6 Además de considerar una economía con dos grupos, Dutt (1984) y Taylor (1983) consideran que el ajuste macro se realiza a través de cambios en la capacidad utilizada.

7 Diferenciando [16] y reemplazando los resultados de [18] y [19], es fácil demostrar que una condición suficiente para que un aumento en la inversión deseada reduzca la participación del trabajo en el producto es $\tau^* < \tau max.$

8 Un incremento en el grado de oligopolio también puede generar un efecto transitorio sobre la inversión. Es decir, el desplazamiento de la función $\varphi(\tau)$ puede significar un aumento en la inversión deseada en las empresas oligopólicas. En nuestro análisis supondremos que cuando aumenta el grado de oligopolio el capital de la economía se redistribuye entre ambos tipos de empresas, de modo de satisfacer la nueva estructura de demanda.

9 En los modelos que se ajustan a través de cambios en la utilización de la capacidad instalada, el aumento en el grado de oligopolio reduce la tasa de utilización y por esta vía cae la tasa de rentabilidad sobre el capital.

10 Formalmente,

$$\frac{\partial \lambda_w}{\partial \varphi(\tau^*)} > 0 \qquad \longleftrightarrow \qquad 1 - \lambda_w + \lambda_w i'(r) > 0$$

lo cual se cumple porque $\lambda_w < 1$ e $i'(r) > 0$.

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INDEXING POLICY IN HISTORICAL AND DOCTRINAL PERSPECTIVE: A SURVEY OF RECENT EXPERIENCE AND THEORETICAL DEVELOPMENT*

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Abstract:

This paper surveys recent experience with indexation as well as the evolving theoretical developments during the last twelve years.

The first part concentrates on recent experiences, first in those countries with long-term indexation experience, then in those where indexation was reduced or terminated (the Southern Cone Countries as well as Finland and Iceland), and where indexing has been practiced under conditions of moderate inflation.

The second part summarizes recent theoretical developments on indexation, both in closed and in open economies. The focus in on the determination of the "optimal" indexing arrangement, and the restrictions which optimal indexing policies place on exchange rate and monetary policy. It evaluates the usefulness of these models, in terms of their ability to explain recent experience as well as to offer policy recommendations for current problems.

I. Introduction

A dozen years have passed since Milton Friedman (1974) and Herbert Giersch (1974) called for the use of full indexation as an instrument for promoting macroeconomic stability and reducing inflation. Since then, indexing, or the linkage of wages to current or past price levels, has been a subject of continuing discussion in the theoretical literature of Macro and International Economics. In the various national experiments

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with indexing, the results have not always conformed to the Friedman/Giersch projections. For example, in Israel, wage indexing has been accepted as a necessity in order to reduce the distortions of high inflation. On the other hand, it has also been blamed for prolonging inflation and perhaps also reducing the will to fight inflation. For this reason, indexing was abolished in the July 1985 stabilization program. In Brazil, indexing was considered a crucial element in the "success story" of the late 60's and early 70's. Since the OPEC shocks and the return of high inflation, however, it is considered a culprit, and policy-makers have taken steps to reduce it in the *Plano Cruzado* stabilization program of February 1986. In Argentina, Chile, and Uruguay, disindexation–a gradual or sudden reduction in the degree of indexing of wages and/or exchange rates to inflation–was an explicit phase in the transition from the "old orthodoxy" of fiscal austerity to the "new orthodoxy" of monetary restraint and liberalization in stabilization policy in the late 70's. However, with the stagnation during the first half of the 1980's, the effects of disindexation were swamped by other factors. With the threat of hyperinflation in 1985, the Argentine government suspended indexation in the *Plan Austral* stabilization program.

The questions that provide the orientation for this review of the literature in indexation address both the broadening experience of different national economies with various partial experiments in using indexing for macroeconomic stabilization purposes as well as the evolving theory.

What lessons come from recent experiences across countries and from recent modelling developments? Does the theoretical literature explain in a systematic way the problems of countries with high indexing? What are the policy implications of these models? Finally, what further research needs to be done, if there is to be a fruitful matching of theoretical work with the problems facing policy-makers in high inflation and highly-indexed economies?

The next section of this paper surveys international experiences with indexing since the Friedman/Giersch proposals. Section III briefly summarizes the doctrinal antecedents of the Friedman/Giersch proposals, and explains in greater detail what was new about the Friedman/Giersch proposal for the use of indexation as an instrument for *stabilization policy*. Section IV is a review of theoretical development on wage indexing and macroeconomic stability. This section includes an assessment of the comparative advantages of indexing and exchange rate policy. Three questions are posed: how well does the literature explain recent experiences, what are the policy recommendations, and what further work needs to be done? The last section is the conclusion.

II. Recent Experience

This section assesses recent experiences with indexing in three sub-groups: (1) Brazil and Israel, countries with long experience with indexing, (2) Argentina, Chile, and Uruguay, where disindexing "experiments" were gradually implemented in the late 70's, as well as Finland and Iceland, which abruptly abolished indexing, and (3) Europe, Canada, and the United States, countries which practice indexing under conditions of moderate inflation. The final section will assess an international cross section study of indexing.

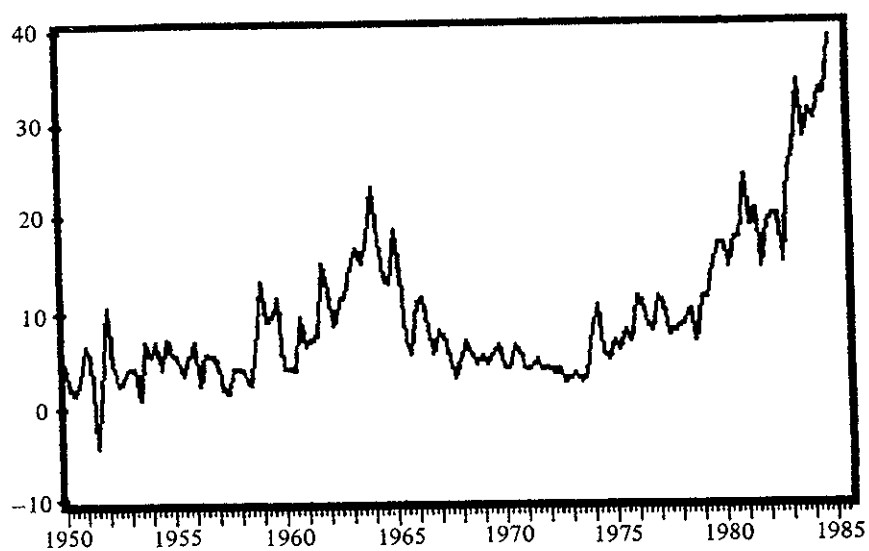
A. *Brazil and Israel: The Long-Term Indexers*

Brazil and Israel are two countries with long experience with indexing–over three decades in Israel, over two in Brazil [see (Fischer (1983b): p.3., Simonsen (1983): p.119]. A comparison is of interest because of the different ways in which indexing policies were introduced and have evolved in each country[1].

In Brazil there is controversy over the role of indexing in the "success story" of the late 60's and early 70's, when annual growth rates reached 10% and inflation was reduced from triple-digit levels to 30% (measured at annual rates of change). There is also controversy over the role indexation played in the return of high inflation in the late 1970's. Figure I pictures the evolution of Brazilian inflation rate between 1950-1985, with inflation measured by quarterly rates of change of the cost of living index of Rio de Janeiro.

FIGURE 1:

Brazilian Quarterly Inflation, 1950-85



PRJB4: Index of Changes in Cost of Living in Río de Janeiro (Getúlio Vargas Foundation).

Fishlow (1974) and Kafka (1974) believe that the combined wage indexing and exchange rate policy of a purchasing-power-parity (PPP) "passive crawl" were critical elements in the success story of the 1960's. However, Simonsen (1983) recently pointed out one aspect of the Brazilian success story with indexing, which Fishlow and Kafka neglected to mention: the wage indexing laws introduced in 1965 were "basically intended to act as incomes policy tools" [Simonsen (1983): p. 119].

As for the return of high inflation in the late 1970's, Simonsen sees wage indexing policy as a culprit. In 1979 the indexing law reduced the adjustment interval for wages from one year to six months, "with no downward revision of the real wage base" [Simonsen (1983): p. 122]. Thus, the government increased indexation at a time when real shocks were impinging on the economy. Simonsen predicted that the new systems of indexation would lead either to "massive unemployment" or to a "sudden leap" in the rate of inflation. [Simonsen(1983): p. 122]. As it turned out, there was sudden leap: the previous annual inflation rate soon doubled. Macedo (1983), on the other hand, takes issue with Sumonsen's analysis. He believes that the 1979 wage law played the role of a "supporting actor" rather than being the "major star of the action" [Mecedo (1983): p. 150]. Macedo blames the "ambiguity of government policies" which led to a "sanction of higher prices" for the accelerated inflation after 1979 [Macedo (1983): p. 150]. Whether the indexing law or the ambiguous government policy were the "major stars" or "supporting actors", one thing is certain: the combination of higher indexing and recurring shocks in oil prices in this period were correlated with increased instability in output and prices.

While the inflation rates in Brazil have remained high, in spite of reductions in aggregate demand, the Brazilian inflation rate has not exploded. In a recent econometric study, Andre Lara-Resende and Francisco Lopes (1981) found that indexing plays the dominant role in explaining the behavior of Brazilian inflation. When Resende and Lopes included changes in the monetary correction index for minimum wages in their inflation-rate estimating equations, they found excess-demand terms to be insignificant.

The resistance of inflation to reductions in excess demand is called inflationary inertia. Barbosa (1977) contends that much of the inertia can be explained by the "feedback effect" of past inflation on current inflation, passed on through the "ex-post" or "backward-looking" indexing system, which links current wages and exchange rates to past rates of inflation. Because current prices are mark-ups over current wages and exchange rates, and these variables are linked to past prices through the indexing system, past price shocks are perpetuated. In this way, past inflation feeds forward into current inflation. Contador (1977), on the other hand, has presented time series/spectral evidence which calls into question any relationships between inflation feedback and the indexing system in Brazil. More recently, Arida and Lara-Resende (1985) argued for disindexation as a way to end the "inertial inflation". Citing the strong adjustment effort made through austerity measure in recent years, leading to a $ 12.5 billion surplus in the current account for 1984 and a low fiscal deficit, Arida and Lara-Resende conclude that the reasons for the 1984 level of 230% inflation must be found "elsewhere" –in the Brazilian indexing system [Arida and Lara-Resende (1985): p. 29].

For Israel, both Karni (1979) and Fischer (1983b) blame the indexing system for significantly reducing the will to fight inflation [Karni (1979): p. 81, Fischer (1983b): p. 37]. Since indexing has removed many of the inflation-induced distortions, policy-makers "frequently assert that the unemployment needed to disinflate successfully cannot be justified in Israel" [Fischer (1983b): p 37]. According to Fischer, memories of the 1965-67 recession with double-digit unemployment rates and net migration "had burned as deep a concern about unemployment in the memory" as the Great Depression did in the United States [Fischer (1983b): p. 37].

One of the major controversies in Israeli indexing experience arose over the linkage of government development loans to the U.S. dollar exchange rate, after a 67% devaluation in 1961. Brenner and Patinkin (1977) state that the "public outcry was immediate" after debtors had the "traumatic experience" of finding that their nominal

debt to the government increased overnight by the same 67% [Brenner and Patinkin (1977): p. 402; Fischer, (1984): p. 18]. Thereafter, the government did not index its loans until 1979. However during the period between 1973-77 inflation jumped to high levels, and government receipts from loan repayment fell substantially in real terms. This became known as the "inflationary subsidy embobied in government loans" or simply the "credit subsidy" [Liviatan and Piterman (1984): p. 5]. Liviatan and Piterman point out that the "significant aspect" of this credit subsidy between 1973-88 was that it was not financed by taxes but "mainly by increasing the net government debt" [Liviatan and Piterman (1984): p. 5]. By the end of 1983, government debt to Israeli citizens grew to 115 percent of GNP, from about 50% in 1970 [Liviatan and Piterman (1984): p. 8]. By 1983, according to Fischer, 83% of the financial assets held in Israel were indexed "either to the price level or the exchange rate" [Fischer (1984): p. 21].

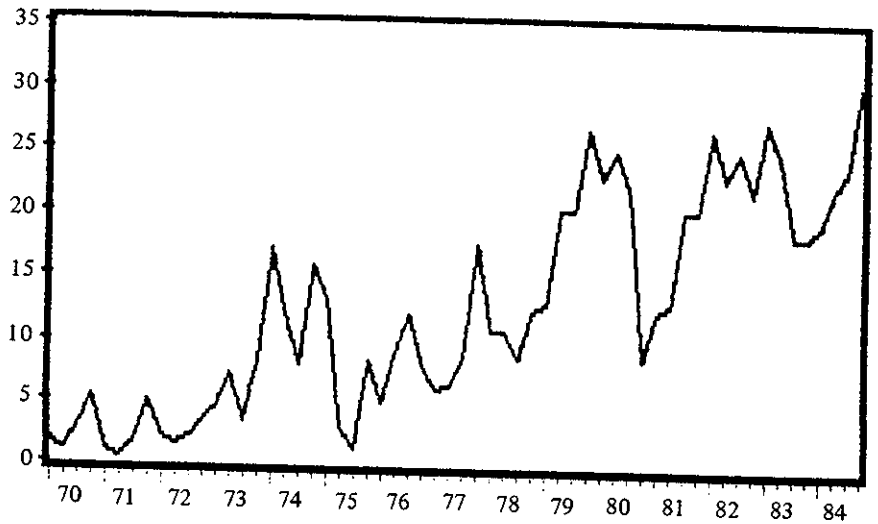
Disindexation, or a reduction in the degree of wage indexing to the consumer price level, has also been an issue in Israel anti-inflation policy. Brenner and Patinkin point out that as early as 1966, a "Committee of Experts" recommended the use of modified price indices for wages, which would exclude taxes and the prices of imported goods [Brenner and Patinkin (1977): p. 399]. These recommendations, unfortunately, were not carried out until the mid-seventies. Another committee in 1975 recommended the indexing of wages at a rate of 70% to the CPI. According to Fischer, this "70% rule" was presented as a "practical alternative" to indexing to the appropriate deflator, which would exclude taxes and imported-goods prices in the wage-adjustment rule. Fischer argued against this alternative, since only "on average" it is right, and "in most periods wrong", sometimes "compensating too little for nominal shocks" and at other times "compensating too much for real shocks" [Fischer (1984): p. 16]. Fischer reports that the 70% adjustment was increased to 80% at the end of 1979, and "more recently contracts have been reopened when real wage erosion exceeded prespecified thresholds" [Fischer (1984): p. 16][2].

The Israeli inflation path between 1979-1984, measured in quarterly rates of change in the price of manufactured goods, appears in Figure II. The dynamics of inflation in recent Israeli experience show discrete step increases. According to Fischer (1984) the "radical change in the inflation process" can be "dated to 1977" rather than 1973, when Israel suffered the double supply shocks from oil and the "increased defense burden in the Yom Kippur War" [Fischer (1984): p. 3]. Since 1977, inflation has risen from the "130% range to the 400% range at the end of 1983, and in the last two months of 1984 to the 1000% range" [Fischer (1984): p. 7].

Given the widespread asset indexation and reduced degree of wage indexing, it is not surprising that Fischer (1984) believes that the "wage indexation has virtually nothing to do with the important dynamics of inflation" while "asset market indexation has been more important" [Fischer (1984): p. 2]. Fischer cites evidence that the Israeli wage indexing system has permitted substantial real wage flexibility [Fischer (1984): p. 34]. Asset market indexation however, has had more serious consequences by "reducing the real wealth effects of devaluations or adverse supply shocks" [Fischer (1984): p. 34]. After a devaluation, the jump in prices and the inflation rate have "no significant effect on aggregate demand", and "because the government is unwilling to risk unemployment", there is "nothing else to bring the inflation rate down" [Fischer (1984): p. 35].

Brazil and Israel represent two highly indexed economies currently experiencing high inflation instability and low growth. Is there anything one can learn from comparing the experiences of these countries, besides the correlation of high indexing with high inflation? Kleiman (1977) points out that indexing spread in different directions in each

FIGURE 2



----- QGZ4: Index of Price Changes for Manufactured Goods.

country; in Brazil, bonds first, then wages, while in Israel, wages first, then bonds [Kleiman (1977): p. 170]. Kleiman cites "political attitudes" in both countries for this different historical ordering; under "pressure of economic and social forces" both countries "had to move away from their original positions" [Kleiman (1977); p. 170]. Kleiman sees one clear message: while selective indexing may be tempting to policy makers, "the Brazilian and Israeli experiences indicate that such selective indexation may be impossible in practice" [Kleiman (1977): p. 170].

Another important difference in the Brazilian and Israeli indexing arrangements lies in the frequency of wage adjustment as the inflation rates have accelerated since the late 70's in each country. Brazil has not changed the adjustment interval for wages since the 1979 law, even with 200% plus inflation. Israel, on the other hand, has experienced a progressive shortening of the wage adjustment interval, from a semi-or annual basis in the mid-sixties, to quarterly from 1980 to 1983, to monthly at the end of 1983 [see Fischer (1984): p. 15]. Dornbusch (1985) believes that Brazil's maintenance of the six month interval, "implying a drastic reduction of the purchasing power of wages between readjustments", is responsible for Brazil's inflation "not having accelerated toward 1000 percent as in Argentina, Bolivia, or Israel" [Dornbusch (1985): p. 47].

In recent stabilization programs, both Israel and Brazil imposed a wage/price freeze, but adopted indexing policies for periods following the "unfreezing". According to the program of July 1985, Israeli indexation is to be suspended for wages and considerably reduced for financial assets. According to the Brazilian *Plano Cruzado* of February 1986, wage indexing is to be considerably reduced (but not abolished) while financial asset indexation is allowed.

B. *Argentina, Chile, Uruguay, Finland and Iceland: Disindexation Experience*

In the past decade Argentina, Chile, and Uruguay have implemented policies of exchange rate preannouncement and wage disindexation. These policies formed part of an overall stabilization/liberalization plan, which involved decontrol of interest rates, tariff reductions, and removal of capital controls. Finland and Iceland, on the other hand, abruptly terminated indexing after long periods in each country. Finland ended its indexing at the time of a devaluation in 1967, while Iceland followed suit in May 1983. Does "abrupt disindexation" do better than gradual disindexation? What lessons come from these attempts at disindexation?

B.1 *Argentina*

Although wage indexation in the private sector is not covered by government policy in Argentina, wage disindexation still had a place in recent stabilization policy. A partial, rather than full, indexing of government workers' salaries, for example, was a major way of cutting public-sector deficits in the mid 70's [see Frenkel (1980)].

The major form of "disindexation" in Argentine stabilization policy in this period was the reduction in the degree of linkage between exchange rate changes and the difference between domestic and foreign inflation. Until this period, Argentina followed a "purchasing power parity" exchange rate policy, in which frequent devaluation were linked to difference between domestic and foreign inflation rates. This policy is also called a "passive crawl" exchange rate policy. On Dec. 20, 1978, under Martinez de Hoz, Argentina introduced an "active crawl" policy, in which exchange rate changes were preannounced at changes lower than the difference between domestic and foreign inflation, in a published table or *tablita*, for three to six months.

During this time, Argentina also lowered tariffs, trade restrictions, and capital controls, deregulated interest rates, and unified exchange markets. With this increased openness, market flexibility, and competition from abroad, policy-makers hoped that domestic price setting behavior would converge to a law-of-one-orice model, in which price adjustment follows changes in foreign prices and exchange rates. By preannouncing devaluations at rates lower than domestic inflation less foreign inflation under these conditions, policy-makers believed that domestic inflation would fall with the lower rates of devaluation[3].

One of the most confusing features of Argentine indexing and disindexation policy is that indexing policies for wages and exchange rates were introduced in different sectors in different ways, showing the lack of any "organic policy" and consistency with the monetary/fiscal regime [see Gaba (1975)]. Hence it would not be surprising that most of the discussion of Argentine policy deals with financial sector reaction to the exchange rate policies aimed at gradual disindexation, through the *tablita*, towards a fixed nominal rate and stable prices. Fernandez (1982), Frenkel (1981), and Rodriguez (1983) have emphasized the credibility problems, increased speculation, and ensuing crises in the banking system resulting from these policy combinations. As the Argentine peso appreciated, its sustainability became less and less credible, and more and more Argentines used the appreciating peso to buy dollars or to transfer capital abroad at favorable rates. The end result was a drying up of deposits in the Argentine banking system (disintermediation), the accumulation of dollar holdings within the country. (dollarization), and an increase in indebtedness (as foreign capital entered the country

when interest rates increased following deregulation). In 1981 Argentina had to abandon the *tablita* disindexing policy with a series of massive devaluations aimed at ending speculation and restoring stability in the financial sector.

Inflation accelerated after the devaluations and the return of democracy in 1984. The *Plan Austral* in 1985 imposed a wage/price freeze; unlike the Brazilian 1986 program, it does not allow for partial indexation of wages after the "unfreezing" of prices.

B.2 *Chile*

In contrast to Argentina, Chile had been subject to explicit wage indexing rules since 1973. Saez (1981), Corbo (1982a), and Cortazar (1983) recently studied the evolution of these indexing policies. After 1973, wages were only partially indexed to past inflation rates. When collective bargaining was allowed in 1979 for a small percentage (10%) of the labor force, full compensation was allowed for this group. Finally, official government indexing rules were suspended in June 1982. Cortazar noted the real wage effects of Chilean partial indexing: between 1973-75, real wages fell 37% below their 1970 levels. Cortazar emphasized three aspects of the Chilean system: (1) nominal wages must be seen as an instrument of policy, like the exchange rate, (2) the official inflation rates in 1977-78 understated the true inflation rate, and (3) the labor market did not function as a market, in the sense that excess demand for labor did not lead to increases in wages [Cortazar (1983): p. 1]

Corbo (1982b) and Cortazar (1983) recently presented econometric studies of Chilean inflation and wage adjustment. Corbo developed and estimated a model from Chile based on mark-up pricing behavior and a distinction between tradeable and non-tradeable goods. Like Lara-Resende and Lopes for Brazil, Corbo found excess demand variables to be insignificant during the period of wage indexation. Cortazar found that wages were exogenously and exclusively determined by indexing policy until 1979. After 1979, he found some evidence for a structural shift, but even with this shift, indexing policy continued to be the major determinant of wage adjustment.

Exchange rate disindexation was also adopted in Chile. As in Argentina, an "active crawl" exchange rate policy, through the *tablita*, was coupled with decontrol of domestic interest rates. Arellano (1983) points out that the consequences of these policies were similar to those of Argentina: the growth of a highly speculative paper economy, a shortening of deposit and credit length, and a build-up of foreign indebtedness[4] . Like Argentina, Chile had to abandon the *tablita* exchange rate disindexing system through devaluations in the early 1980s.

B.3 *Uruguay*

Like Argentina, wage indexing policy was not a central part of the Uruguayan stabilization program during the past ten years. In 1974, the government suspended wage controls and gradually lifted price controols. In 1979, exchange rate disindexation through the *tablita* became a central instrument for stabilization policy. As in Argentina and Chile, interest rates were decontrolled by the time the *tablita* was implemented. Hanson and de Melo (1984) point out that in the first twelve months of this policy, inflation actually rose. Thus, the policy "did not fulfill its intended objective of rapidly bringing down the rate of inflation [Hanson and de Melo (1984): p 45]. Convergence of the domestic inflation rate to the exchange rate preannouncing ocurred 24 months after the start of the program [Hanson and de Melo (1984): p. 45] During this 24-month period the economy underwent a boom and then a severe recession. Uruguay had to abandon the *tablita* in 1982.

Some of the difficulties of the Uruguayan disindexation policy may be traced to a lack of coordination and consistency with Argentine policy. Hanson and de Melo point out that "as long as Argentina was pursuing a policy of overvaluation", the Uruguayan policy "dampened inflationary pressures" [Hanson and de Melo (1984): p. 51] However, when Argentina abandoned its *tablita* and "embarked on a series of massive devaluations", Uruguay "continued its slow rate of crawl" thereby "aggravating the recession" as Uruguayans transferred their demand to Argentina. [Hanson and de Melo (1984): p. 51.]

The unsuccessful experiences of Argentina, Chile, and Uruguay with exchange rate disindexation through the *tablita* point out the need for consistency in the implementation and sequencing of stabilization programs, indexing rules, and liberalization, both within a particular country, and among close major trading partners. As Hanson and de Melo point out, stabilization policy in countries with a long history of high inflation is a "difficult and slow process [Hanson and de Melo (1984): p. 52]. The experience of these three countries suggest that uncoordinated disindexation of wages and/or exchange rates may make that process even more difficult.

B.4 *Finland and Iceland: Abrupt Disindexation*

Indexing was introduced in Finland in 1944, as a result of the Moscow armistice in which Finland ceded about 10% of its territory to the USSR. Indexed indemnity bonds were given to the displaced families. After this, indexing spread to other sectors of the economy. By 1968, 75% of the total bonds outstanding were indexed.

The Finnish experience of indexation was ended after a 1967 devaluation, when it was feared that the indexed system of wages and assets would "undo the benefits of the devaluation" and lead to a severe inflation [Braun (1976): p. 226]. At the time of the devaluation, the government pressed only for the removal of wage indexing, since wage linkage was considered the main factor for the "propagation of the inflationary impulses from abroad" [Linnamo (1974): p. 23]. But as Linnamo reports, "in an effort to protect their share of national income", the "unions demanded the removal of other types of linkages as well" [Linnamo (1976): p. 23].

After Finland abolished indexation, unemployment decreased from over 4% to less than 2% between 1968-70, while the rate of change of wages continued to fluctuate between 6 and 12%. Only after the oil shock of 1973 did the rate of change of wages rise to levels above 18%. In an econometric study of wage inflation in Finland, Paunio and Suvanto (1981) report one result which seems to recur in most empirical studies of indexed systems. They found that during the period of indexing, "unemployment was not a significant determinant of wage change" [Paunio and Suvanto (1981): p. 1979]. After the abolishment of indexing however, the rate of unemployment became "significant in all the regressions" [Paunio and Suvanto (1981): p. 179]. They conclude that a regime of indexing based on *ex post* compensation "may greatly weaken the influence of excess demand" on money wages [Paunio and Suvanto (1981): p. 180].

As for Iceland, since 1939, indexation of all wages and salaries had been the general rule, whereas indexed bonds were fully permitted since 1979. Since the early 1980's, inflation accelerated to rates in excess of 100%, while GNP dropped by 2% in 1982 and 5.5% in 1983. Sigurdsson (1985) reports that the increase in the Cost of Living Index

between February and May 1983 was equivalent to 132 percent at an annualized rate [Sigurdsson (1985): p. 110].

After the general election in May 1983, indexing was suspended the same day that a devaluation was announced. The new program prohibited wage indexing until May 1985. However, Sigurdsson (1985) reports that the government maintained indexation in the financial system in order to "stimulate financial savings in the face of a serious external deficit" [Sigurdsson (1985): p. 112]. The government also gave commercial banks a "freer hand" to set interest rates in the summer of 1984 [Sigurdsson (1985): 112].

Sigurdsson (1985) reports a significant accomplishment as a result of the abrupt disindexation of wages in Iceland. Inflation fell from 130% in early 1982 to 10-15% in the autumn of 1984, while unemployment has remained satisfactory ("slightly above 1% of the labor force") and the external balance of payments improved [Sigurdsson (1985): p. 112]. Sigurdsson (1985) concludes his analysis of the Icelandic experience by stating that disindexation is probably necessary for a "rapid suppression of internal inflation" [Sigurdsson (1985): p. 115]. While a high degree of indexation may stabilize success, "it also aggravates failure", and since "failure is more common than success", he recommends that Iceland continue without wage indexation [Sigurdsson (1985): p. 116].

C. *Western Europe, Canada, and United States*

Europe, Canada and the United States practice indexing under conditions of moderate inflation. What information comes from the recent experiences of these countries?

C.1 *Western Europe*

In a recent survey of European indexing, Emerson (1983) reports that there is some movement in Europe in favor of "less complete" wage indexation and "more extensive" financial asset indexation [Emerson (1983): p. 162]. The "extreme indexers" (Belgium and Italy) have moved to more qualified indexing, while the "intermediate indexers" (France, the Netherlands, Denmark, Ireland and Greece) have reduced the degree of indexing in wage adjustments. Emerson offers one specific motive for this movement toward disindexation in Europe: if these countries hope to create a regional monetary "block, then they must adjust and adapt ' before a lethal mix of highly diverse indexing practices, international shocks, and integrationist monetary ambitions explodes" [Emerson (1983): p. 163].

Indexing in Europe also plays a part in the debate about the reasons for the relatively slower recovery in Europe than in the United States after 1983. One explanation for the relatively slower European recovey is that real wages are relatively more rigid, less flexible than in the United States. This relatively stronger rigidity, of course, is partly due to the more widespread use and higher degree of index linking in Europe. Sachs (1983) pointed out that in the United States "nominal wage growth is well described as a function of unemployment and a distributed lag of changes in consumer prices" while in Europe "the link between changes in wages and consumer prices is virtually instantaneous" [Sachs (1983): p. 275]. In order to promote "faster demand expansion" in Europe, Sachs calls for "social contracts between governments and trade unions" aiming at "moderation of real wages" [Sachs (1983): p. 286]. Sachs singles out the reduction in indexing in Belgium, Denmark, France, and Italy in 1982 as models for the rest of Europe[5].

C.2. *Canada and the United States*

Canada and the United States have a similar approach to indexing. There are no official indexing rules, but neither are there prohibitions against indexing in private contracts. In contrast to indexing policy changes in Europe, how has indexing evolved in these two countries?

In a empirical study of private sector indexing in Canada, Card (1983) found evidence of time-varying elasticities of indexation of wages to the general price level. He reported that there was a "tendency towards higher marginal elasticities over the 1968-75 period" but that his trend has been irregular [Card (1983): p. 35]. One explanation he offered for this trend was the "increased volatility" in the aggregate price level over this period [Card (1983): p. 35].

For the United States, Ehrenberg, Danziger, and San (1983) report that most of the changes in the proportion of indexed contracts seems to be correlated whith aggregate price uncertainty. In 1958, the proportion of workers in major union contracts with indexing as a percentage of workers covered by major union contracts was 50%, in 1966, 20%, and in 1978, 60%, with little fall since then. All of these clauses link wages to the consumer price level rather than some other price index, such as the GNP deflator, which would exclude the price of imported goods [see Card (1983): p. 30, footnote 32].

The inflationary experience of Europe, Canada, and the United States is, of course, different from that of countries with long and high inflation, so indexing policies have not been as controversial. Two lessons emerge from the experience of these countries. First, the movement in Europe towards coordinated disindexation policy follows efforts to coordinate monetary policy, and may enhance the hopes for integrationist monetary ambitions. Secondly, the correlation of the level of indexation (measured either by a time-varying elasticity or the percentage of workers with indexed contracts) with price level uncertainty in Canada and the United States suggests that the level of indexation could become much larger –and thus a destabilizer, as in Brazil– if monetary authorities let price variability significantly increase, since such variability would increase uncertainty. Given the problems of reducing the level of indexation when real shocks occur, such as increases in oil prices, and the destabilizing effects of high indexation when coupled with recurring real shocks, it is better for policy makers in Canada and the United States to obviate the need for indexing by maintaining stable prices, rather than trying to reduce indexing later, under conditions of high indexation and increasing instability in output and prices.

D. *International Cross Section Evidence*

Recently, Fischer (1983a) presented a simple cross section study of 40 countries designed to determine the effects of various forms of indexation on the rate of inflation before and after the OPEC shocks. Fischer's independent variables were a series of dummy variables for various forms of indexing, in wages, taxes, government bonds,social security, and capital markets. He found that none of the indexing variables were significant factors in determining the ratio of post-OPEC to pre-OPEC inflation. Some of the "indexing dummies" turned out to have negative (but insignificant) effects on this inflation ratio[6].

For purposes of single-equation estimation and analysis, Fischer's classification of the independent indexing variables had to be quite simple. Brazil and the United States, for example, had wage indexing dummies set at one, even though the United States simply

permits indexing in private contracts, while Brazil has an extensive system of official rules of wage adjustments. There was also no dummy variable for exchange rate indexing in Fischer's study.

The results of Fischer's study illustrated one basic point: indexing is ambiguous. There is little one can say about the effects of indexing on stability, except in the context of an economy's monetary policy, exchange rate regime, openness, and perhaps the indexing policies of major trading partners. Indexing is a macroeconomic policy, and its effectiveness and advisability depend on an broad view of a country's stabilization goals and international position. The theoretical literature in succeeding sections tries to spell out the conditions under which indexing may help or hinder stabilization efforts.

III. Doctrinal antecedents

Indexing proposals for wages and assets go back to the first decades of the 19th century in the writings by Lowe (1822) and Scrope (1822), and were further developed in the late 19th century and early twentieth century by Jevons (1884) and Fisher (1922). Fisher acknowledged that the purpose of indexing is not directly related to reducing price level fluctuations, but rather to preventing such fluctuations from inserting a "speculative element into business". [Fisher (1922): p. 335]. However, he saw that an "incidental result" of a fully-indexed system would be that "fluctuations in the level of prices would be less than before" because "credit cycles would no longer be stimulated" in an indexed system, since the "alternative abnormal encouragement and discouragement of loans would cease" [Fisher (1922): p. 335]. With indexing, Fisher thus argued that "credit fluctuations would become less" and "the level of prices would be comparatively unaffected by them" [Fisher (1922): p. 335].

The discussion of indexing continued in the period from Fisher to Friedman and Giersch. In the 1940's and early 1950's Finland and Israel adopted widespread wage and asset indexing while in Germany the Currency Act of 1948 prohibited indexing. During this same period, indexing research concentrated on the potential of indexing policies for reducing the distortions of inflation as well as its potential to reduce the will to fight inflation. What was new about Friedman and Giersch was not their proposal to adopt indexing in an inflationary environment, but their proposal to use indexing as an instrument to *reduce* inflation.

In their advocacy of thoroughgoing indexing, both Friedman and Giersch argued against the "widespread prejudice" that indexing may cause inflation to accelerate, and advocated indexing as a help to stabilization policy. Rather than being interpreted as an "act of despair" and as an "indication of willingness to capitulate", indexing is introduced, according to Giersch, in order to "make sure that a monetary policy program aiming at price stability will not be endangered by a worsening of the employment situation or by crises originating in overindebtedness" [Giersch (1974): p. 12]. Denying that indexing will "condem us to perpetual inflation" Friedman argues that indexing will "temper some of the hardships that now follow from a drop in the rate of growth of total spending" and will permit this drop to have full "effect in reducing the rate of inflation" [Friedman (1974): p. 43].

The essence of the Friedman/Giersch argument is that indexing is symmetric during accelerations or retardations of inflation. During a monetary disinflation process, full indexation will prevent rising real wages, and through this prevention will reduce, if not eliminate, the employment/output costs of reducing inflation. There will also be less incentive for policy-makers to inflate in the future, since the system of full indexation will prevent real wages from falling, and thus reduce or eliminate the output gains from monetary expansion.

Giersch advocated the repeal of the anti-indexing provisions of the Currency Act of 1948 in West Germany while Friedman put forward specific proposals for tax/asset indexing in the United States in addition to encouraging wider use of wage escalator clauses in the United States [See Giersch (1974): p. 14 and Friedman (1974): p. 36-41]. Both Friedman and Giersch presented surveys of indexing procedures in various countries in the 60s and 70s, references to classical writings on economists prior to Fisher, and discussions of indexing in professional journals prior to 1974.

Since the Friedman/Giersch proposals, major oil shocks, the experience of floating exchange rates, and trade/capital account liberalization schemes have made the question of indexing considerably more complicated and widely discussed, both in theoretical literature and in the analysis of recent experience. New types of models, incorporating expectations, real shocks, policy trade-offs, and more complicated indexing rules moved to the center of the stage, with new insights about the effectiveness and limitations of indexing. However, the fundamental issue raised by Friedman and Giersch remained: does indexing contribute to or detract from overall macroeconomic stability? Succeeding literature has focused on this issue, and on the restrictions which indexing imposes on alternative policy instruments. In evaluating this literature, this review poses three questions: how well does recent literature explain recent experiences, what policy actions do these models recommend, and what important aspects of recent experience do the models neglect?

IV. Theoretical developments

The theoretical literature of the past decade concentrated on the effects of wage indexing on overall macroeconomic stability and on the policy-tradeoffs and comparative advantages of wage indexing policy and exchange rate intervention. The goal was to develop optimal rules for indexation of wages and exchange rate intervention. Most of these models were small stochastic models with rational expectations. These relatively simple models offer some explanation of recent experiences and have specific consequence for policy-making. However, they neglect important aspects of indexing which need to be addressed in subsequent research.

A. *Explaining past experiences*

The models of the past decade tell us that complete wage indexing when real shocks occur, or a high degree of asset and tax indexing coupled with indexed wages, lead to increased output and price instability. These models thus offer some explanation for the problems of several countries which increased wage or asset indexing at the time of increasing real disturbances in the form of oil price shocks. They imply that the increased output and price stability could have been reduced if less-than-full indexation had been adopted.

A.1 *The degree of wage indexing*

The theoretical literature tells us that indexation should be partial rather than complete, if the economy is subject to recurring real shocks (which are disturbances

affecting productivity) as well as continuing monetary growth rates. This is the central result of models by Gray (1976) and Fischer (1977).

In the Gray/Fischer framework, current wage levels are linked to current price levels. Full indexation is simply complete linkage of wage changes to current price changes. Thus, the degree of indexing is unity. With partial indexation, the linkage is less than complete, and the degree of indexation is less than unity[7]. The models thus deal with a system of current indexation. Models in which wages are linked to past prices are called models of "lagged indexation"[8].

The Gray/Fischer models show that full indexation will fully neutralize the effects of monetary growth changes on real output. Since the welfare criterion is to minimize the deviations of actual output from output in a fully flexible economy, a system of full indexation in preset nominal wage contracts will reduce the real wage effects of monetary policy action, and thus prevent output from expanding. This result is consistent with the call of Friedman and Giersch for full indexation.

The Gray/Fischer models go beyond Friedman and Giersch by considering the case of real shocks as well as nominal monetary shocks. With only real disturbances, the degree of indexation should be zero. A real shock in the Gray/Fischer framework is a stochastic disturbance to productivity. It is assumed to be an independently and identically distributed shock with a zero mean and a finite variance. A monetary shock, on the other hand, is a stochastic disturbance in the demand-for-money equation, also identically and independently distributed, with zero mean and a finite variance. Furthermore, the demand for money in this model is always equal to supply. In this framework, a sudden expansion or contraction in monetary growth rates is a monetary shock.

With preset nominal wages, a negative shock to productivity will reduce output and lead to higher prices. Demand for labor will fall, and with it, output and employment, if wages are fully indexed to the increased price level. However, if real wages fall, in the absence of any indexing, the output and employment decline will be mitigated, since the per-unit costs of labor will fall. Thus, Gray/Fischer recommend no indexation when real shocks impinge on the economy. The welfare criterion is explicit: minimization of deviations of actual output from output in a completely flexible economy, with no pre-set wage contracts?

Since an economy is subject to a mix of real as well as nominal disturbances, Gray and Fischer recommend that the degree of indexing should be between zero and one.[10] Like Friedman and Giersch, they see a place for indexation, but they do not call for complete indexation.[11] They show that there is no *a priori* way to define the optimal degree of inxexation; it depends on the mix of real and monetary influences impinging on the economy.

The approach of these models is thus highly formal, and thus removed from the dilemmas and constraints facing policy-makers. A wage rule, for example, once enacted becomes embedded in legal and contractual obligations, and it would not be easy to change the degree of indexation when the mix of real and monetary disturbances change from year-to-year or quarter-to-quarter.

Misperception of real for monetary or monetary for real disturbances is also a issue which these models neglected. More recently, however, Gray (1983) has recommended less-than-full indexation even for an economy subject only to recurring monetary shocks. She recommends this because of the possibility of misperception or "information confusion"; some part of every monetary disturbance will be mistakenly perceived as a "relative demand disturbance (or industry specific shock). The purpose of indexation, of course, is to offset this misperception, so that monetary shocks will not have real effects.

However, because the misperception is only partial and not complete, full indexation will go too far. In Gray's framework, a monetary shock will thus involve some real disturbance due to misperception, and thus "full indexation of wages will not completely insulate the real sector from monetary disturbances" [Gray (1983): p. 25].

The experience of Brazil is consistent with the theoretical predictions of the Gray/Fischer models. Brazil increased the degree of indexation in 1979, just as new oil shocks were forcing major adjustments in the economy. The result of the higher indexing was increasing inflation and instability in output and inflation.

Blanchard (1979), Pazner (1981), Karni (1983) and Marston and Turnovsky (1985) expanded upon the Gray/Fischer framework, and offered alternative indexing rules, in which wages ere either linked to several variables, or firms received tax credits for labor used following supply shocks. Productivity shocks, as well as shocks to imported-input prices or raw-materials prices, were explicitly incorporated, and special deflators, which net out the effects of foreign price increases, were proposed for indexing rules. The goal of this literature was to show how the loss function could be minimized at zero. However, the implication of the Gray/Fischer models remained: wages could not simply rise in proportion to current prices following real shocks, if the goal is to reduce output and price instability[12].

A.2 *Asset and tax indexing with indexed wages*

Blinder (1977) and Liviatan (1983) have shown how wage and bond indexing may be substitutes under perfect capital markets. In this situation, wage earners with non-indexed contracts may borrow the value of their income with a non-indexed loan and purchase an indexed asset. The loan can be repaid with the earned income at the end of the period. According to Blinder, "workers have less to gain from indexing wages and firms have more to lose" when indexed bonds are prevalent [Blinder (1977): p. 69]. Liviatan points out that in an economy with indexed and non-indexed bonds as well as *perfect capital markets,* the optimal degree of wage indexation may be indeterminate [Liviatan (1983): p. 271].

Bruce (1981) argued that combined wage and tax indexing may have ambiguous stabilizing effects on output and prices resulting from monetary and real shocks. While full wage indexing reduces the sensitivity of output to monetary shocks and increases its sensitivity to real shocks, tax indexation has the reverse effects.

Following a monetary shock, a non-indexed tax system forces income-earners into higher nominal tax brackets. This reduces disposable income and demand. A non-indexed system is thus an automatic stabilizer if monetary shocks impinge on the economy. In this case, tax indexation is less desirable. However, for real shocks the opposie is true. With a non-indexed system both the price and output effects of a real shock would affect demand through the tax bracket effects; with an indexed system, only the output effects would affect demand through the tax system. Hence, the destabilizing effect of the real shock on subsequent demand would be reduced, but not eliminated, if taxes were fully indexed rather than non-indexed.

The results on asset and tax indexation come from formal models, and the realism of the assumptions may be challenged from several viewpoints.[13] However, the implication is clear: policy-makers should proceed with indexing with caution. Indexing in one sector may have the opposite effects of indexing in another sector, and overall macroeconomic stability may be reduced by the spread of indexing from one sector, such as wages, to other sectors, such as financial assets and taxes.

Israel, like Brazil, has had extensive wage, asset, and tax indexing. While Israel had taken steps to reduce the degree of wage indexing in the past decade, the coverage of asset indexing steadily increased, spreading to very short term assets by the early 1980's, when real shocks and maxidevaluations were taking place. The experience of increased output and price instability in Israel is consistent with the predictions of these models.

B. *Policy recommendations*

The literature on indexing raises questions about the effectiveness of explicit government policy, and there is considerable discussion about the trade-offs and comparative advantages of wage indexing rules and exchange rate rules for monetary policy, for the purposes of overall macroeconomic stabilization.

The literature implies that the effectiveness of wage indexation in promoting macroeconomic stability could be reduced by the adoption of "inconsistent" monetary intervention rules in the exchange market. Exchange rate policy and wage indexation must be consistent with each other, from the perspective of overall stabilization, in the sense that both exchange rate and wage rules should be used in combination to minimize well-defined welfare losses. While these models are not complex enough to cover all the details of the Southern Cone exchange rate disindexation policies in the late 1970's, they would imply that such policies would be sub-optimal, if not damaging, to stability, since these rules were not coordinated with wage indexation policy.

B.1 *The effectiveness of government intervention*

The Gray/Fischer models tell us that the optimal degree of indexation is less than unity, if the economy is subject to a mix of real and monetary shocks. The question arises if indexing rules should be restricted by the government to be less than unity, or if such rules should simply be permitted to evolve through private market forces. In the latter case, the role of the government is to refrain from imposing rules with full indexation.

Indexing would not be necessary, of course, if frequent recontracting were costless. The relationship between indexing and the duration of contracts is of fundamental importance. To investigate the consequences of indexing without considering the alternative of short-term contracts is akin to discussing demand without reference to price.[14] On this basis, Gray (1978) argued against government intervention in indexing.

Gray showed that for any degree of indexing, contract length will decrease with the level of uncertainty and increase with the cost of contracting [Gray (1978): p 1]. If indexing is costly, on the other hand, it will appear only in longer contracts. The optimal level of indexing is thus jointly determined with contract length, and will vary across industries "in response to variations in the size of industry specific shocks" [Gray (1978): p. 15] since the size of these shocks indicate the level of industry-specific uncertainty, and thus the need for shorter contracts in each industry. Government intervention, which imposes a fixed degree of indexing in all contracts, cannot help but force each industry away from the "optimal degree of indexing" and impose "real resource costs" in each sector, reflected in "decreased contract length", because the imposed indexing rule may be inappropriate for specific industries [Gray (1978): p. 15].[15]

On the other hand, intervention through an imposed indexing rule can be an important source of information to economic agents about policy regime changes of the government, and thus could be a useful instrument of stabilization policy. Suppose that a high degree of indexing has evolved through market forces during periods of high and

variable inflation, or was imposed by past government policy. If the government intervenes with a rule forbidding all indexing, or cutting the degree of indexing, and if this rule is coupled with a monetary/fiscal program aimed at lowering inflation, as has happened in the recent stabilization programs in Argentina, Brazil, and Israel, then this indexing intervention might enhance the credibility of the stabilization program, speed-up the disinflation process, and reduce the output costs of lowering inflation. In this case, an explicit government disindexation rule coupled with monetary/fiscal policy changes may help bring about a "regime change" in Sargent's sense, in which inflation can be "eliminated very rapidly and with virtually no Phillips-curve costs in terms of foregone real output" [Sargent (1983): p. 57].

Whether intervention in the form of rules for reducing indexing is needed to make disinflation programs work more effectively and more rapidly and whether the disindexation rules for wages (or assets) should be abruptly imposed or gradually phased-in, are unresolved issues. Since monetary/fiscal policy changes aimed at lower monetary growth and balanced budgets usually take time, while indexing rules may be imposed relatively quickly in the absence of legislative delays, perhaps the monetary/fiscal changes should precede the imposition of indexing rules in such a stabilization program.[16]

Of course, the "optimal indexing rule" for wages may involve linkage of wages to many variables, as has been shown by Karni (1983). These variables may be indices for the costs of imported inputs (such as the price of output) or aggregate output itself. With this type of extended indexing rule, a fall in output due to a productivity shock would cause a fall in real wages, even if the coefficient linking wages to prices was set at unity, since the output coefficient would be positive in the wage rule. This type of rule has more indexing parameters, and thus more instruments for minimizing the loss function, than the partial indexing rule linking wages only to prices. Thus the loss function may be minimized at a lower value with more parameters.

Succeeding literature on the comparative advantages of wage indexing and exchange rate rules for monetary policy stress that optimal indexing rules will be multivariate rules.[17] Yet private sector rules in general are not contingent upon multiple variables. Hence, there must be an information advantage of the government in setting "optimal rules" for wages, which the private agents do not possess, since private agents do not adopt such rules, in order to justify the imposition of multivariate optimal rules for wage indexing. This information advantage of the government over the private sector, of course, also justifies other forms of intervention, particularly monetary intervention in exchange markets.[18] The ways these forms of intervention can be fully exploited for optimal stabilization policy is the subject of the following section.

B.2 *Indexing and monetary policy*

Both the wage level and the exchange rate are nominal variables. Through intervention in the form of indexing rules and monetary policy set at exchange rate targets, both variables may be adjusted to help stabilize output and prices.[19] Recent literature makes specific recommendations for the optimal combination of wage indexing and monetary policy.

The exchange rate system may be a fixed, flexible, or managed float system. The literature assesses the advantage of fixed vs. flexible exchange rates with wage indexing, and makes specific recommendations on this choice for various types of external and internal shocks affecting macroeconomic stability. However, multivariate rules for wages

and monetary intervention are superior to rules which link wages to prices and limit monetary policy to constant growth rates or to the maintenance of a fixed system.

B.2.a *Indexing and fixed vs. flexible exchange rates*

Like Gray (1978), Aizenman considers the question of indexing in the same framework as the question of the frecuency of recontracting, and through this route, makes specific recommendations on the choice of fixed vs. flexible exchange rates.

Aizenman supports the Gray/Fischer result that the optimal degree of wage indexing depends on the "relative importance" of real and monetary shocks affecting the economy. The "optimal frequency" of recontracting, however, depends on "aggregate volatility", and with respect to this variable, the optimal degree of indexation is homogeneous of degree zero, and the optimal frequency of recontracting is homogeneous of degree one [Aizenman (1984): p. 257].

The implications of Aizenman's model are different from those of Gray. A high degree of indexing is not simply a substitute for shorter contract length, and thus a high degree of indexing does not necessarily imply longer contracts. The frequency of contracts is a function of uncertainty in the system, given by aggregate volatility. Aggregate volatility may increase, and thus shorten contracts, but the ratio or relative importance of real to monetary variability may remain the same, and thus the optimal degree of indexing may remain the same.

If we assume that frequent recontracting imposes social costs, as Gray (1978) did, the choice of exchange rate system plays a major role in reducing these costs, since the choice of fixed or flexible rates can reduce aggregate volatility, and thus reduce the need for frequent recontracting, even if the optimal degree of indexing does not change.

Assuming a flexible exchange rate system which adjusts to purchasing power parity levels, Aizenman argues for flexible exchange rates over fixed rates if the source of volatility is variability in foreign prices and real shocks[20]. With flexible rates, the effects of foreign price changes on domestic prices would be neutralized by the flexible ppp-system. With real domestic shocks, flexible rates are preferable, since the alternative would require accomodating money stock changes following the real shock, in order to maintain the fixed exchange rate. These money supply changes lead, in turn, to increased output and price variability in the system, and thus the need for more frequent recontracting.

Aizenman finds a fixed exchange rate superior if the source of the aggregate volatility is variability in domestic money or foreign interest rates. With perfect capital mobility, excess money is "exported", and thus the potential destabilizing effects of domestic monetary variability are fully offset by capital outflows in a "small economy", or partially offset in a large economy, under the fixed system. Similarly, foreign interest rate variability induces capital flows which increase or decrease the domestic money supply, but these changes mirror changes in the underlying demand for money. With perfect mobility of capital, the domestic interest rate is linked to the foreign rate, so that the demand for money adjusts to the interest rate changes. With a rise in foreign interest rates, for example, there is a capital outflow and a fall in domestic money supply. However, the higher domestic interest rates reduce demand for money, so equilibrium is maintained. With the fixed system and perfect capital mobility, foreign interest rate effects are thus confined to the monetary sector.

In Aizenman's framework, the choice of exchange rate regime depends on the underlying cause of volatility, and the choice of the degree of indexing depends on the relative importance of real and monetary shocks. There are thus comparative advantages for indexing and exchange rate policy. The exchange rate system can be used to reduce overall volatility (a flexible system if there is higher real or foreign price variability, a fixed system if there is higher domestic money or foreign interest variability), and the indexing degree can be adjusted for further gains in stability[21].

Aizenman's approach, like the Gray/Fischer approach, is highly formal, and detached from the constraints on policy-making. The model implies that the exchange rate regime should change from year-to-year or month-to-month, depending on changes in the source of "aggregate volatility", and there may also be problems of misperception about the source of the aggregate volatility. Furthermore, choosing fixed or flexible rates (with instantaneous adjustment to purchasing power parity) are extreme choices. Instead of choosing between a pure fixed or floating system when facing with changes in the sources of volatility, most policy-makers would adopt a system of exchange market intervention or "managed float" system which would allow greater flexibility in exchange rate policy than these extreme choices, and might look for rules which would produce further gains in stability, beyond those offered by systems of purely fixed or flexible rates. The advantages of rules for exchange market intervention and wage adjustment are the subjects of the next section.

B.2.b *Indexing and exchange market intervention*

Aizenman and Frenkel (1985) present a "joint optimizing framework" for the determination of an indexing rule and a monetary intervention function.[22] They show that a money supply rule geared to exchange rate targets, deviations from purchasing-power-parity (ppp), and foreign interest rates in combination with a wage rule linked to prices allows an "optimal degree" of indexation that is "larger than the closed economy coefficient" [Aizenman and Frenkel (1985): p. 412].[23] However, they argue that the use of only one variable in the wage rule is sub-optimal, since it does not permit "efficient use of the more detailed information that is available in the open-economy and that could be exploited in the adjustment of real wages" [Aizenman and Frenkel (1985): p. 412]. They conclude that the "optimal policy" of wage indexing and exchange-market intervention will succeed in attaining its target only if the instruments (wages and the money supply) are influenced by a "sufficient number" of indicators. This sufficient number is identical to the number of independent sources of information that "influence the determination of the undistorted level of the targets" [Aizenman and Frenkel (1985): p. 412].[24]

The logic of the Aizenman/Frenkel argument for extended rules for monetary intervention and indexation is similar to the Karni argument for extended wage rules. With extended rules for both exchange market intervention and for wages, there are more policy parameters, and thus more instruments, with which to minimize the loss function. The loss function could be minimized at the "target value" of zero (with no deviations of actual output from the level of output in a frictionless economy) if the number of instruments match the number of independent "sources of information" about disturbances, which affect deviations of actual output from the target level of output.

Aizenman and Frenkel thus call for a multivariate rule for wage indexing and exchange market intervention as the optimal policy combination. When wages are only linked to prices, the indexing system is not sufficiently exploiting the number of independent sources of information, and is thus less-than-optimal.[25] The implication of this analysis is simple: if wage indexing is taken seriously as a stabilization instrument,

then it cannot be set independently of exchange rate policy. Both variables (the exchange rate and wages) can be adjusted to achieve specific policy goals, and misuse of one variable may mitigate (or offset) the effects of adjusting the other variable for purposes of reducing instability. The policy recommendation is clear: if indexing is to become an official government policy, then the rule should be a jointly determined with exchange rate policy. Without this joint determination, any government intervention in indexing may do more harm than good. Simlarly, an ad-hoc exchange market intervention rule, such as preannouncing the rate of exchange rate devaluation at rates lower than expected inflation, may offset the gains in stability from wage indexation.

C. *Further developments for research*

The previous literature on indexation has emphasized the role of indexation in macroeconomic stability. A missing link in the literature is the effect of indexation on the distribution of income. Although the distributional costs of high inflation processes have long been recognized, the role of wage indexation in providing a cushion against these adverse distributional consequences has not been adequately discussed in the literature[2 6]. Such explicit treatment of income distribution would enrich the literature from the perspective of policy-usefulness, since the decision for disindexation, or for a degree of indexation below unity, as the models would recommend when real shocks occur, is usually a decision that has to be made as part of a stabilization program after inflation has taken hold, and the income distribution consequences cannot be avoided. Income distribution considerations may be the most significant constraints on policy-makers' "choice set" or range of feasible rules for wage indexing, and it is the neglect of income distribution that makes the theoretical indexing literature appear too detached. From this perspective, the recent models cannot explain well the decisions to step-up the degree of indexation in recent experience, nor can they offer much help to policy-makers facing the trade-offs between a socially desirable distribution of income and stability in output and prices.

Two recent studies have examined the effect of wage indexation on the dispersion of wage changes across sectors. Hamermesh (1986) has analyzed the relation between unexpected inflation and relative wage variability in the U.S. and found that increases in unexpected inflation tended to narrow the dispersion of wage changes. This result has sharply differed from earlier and well established results on relative price variability, according to which increases in unanticipated inflation are associated with increased relative price variability. Drazen and Hamermesh (1986) have found that in Israel, just as in the U.S., wage dispersion tended to decline with unexpected rises in inflation. They have reconciled these apparently opposite results by showing that if the degree of indexation rises with inflationary shocks, then these shocks can reduce the dispersion in wage settings.

Further models of indexation may take into account the effects of indexing on wage dispersion by allowing contracts to be staggered over several quarters or years, and explicitly treating an index of wage dispersion as an argument in a social welfare loss function. In periods of sudden inflation allowing contract length may become endogenous, and dependent on the degree of wage dispersion. From this perspective the determination of the optimal degree of indexation becomes a richer and more interesting policy problem. By taking into account the social costs of increased wage dispersion as well as the losses resulting from the more abstract criterion of "deviations of actual output from the level of output in a frictionless economy", such a loss function would make the

design of optimal indexing and exchange rate policy more complex, but also more interesting and realistic.

V. Conclusion

This paper has reviewed recent experiences of indexing policies as well as the theoretical developments in recent literature. The literature has offered some explanations for the inflationary and real instabilities that have occurred when indexing was increased at a time of recurring oil and supply shocks in the world economy, and when indexing spread to assets and taxes. The literature also shows how specific exchange rate policies, if not coordinated with wage policies, may pose further problems for stability. However, there has been little, if any, rigorous empirical testing of these models in high inflation economies. Simulation studies using these models as a foundation, with prespecified parameter values, may be the most useful way to see if the dynamic predictions of these models are similar to the observed output and price instabilities observed in countries with high inflation and indexation.

The literature makes a case for government intervention in indexing, through the use of specific rules, based on information asymmetries between the government and private sector decision makers. Specific rules, especially multivariate rules, may be beneficial for improving stability, but only if the rule is jointly determined with monetary policy. An ad-hoc wage indexing rule may in fact work at cross-purposes with monetary policy, just as an ad-hoc exchange rate policy may undo the benefits of wage indexation for stability.

So far, the emphasis of recent research has been on the macroeconomic stabilization aspects of indexing policy. The effects of indexing on income distribution have been neglected. Yet adverse distributional consequences of a stabilization plan may lead to its undoing, through the social and political instability generated by the stabilization plan. For this reason, the loss functions or social welfare criteria which are used to determine the optimal levels of indexing should include the effects of indexing (or disindexation) on wage dispersion during inflation, as well as stabilization goals. Starting from this approach, the research would become more complex, but also more interesting and relevant for policy-making in a high-inflation environment.

NOTES

1 It should be noted, however, that the bargaining structure in Israel is quite different from the one in Brazil. In Israel, contracts are set in a three-part agreement process involving the government, the manufacturing leaders, and the central union. In Brazil, the rules for indexing were set by the government. For this reason, any comparison berween Brazilian and Israeli indexation covers only one aspect of a broader bargaining context.

2 The rationale for an appropriate deflator, which would compensate more for nominal shocks than for real shocks, will be treated in detail in the theoretical section. An example of a real shock is an increase in the price of oil; in order for demand to fall, there should be little or no compensation. A example of a nominal shock is a change in the money supply. In order to prevent this shock from having output effects, wages should be fully compensated. In this way, the real wage does not change, and employment/production consequences are mitigated.

3 Roberto Frenkel (1980) sees this exchange rate disindexation policy as one phase in the transition from the Keynesian "old orthodoxy" based on devaluation and fiscal austerity to the "new orthodoxy" based on the monetary approach to the balance of payments and the law of one price model.

4 The path of the causation is from the appreciation of the domestic currency to the increased speculation and capital flight to disintermediation and dollarization. The decontrol of interest rates, and high level of interest rates after decontrol, lead to increased foreign borrowing and indebtedness.

5 Charles Schultze (1985) elaborated on some of the reasons for wage/price stickiness in Europe and the United States in his 1984 Presidential Address to the American Economic Association.

6 This result is not so surprising, since one would expect the oil shock to have widely different effects on different countries even if there were no indexing or if there were identical indexing in all countries. Fischer's study was an empirical illustration rather than a rigorous statistical test of the ambiguous effects of indexing on inflation and inflationary instability.

7 Indexation can also be greater than unity. This has been called "100 per cent plus" indexation, but this case is not the focus of recent literature.

8 Simonsen (1983) has discussed in greater detail the different implications of lagged and current indexing systems for overall macroeconomic stability.

9 Cukierman (1980) considers a more general case, when the employment rule is supply-determined. In this case, full indexation reduces uncertainty in expected real wages, and by stabilizing the labor supply, may reduce output instability, even when real shocks are occurring.

10 It should be noted that the loss function will be minimized. The losses will not be eliminated in this framework, since wages are linked to only one variable when two types of shocks impinge on the economy.

11 It may be objected that the welfare criterion is too narrow. Countries concerned about indexing, for example, are really concerned about inflation, and not about deviations of actual output from output in a flexible economy. However, minimizing actual output from output in a flexible economy is equivalent to minimizing the deviations of actual inflation from expected inflation in a rational expectations framework, since output deviations occur as a result of inflationary surprises.

12 In addition to the use of extended rules for wage indexing, special price deflators have been proposed for the wage adjustment rules. This deflators are called "value– added deflators" in Marston and Turnovsky (1982), and a "basket indicator" in Aizenman (1983a). Marston (1983) discusses two deflators: the general price level, or the price of domestic output. The implication of this literature is that full indexation to the general price level or CPI is sub-optimal.

13 For example, one can argue that governments issue indexed bonds in order to borrow in a market with inflationary uncertainty, and that there is little substitutability between indexed wages and assets, since capital markets are not perfect. The simple tax indexation results also can be faulted for not treating capital gains and depreciation under inflationary uncertainty.

14 Jurg Niehans made this point in private correspondence.

15 Aizenman (1984) elaborated on this issue: he found that the optimal degree of indexing depends on relative importance of real and monetary shocks, while the optimal degree of recontracting depends on the "aggregate volatility", so that the relationship between indexing and recontracting is more complex than in the Gray framework. This is discussed below.

16 Jacob Frenkel made this point in private conversation.

17 See, for example, Aizenman and Frenkel (1985), discussed in greater detail below.

18 See Canzoneri, Henderson, and Rogoff (1983) for an elaboration of the information advantages of public and private sector agents.

19 Turnovsky (1983) has also pointed out that specific rules for one variable may offset the gains in stability from specific rules for the other variable. For example, full indexing of wages to consumer prices may offset the gains exchange market intervention may bring in stabilizing the system from real disturbances [Turnovsky (1983): p. 1983]. Thus, exchange rate and indexing policy may offset one another as well as enhance one another.

20 Aizenman (1983b) also considered the case of "sticky" price setting behavior, in which there could be deviations from ppp under flexible exchange rates. He found that the beneficial results of optimal indexing depend on the internal flexibility of prices. With an optimal level of indexing, a more rigid price structure would lead to "higher output variability" [Aizenman (1983b): p. 10].

21 When the economy is subject to higher variability in real shocks, we would expect to find a flexible system coupled with a low degree of indexing. With higher variability in domestic monetary shocks, we would expect to see a fixed system with full indexation. Flood and Marion (1982) found similar results. Marston (1982) also considered the case of indexation abroad as well as at home, and how this would affect the choice of exchange rate regime.

22 It should be remembered that the optimizing problem is the minimization of a loss function, based on deviations of actual output from the level of output in a frictionless economy with flexible, market-clearing wages.

23 This result is dependent on the particular mix of disturbances which the authors consider in their model, and may not be true for a variety of other types of shocks which may affect the system. Paul DeGrauwe made this point in private corresponce.

24 Aizenman and Frenkel do not consider the use of money supply changes through purchases of domestic bonds. Foreign exchange market intervention is the only means by which money supply can be increased or decreased in their model.

25 Turnovsky (1986) differentiates between anticipated and unanticipated, and permanent and transitory shocks. When shocks are perfectly anticipated, a simple wage rule *or* a simple monetary policy rule will achieve perfect stabilization (i.e., minimize the loss function at zero).

26 Ashenfelter and Pencavel (1975) have looked at the relation between wage changes and the frequency of wage settlements, and Freeman (1980) examined unionism and the dispersion of wages. Neither have looked at the relation between the dispersion of wages on the one hand, and the degree of indexation or the frequency of recontracting on the other.

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