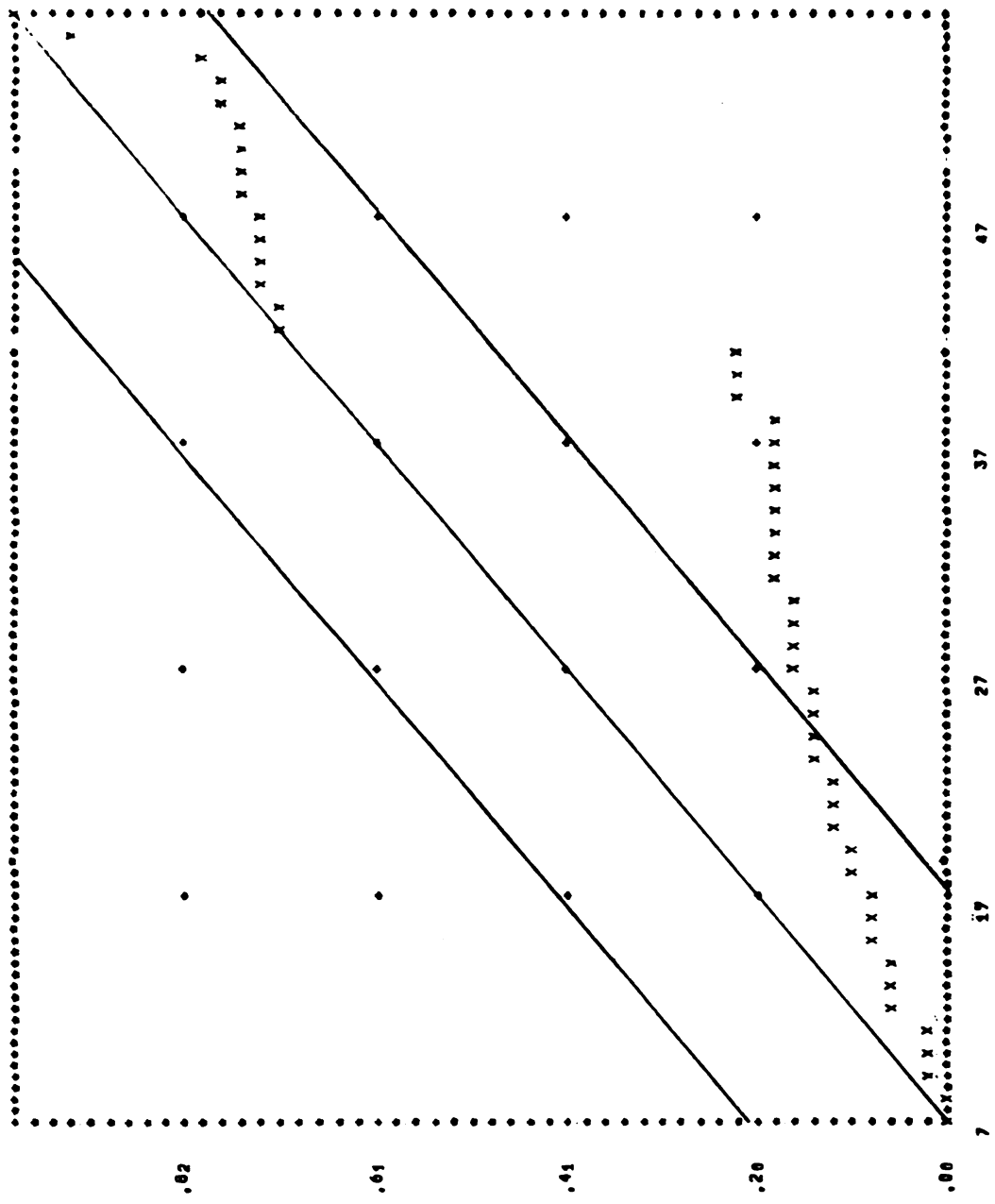

FIGURE 17

TABLE 11. WAGE EQUATIONS FOR ITALY (1959-IV to 1973-III)

Equation Number	Constant Term	Coefficients of Explanatory Variables[b]														
		U_t	DU_t	$\dot{P}_t$	$\dot{P}_t$*D42	$L\dot{P}_t$	$L\dot{P}_t$*D42	D42	Q2	Q3	Q4	$\dot{W}_{t-1}$	R^2	D.W.[c]	S.E.E.	d.f.
IT2	5.828	-.932	-.883	0.936	1.492	0.152	-.067	-.720	-3.025	-.501	-4.830	0.071				
	(2.75)[a]	(1.95)	(1.99)	(2.03)	(1.75)	(1.89)	(1.42)	(0.55)	(2.51)	(0.38)	(3.69)	(0.54)	0.62	5.55[c]	1.552	44
IT3	5.675	-.912	-.909	1.090	1.128	0.147	-.062		-2.886	-.463	-4.755					
	(3.07)	(2.13)	(2.09)	(2.73)	(3.27)	(1.89)	(1.36)		(2.49)	(0.36)	(3.70)		0.62	1.64	1.527	46
IT4	6.098	-.993	-.891	0.997	1.515	0.145	-.067	-.651	-2.890	-.568	-4.771					
	(2.98)	(2.15)	(2.02)	(2.25)	(1.79)	(1.84)	(1.42)	(0.50)	(2.47)	(0.43)	(3.68)		0.62	1.62	1.540	45
IT5	4.273	-.632	-.978	1.488		0.147	-.043	1.464	-2.861	-.183	-4.636					
	(2.36)	(1.49)	(2.18)	(4.19)		(1.82)	(0.93)	(2.69	(2.39)	(0.14)	(3.50)		0.59	1.71	1.576	46
IT6	3.700	-.493	-1.042	1.927		0.123	-.030		-2.823	-.269	-4.387					
	(1.93)	(1.10)	(2.19)	(5.73)		(1.44)	(0.60)		(2.22)	(0.19)	(3.12)		0.53	1.75	1.677	47
IT7	4.194	-.588	-.919	1.461		0.098		1.410	-2.681	-.648	-4.073					
	(2.32)	(1.39)	(2.07)	(4.13)		(1.61)		(2.61)	(2.27)	(0.53)	(3.47)		0.58	1.81	1.574	47
IT8	3.660	-.466	-.999	1.897		0.089			-2.698	-.592	-4.000					
	(1.92)	(1.05)	(2.13)	(5.74)		(1.39)			(2.16)	(0.46)	(3.22)		0.52	1.83	1.666	48

[a]The number in parentheses below each coefficient is its t-statistic (absolute value).

[b]The variables are as defined previously except for:

D42 = a dummy variable taking on the value of 1.0 for quarters 42 to 56, 0.0 otherwise.

[c]The Durbin-Watson test is inappropriate in the presence of the lagged dependent variable; therefore, in equation (IT2), we computed the Durbin h-statistic.

All in all, equation (IT3) seems to best reflect the interaction of all these factors. It has the highest explanatory power (in terms of the standard error of estimate), and all of the coefficients are statistically significant; the Durbin-Watson test for serial correlation is inconclusive.

THE PRICE EQUATION

The basic Italian price function was estimated as:

$$(IT9)\quad \dot{P}_t = \underset{(3.38)}{0.719} + \underset{(3.56)}{0.163}\dot{W}_t + \underset{(1.82)}{0.068}\dot{P}_{mt} + \underset{(0.12)}{0.003}L\dot{P}_t$$

$$- \underset{(0.95)}{0.213}Q2 - \underset{(0.76)}{0.304}Q3 + \underset{(0.40)}{0.157}Q4 \qquad R^2 = 0.47$$

$$D.W. = 1.60$$

$$S.E.E. = 0.571$$

The only two significant variables are the rates of change of wages and import prices, though the influence of the former is somewhat smaller than expected. The labor productivity variable appears with the wrong sign and is insignificant.

This equation can also be seen to have been stable over the sample period, as evidenced in the forward CSR in Figure 18. We do, however, detect an erratic movement starting at observation 26 which is sharply reversed at observation 42. In fact, the period from the first quarter of 1966 to the last quarter of 1969 (observations 26-41) was characterized by official attempts to reduce the rise in incomes in accordance with the goals of the five-year development plan. And, as we saw earlier, economic variables in the first quarter of 1970 (observation 42) were significantly modified by the events of the previous autumn. We thus omitted that observation from our subsequent estimates; these results appear in Table 12.

FIGURE 18

THE PRICE EQUATION FOR ITALY:
FORWARD CUSUM OF SQUARED RESIDUALS NORMALIZED

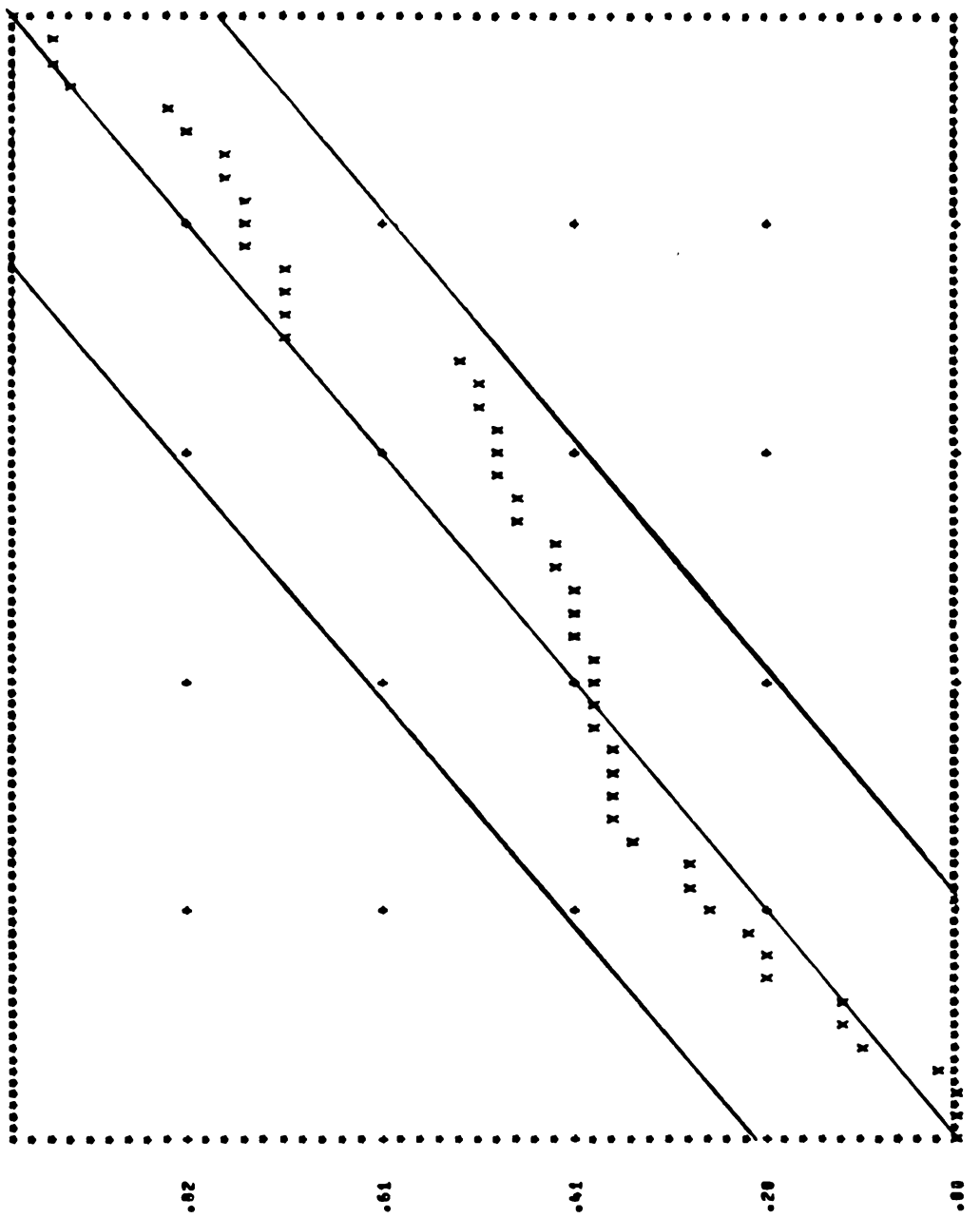

FIGURE 18

TABLE 12. PRICE EQUATIONS FOR ITALY (1959-IV to 1973-III)

Equation Number	Constant Term	Coefficients of Explanatory Variables[b,d]													
		$\dot{W}_t$	$\dot{W}_{t-1}$	$\dot{P}_{mt}$	$\dot{P}_{mt-1}$	$L\dot{P}_{t-1}$	D26-41	Q2	Q3	Q4	$\dot{P}_{t-1}$	R^2	D.W.[c]	S.E.E.	d.f.
IT10	1.073	0.249	0.054	0.016	-.023	-.029	-.237	-.797	-.732	-.671					
	(2.62)[a]	(3.97)	(1.23)	(0.38)	(0.51)	(1.41)	(1.42)	(2.12)	(2.11)	(1.05)		0.64	1.94	0.495	45
IT11	1.031	0.263	0.053		-.016	-.028	-.229	-.784	-.696	-.648					
	(2.64)	(5.22)	(1.21)		(0.40)	(1.40)	(1.39)	(2.12)	(2.10)	(1.02)		0.64	1.95	0.490	46
IT12	0.989	0.281				-.023	-.276	-.613	-.573	-.476					
	(2.59)	(6.92)				(1.16)	(1.75)	(1.80)	(1.83)	(0.78)		0.62	2.00	0.488	48
IT13	1.050	0.255	0.046			-.028	-.242	-.767	-.691	-.642					
	(2.74)	(5.52)	(1.16)			(1.38)	(1.51)	(2.10)	(2.10)	(1.02)		0.63	1.90	0.486	47
IT14	1.044	0.253	0.045			-.028	-.239	-.766	-.689	-.638	0.010				
	(2.63)	(4.53)	(1.05)			(1.36)	(1.45)	(2.08)	(2.06)	(1.00)	(0.07)	0.63	-	0.491	46

[a]The number in parentheses below each coefficient is its t-statistic (absolute value).

[b]The variables are as defined previously except for:
D26-41 = a dummy variable taking on the value of 1.0 for quarters 26 to 41, 0.0 otherwise.

[c]The Durbin-Watson test is inappropriate in the presence of the lagged dependent variable. For (IT14), it was impossible to calculate Durbin's h-statistic.

[d]Observation 42 was deleted in these equations. The D.W. statistic was adjusted accordingly.

All of our estimates suggest that price increases were significantly dampened between 1966 and 1969, the order of magnitude being roughly one quarter of a percentage point (on a quarterly basis). In addition, based on preliminary work, we found that the rise in prices was moderated in the first quarter of 1970, immediately following the widespread strikes of the previous atuumn; this resembles French price behavior after the social unrest of 1968.

Turning to the other variables examined, we note that import prices (current and lagged) and the lagged values of both the wage variable and the dependent variable are not statistically significant. On these grounds and, based on the standard error of estimate criterion, equation (IT12) is chosen to be retained as the "best" Italian price relationship. Again, there are no indications of the presence of serial correlation.

H - NETHERLANDS

THE WAGE EQUATION

The econometric investigation of wage movements in the Dutch economy covered the period from the first quarter of 1959 to the first quarter of 1974. The inverted version of the unemployment variable fared slightly better than the linear version, though both were insignificant. Both the current and lagged values of the rate of inflation were highly significant, as were all three quarterly dummies. Examples of these estimates are given below for the two unemployment specifications:

$$(N1) \quad \dot{W}_t = \underset{(3.36)}{2.316} + \underset{(1.01)}{0.607}U_t^{-1} + \underset{(3.77)}{0.666}\dot{P}_t + \underset{(2.12)}{0.369}\dot{P}_{t-1}$$

$$- \underset{(3.74)}{2.113}Q2 - \underset{(2.76)}{1.812}Q3 - \underset{(4.93)}{2.786}Q4 \qquad R^2 = 0.53,\ D.W. = 2.14,\ S.E.E. = 1.491$$

$$(N2) \quad \dot{W}_t = \underset{(4.68)}{3.159} - \underset{(0.78)}{0.238}U_t + \underset{(3.70)}{0.650}\dot{P}_t + \underset{(2.12)}{0.376}\dot{P}_{t-1}$$

$$- \underset{(3.68)}{2.097}Q2 - \underset{(2.69)}{1.750}Q3 - \underset{(4.88)}{2.772}Q4 \qquad R^2 = 0.53,\ D.W. = 2.11,\ S.E.E. = 1.496$$

However, the stability tests reveal that both equations above were unstable at the 10% level of significance. Since our results are identical for both specifications, we present those dealing only with equation (N2); the forward CSR is plotted in Figure 19. The most obvious break occurs at observation 21, a finding which is supported by Quandt's LLR. This latter test also designates the vicinity of observations 49-53 as another potential period of inconstancy. In fact, plots of several of the recursive coefficients show marked breaks after observation 50.

An examination of the past history of incomes policies in Holland suggests plausible reasons for these instances of instability. Official attempts to restrain the growth of incomes in the early 1960's proved unsuccessful and, in 1963, measures were introduced to revive the concept of free collective bargaining. The subsequent wage explosiion in 1964 (the first quarter of which corresponds to observation 21) could be attributed to such an institutional change.[19] The next significant change in policy was

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[19]Cf. Ulman and Flanagan, op. cit., pp. 65-71.

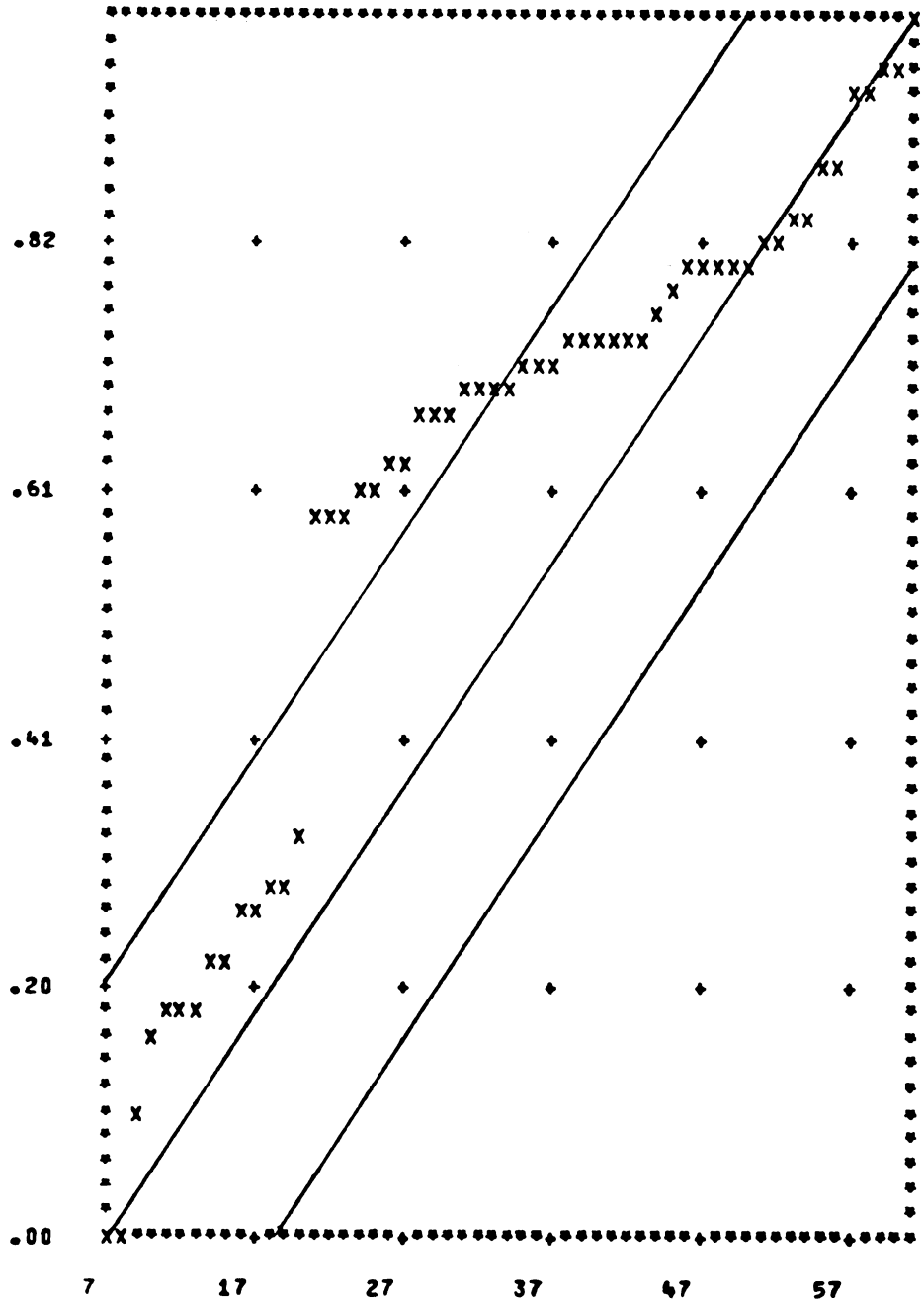

FIGURE 19

THE WAGE EQUATION FOR THE NETHERLANDS:
FORWARD CUSUM OF SQUARED RESIDUALS NORMALIZED

the institution of a wage pause in the latter part of 1970 and the early part of 1971.[20] The structural change detected in the second quarter of 1971 (observation 50) might reflect a response to the removal of such wage controls. These various hypotheses were subjected to empirical testing, the more interesting results of which are presented in Table 13; as previously, we deleted observation 21.

We note immediately that the intercept dummy is highly significant. In words, the intercept of the equation shifted upwards for the entire subperiod from 1971 to early 1974, possibly as a result of the termination of the wage pause. Thus quarterly wage increases were 1¼% higher in the latest period, given the values of the other explanatory variables. With this exogenous influence taken into account, the lagged value of the rate of inflation no longer remained significant and the impact of the current value of that variable was diminished somewhat. Moreover, the linear version of the unemployment variable now dominated the inverted specification and, in equations (N3) and (N8), its coefficient showed signs of decreasing in absolute value beginning in 1964. Thus the relaxation of official wage restraints led to a counter-clockwise movement in the wage-unemployment relationship, implying a greater downward rigidity of wage increases. In sum, equation (N3) seems to best capture the nature of postwar wage behavior in the Netherlands. It records the lowest standard error of estimate and, based on all of our preliminary work, serial correlation is not an apparent problem.

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[20] Cf. Braun, op. cit., especially Chart 1, p. 11.

TABLE 13. WAGE EQUATIONS FOR THE NETHERLANDS (1959-I to 1974-I)

Equation Number	Constant Term	Coefficients of Explanatory Variables[c,d] U_t	U_t*D21	U_t^{-1}	U_t^{-1}*D21	$\dot{P}_t$	$\dot{P}_{t-1}$	D50	Q2	Q3	Q4	R^2	D.W.[b]	S.E.E.	d.f.
N3	4.052	-.982	.544			.348		1.254	-1.498	-1.679	-3.073				
	(5.25)[a]	(2.17)	(1.80)			(2.04)		(1.90)	(3.04)	(2.82)	(5.81)	0.56	2.33	1.302	52
N4	2.244			.763	.218	.441		1.291	-1.480	-1.519	-2.902				
	(3.44)			(1.12)	(0.53)	(2.51)		(2.32)	(2.93)	(2.49)	(5.50)	0.53	2.27	1.341	52
N5	3.548	-.510				.454	.218	1.280	-1.688	-1.710	-2.820				
	(4.58)	(1.34)				(2.73)	(1.32)	(1.89)	(3.26)	(2.77)	(5.21)	0.54	2.34	1.320	52
N6	3.737	-.528				.436		1.537	-1.502	-1.502	-2.953				
	(4.87)	(1.38)				(2.61)		(2.35)	(2.99)	(2.50)	(5.51)	0.53	2.27	1.329	53
N7	2.117			.792		.484	.212	1.036	-1.655	-1.657	-2.742				
	(3.26)			(1.22)		(2.91)	(1.28)	(1.78)	(3.20)	(2.71)	(5.19)	0.54	2.33	1.324	52
N8	3.887	-.900	.460			.372	.134	1.140	-1.612	-1.779	-2.973				
	(4.84)	(1.93)	(1.43)			(2.14)	(0.77)	(1.68)	(3.12)	(2.90)	(5.44)	0.56	2.36	1.307	51

[a]The number in parentheses below each coefficient is its t-statistic (absolute value).

[b]The Durbin-Watson statistic was adjusted for the gap in the data.

[c]The variables are as defined previously except for:

D50 = a dummy variable taking on the value of 1.0 for observations50 to 61, 0.0 otherwise.

[d]Observation 21 was deleted in these equations.

THE PRICE EQUATION

The conventional price function for Holland, for the period 1959 (I) to 1974 (I), was estimated to be:

$$(N9) \quad \dot{P}_t = \underset{(1.35)}{0.630} + \underset{(3.17)}{0.272}\dot{W}_t + \underset{(0.57)}{0.029}\dot{P}_{mt} + \underset{(0.96)}{0.042}L\dot{P}_t$$

$$+ \underset{(1.02)}{0.497}Q2 - \underset{(1.35)}{0.599}Q3 - \underset{(0.63)}{0.646}Q4$$

$R^2 = 0.42$
D.W. = 2.27
S.E.E. = 1.043

This equation is rather poor in that its explanatory power is relatively low and only one variable, the rate of change of wages, is statistically significant. However, as seen in Figure 20, the forward CSR indicates that the relationship was structurally unstable beginning between observations 15 and 29. Quandt's LLR test suggests the vicinity of quarter 21 as the more likely point of rupture and this corresponds, as discussed earlier, to the period in which incomes policies were moderated to some extent. In addition, both the LLR test and the plots of some of the recursive coefficients propose that some inconstancy might potentially have occurred after the forthy-sixth observation, though the explanation for such a phenomenon is not apparent. Price controls were already in effect at that time (1970-II) and were not lifted until the middle of 1971. We therefore modified and re-estimated our equation to test the various hypotheses just proposed; some of our findings appear below in Table 14.

One of the more prominent conclusions to be drawn from our estimated equations is that the constant term has shifted upwards significantly in two subperiods. Beginning in 1964, prices increased an average of six-tenths of a percentage point more than had previously

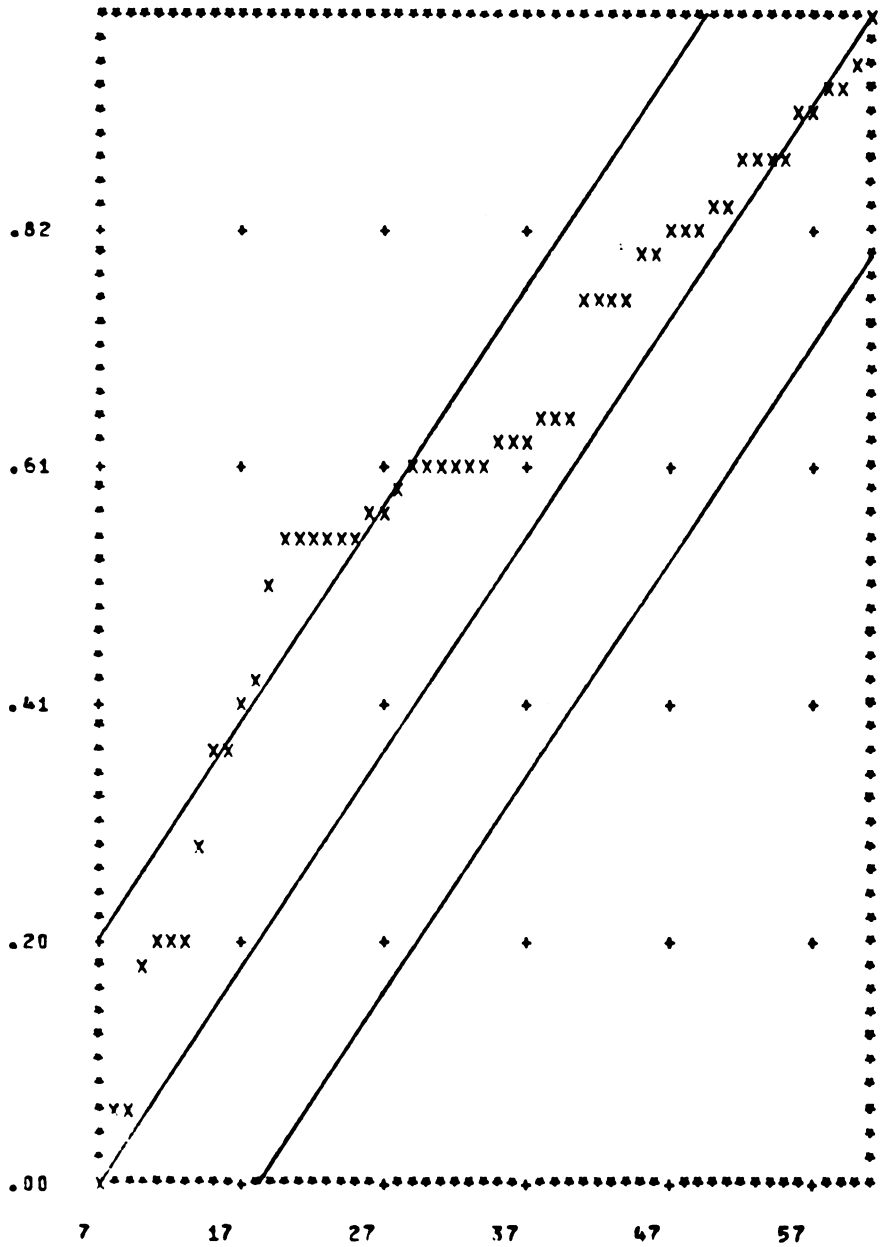

FIGURE 20

THE PRICE EQUATION FOR THE NETHERLANDS:
FORWARD CUSUM OF SQUARED RESIDUALS NORMALIZED

TABLE 14. PRICE EQUATIONS FOR THE NETHERLANDS (1959-I to 1974-I)

Equation Number	Constant Term	Coefficients of Explanatory Variables[b,c]														
		$\dot{W}_t$	$\dot{W}_t$*D46	$\dot{P}_{mt}$	P_{mt}*D46	$L\dot{P}_{t-1}$	D21	D46	Q2	Q3	Q4	$\dot{P}_{t-1}$	R^2	D.W.[b]	S.E.E.	d.f.
N10	0.871	0.229		0.021		-.035	0.659	0.552	0.122	-1.145	-0.923	-0.203				
	(1.11)[a]	(2.69)		(0.40)		(0.81)	(2.07)	(1.64)	(0.13)	(1.56)	(0.85)	(1.56)	0.51	-	0.987	51
N11	0.331	0.232		0.010			0.636	0.563	0.791	-.667	-.119	-0.214				
	(0.79)	(2.74)		(0.19)			(2.01)	(1.67)	(1.91)	(1.53)	(0.26)	(1.66)	0.50	-	0.983	52
N12	0.605	0.248	-.193	0.199	-.170	-.022	0.553	1.190	0.488	-.861	-.645	-0.205				
	(0.76)	(2.86)	(0.98)	(1.37)	(1.10)	(0.50)	(1.73)	(1.87)	(0.52)	(1.16)	(0.59)	(1.59)	0.54	-	0.974	49
N13	0.755	0.226		0.227	-.224	-.033	0.579	0.667	0.381	-.972	-.793	-0.211				
	(0.97)	(2.70)		(1.59)	(1.55)	(0.79)	(1.82)	(1.95)	(0.41)	(1.33)	(0.73)	(1.64)	0.53	-	0.974	50
N14	0.238	0.229		0.218	-.226		0.556	0.678	1.023	-.513	-.024	-0.221				
	(0.57)	(2.75)		(1.54)	(1.57)		(1.76)	(2.00)	(2.35)	(1.16)	(0.05)	(1.73)	0.52	-8.22[b]	-.970	51
N15	0.621	0.259	-.270	0.052		-.018	0.595	1.324	0.359	-.931	-.672	-0.198				
	(0.78)	(2.99)	(1.46)	(0.93)		(0.42)	(1.87)	(2.12)	(0.39)	(1.26)	(0.62)	(1.53)	0.53	-	0.976	50
N16	0.269	0.253	-.219	0.190	-.164		0.535	1.268	0.893	-.566	-.156	-0.211				
	(0.65)	(2.96)	(1.16)	(1.33)	(1.07)		(1.69)	(2.08)	(2.00)	(1.28)	(0.33)	(1.65)	0.54	-6.51[b]	0.967	50

[a]The number in parentheses below each coefficient is its t-statistic (absolute value).

[b]The Durbin-Watson test is inappropriate in the presence of the lagged dependent variable; therefore, where possible, we computed the Durbin h-statistic.

[c]The variables are as defined previously except for:

D21 = a dummy variable taking on the value of 1.0 for observations 21 to 61, 0.0 otherwise.

D46 = a dummy variable taking on the value of 1.0 for observations 46 to 61, 0.0 otherwise.

been the case (other things equal). And from the second quarter of 1970, price rises were an additional two-thirds of a percentage point higher, given the values of the other explanatory variables. Additionally, import prices appear to have lost their influence in the latter period, with the value of the estimated coefficient approaching zero. Whether or not this will be a short-lived phenomenon, which is what we would expect, is yet to be determined.

The only other variables which consistently appear with significant coefficients are the rate of change of wages, two of the three seasonal dummies, and the lagged value of the rate of inflation itself. The coefficient of this last variable is interesting since it indicates that the impact reaction of prices to changed circumstances is slightly larger than the long-run response. For instance, the short and long-run coefficients on the wage variable, in equation (N14), are 0.229 and 0.188 (0.229/1.221), respectively.

If we consider the joint criteria of minimum standard error of estimate and coefficient significance, equation (N14) must therefore be our choice as the "superior" price function for the Netherlands.

I - UNITED KINGDOM

THE WAGE EQUATION

Of all the national wage equations estimated, we encountered the greatest difficulties with the aggregate wage function for the United Kingdom. Such a phenomenon should not surprise us since, over our sample period from the first quarter of 1956 to the fourth quarter of 1973, the U.K. has been one of the nations which has resorted most often to incomes restraint policies. Examples of the effects of such

factors on wage behavior were discussed above in Chapter III. It was seen there that the Phillips curve had indeed been unstable between policy on and policy off years.

Our own preliminary estimates all suggest that the coefficient on the unemployment variable, regardless of the specification, enters the equation with the theoretically incorrect sign. An example of one of these estimates is given in the following equation:

$$(UK1) \quad \dot{W}_t = \underset{(3.68)}{1.434} - \underset{(1.95)}{1.313}U_t^{-2} - \underset{(1.03)}{0.671}DU_t + \underset{(4.98)}{0.734}\dot{P}_t$$

$$- \underset{(2.07)}{1.004}Q2 + \underset{(0.69)}{0.273}Q3 - \underset{(1.11)}{0.386}Q4 \qquad R^2 = 0.36$$

$$D.W. = 1.56$$

$$S.E.E. = 1.007$$

The various stability tests performed on this equation indicate some plausible explanations for this perverse result. For instance, the forward CSR in Figure 21 reveals that the wage function has been highly unstable beginning sometime after observation 34. Quandt's LLR test proposes quarter 47 as the most likely point of rupture. At that time, the third quarter of 1967, we note that the authorities had just removed the wage and price freeze which had been imposed in July of 1966.[21] Thus some alteration in the behavior of the various economic variables might be expected.[22] In addition, the plots of some of the recursive coefficients suggest that some inconstancy might have accurred beginning in the first quarter of 1973. In fact, this period was characterized by the introduction of a new

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[21] Cf. E. Schiff, Incomes Policies Abroad, American Enterprise Institute, Washington, D.C., pp. 3-14, and Ulman and Flanagan, op. cit., pp. 11-47.

[22] To improve the use of labor in the economy, particularly in the manufacturint sector, the government introduced a Selective Employment Tax in September 1966. Cf. OECD, Economic Surveys: United Kingdom

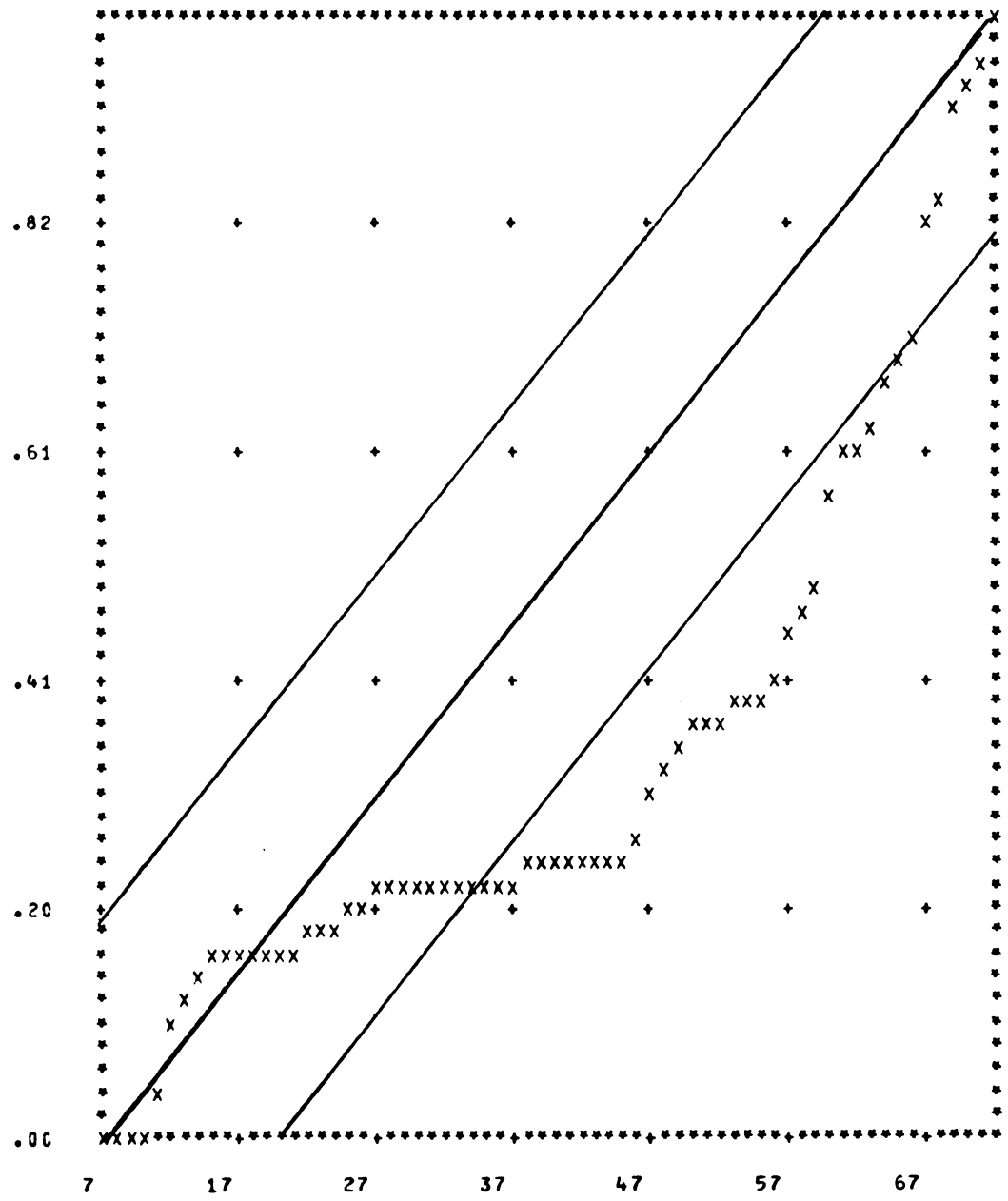

FIGURE 21

THE WAGE EQUATION FOR THE UNITED KINGDOM:
FORWARD CUSUM OF SQUARED RESIDUALS NORMALIZED

wage and price freeze in the face of a rapidly-escalating inflation spiral.[23] Table 15 reports our subsequent estimates, modified to include the factors just outlined.

It is immediately apparent, in equations (UK2) and (UK3), that the Phillips relation has been dramatically altered after 1967 (III). The intercept has shifted upwards significantly and the slope of the function (the unemployment coefficient) has become positive rather than negative. The reasons for such a rotation become apparent when we examine equations (UK4),(UK5),(UK8), and (UK9). The introduction of T*D47 (essentially a time trend from 1967-III on) eliminates the significance of the unemployment coefficient shift variable. Thus, the Phillips curve has been shifting outwards at an increasing rate, as might be expected during a wage-price spiral with expectations changing very rapidly. However, there are no indications that the coefficient of the price variable had risen in value; the shift was restricted to the constant term. In addition, we note that the latest incomes policy episode, beginning in 1973, has had a significant dampening effect on wage increases, on the order of 1.5% per quarter. All criteria thus point to equation (UK9) as our choice of wage function for the United Kingdom; the squared, inverted version of the unemployment variable performed slightly better than the simple inverted specification. As before, serial correlation does not pose any significant problems.

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[23] Cf. Braun, op. cit., p. 11.

TABLE 15. WAGE EQUATIONS FOR THE UNITED KINGDOM (1956-I to 1973-IV)

Equation Number	Constant Term	Coefficients of Explanatory Variables[b] U_t^{-1}	U_t^{-1}*D47	U_t^{-2}	U_t^{-2}*D47	$\dot{P}_t$	$\dot{P}_t$*D47	D47	T*D47	D69	Q2	Q3	Q4	R^2	D.W.	S.E.E.	d.f.
UK2	0.302	1.128	-9.886			0.287		5.051			-.401	0.038	-.305				
	(0.49)[a]	(1.08)	(3.13)			(1.70)		(3.78)			(1.28)	(0.11)	(1.01)	0.51	1.83	0.892	64
UK3	0.298	1.133	-9.968			0.289	-.024	5.108		0.094	-.397	0.030	-.304				
	(0.47)	(1.05)	(3.04)			(1.37)	(0.09)	(3.49)		(0.18)	(1.25)	(0.09)	(1.00)	0.51	1.84	0.906	62
UK4	0.224	1.632	0.347			0.115			0.143	-1.585	-.359	-.243	-.478				
	(0.39)	(1.63)	(0.38)			(0.65)			(4.86)	(2.73)	(1.20)	(0.73)	(1.66)	0.56	1.86	0.848	63
UK5	0.301	1.496				0.131			0.146	-1.611	-.368	-.217	-.469				
	(0.57)	(1.61)				(0.76)			(5.19)	(2.81)	(1.25)	(0.67)	(1.65)	0.56	1.86	0.842	64
UK6	0.626			0.956	-14.030	0.269		3.336		0.062	-.390	0.032	-.292				
	(1.74)			(1.16)	(3.14)	(1.53)		(4.30)		(0.12)	(1.24)	(0.09)	(0.97)	0.51	1.86	0.896	63
UK7	0.618			0.940	-14.248	0.290	-.054	3.430		0.091	-.391	0.028	-.292				
	(1.70)			(1.13)	(3.07)	(1.39)	(0.19)	(3.72)		(0.17)	(1.23)	(0.08)	(0.96)	0.51	1.85	0.903	62
UK8	0.896			0.706		0.178			0.103		-.379	-.123	-.406				
	(2.75)			(0.95)		(1.00)			(4.57)		(1.23)	(0.37)	(1.37)	0.51	1.85	0.883	65
UK9	0.741			1.171		0.143			0.139	-1.531	-.373	-.200	-.457				
	(2.34)			(1.61)		(0.84)			(5.52)	(2.74)	(1.27)	(0.63)	(1.61)	0.56	1.88	0.842	64

[a]The number in parentheses below each coefficient is its t-statistic (absolute value).

[b]The variables are as defined previously except for:

D47 = a dummy variable taking on the value of 1.0 for quarters 47 to 72, 0.0 otherwise.
D69 = a dummy variable taking on the value of 1.0 for quarters 69 to 72, 0.0 otherwise.
T*D47 = an interaction variable between a time trend and the D47 dummy where T*D47 = 1.0 for quarter 47 and so on.

THE PRICE EQUATION

The difficulties outlined above were, surprisingly, not encountered in our estimates of the price function for the period 1956 (II) to 1973 (IV). The basic equation was estimated to be:

$$(UK10)\quad \dot{P}_t = \underset{(2.50)}{0.497} + \underset{(3.97)}{0.293}\dot{W}_t + \underset{(3.01)}{0.105}\dot{P}_{mt} - \underset{(0.31)}{0.008}L\dot{P}_t$$

$$+ \underset{(2.80)}{0.641}Q2 - \underset{(2.60)}{0.622}Q3 + \underset{(0.66)}{0.186}Q4 \qquad R^2 = 0.54,\ D.W. = 1.63,\ S.E.E. = 0.680$$

And, as evidenced by the forward CSR in Figure 22, this equation was not significantly unstable at any time in the sample. This finding casts doubt on the dummy variable included in the Bodlin et al. price function to capture the impact of incomes policies, though it did appear with the theoretically incorrect sign.[24]

In Table 16, we present some further results which incorporate lags on the explanatory variables and the lagged value of the dependent variable itself. We note that the wage variable is the only one which affects prices with a three-month lag. In addition, prices change somewhat sluggishly, as witnessed by the value of the lagged rate of inflation. The two labor productivity variables are not significant, nor is the dummy for the fourth quarter. Overall, equation (UK13) appears to best represent the movement of consumer prices in the United Kingdom.

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[24] Cf. Bodkin et al., op. cit., p. 238.

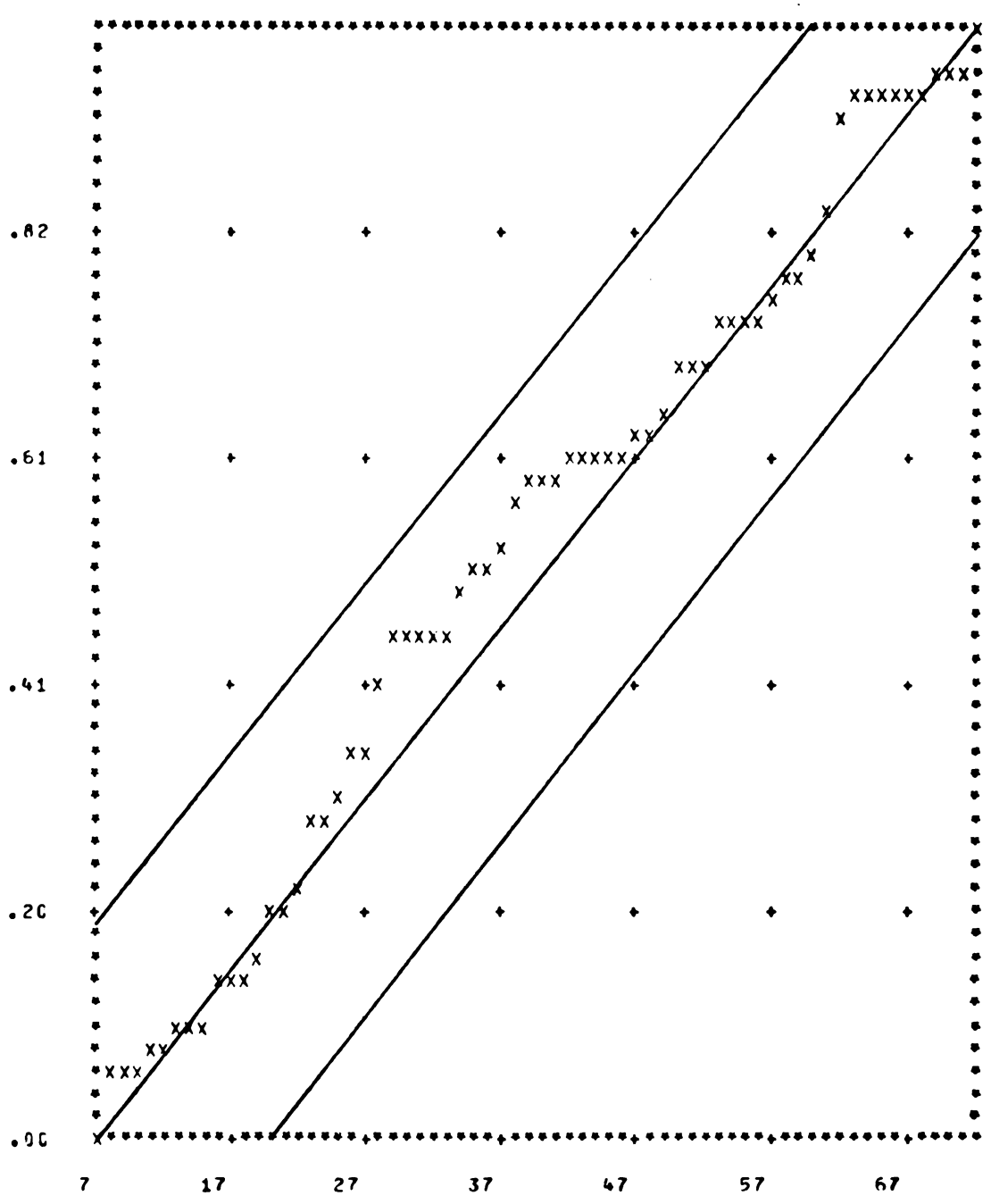

FIGURE 22

THE PRICE EQUATION FOR THE UNITED KINGDOM:
FORWARD CUSUM OF SQUARED RESIDUALS NORMALIZED

TABLE 16. PRICE EQUATIONS FOR THE UNITED KINGDOM (1956-II to 1973-IV)

Equation Number	Constant Term	Coefficients of Explanatory Variables[b,c]													
		$\dot{W}_t$	$\dot{W}_{t-1}$	$\dot{P}_{mt}$	$\dot{P}_{mt-1}$	$L\dot{P}_t$	$L\dot{P}_{t-1}$	Q2	Q3	Q4	$\dot{P}_{t-1}$	R^2	D.W.[c]	S.E.E.	d.f.
UK11	0.340	0.175	0.204	0.074	0.003	-0.008	-0.007	0.454	-0.872	0.151	0.175				
	(1.34)[a]	(2.25)	(2.42)	(1.67)	(0.07)	(0.32)	(0.31)	(1.70)	(2.84)	(0.45)	(1.48)	0.64	-6.67	0.622	60
UK12	0.291	0.174	0.205	0.072	0.004	-0.006		0.503	-.811	0.210	0.175				
	(1.49)	(2.26)	(2.46)	(1.66)	(0.08)	(0.26)		(2.37)	(3.49)	(0.76)	(1.49)	0.64	-3.98	0.618	61
UK13	0.288	0.173	0.209	0.074				0.510	-.792	0.167	0.174				
	(1.50)	(2.28)	(2.57)	(2.32)				(2.45)	(3.66)	(0.75)	(1.56)	0.64	-1.80	0.608	63

[a]The number in parentheses below each coefficient is its t-statistic (absolute value).

[b]The variables are as defined previously.

[c]The Durbin-Watson test is inappropriate in the presence of the lagged dependent variable; therefore we computed the Durbin h-statistic.

J - A SUMMARY OF THE RESULTS

Given the large number of estimates presented above, it might prove useful to summarize our more significant results. Some of the salient features of the preferred wage and price equations are outlined in Table 17. For the wage equation, these are the unemployment specification, the sum of the price coefficients, and the significant departures from stability. For the price equation, we present the sum of the wage coefficients and occurrences of instability.

One interesting finding is that the wage-unemployment relation is linear in five countries. This specification proved superior to the non-linear versions, probably owing to the range of variation of the unemployment rate in the postwar period.

In addition, the test of the Friedman-Phelps hypothesis is particularly significant for our present purposes. We note that the sum of the price coefficients is significantly different from unity in all nations, except Belgium and Denmark.[25] In the other countries, money illusion is evident, with wages rising less than prices, even in the long-run. However, Italy provides one exception; Italian wages are seen to have risen twice as fast as prices since 1970.

Thus, according to the accelerationist hypothesis, we would expect to encounter vertical long-run trade-off frontiers in Belgium and Denmark (assuming wages and prices rise at the same rate). The

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[25] At least in these two nations, wages are closely linked to the consumer price index. Cf. Finet, op. cit., and Ulman and Flanagan, op. cit.

TABLE 17. A SUMMARY OF THE EMPIRICAL RESULTS

COUNTRY	EQUATION FOR	UNEMPLOYMENT SPECIFICATION	SUM OF $\dot{P}$ COEFFICIENTS	DIFFERENT FROM UNITY?	SUM OF $\dot{W}$ COEFFICIENTS	STABLE?	DEPARTURES FROM STABILITY (LONG-TERM)
BELGIUM	$\dot{W}$	U	1.091	No		No	1968(III)
	$\dot{P}$				0.299	Yes	
DENMARK	$\dot{W}$	U	1.156	No		No	1968(I)
	$\dot{P}$				0.315	Yes	
FRANCE	$\dot{W}$	U^{-2}	0.339	Yes[a]		No	1963(IV)
	$\dot{P}$				0.432	Yes	
GERMANY	$\dot{W}$	U^{-1}	0.683	Yes[b]		No	1966(I)
	$\dot{P}$				0.105	No	1970(IV)
IRELAND	$\dot{W}$	U	0.213	Yes[a]		No	1971(I)
	$\dot{P}$				0.299	No	1971(I)
ITALY	$\dot{W}$	U	2.218	Yes[a]		No	1970(I)
	$\dot{P}$				0.281	No	1966(I)-1969(IV)
NETHERLANDS	$\dot{W}$	U	0.348	Yes[a]		No	1971(II)
	$\dot{P}$				0.229	No	1964(I);1970(II)
UNITED KINGDOM	$\dot{W}$	U^{-2}	0.143	Yes[a]		No	1967(III);1973(I)
	$\dot{P}$				0.382	Yes	

[a]Statistically different from unity at the 1% level of significance.

[b]Statistically different from unity at the 5% level of significance.

implications of such a phenomenon for monetary integration will be spelled out in the next chapter. We will also examine the implications of monetary unification for the internal balance of the individual members of the European Community.

CHAPTER VI

MONETARY INTEGRATION AND INTERNAL BALANCE

A - THEORETICAL BACKGROUND

The welfare of the individual nation has increasingly been associated with concrete goals such as low rates of inflation and unemployment, an adequate rate of economic growth, and equilibrium in the balance of payments. Thus policymakers, especially in the last three decades, have taken it to be their primary responsibility to direct the economy toward the simultaneous attainment of these targets. Fiscal, monetary, and exchange rate policies have been the more prominent tools which they have employed in this task. However, experience has shown that the above goals often conflict with one another, forcing the authorities to evaluate the relative importance of one target in terms of another. For instance, the analysis in Chapter V has shown that lower unemployment can only be obtained at the cost of higher inflation. Conversely, a lower rate of inflation requires the dampening of aggregate demand, thereby leading to more unemployment.

As a result, the objective trade-off curve relating the rate of price increase to the rate of unemployment is the policymaker's constraint.[1] He must then choose, and attempt to attain, that point

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[1]The focus of the analysis is restricted to these two short-run targets since monetary unification will effectively remove the balance of

on the target frontier which, in his estimation, will maximize the welfare of the nation. As in consumer demand theory, this optimum target choice will be determined by the tangency of the trade-off and social indifference curves in inflation-unemployment space.[2] It is the nature of these curves that the policymaker is indifferent between the various combinations of inflation and unemployment lying along any one of them. And the curves closer to the origin represent ever higher levels of social welfare.[3]

Such an analytical scheme is extremely useful in the analysis of European monetary unification. It permits us to clearly portray the impact of EMU on the internal balance of the member nations. And it also allows us to precisely deduce the conditions necessary for the success of the European venture. For simplicity, we restrict our exposition to two countries; similar conclusions would hold, likely more forcefully, if we extended the analysis to all members of the Community.

We begin with the case in which the two countries exhibit identical preferences but are faced with different trade-off curves. As can be seen in Figure 23, points A_0 and B_0 are deemed to be

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intra-EEC payments as a significant goal of policy. The rate of economic growth is a longer-term objective and will figure prominently in the conclusions to the study.

[2]Ignoring the practical significance of deriving such social indifference curves, we take them to be the policymaker's perception of the nation's preferences. These curves are concave to the origin since they relate to two "evils" with increasing marginal disutilities.

[3]One of the earliest presentations of this analytical framework in graphical terms can be found in R.G. Lipsey, "Structural and Deficient-Demand Unemployment Reconsidered", in A.M. Ross (ed.), Employment Policy and the Labor Market, University of California Press, Berkeley, 1965, p. 211.

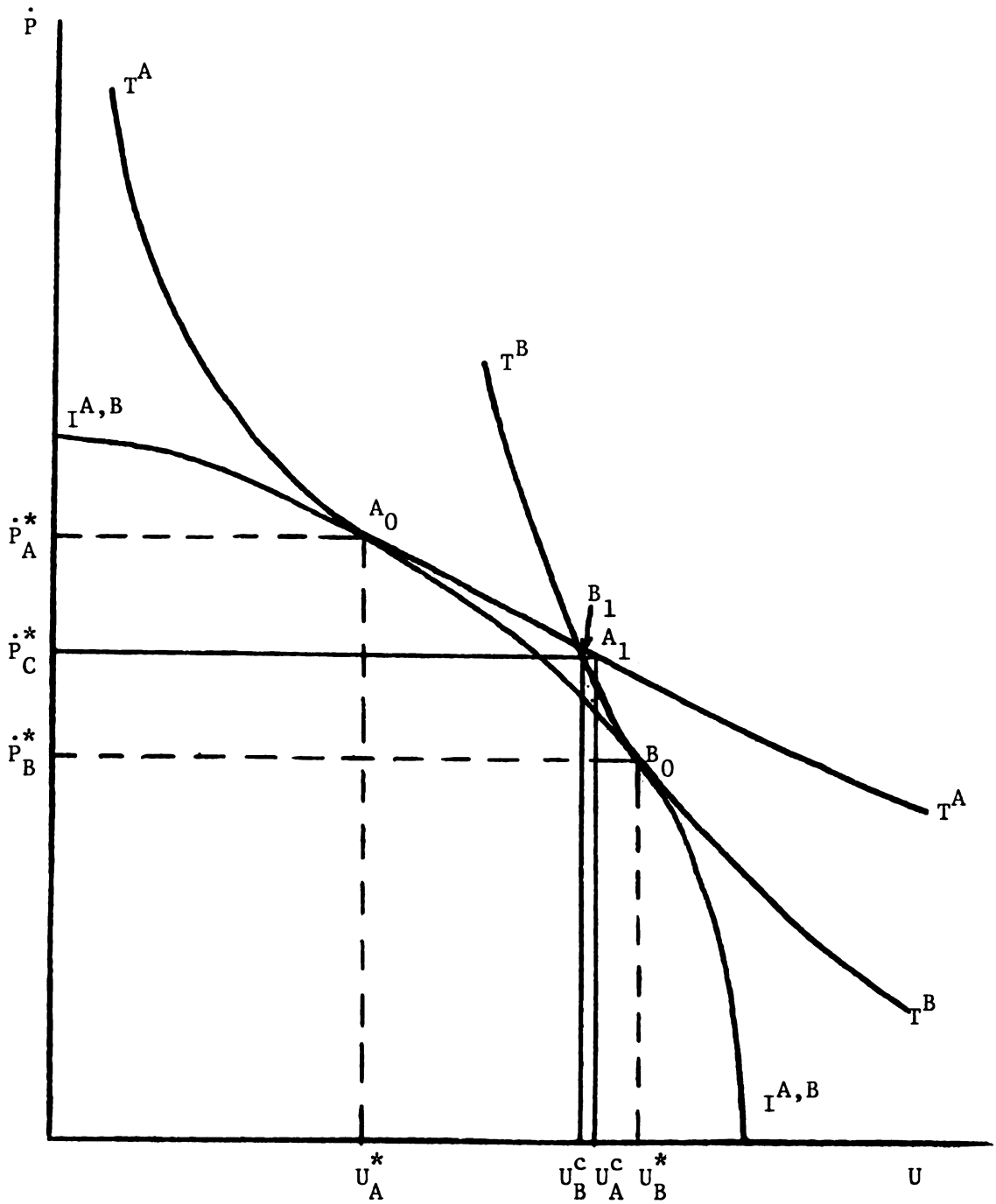

FIGURE 23

MONETARY UNION AND INTERNAL BALANCE
WITH DIFFERENT TRADE-OFFS AND IDENTICAL PREFERENCES

the optimal combinations of inflation and unemployment in countries A and B. Now, we assume that these nations adopt a complete exchange rate union with one unified currency and a common monetary policy. The analysis in Chapter III above indicated that, given the imperfections of the adjustment mechanism, identical monetary policies and identical rates of price increase would be necessary to ensure the fixity and stability of the exchange rate. This conclusion is reinforced in a customs union which prohibits the use of trade controls to pursue national policy goals.[4]

If we assume that the monetary authorities weight the inflation targets of both nations equally, a rate of inflation equal to $\dot{P}_c^*$ will be chosen and will be pursued with the appropriate monetary policy. This will move both countries away from their preferred positions. At A_1, the first country will be required to tolerate higher unemployment than desired. And at B_1, the second country will need to tolerate more inflation than desired. In this case, monetary union will have led to a reduction in social welfare in both nations, since points A_1 and B_1 lie above their social indifference curves. The same situation arises, and identical conclusions are drawn, when both nations exhibit identical trade-offs but different preferences; this case is presented in Figure 24.

It would seem a logical conclusion that, in both of these cases, the losses incurred in terms of economic objectives would impose

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[4]The prohibition is not effectively binding as witnessed by the recent experience in Italy which imposed a special 50% deposit on most imports in the face of severe balance of payments difficulties. Cf. International Monetary Fund Survey, May 6, 1974, p. 139.

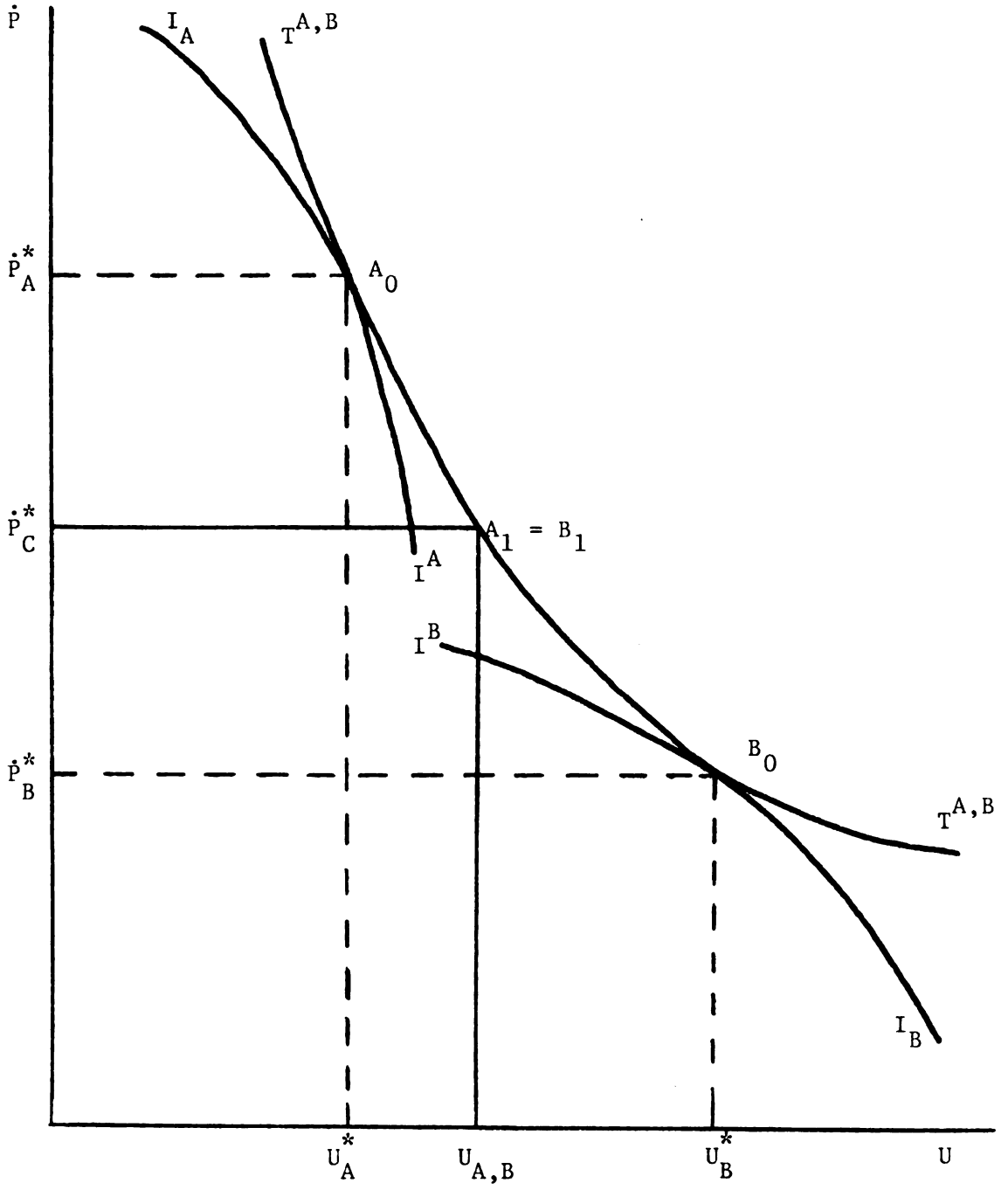

FIGURE 24

MONETARY UNION AND INTERNAL BALANCE
WITH IDENTICAL TRADE-OFFS AND DIFFERENT PREFERENCES

serious strains on the stability of any monetary union.[5] There are, however, certain conditions which, if satisfied, would avoid any welfare losses and which, consequently, would ensure the success of integration in the monetary sphere. The obvious situation would be one in which all integrating parties had identical preferences and were confronted by identical trade-offs. A more realistic case is one in which both preferences and trade-offs differ, but in such a manner that monetary union leaves each country at its optimum position. In Figure 25, it is evident that, since the pre-unification tangency points lead to identical "optimal" rates of price increase, a union of both national currencies would not reduce the level of welfare in either country.[6]

We might also consider the implications of monetary union when the long-run trade-offs are vertical, as postulated by Friedman and Phelps. In Figure 26, we portray two nations with different "natural" rates of unemployment, U_A and U_B. Given their national indifference maps, we note that both nations would maximize their welfare by striving for a corner solution, namely at $\dot{P}^*_{A,B} = 0$. Thus monetary integration would not impose any welfare loss on any member and would appear to be feasible.

The situation is markedly different, however, when the members of the integrating group exhibit a variety of trade-off relations.

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[5] In the spirit of positive analysis, we must abstract from potential political (or other) gains to be derived from a monetary union.

[6] The points of tangency need not be identical as long as $\dot{P}^*_A = \dot{P}^*_B$.

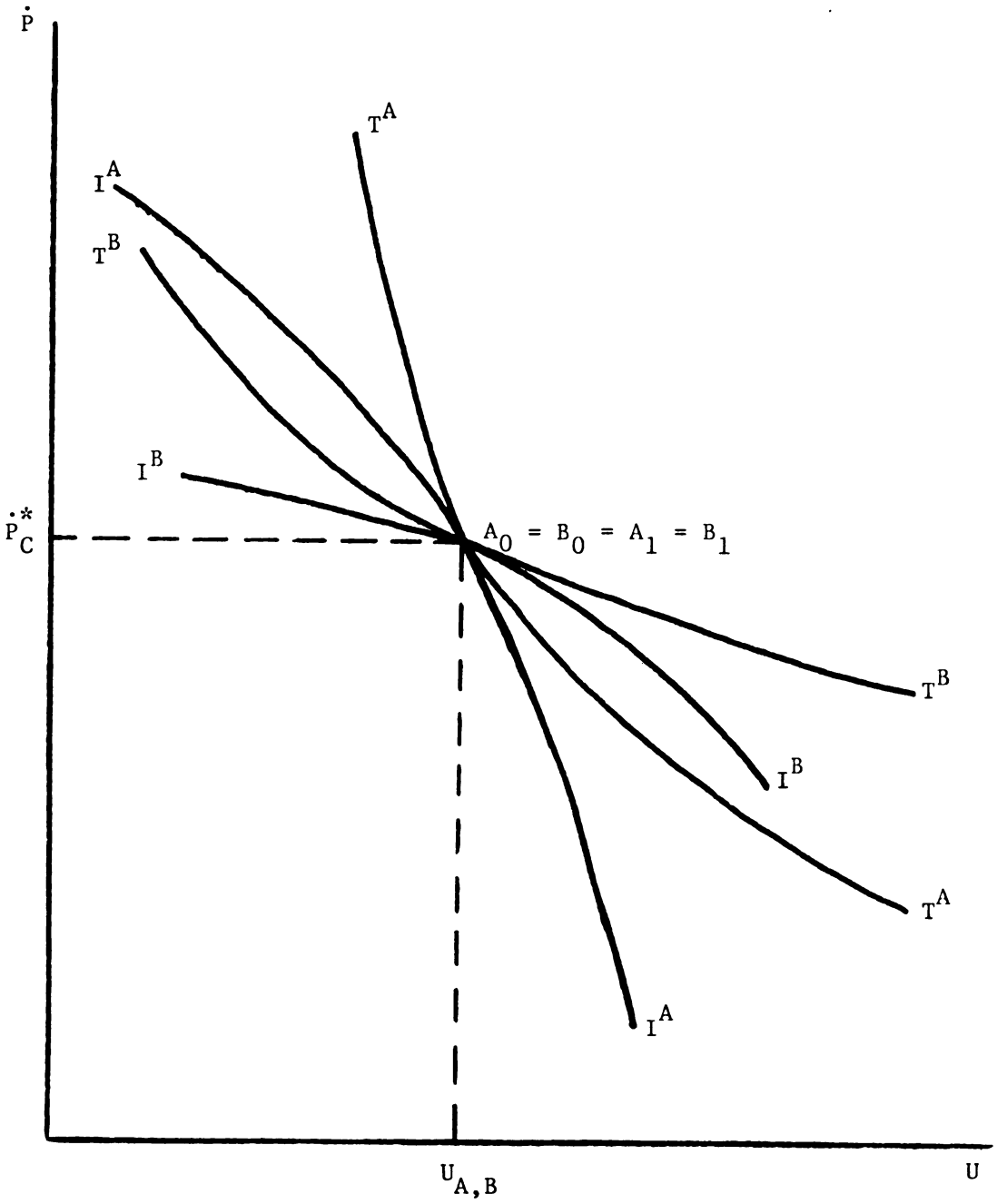


FIGURE 25

MONETARY UNION AND INTERNAL BALANCE
WITH DIFFERENT TRADE-OFFS AND DIFFERENT PREFERENCES

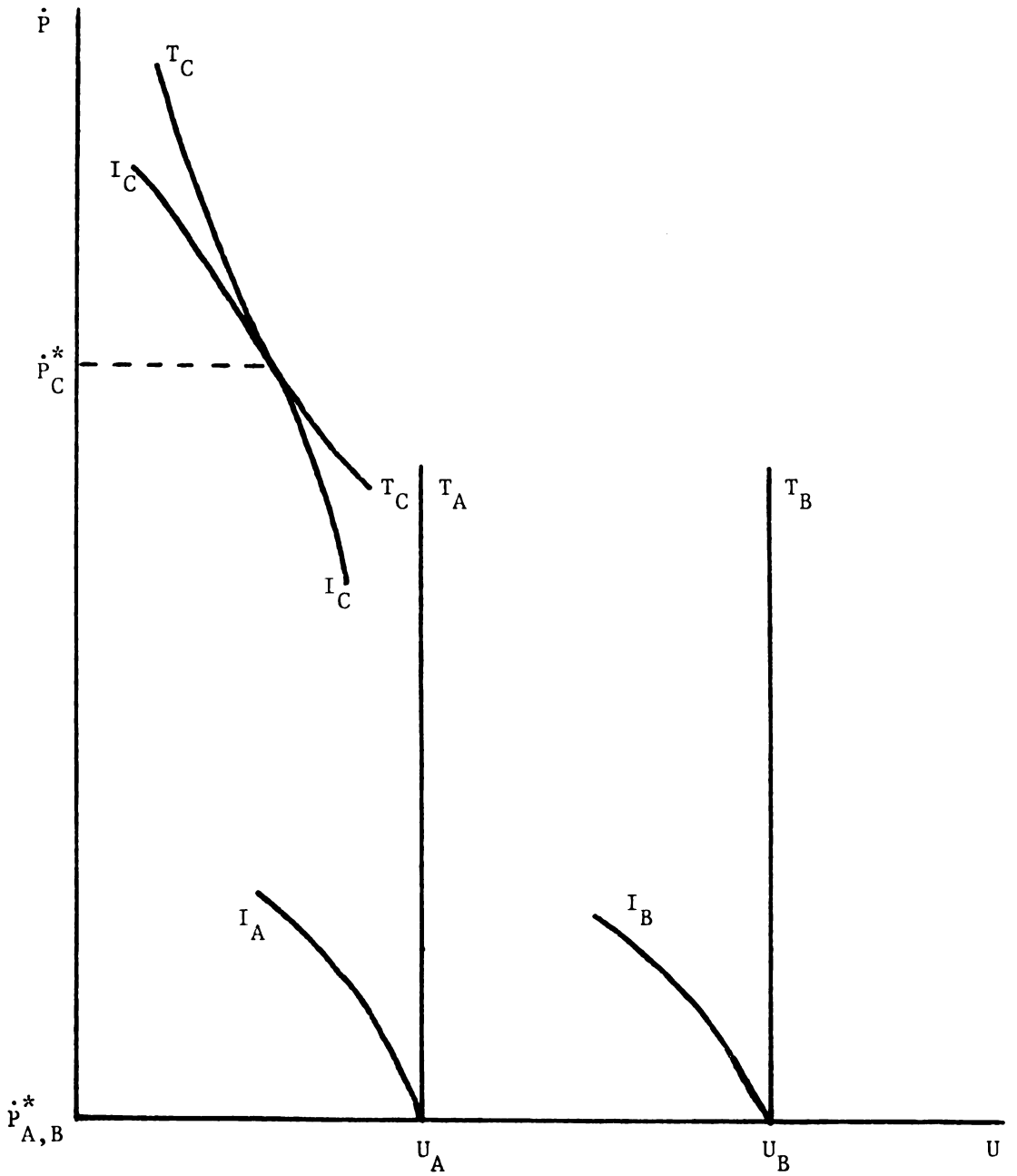


FIGURE 26

MONETARY UNION AND INTERNAL BALANCE
WITH VERTICAL STEADY-STATE TRADE-OFFS

In Figure 26, if country C is confronted by a negatively-sloped target frontier such as T_C, it will desire to inflate at some positive rate $\dot{P}^*_C$. As a result, monetary unification would prove unworkable, regardless of the shape of the trade-off and preference functions. Therefore, either all nations must exhibit vertical long-run trade-offs or none can, if EMU is to be successful.

In the remainder of this chapter, we will determine whether such conditions are satisfied among the members of the European Community. Such an examination should provide concrete evidence on the feasibility of a single, unified European currency in the very near future. We begin with an explanation of steady-state target frontiers, along with the presentation of such curves for the individual members of the EEC. Then we examine alternative integration schemes and derive their implications for the internal balance of each nation. We conclude with the prospects for stable and successful monetary unification.

B - THE STEADY-STATE POLICY FRONTIERS

The policymaker's target constraint is derived from the two-equation model which was specified and estimated above. We concentrate on the long-run, steady-state, in which all variables have attained their equilibrium values. Thus, given the wage and price equations below (in their most general form):

$$(1)\quad \dot{W}_t = \alpha_0 + \alpha_1 U_t + \alpha_2 DU_t + \alpha_3 \dot{P}_t + \alpha_4 \dot{P}_{t-1} + \alpha_5 L\dot{P}_t + \alpha_6 L\dot{P}_{t-1} + \alpha_7 Q2 + \alpha_8 Q3 + \alpha_9 Q4 + \alpha_{10} \dot{W}_{t-1}$$

$$(2)\quad \dot{P}_t = \beta_0 + \beta_1 \dot{W}_t + \beta_2 \dot{W}_{t-1} + \beta_3 \dot{P}_{mt} + \beta_4 \dot{P}_{mt-1} + \beta_5 L\dot{P}_t + \beta_6 L\dot{P}_{t-1} + \beta_7 Q2 + \beta_8 Q3 + \beta_9 Q4 + \beta_{10} \dot{P}_{t-1}$$

we derive the corresponding steady-state equations by assuming that all variables are at their equilibrium levels (e.g. $\dot{W}_t = \dot{W}_{t-1}$), and therefore that the absolute change variables are equal to zero (e.g. $DU_t = 0$), and that the quarterly dummies are also equal to zero. This results in the following two functions:

$$(3)\quad \dot{W}^e_t = \frac{\alpha_0}{1 - \alpha_{10}} + \frac{\alpha_1}{1 - \alpha_{10}} U^e_t + \frac{(\alpha_3 + \alpha_4)}{1 - \alpha_{10}} \dot{P}^e_t + \frac{(\alpha_5 + \alpha_6)}{1 - \alpha_{10}} L\dot{P}^e_t$$

$$(4)\quad \dot{P}^e_t = \frac{\beta_0}{1 - \beta_{10}} + \frac{(\beta_1 + \beta_2)}{1 - \beta_{10}} \dot{W}^e_t + \frac{(\beta_3 + \beta_4)}{1 - \beta_{10}} \dot{P}^e_{mt} + \frac{(\beta_5 + \beta_6)}{1 - \beta_{10}} L\dot{P}^e_t$$

Then, substituting (3) into (4), we obtain the final steady-state trade-off frontier:

$$(5)\quad \dot{P}^e_t = \gamma_0 + \gamma_1 U^e_t + \gamma_2 L\dot{P}^e_t + \gamma_3 \dot{P}^e_{mt}$$

where

$$\gamma_0 = \left[\frac{\beta_0}{1 - \beta_{10}} + \left(\frac{\beta_1 + \beta_2}{1 - \beta_{10}} \right) \left(\frac{\alpha_0}{1 - \alpha_{10}} \right) \right] / D$$

$$\gamma_1 = \left[\left(\frac{\beta_1 + \beta_2}{1 - \beta_{10}} \right) \left(\frac{\alpha_1}{1 - \alpha_{10}} \right) \right] / D$$

$$\gamma_2 = \left[\left(\frac{\beta_1 + \beta_2}{1 - \beta_{10}} \right) \left(\frac{\alpha_5 + \alpha_6}{1 - \alpha_{10}} \right) + \left(\frac{\beta_5 + \beta_6}{1 - \beta_{10}} \right) \right] / D$$

$$\gamma_3 = \left(\frac{\beta_3 + \beta_4}{1 - \beta_{10}} \right) / D$$

$$D = \left[1 - \left(\frac{\beta_1 + \beta_2}{1 - \beta_{10}} \right) \left(\frac{\alpha_3 + \alpha_4}{1 - \alpha_{10}} \right) \right]$$

We note that a vertical long-run trade-off would only result if the expression D were zero. This would be the case if: a) the price coefficients in the wage equation summed to unity and b) the wage coefficients in the price equation summed to unity. Referring to Table 17 above, we see that the wage coefficients in all nations are relatively small in value; negatively-sloped trade-offs would thus be expected. This would also be the case in Belgium and Denmark, for which we found a complete lack of money illusion in wage negotiations.

Based on the preferred wage and price functions which we estimated in the preceding chapter, we derived equation (5) for each nation of the EEC. For the purposes of the subsequent analysis, we then assumed that $L\dot{P}_t^e$ and $\dot{P}_{mt}^e$ take on their average values over

the sample period. The results are displayed in Table 18; the different versions of the trade-off for each country depend on the assumptions we choose to make regarding the value of the various shift and slope dummy variables. These functions are also plotted in price-unemployment space in Figures 27 through 34. The range of unemployment rates actually experienced in each nation is delineated by a solid line. We point out that any extrapolations outside that range are very hazardous; this is particularly true in the case of a non-linear trade-off relationship.

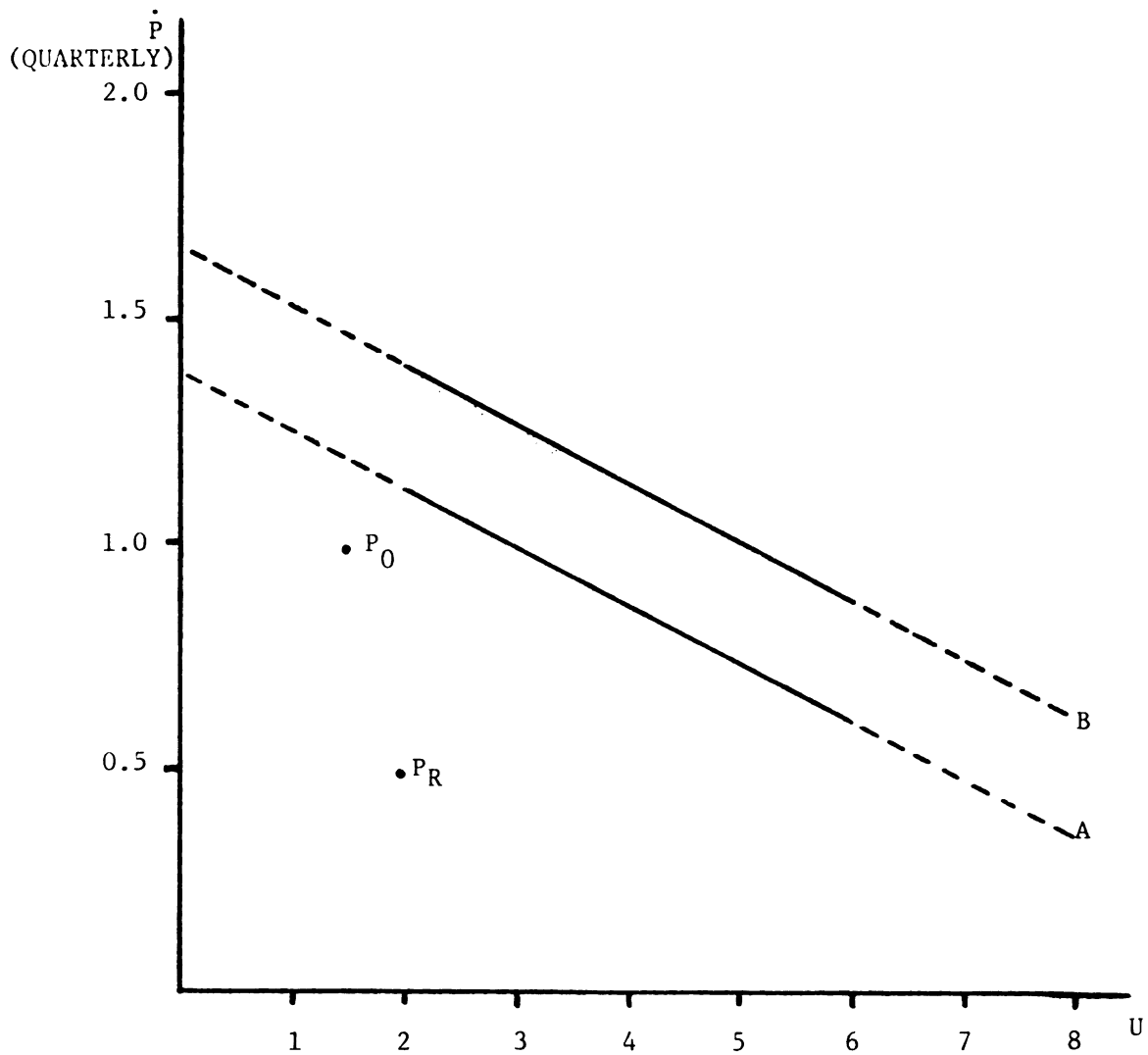
It is apparent that all target frontiers have shifted outwards in the latter part of the 1960's. Some reflect a simple upward movement while others have also rotated, with unemployment exerting a much larger influence on price changes (Denmark). Overall, we must conclude that, in all nations, the policymaker's task has recently become more difficult. The target choices available to him are significantly inferior to those in the early 1960's; consequently,

TABLE 18. STEADY-STATE TRADE-OFFS FOR THE NATIONS OF THE EC

Country	Constant	U_t^e	$(U_t^e)^{-1}$	$(U_t^e)^{-2}$	Assumptions
BELGIUM	1.396	-.134			$\overline{D31} = 0.0$; $\overline{\dot{P}_{mt}} = .729$; $\overline{L\dot{P}_t} = 1.382$
	1.674	-.134			D31 = 1.0
DENMARK	0.871	-.032			$\overline{D37} = 0.0$; $\overline{\dot{P}_{mt}} = .721$; $\overline{L\dot{P}_t} = 1.160$
	1.297	-.108			D37 = 1.0
FRANCE	1.210			.554	$\overline{D28} = 0.0$; $\overline{T*D28} = 0.0$; $\overline{\dot{P}_{mt}} = .905$; $\overline{L\dot{P}_t} = 2.530$
	1.768			1.070	D28 = 1.0; T*D28 = 52.0 (1969-IV)
	2.804			1.070	D28 = 1.0; T*D28 = 68.0 (1973-IV)
GERMANY	0.952		.025		$\overline{D33} = 0.0$; $\overline{D52} = 0.0$; $\overline{\dot{P}_{mt}} = -.085$; $\overline{L\dot{P}_t} = 1.744$
	1.841		.025		D33= 0.0; D52 = 1.0
	0.802		.114		D33 = 1.0; D52 = 0.0
	1.691		.114		D33 = 1.0; D52 = 1.0
IRELAND	0.836	-.045			$\overline{D61} = 0.0$; $\overline{\dot{P}_{mt}} = 1.071$; $\overline{L\dot{P}_t} = 1.241$
	1.871	-.045			D61 = 1.0
ITALY	3.783	-.369			$\overline{D42} = 0.0$; $\overline{\dot{P}_{mt}} = .913$; $\overline{L\dot{P}_t} = 2.314$
	6.861	-.679			D42 = 1.0

TABLE 18. CONTINUED.

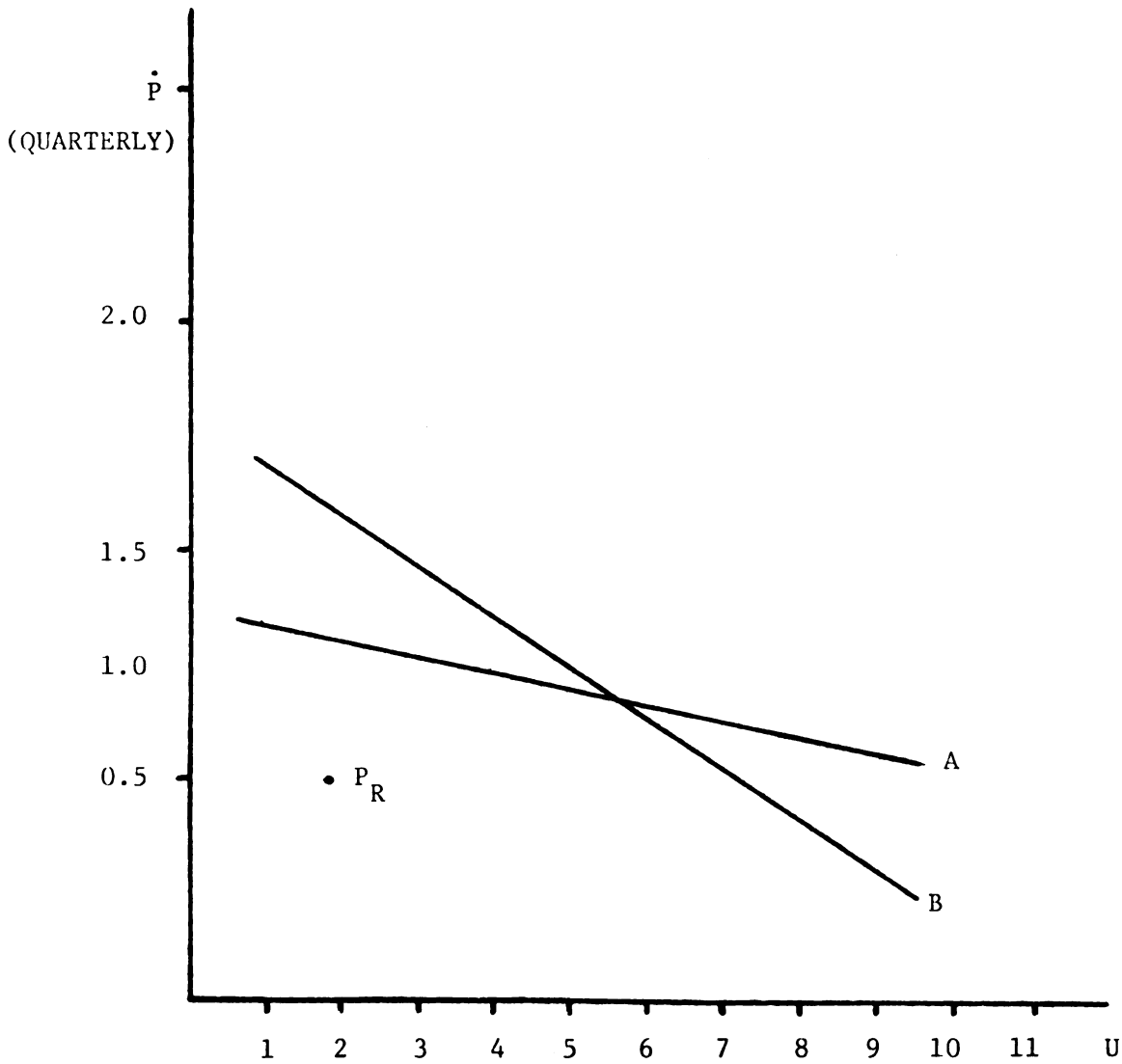
Country	Constant	U_t^e	$(U_t^e)^{-1}$	$(U_t^e)^{-2}$	Assumptions
NETHERLANDS	1.162	-.198			D21 = 0.0; D46 = 0.0; $\overline{D50}$ = 0.0; $\overline{\dot{P}_{mt}}$ = .722; $\overline{L\dot{P}_t}$ = 2.279
	1.648	-.088			D21 = 1.0; D46 = 0.0; D50 = 0.0
	2.352	-.088			D21 = 1.0; D46 = 1.0; D50 = 1.0
UNITED KINGDOM	0.834			.579	D47 = 0.0; T*D47 = 0.0; D69 = 0.0; $\overline{\dot{P}_{mt}}$ = .979; $\overline{L\dot{P}_t}$ = .881
	1.522			.579	D47 = 1.0; T*D47 = 10.0; D69 = 0.0 (1969-IV)
	2.622			.579	D47 = 1.0; T*D47 = 26.0; D69 = 0.0 (1973-IV) (No incomes policy effect)
	1.865			.579	D47 = 1.0; T*D47 = 26.0; D69 = 1.0 (1973-IV) (With incomes policy effect included)



NOTE: EQUATION A: D31 = 0.0
EQUATION B: D31 = 1.0

FIGURE 27

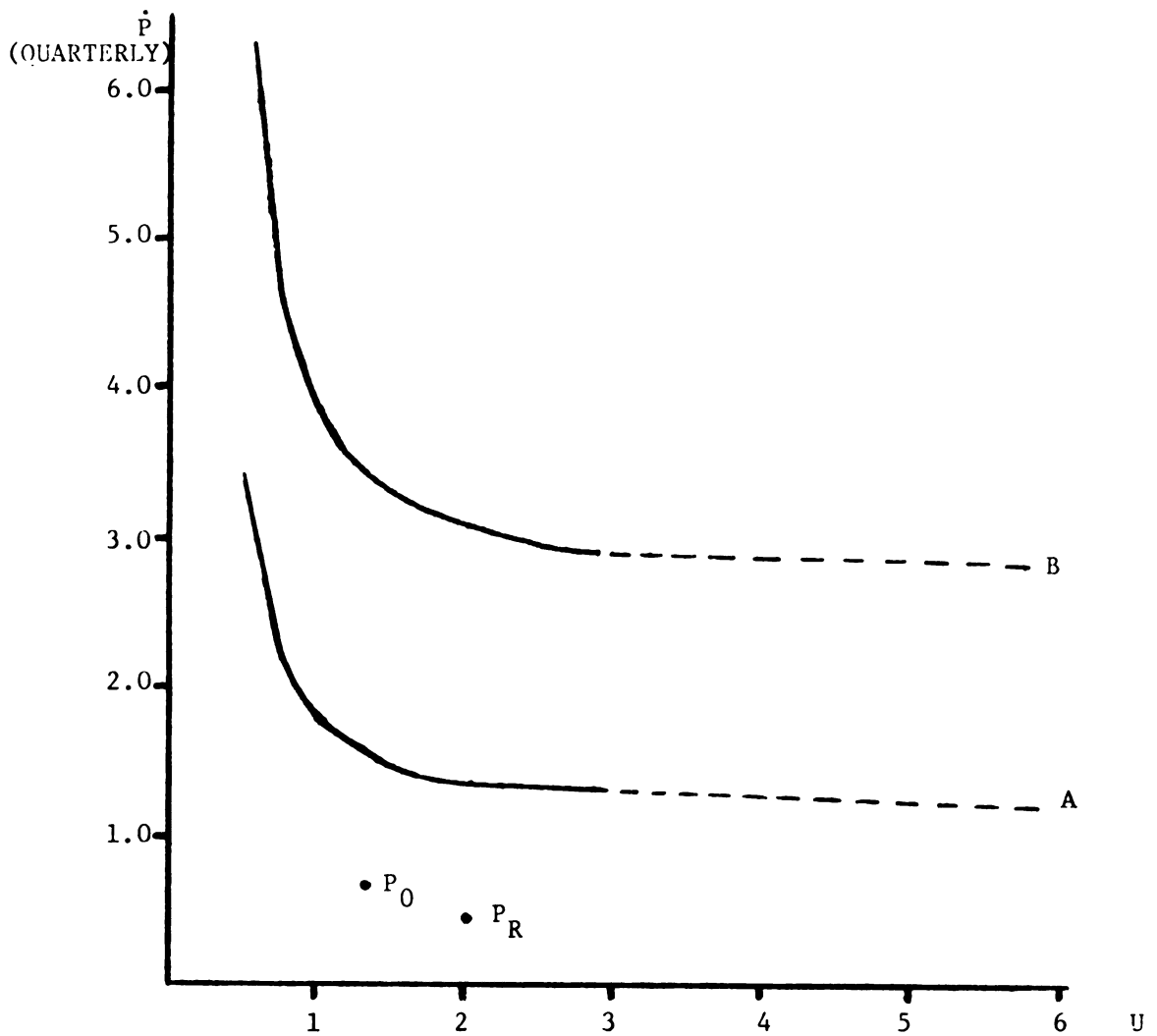
THE STEADY-STATE TRADE-OFF FOR BELGIUM



NOTE: EQUATION A: D37 = 0.0
EQUATION B: D37 = 1.0

FIGURE 28

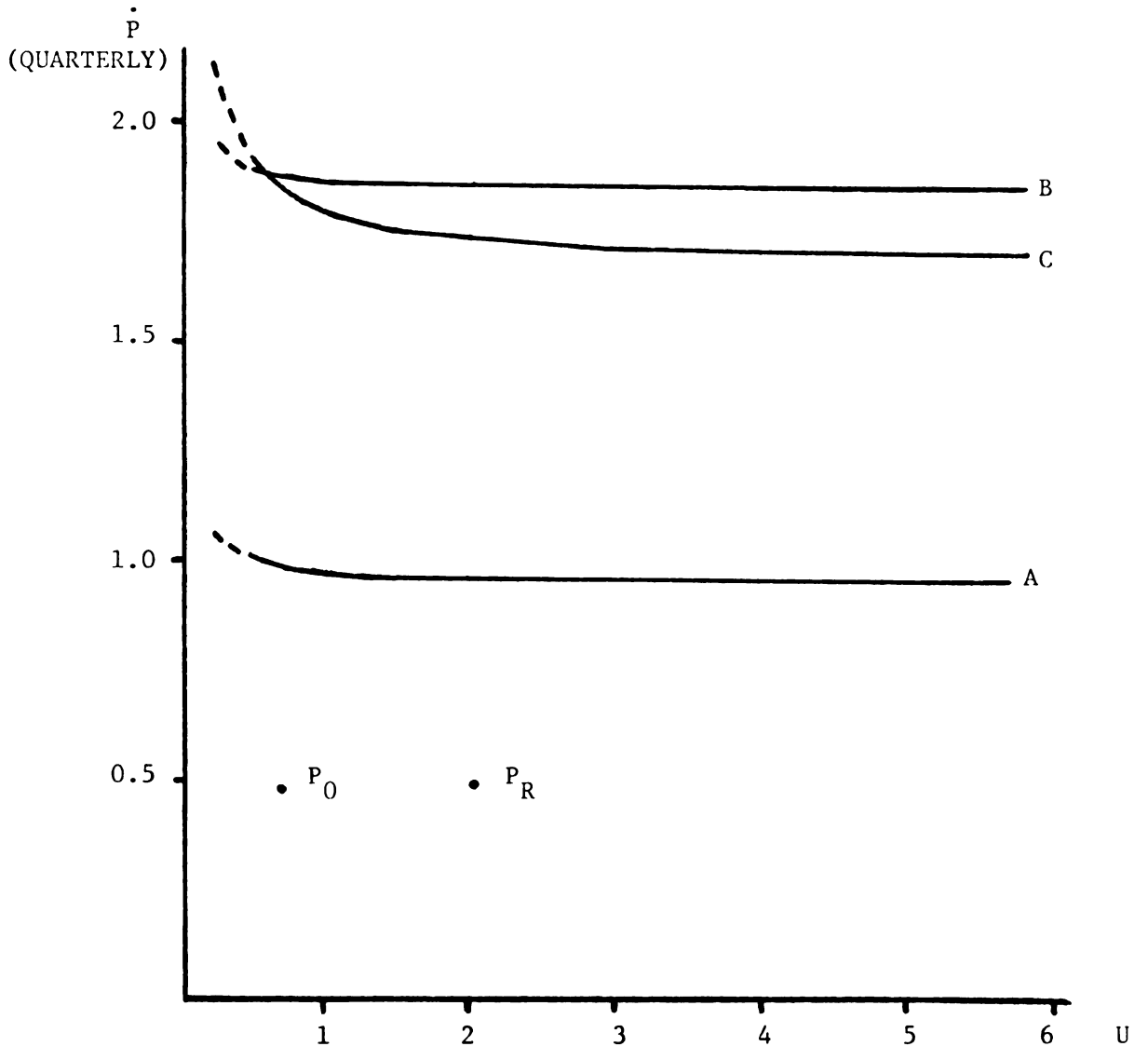
THE STEADY-STATE TRADE-OFF FOR DENMARK



NOTE: EQUATION A: D28 = 0.0
EQUATION B: D28 = 1.0; T*D28 = 68

FIGURE 29

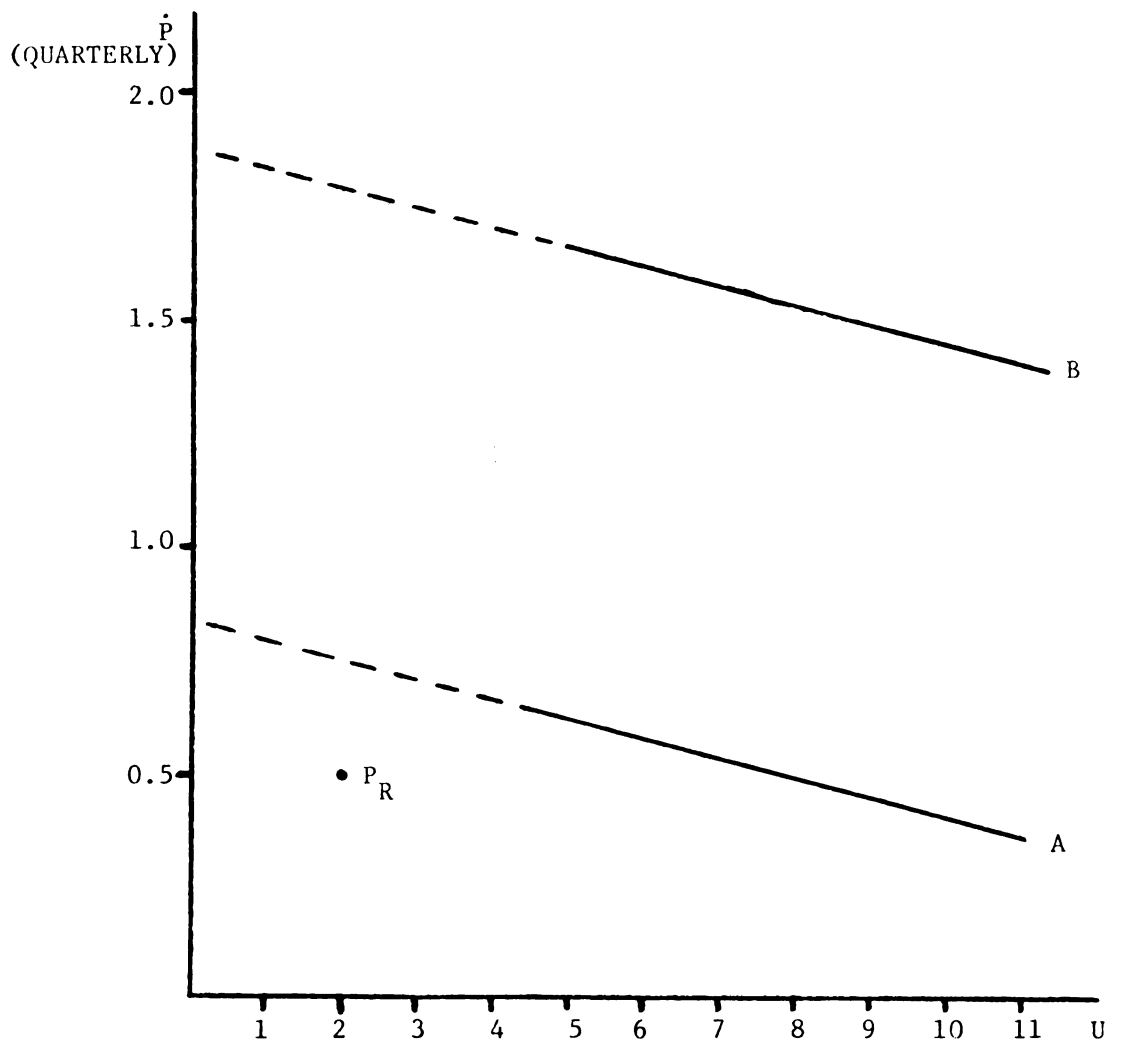
THE STEADY-STATE TRADE-OFF FOR FRANCE



NOTE: EQUATION A: D33 = 0.0; D52 = 0.0
EQUATION B: D33 = 0.0; D52 = 1.0
EQUATION C: D33 = 1.0; D52 = 1.0

FIGURE 30

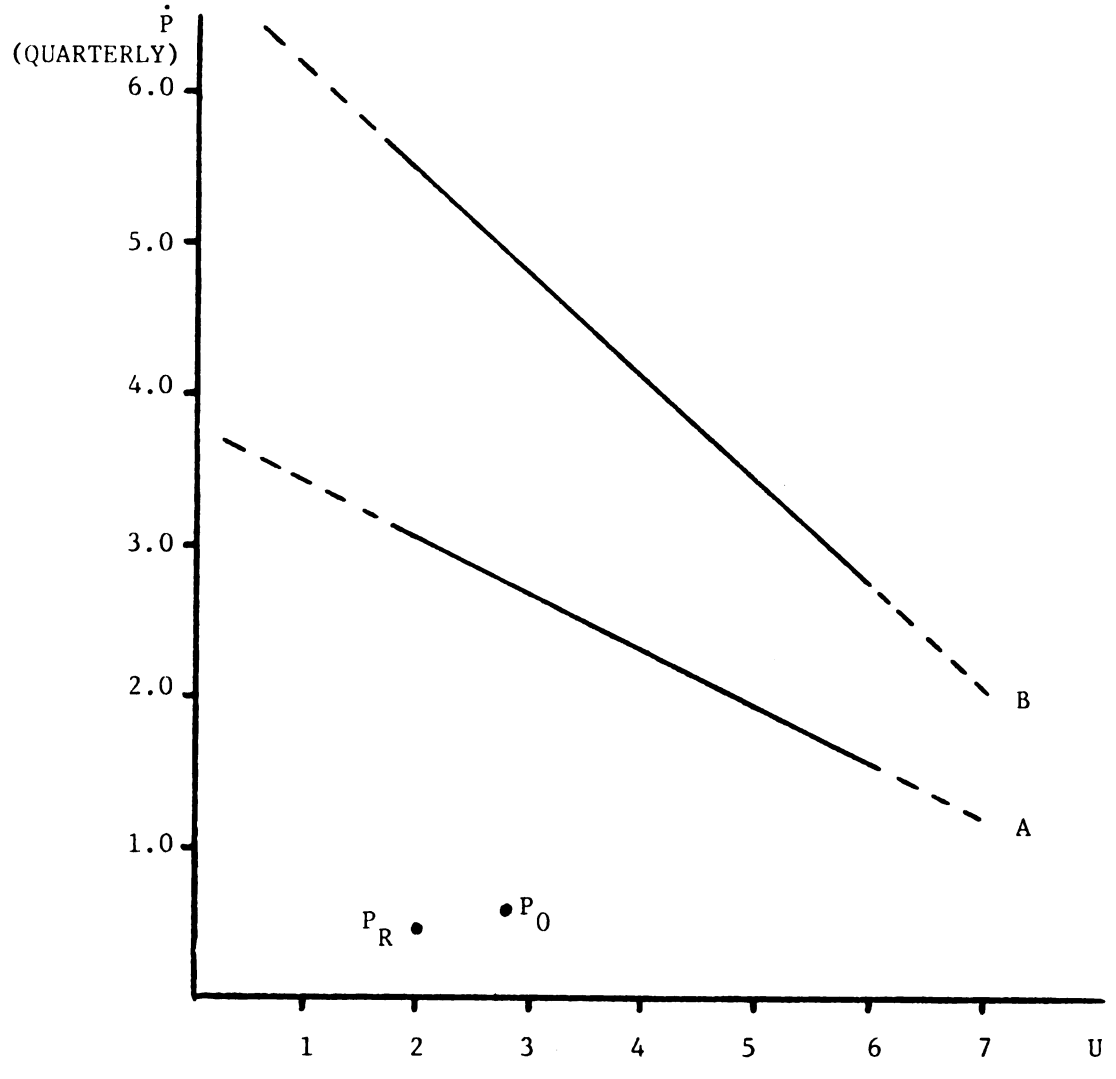
THE STEADY-STATE TRADE-OFF FOR GERMANY



NOTE: EQUATION A: D61 = 0.0
EQUATION B: D61 = 1.0

FIGURE 31

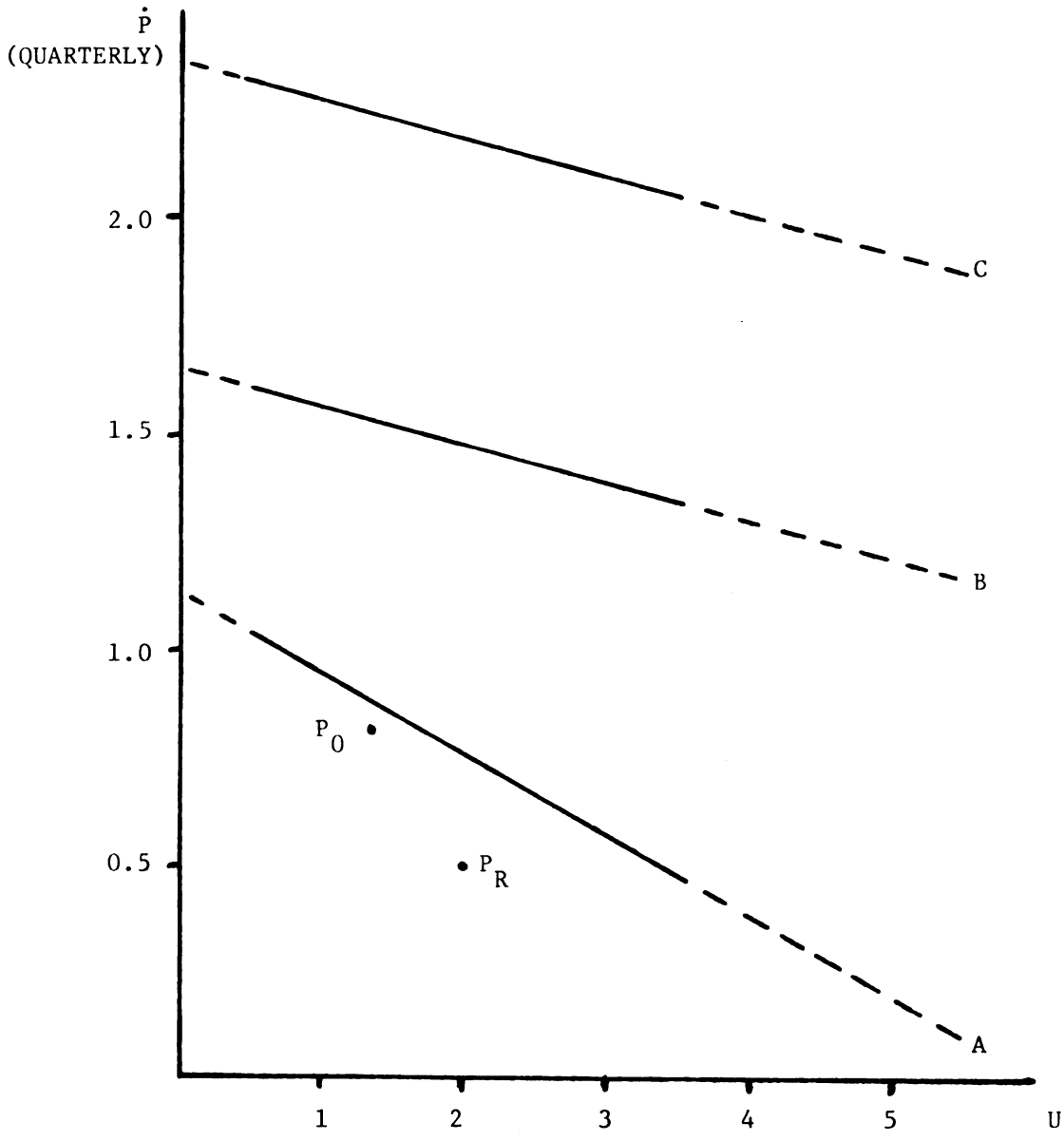
THE STEADY-STATE TRADE-OFF FOR IRELAND



NOTE: EQUATION A: D42 = 0.0
EQUATION B: D42 = 1.0

FIGURE 32

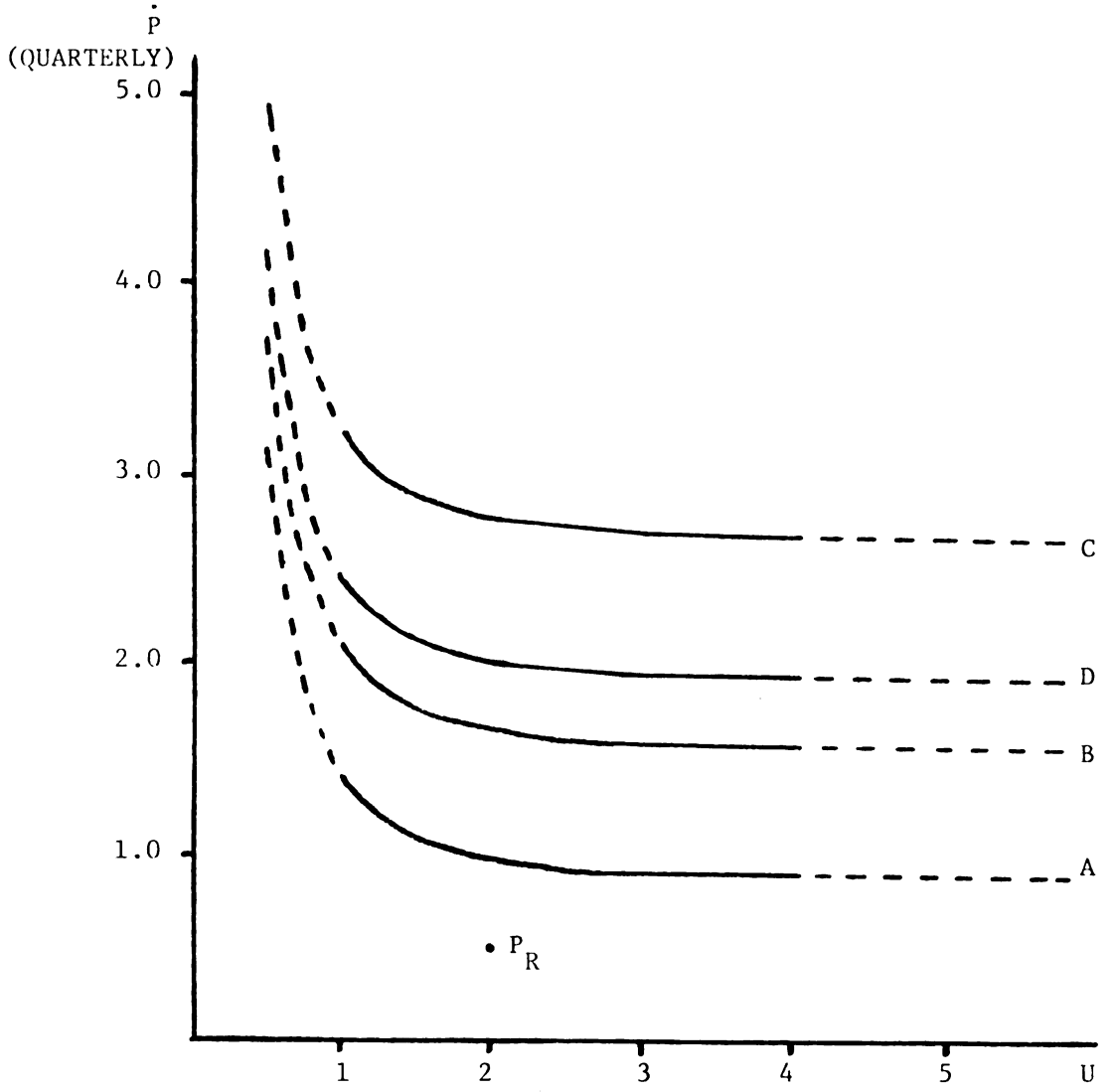
THE STEADY-STATE TRADE-OFF FOR ITALY



NOTE: EQUATION A: D21 = 0.0; D46 = 0.0; D50 = 0.0
EQUATION B: D21 = 1.0; D46 = 0.0; D50 = 0.0
EQUATION C: D21 = 1.0; D46 = 1.0; D50 = 1.0

FIGURE 33

THE STEADY-STATE TRADE-OFF FOR THE NETHERLANDS



NOTE: EQUATION A: T*D47 = 0.0; D69 = 0.0
EQUATION B: T*D47 = 10.0; D69 = 0.0
EQUATION C: T*D47 = 26.0; D69 = 0.0
EQUATION D: T*D47 = 26.0; D69 = 1.0

FIGURE 34

THE STEADY-STATE TRADE-OFF FOR THE UNITED KINGDOM

the level of social welfare in all countries has been reduced.

With respect to the impact of incomes policies on the trade-off, only the United Kingdom has exhibited any success in lowering the rate of price inflation for given rates of unemployment. This only occurred in 1973, as reflected by the downard shift of the target frontier from C to D in Figure 34. On average, this latest wage and price control scheme has reduced the rate of inflation by three quarters of a percentage point per quarter.

The information contained in these objective trade-off functions will now permit us to evaluate various schemes for monetary unification in the Common Market.

C - THE FEASIBILITY OF EUROPEAN MONETARY INTEGRATION

It is instructive to examine the prospects for successful monetary unification at different periods in recent history. Such an exercise will provide additional evidence on difficulties to be encountered in the drive toward EMU. These difficulties should gradually diminish if economic conditions in the member countries are becoming more similar over time. Two factors might produce such a phenomenon: the opening up of trade channels within the context of the customs union; and conscious efforts, since 1970, to harmonize economic policies within the Community.

As outlined above in Chapter II, the publication of the Barre Report, in 1969, marked the beginning of serious attempts at monetary unification. The situation in the latter part of that year provided the background against which the Community, via the Werner Report, accepted the aim of, and vowed to progress toward, a single European currency. Our point of reference then will be the fourth quarter of

1969, for which we have plotted the individual steady-state target frontiers in Figure 35. We should note that, as described in the data Appendix, there is a wide difference in the definitions of unemployment, along with the survey techniques utilized in the various countries of the Community. This is particularly evident in the case of France, for which we had to adjust the unemployment data in order to obtain a more accurate estimate of the number of persons actually seeking employment. Such discrepancies do not, however, invalidate the analysis which will follow from Figure 35. It is our contention that the national policymakers react to their own concepts of unemployment and this is the crucial determinant of the feasibility of EMU. Adjusting the unemployment data by constant blow-up factors would not alter any of our main conclusions. It should, however, be borne in mind that the vertical axis in the succeeding figures should perhaps be different for each national trade-off function.

Turning to Figure 35, we note that these national trade-offs are somewhat concentrated, during that quarter, about an inflation rate of 1-1.5% per quarter. However, given this range of values for $\dot{P}$, it is evident that three countries would find themselves in delicate situations. Italy would be required to accept a moderately high rate of unemployment while Germany would need to tolerate a very low rate of unemployment, in the vicinity of one-quarter of a percentage point. France, however, would provide the major stumbling block to a common rate of inflation. Since the French trade-off has a relatively larger lower asymptote, the monetary authorities in the Community would inevitably be forced to accept a rate of price increase exceeding 1.768% per quarter. This would lead to very low rates of unemployment in most of the other nations (below 1%), and in the area of 5% in Italy.

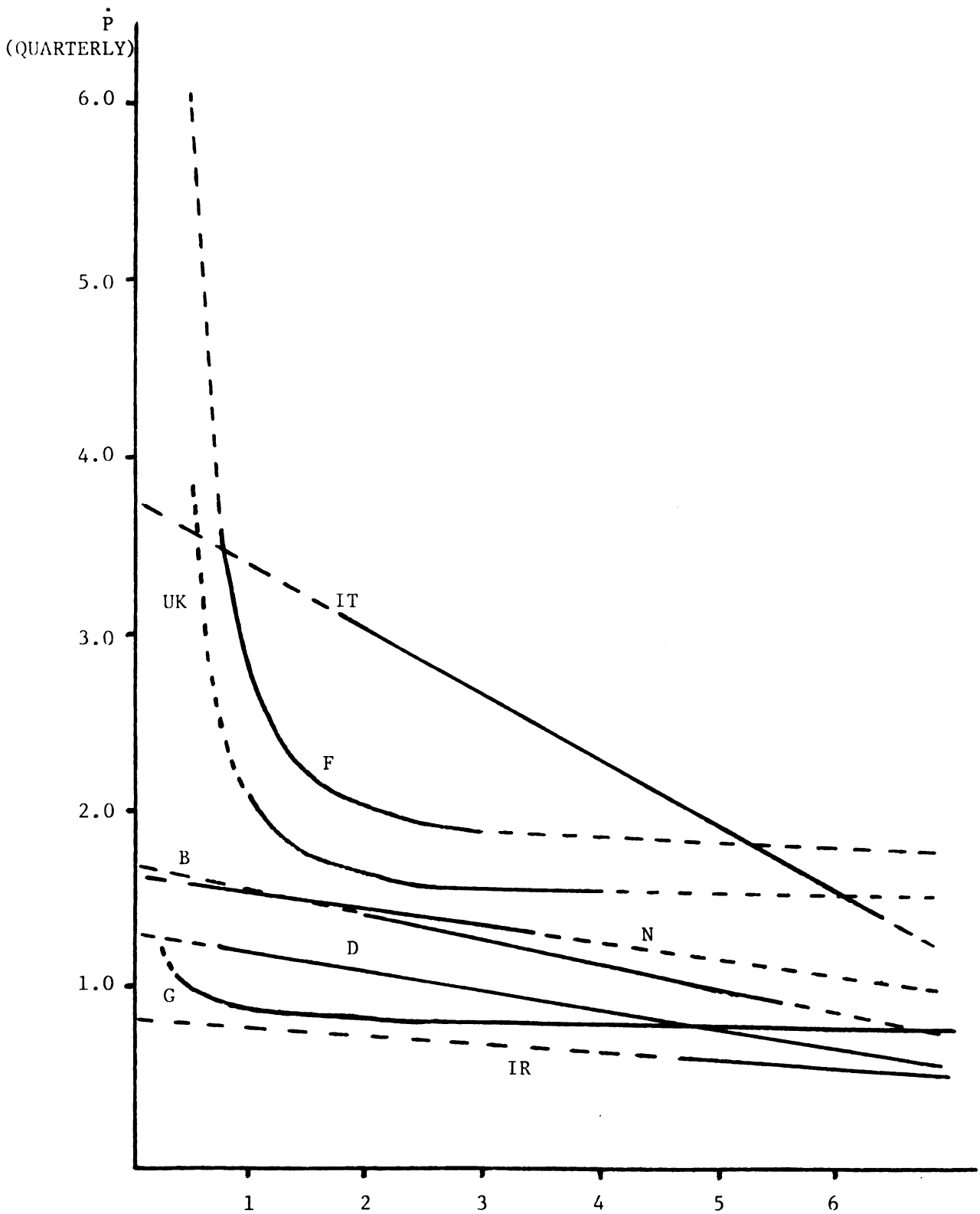


FIGURE 35

STEADY-STATE TRADE-OFFS IN THE EC (1969-IV)

The possibility of achieving such a compromise situation must, in the end, depend on the various national preferences as to unemployment and inflation. Though most nations are wary of officially specifying quantitative values for these two targets, the concensus of opinion would seem to be that a rate of unemployment in the neighborhood of 2% would be highly desirable, accompanied by a preferred rate of inflation of 2% per annum.[7] A recent Community survey of the preferences of the original members of the EEC provides some support for these approximate figures.[8] The "official" targets for inflation and unemployment, respectively, are: Germany (1.9% and 0.7%), France (2.8% and 1.3%), Italy (2.5% and 2.7%), Netherlands (3.3% and 1.3%), and Belgium (3.7% and 1.5%).

To examine the realism of such aggregate objectives, we converted the inflation rates above to a compounded, quarterly rate and then plotted both sets of targets for each nation in Figures 27 through 34; the rough targets are labeled P_R, and those officially pronounced are labeled P_0. It is immediately apparent that all combinations of $\dot{P}^*$ and U^*, in every country, are highly implausible, at least in terms of the experience of the last two decades. And these targets become even more unrealistic when we allow for the widespread outward shift in the national trade-off functions which occurred toward the end of our sample period.

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[7] This figure is presented by Gordon, based on personal interviews with European officials. Cf. R.A. Gordon, "Full Employment as a Policy Goal", in Ross, op. cit., pp. 25-55, especially footnote 33, p. 43.

[8] Cf. "Projet de troisième programme de politique économique à moyen terme", Journal Officiel des Communautés européennes, 1er mars, 1971.

In any case, such numbers still represent policymakers' preferences and, thus, we must accept them at face value. Given these, and referring again to Figure 35, it is evident why very few concrete steps toward policy coordination were implemented after the publication of the Werner Report. Few nations would accept the already-mentioned rate of inflation of 1.768% (7.3% on an annual basis), along with rates of unemployment well under 1%. And it would be difficult for Italy, already burdened with seriously-depressed regions, to tolerate a 5% rate of unemployment. Further departures from internal balance, for the sake of a political ideal, simply imposed welfare losses too heavy to accept.

We might then ask whether the situation has improved over time, as we might expect with a group of nations which is closely-linked economically and which is making modest attempts to coordinate policies. If we examine the rates of price increase in the members of the EEC for selected subperiods, the evidence is not encouraging.

TABLE 19. PERCENTAGE PRICE INCREASES, SELECTED PERIODS

Country	1960-65	1966-69	1970-73
BELGIUM	2.82	3.07	6.83
DENMARK	5.86	5.97	9.88
FRANCE	4.00	4.10	8.20
GERMANY	3.15	1.80	7.12
IRELAND	4.64	4.82	12.78
ITALY	5.19	2.31	9.02
NETHERLANDS	4.07	4.17	9.67
UNITED KINGDOM	3.90	3.97	11.07
AVERAGE	4.20	3.78	9.32
STANDARD DEVIATION	1.01	1.35	2.00

As Table 19 reveals, in any given subperiod, the national rates of inflation have varied widely. But even more disturbing is the finding that these rates have not been converging toward one another from 1960 to 1973, as witnessed by the standard deviation of the figures in each period. Instead, nations have been inflating in an increasingly-diverging fashion. Such developments do not promise well for the maintenance of absolutely rigid exchange rates in the Community.

A very similar prognosis is suggested by the plots of the steady-state trade-off curves for the fourth quarter of 1973. Figure 36 discloses that these functions, in addition to having shifted outwards, are now much farther apart than was the case in late 1969. The conclusion to be drawn is that it will be even more difficult to design a common monetary policy in the future. The maximum rates of inflation in Belgium, Denmark, Ireland and the Netherlands (1.3 - 2.3%) are in direct conflict with the minimum rates in France and the United Kingdom (2.6%). And, again, Italy and Germany would be required to accept relatively high and low rates of unemployment, respectively.

The above analysis, though indicative of the braod tendencies, is not sufficiently precise. What is really needed is an examination of the rankings of the unemployment implications of EMU along with the rankings of the national preferences as to unemployment. If these are roughly matched, then we can conclude that EMU will have some chances of success.

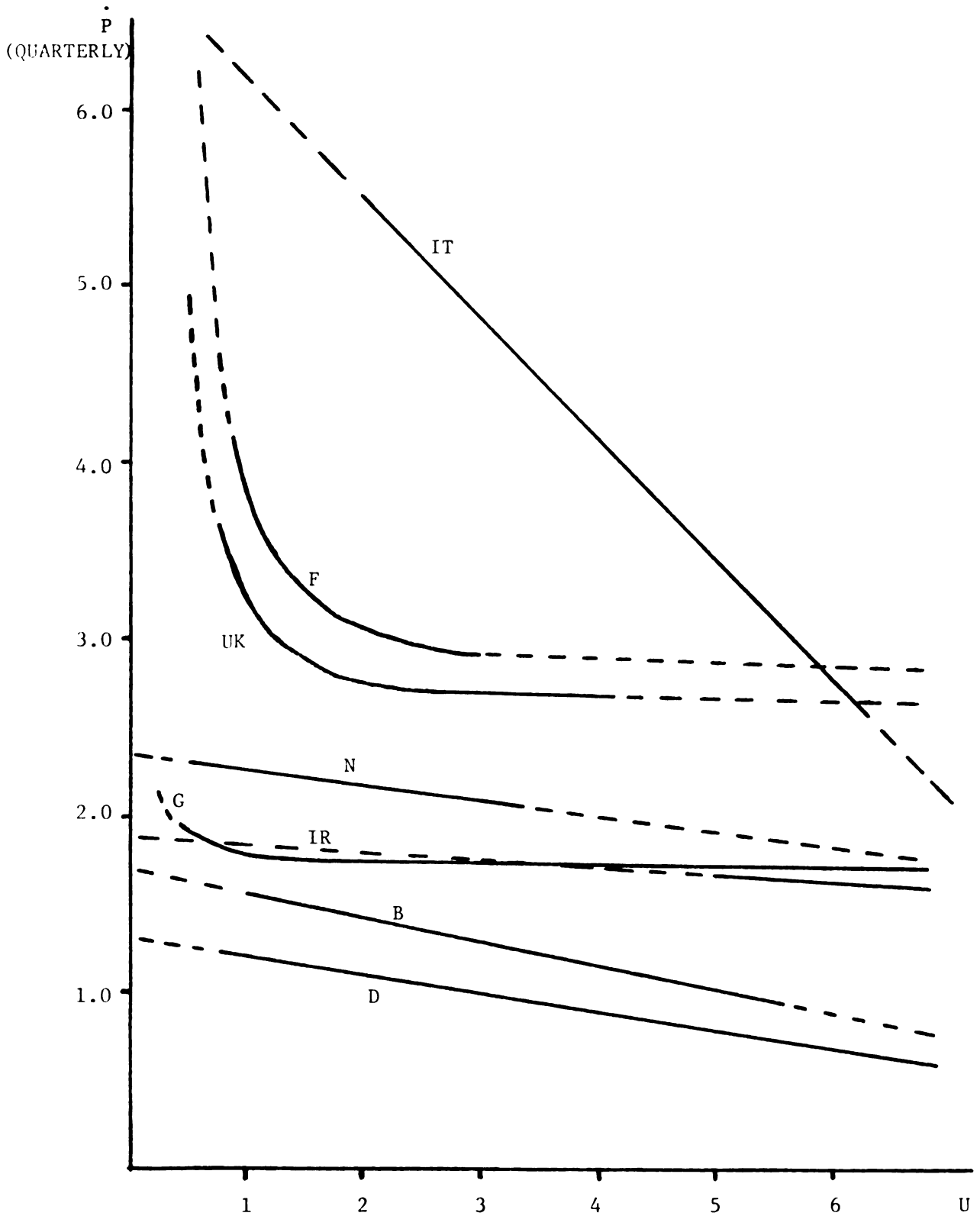


FIGURE 36

STEADY-STATE TRADE-OFFS IN THE EC (1973-IV)

Given the situation in 1973-IV, we note that France and the United Kingdom could not participate in a monetary union; there are no inflation rates which are compatible with experience in the other nations. In addition, the trade-offs in Belgium and Denmark are too low relative to the others, such that joining the EMU would not seem to be feasible. Among the remaining nations, Germany provides the lower bound to the range of possible inflation rates. Table 20 outlines the unemployment implications of various common rates of price increase, along with the national preferences for unemployment.

TABLE 20. THE UNEMPLOYMENT IMPLICATIONS OF EMU (1973-IV)[a]

COUNTRY	RATES OF PRICE INFLATION				UNEMPLOYMENT PREFERENCES	
	1.70	1.75	1.80	1.85		
GERMANY	12.7 (4)	1.9 (1)	1.1 (1)	0.7 (2)	0.7%	(1)
IRELAND	3.8 (1)	2.7 (2)	1.6 (2)	0.5 (1)	6.9% (mean)	(4)
ITALY	7.6 (3)	7.5 (4)	7.5 (4)	7.4 (4)	2.7%	(3)
NETHERLANDS	7.4 (2)	6.8 (3)	6.3 (3)	5.7 (3)	1.3%	(2)

[a]The rankings are in parentheses

It would appear that a monetary union might be feasible among a subgroup of European nations, as long as the rate of inflation exceeded 1.75% per quarter. The exception is Ireland which would experience lower rates of unemployment than were experienced, on average, over our sample period. This would tend to indicate that it might prefer lower rates of inflation than those indicated above.

Given these pessimistic results, we might examine the changes for the success of a much broader EMU if pre-1970 conditions were to

return. Referring again to Figure 35, we note that both France and Ireland are outside the range of the other target frontiers; the United Kingdom would appear to be marginal. In Table 21, we perform a similar exercise as above in Table 20.

TABLE 21. THE UNEMPLOYMENT IMPLICATIONS OF EMU (1969-IV)[a]

COUNTRY	RATES OF PRICE INFLATION						UNEMPLOYMENT PREFERENCES	
	0.85	1.00	1.25	1.60	1.625	1.64		
BELGIUM	6.2(2)	5.0(3)	3.2(3)	0.6(2)	0.4(3)	0.3(3)	1.5%	(3)
DENMARK	4.1(1)	2.8(2)	0.4(2)	-	-	-	3.5% (mean)	(6)
GERMANY	8.8(4)	0.6(1)	0.3(1)	0.1(1)	0.1(1)	0.1(1)	0.7%	(1)
ITALY	8.0(3)	7.5(5)	6.9(5)	5.9(5)	5.9(5)	5.8(5)	2.7%	(5)
NETHERLANDS	9.1(5)	7.4(4)	4.5(4)	0.6(2)	0.3(2)	0.1(1)	1.3%	(2)
UNITED KINGDOM	-	-	-	2.7(4)	2.4(4)	2.2(4)	2.0% (mean)	(4)

[a]The rankings are in parentheses.

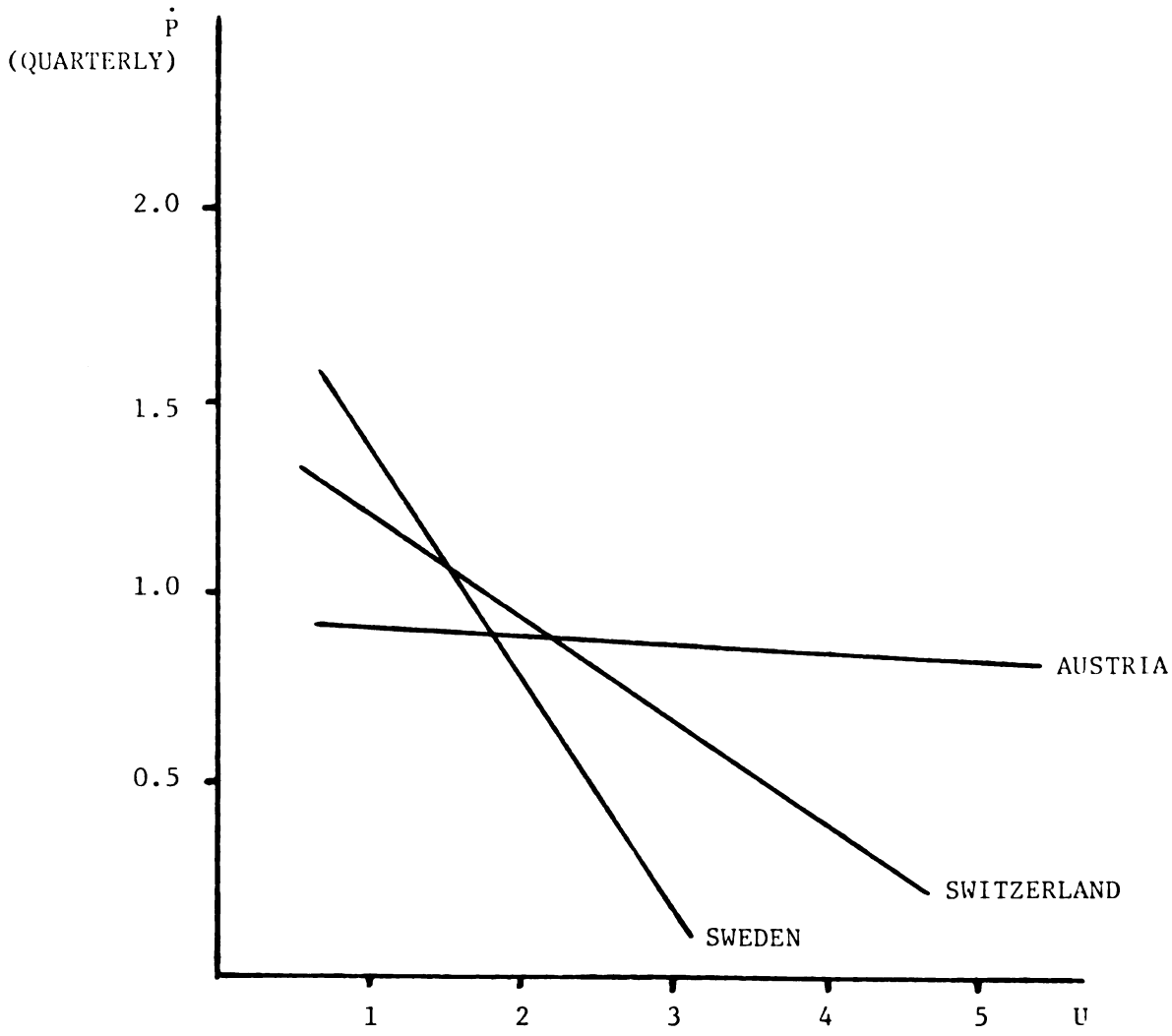
A comparison of national preferences with the unemployment implications of EMU in the first three columns indicates that unemployment would be much too low in Denmark, if it joined in a monetary union. The next three columns, however, appear to be more encouraging. At rates of inflation exceeding 1.6% per quarter, the preference rankings seem to match fairly well with the implications of a common money. Thus, monetary integration might prove feasible for Belgium, Germany, Italy, the Netherlands, and the United Kingdom if the economic conditions of the 1960's were to reappear.

Since such an occurrence is uncertain at the present time, it might be interesting to evaluate the viability of the current

European joint float. Figure 36 discloses that, with the permitted range of currency fluctuations of 2¼%, the snake arrangement may indeed be a feasible proposition. Most of the trade-offs are clustered in the vicinity of 1-2% rates of inflation. The position of these trade-offs for France, Italy, and the United Kingdom explains why these nations dropped out of the float in January 1974, March 1973, and June 1972, respectively. France's decision to rejoin the arrangement in July of 1975 would thus appear to be questionable. Given its trade-off frontier, we would foresee a need, on the part of the authorities, to intervene in foreign exchange markets in order to maintain the value of the franc above the lower bound of the snake.

In the case of the United Kingdom and Italy, the possibility of their rejoining the float appears dim. On one hand, we note that the UK's trade-off is shifting outwards continuously, thus reducing the chances for maintaining the value of the pound sterling fixed vis-à-vis other European currencies. In the case of Italy, the situation is clear-cut. Its trade-off has shifted outwards to such an extent that it would need to tolerate a rate of unemployment in the area of 5% in order to rejoin the snake. This conflicts directly with their officially announced target of 2.7%.

The joint float is also being adhered to, either officially or informally, by Norway, Sweden, Austria, and Switzerland. Figure 37 depicts their trade-off experiences for the 1960's, based on other empirical estimates which were available (no satisfactory trade-off for Norway could be found). If we compare these functions with those



SOURCE: U.N. ECONOMIC COMMISSION FOR EUROPE, op. cit., SPITÄLLER, op. cit.

NOTE: Rates of inflation were converted to compounded quarterly rates.

FIGURE 37

STEADY-STATE TRADE-OFFS FOR AUSTRIA, SWEDEN AND SWITZERLAND

in Figure 35, we discover that they seem quite consistent with those of the majority of Community nations. If we make the reasonable assumption that these frontiers have also shifted outwards since 1970, it would appear that their adherence to the joint float is practicable.

D - IMPLICATIONS FOR MONETARY UNIFICATION

The above analysis has discovered some of the reasons for the recent difficulties encountered in attempts to approach monetary integration in Europe. As far as the future of EMU is concerned, we can only draw certain inferences from our research.

In the first place, the German approach to integration seems to be the more reasonable and promises the most for any future success. The integration of Community currencies will only be a feasible scheme once economic trends and policies have been coordinated to a greater extent. Only then will acceptance of a common monetary policy be possible, since welfare losses among member nations would presumably be much smaller. Thus it would seem desirable to maintain some flexibility in EEC rates of exchange, perhaps through an indefinite extension of the current "joint float" arrangement, until conditions are more propitious for the adoption of a common currency.

Finally, it might be necessary to introduce, at a very early stage, a programme of extensive fiscal transfers from one nation to the other to alleviate the unemployment effects of greater economic coordination. This could possibly be achieved in the framework of the current European Monetary Cooperation Fund. If property administered, such transfers should channel capital into infrastructure improvements

such that labor productivity were increased. In addition, investments could be made in programs to retrain and relocate unemployed workers. In the long run, we would expect such measures to draw the trade-off curve down closer to the origin. Only if such shifts in the national target frontiers can be accomplished, will an irreversible unification of Community currencies prove feasible in the very near future.

CHAPTER VII

SUMMARY AND CONCLUSIONS

The purpose of this research has been to evaluate the feasibility of monetary integration in the European Economic Community. The member nations have pledged to pursue this goal in successive phases, as outlined in the Werner Report, with each stage involving a greater degree of policy coordination. The ultimate objective, to be achieved in 1980, is the adoption of a single European currency along with a common monetary policy to be administered by a Community central bank.

In this study, we thus set out to determine the viability of a common European monetary policy and the impact of such a program on the internal balance of the member states. We began by specifying and estimating a two-equation model of wage and price determination for each country. We then submitted each equation to a newly-developed series of statistical tests to determine if, and when, any of the structural coefficients had exhibited instability over the sample period. Armed with this information, we then re-estimated the equations, including the appropriate combination of various shift and slope dummy variables. From our preferred estimates, we subsequently computed the steady-state target frontiers for each country, given different values of the dummy variables.

These long-run inflation-unemployment trade-offs permitted us to evaluate the European drive toward monetary union. It was seen

that, given the significant differences in the shape and position of these functions at the time of the introduction of the Werner Report, only meagre steps in the direction of a common currency could have been taken. This indeed turned out to be the case, as witnessed by recurring failures, after 1970, to coordinate national economic policies.

It was also shown that future prospects for the successful adoption of a European currency were no brighter, and were likely even worse. We discovered that the target frontiers had actually shifted outwards in the recent past, thus worsening the policymaker's dilemna of choosing an optimal combination of inflation and unemployment. Moreover, at the end of 1973, these curves were significantly farther apart than had previously been the case. Therefore, the viability of a common monetary policy, along with identical rates of price increase, proved to be even more doubtful than at the start of the drive toward EMU. It thus appeared that severe problems of economic coordination were primarily responsible for the recent dampening of the integrative spirit.

The implications of our research for the future of EMU seem straightforward. As the Germans have always claimed, a greater degree of policy coordination will be required in coming years if a common currency is to be a feasible proposition. Only when economic trends in the member states become more similar will the loss of monetary autonomy be acceptable to national policymakers. This approach was recently suggested by a group of experts as being the only one which would hold any promise for the long-run stability of a monetary union. In their words:

> The approach recognizes the danger that a premature fixing of exchange rates may serve only to bring about a suspension of convertibility and put an end to the free flow of goods and services as well as of capital and labor. If the common political will is strong enough against divergent national trends, coordination of monetary policy will lead eventually to constant rates of exchange.[1]

Therefore, it would seem desirable to maintain, for the foreseeable future, some flexibility of intra-EEC exchange rate relationships. This could easily be accomplished through an indefinite extension of the current "joint float" system whereby Community rates of exchange float as a group vis-à-vis the outside world, but are also permitted a fixed margin of variation vis-à-vis one another.

Finally, an extensive system of fiscal transfers from flourishing to stagnating regions (regardless of national boundaries) will be required to prevent the development of chronically-depressed regions within the Community. Such capital transfers will, however, need to be closely supervised such that they result in beneficial infrastructure improvements to increase the competitive position of laggard areas. In this vein, a broadening of the current European Monetary Cooperation Fund at the outset might increase the political will to integrate further, by effectively reducing the economic costs of giving up national sovereignty over monetary policy.

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[1] Cf. Sir A. Cairncross et al., Economic Policy for the European Community: The Way Forward, Holmes and Meier Publishers, New York, under the auspices of the Institut für Weltwirtschaft an der Universität Kiel, 1974, p. 38.

Overall, we must conclude that only a gradual approach to monetary unification may prove feasible. The Werner Report was indeed correct in specifying a step-by-step approach toward the accomplishment of that goal. Nevertheless, past experience has shown that difficult choices lie ahead for the national authorities. Given the economic costs, they must then evaluate the potential political and cultural gains to be reaped from complete integration.

APPENDICES

APPENDIX A

DEFINITIONS AND DATA SOURCES

The raw data utilized in this study are, for the most part, taken from the OECD's Main Economic Indicators, except for the unemployment data which are taken from the ILO's Bulletin of Labour Statistics and the Statistical Supplement to their International Labour Review. Most of the quarterly data are averages of the three appropriate monthly figures. Any exceptions to these general principles will be reported below.

The percentage change in any variable is calculated on a quarter-to-quarter basis such as:

$$\dot{x} = \left(\frac{x_t - x_{t-1}}{x_{t-1}} \right) \times 100 \ .$$

This differencing procedure is employed for wages, consumer prices, import prices, and labor productivity. To assure the proper alignment of the other variables with these percentage change variables, we have defined:

$$U = \frac{(U_t + U_{t-1})}{2}$$

and

$$DU = U_t - U_{t-1}$$

where U and DU are the rate of unemployment and the change in the rate of unemployment, respectively, and both are expressed in

percentage terms. And labor productivity is defined as:

$$LP = \frac{Q}{N \cdot H}$$

where Q is the index of industrial production (or some other measure of economic activity), N is an indicator of total employment (absolute numbers or an index), and H is the number of hours worked per employee. Finally, the quarterly dummies are conventional binary variables which take on the value of one during a specified quarter and zero during other quarters:

$$Q_i = \begin{cases} 1.0 & \text{during quarter } i \\ 0.0 & \text{otherwise} \end{cases}, \quad i = 1,2,3,4.$$

For some countries, data limitations forced us to construct variables in a slightly different manner. These exceptions will now be presented for each nation individually along with the precise definition and source (other than those mentioned above) for each variable employed.

BELGIUM

U: registered, wholly unemployed persons receiving insurance benefits as a percentage of the total number of insured workers. The data for 1958-62 were computed through the use of various raw data sources: the civilian labor force from the ILO's Manpower Statistics; registered unemployment from the OECD's Main Economic Indicators, Historical Statistics 1955-1971; the index of employment in industry from the Banque Nationale de Belgigue, Bulletin d'information et de documentation; number of workers insured from Institut national de Statistique, Bulletin de Statistique. The purpose of these calculations was to transform the pre-1962 unemployment rate data from one base (civilian labor force) to another (insured workers) such that they would conform with the post-1962 data.

W: hourly rates in manufacturing

P: consumer price index excluding rent

P_m: index of average value of imports

Q: index of total industrial production

N,H: index of man-hours worked in mining and manufacturing by wage earners

DENMARK

U: number of unemployed trade union members as a percentage of total trade union membership. Source: The Nordic Council, Yearbook of Nordic Statistics.

W: hourly earnings in industry (including construction), including bonuses

P: consumer price index

P_m: index of average value of imports

Q: index of industrial production. Source: IMF, International Financial Statistics.

N: total number of wage earners in mining and manufacturing

H: index of hours worked in manufacturing

FRANCE

U: unfilled applications. To obtain a more precise measure of the number of people available for work and in search of unemployment, the figure for unfilled applications is blown up by a factor of 1.9 for 1957-67, 1.65 for 1968-71, and 1.3 for 1972-73. This is suggested in OECD, Main Economic Indicators, Sources and Methods. To obtain a percentage figure for U, we divide the above data series by the total number of employed and unemployed. The number of employed is derived by multiplying the index of employment for all employees in all activities (base of 1963) by the absolute number of persons in civilian employment during 1963. These data are taken from OECD, Main Economic Indicators and OECD, Manpower Statistics, respectively. The figure for the second quarter of 1968 is obtained by interpolating between the two adjoining figures.

W: hourly rates in manufacturing; last week of preceding quarter

P: index of consumer prices (all goods and services)

P_m: index of average value of imports

Q: index of industrial production excluding clothing, wood products, furniture, and construction. The figure for the second quarter of 1968 is obtained by interpolating between the two adjoining figures.

N: index of employment in manufacturing (all employees). Data refers to the last week of the preceding quarter.

H: number of weekly hours worked by wage earners in all activities; last week of preceding quarter. The figure for the second quarter of 1963 is obtained by interpolating between the two adjoining figures.

GERMANY

U: registered unemployed as a percentage of the total civilian labor force; last month of quarter.

W: hourly earnings in manufacturing; refers to first or second month of quarter.

P: index of consumer prices

P_m: index of average value of imports

Q: index of industrial production excluding construction

N: index of industrial employment. Source: IMF, International Financial Statistics, 1973 Supplement.

H: weekly hours worked in manufacturing; first month of quarter. Source: ILO, Bulletin of Labour Statistics and International Labour Review, Statistical Supplement.

IRELAND

U: number of registered, insured unemployed as a percentage of the total number of insured; excluding agriculture, fishing, and private domestic service.

W: hourly earnings in manufacturing

P: index of consumer prices

P_m: index of average value of imports

Q: index of industrial production (mining and manufacturing)

N: number of total employees in manufacturing

H: weekly hours worked in manufacturing

ITALY

U: number of unemployed as a percentage of the civilian labor force; first month of quarter.

W: hourly rates in manufacturing excluding family allowances

P: index of consumer prices

P_m: index of average value of imports

Q: index of industrial production

N: total number of persons employed; first month of quarter

H: daily hours worked in manufacturing. Source: U.N., Monthly Bulletin of Statistics; third month of quarter.

NETHERLANDS

U: registered unemployment as a percentage of the total number of wage and salary earners (including the unemployed)

W: hourly rates in industry (including construction) for male employees

P: index of consumer prices

P_m: index of average value of imports

Q: index of total industrial production

N: total number of employees in mining and manufacturing; end of quarter. The figures for the four quarters of 1972 were obtained by interpolating the two adjoining figures.

H: adequate data for hours worked were unavailable.

NOTE: The labor productivity variable was defined as the ratio of Q to N owing to the lack of reliable data for H.

UNITED KINGDOM

U: the number of registered, wholly unemployed as a percentage of total employees (employed and unemployed). This data was computed for 1956-1959 (II) based on OECD, General Statistics, November 1959. This was done to obtain a figure which excluded the partially unemployed and which would therefore be compatible with figures after 1959 (II) reported in ILO, Bulletin of Labor Statistics.

W: index of basic weekly wage rates in all industries and services (all workers). Source: Central Statistical Office, Monthly Digest of Statistics.

P: index of consumer prices

P_m: index of average value of imports

Q: index of total industrial production excluding construction

N: This data series was computed as follows. The number of unemployed was divided by the unemployment rate to obtain an estimate of the labor force. From this estimate, we subtracted the number of unemployed to derive a figure for the number of persons employed.

H: weekly hours worked in non-agricultural sectors, excluding coal mines, commerce, railways, by male employees. Quarterly figures were obtained by interpolating between April and October figures up to 1969 and between October figures only from 1970 to 1973. Source: ILO, Bulletin of Labour Statistics and International Labour Review, Statistical Supplement.

APPENDIX B

THE BROWN-DURBIN-EVANS TEST FOR STRUCTURAL STABILITY[1]

The statistical theory underlying the stability test utilized in this study is presented here in order to clarify the analysis in Chapter V above. We will dwell only on those points which are relevant for our present purposes. The interested reader is referred to the Brown, Durbin and Evans paper cited below and to the documentation which accompanies the TIMVAR computer program.[2]

Consider a regression equation such as:

$$(1) \qquad y_t = x_t'\beta_t + u_t \qquad t = 1,\ldots,T$$

where y_t and x_t are the t^{th} observations on the dependent and explanatory variables respectively; y_t is a (1×1) scalar and x_t is a $(k \times 1)$ column vector. Note that the coefficient vector β is written with a time subscript to indicate that it may possibly vary from period to period. We must also point out that the vector of independent variables, x, may not contain any variable which is stochastic; hence the technique is inapplicable to equations containing the lagged value of the dependent variable. Finally, the error terms u are assumed to possess the classical properties of

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[1]The specific details of this test and the discussion of some supplementary tests are reported in Brown, Durbin and Evans, op. cit.

[2]Cf. J.M. Evans, Users' Guide to TIMVAR, Research Exercise Note 10/73, Central Statistical Office, London, June 1973.

being normally distributed with zero mean and constant variance, i.e. $u_t \sim N(0,\sigma^2)$.

The purpose of the following statistical tests is to examine the validity of the null hypothesis, H_0, that the coefficient vector is identical from one period to the next. That is,

$$H_0: \quad \beta_1 = \beta_2 = \ldots \beta_T = \beta$$

where T is the size of the sample. The basic technique is that of recursive regression, beginning with the first k observations and adding one more observation at each iteration until the entire sample is exhausted. At the r^{th} iteration, we would have an estimate of the coefficient vector over the previous (r-1) observations according to standard linear regression techniques, namely

$$\hat{\beta}_{r-1} = (X'_{r-1}X_{r-1})^{-1}X'_{r-1}Y_{r-1} \tag{2}$$

and the recursive residual (or prediction error) would be defined as

$$w_r = \frac{y_r - x'_r\hat{\beta}_{r-1}}{[1 + x'_r(X'_{r-1}X_{r-1})^{-1}x_r]^{\frac{1}{2}}} \tag{3}$$

where $X'_{r-1} = (x_1,\ldots,x_{r-1})$ and $Y'_{r-1} = (y_1,\ldots,y_{r-1})$. The denominator merely serves to standardize the w's such that their variance under H_0 is σ^2. This procedure would be executed for values of r ranging from k through T. Brown, Durban and Evans prove that, under H_0, the w's are independent, normally distributed random variables with zero mean and constant variance (σ^2).

Finally, these recursive residuals are utilized to derive the statistic Sr, which is:

$$(4) \qquad Sr = \frac{\sum_{k+1}^{r} w_t^2}{\sum_{k+1}^{T} w_t^2} \quad .$$

As can be seen, this is the ratio of the cumulated sum of recursive residuals up to point r to the total sum of such recursive residuals. Therefore, Sr will lie between zero and one; it will equal zero when r is smaller than $k+1$ and will equal unity when r equals T. BDE also prove that, under H_0, Sr has a beta distribution with mean $(r-k)/(T-k)$. If the null hypothesis is correct, the plot of Sr over time should lie along this mean value line.

To determine the validity of H_0 at various significance levels, we draw a pair of lines defined by

$$(5) \qquad Sr = \pm c_0 + (r-k)/(T-k)$$

parallel to the mean value line. Then the probability that the sample path crosses one or both lines is α, the required level of significance. If the sample path does in fact cross either line, the null hypothesis can be rejected. The c_0 are distributed as Pyke's modified Kolmogorov-Smirnov statistics and values for different levels of α are provided in Evans.[3]

As an additional indication of where the structural break has occurred, it is also instructive to perform the above procedures backwards beginning at the end of the sample. Then, if either or both of these plots indicates a departure from constancy, it is useful

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[3]Cf. Evans, op. cit.

to examine the plots of the various individual coefficients over time in order to isolate the potential source of instability.

Finally, supplementary documentation on the point of instability can be provided by a calculation of Quandt's log likelihood ratio:

$$(6) \quad \lambda_r = \log_{10}\left(\frac{\text{max likelihood of the observations given } H_0}{\text{max likelihood of the observations given } H_1}\right)$$

where H_0 is the hypothesis that the observations in periods (1...r) and (r+1...T) come from the same regression. The observation at which λ_r attains a minimum would be a prime candidate for that point at which instability has occurred.

Thus the techniques presented in this Appendix can be seen to be, for the most part, graphical in nature. They are intended to indicate departures from constancy and, when employed together to complement one another, should provide adequate indications of such changes. The task of the researcher then is to modify his model to take these results into account.

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