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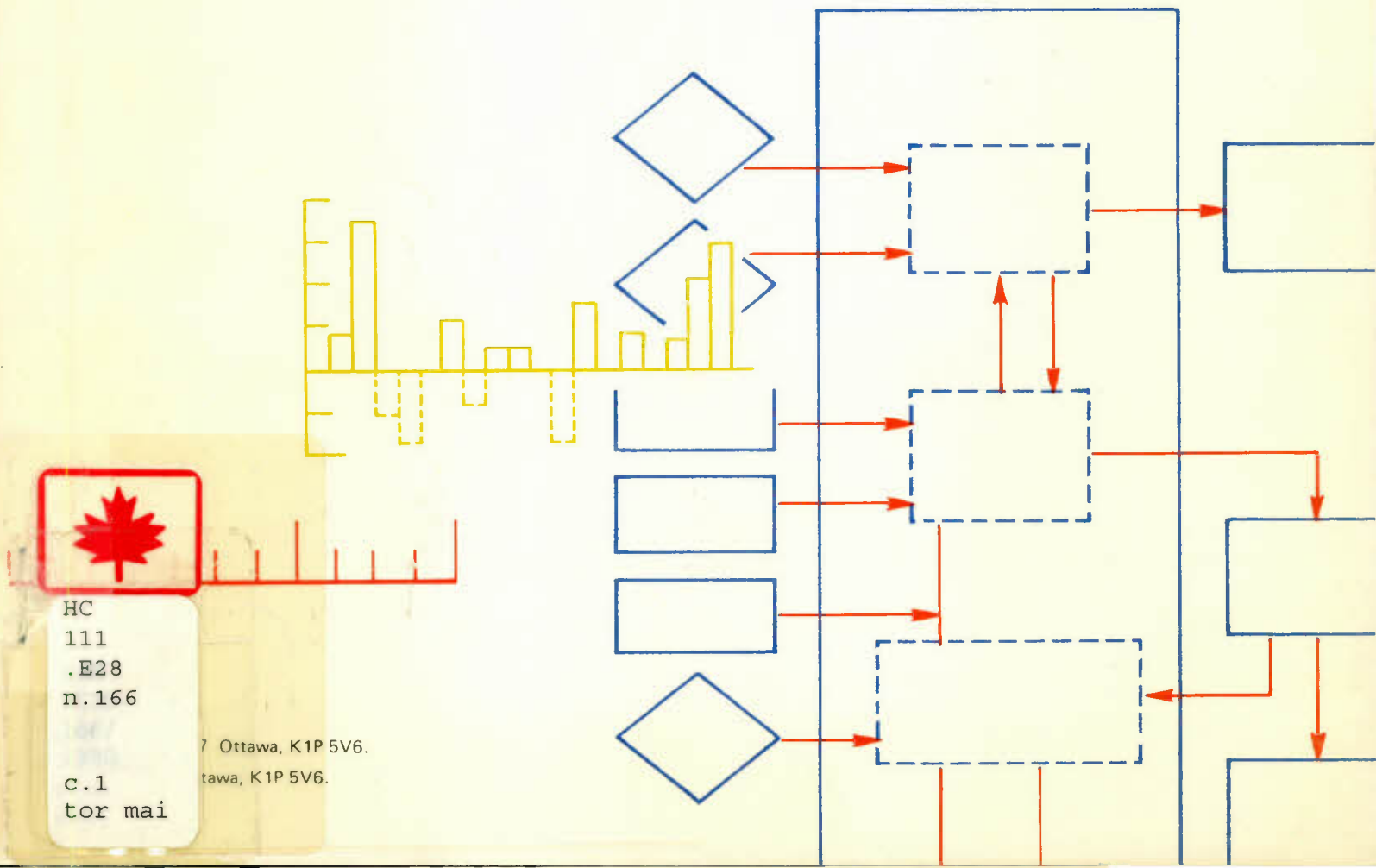

DISCUSSION PAPER NO. 166

The Relative Impact of Wage-Price Controls and Wage-Indexation on Economic Growth and Price Stability

by P. Someshwar Rao

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Résumé

Le but de cet exposé est d'étudier les répercussions des mesures de contrôle des prix et des salaires, ainsi que de l'indexation des salaires, sur la stabilité des prix et la croissance économique au Canada. A cette fin, nous avons, à l'aide du modèle CANDIDE 2.0, effectué plusieurs simulations afin de découvrir les effets à moyen terme des politiques sur les revenus et de diverses formes d'indexation des salaires sur l'ensemble de l'économie canadienne.

Voici quelques-unes des conclusions importantes de la présente étude :

1. Nos résultats démontrent que le programme de contrôle des prix et des salaires réduira l'inflation et le chômage durant sa mise en application. Cependant, une fois les contrôles supprimés, le taux d'inflation sera de beaucoup supérieur à la valeur du scénario de base, ce qui laisse supposer que le programme ne réduira pas le problème de la stagflation de façon permanente.

2. Nos résultats donnent fortement à entendre aussi que l'indexation des salaires (même sous sa forme la plus poussée) n'entraînera pas à la longue une accélération de l'inflation.

3. Nos résultats laissent supposer également que la politique monétaire sera plus efficace pour contrôler l'inflation quand les salaires seront parfaitement ajustés aux changements du coût de la vie.

4. La dépréciation du dollar a d'abord amélioré la balance du compte courant dans tous les scénarios (avec ou sans indexation des salaires). Cependant, en raison de l'augmentation plus rapide des prix et des salaires, cette amélioration se détériore au cours de la période de simulation, et cette détérioration devient grave lorsque les salaires sont indexés. De fait, dans le scénario de la pleine indexation décalée par rapport à l'IPC, le déficit au compte courant augmente de 1,9 milliard de dollars vers la fin de la période de simulation. Par contre, lorsque les salaires sont indexés sur l'indice de prix du PNB (plutôt que sur l'IPC), la dépréciation prend une incidence positive sur la balance du compte courant, même à la fin de la période de simulation.

5. Enfin, nos résultats indiquent que, suite à l'indexation des salaires, le problème de la montée en spirale des prix et des salaires sera de beaucoup aggravé par des changements subits du taux de change, par les prix énergétiques et les autres pénuries du côté de l'offre.

Abstract

The objective of this paper is to study the impact both wage-price controls and wage-indexation have on price stability and economic growth in Canada. For this purpose, using the CANDIDE Model 2.0, we have run several simulation experiments to uncover the general equilibrium impacts of income policies and various forms of wage-indexation on the Canadian economy in the medium run.

The following are some of the important findings of the present study:

1. Our results show that the wage-price controls programme will reduce both inflation and unemployment, when the controls are in operation. However, once the controls are removed, the inflation rate is well above the base case value. This implies that the controls programme will not reduce the stag-flation problem permanently.

2. Our results also strongly suggest that the wage-indexation (even in its extreme form) will not result in the acceleration of inflation over time.

3. Our results imply that the monetary policy will be more effective in controlling inflation when wages are fully compensated for changes in the cost of living.

4. Devaluation of the dollar has improved the current account balance initially in all the scenarios (with or without wage-indexation). However, due to the acceleration of wages and prices, this improvement deteriorates over the simulation period, and the deterioration is severe when wages are indexed. As a matter of fact, in the full indexation-lag CPI scenario, the current account deficit has increased by 1.9 billion dollars by the end of the simulation period. In contrast, when wages are indexed on the basis of GNP deflator (rather than CPI), even by the end of simulation period devaluation has a positive impact on the current account balance.

5. Our results show that the wage-price spiral problem will be much more severe to shocks in exchange rate, energy prices and other supply shortages with the institution of wage-indexation.

Acknowledgement

I am grateful to Dr. R. S. Preston, Director, CANDIDE Project, for his guidance and encouragement on this study. I am indebted to Dr. Levesque and Dr. Slater for many useful comments on an earlier draft of this paper. I am thankful to Haider Saiyed for helping me with the simulations and Marg Willis for preparing the graphs I am also thankful to Denyse Desaulniers for patiently typing the whole manuscript.

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I Introduction

Policy makers as well as ordinary citizens all over the world (especially during the decade of the '70's) are trying to seek ways to deal with apparently unstoppable and socially divisive problem of accelerating inflation. For many years, the politicians and some of the economists have taken the view that inflation cannot be controlled without some kind of prices and income policy. However, the opponents of mandatory income policies have argued that the empirical evidence from many countries shows that these policies have little or no permanent effect in inflation and the long-term harmful effects of these policies (inequities, economic distortions, increasing industrial concentrations and increasing power of trade unions, et cetera) outweight any short-term gains on the inflation front. [Lipsey and Parkin (1970), Lipsey (1977), Walker (1976)].

As during past inflationary episodes, many are looking again at indexing of money wages as an aid in solving the inflation problem. The worsening of stagflation problem in the 1970's has created an upsurge of interest both among the economists and the policymakers in studying the impacts of wage indexation on economic growth and price stability [Friedman (1974), Griersch (1974), Gray (1976), Morley (1977), Goldstein (1975), and Cukierman (1977)]. Indexing means expressing contracts in real instead of money terms. In constrast to the income policies, wage-indexation programme helps the people to live with inflation. On the face of it there

is no logical inconsistency in studying both policies designed to control inflation and policies designed to make whatever inflation remains more comfortable. This is on the assumption that indexation as such does not alter inflation. But Friedman and the other supporters of wage indexation have argued that indexation will lower the inflation rate by increasing the will power of the government to control inflation, since the output and employment losses associated with the anti-inflationary policies will be small in an indexed economy. However, the opponents of wage-indexation have argued that the indexation scheme will convert a "softcore" inflation into a "hardcore" wage-price spiral reaching well into the future.

The objective of this paper is to study the impact of both wage-price controls and wage-indexation on a small open economy like Canada. Using CANDIDE Model 2.0, we have run several simulation experiments to uncover the general equilibrium impacts of incomes policies and various forms of indexation on the Canadian economy both in the short and medium run.

The following are some of the important questions we hope to answer:

1. Are the income policies effective in controlling inflation in the long-run?

2. How does the income policies effect the real wage rate and the functional distribution of income?

3. Does the income policies help to reduce the problem of stagflation?

4. Does the wage-indexation produce an accelerating inflation or under what circumstances?

5. What is the impact of wage indexation on the government budget position?

6. Are the output employment losses associated with the anti-inflationary policies small in an indexed economy?

7. What is the impact of wage-indexation on the efficiency of exchange rate policy in improving the trade balance?

8. How does the impact of indexation on the efficiency of stabilization and exchange rate policies compare if money wages are linked to GDP deflator rather than the CPI?

The plan of the paper is as follows:

In Section II, we will discuss the wage-price dynamics of the CANDIDE 2.0 Model in some detail. This will help the reader in appreciating the general equilibrium effects of the price and income policies and the various forms of wage indexation.

Section III analyzes the impact of wage-price controls and the various forms of wage-indexation on some of the key macro-economic variables.

In Section IV, we examine the impact of monetary shock on the Canadian economy with and without the institution of wage indexation. We will also examine the sensitivity of responses to the choice of price index.

Section V analyses the efficiency of exchange rate policies in improving the trade balance with and without wage indexation. Here too, we will examine the impact of indexation to the choice of price index.

Finally, the important findings of the study are summarized in the last section.

II Wage-Price Dynamics of the CANDIDE Model 2.0

The multiplier properties of an econometric model critically depends upon the response of wages and prices to pressures in both the product and factor markets. Moreover the simulation results on wage-price controls and wage-indexation are mainly determined by the wage-price and employment dynamics of the CANDIDE Model. Therefore, the analysis of simulation results should be preceded by a discussion of the properties of the wage-price block of the CANDIDE Model 2.0. This would enable the reader to appreciate fully the general equilibrium effects of wage-price controls and wage-indexation on some of the key macro-economic variables in the system.

In this section, first, we will briefly discuss the determination of sector wages and prices in the CANDIDE Model 2.0. Next, we will outline the relationship between sector prices and final demand prices. Finally, using the aggregated equations (derived from the parameters of the disaggregated equations) of wages, sector prices, consumer prices, labour supply and labour demand, we will derive the partial elasticities of real wage with respect to the variables exogenous to the wage-price block. We will also indicate the implications of these movements in real wage for ecomonic growth and unemployment rate, in the first round.

If both labour supply and labour demand are responsive to real wage rate, these first round effects on real wage rate will play a key role in determining the division of nominal expenditure between prices and output in both the short and long run.

a) Determination of Wages in CANDIDE 2.0

Like the previous versions of the CANDIDE Model, (CANDIDE Model 1.0,CANDIDE Model 1.1, CANDIDE Model 1.2 and CANDIDE Model 1.2M) CANDIDE 2.0 is a large scale econometric model with extensive industry detail. However, unlike the previous versions, CANDIDE 2.0 is more balanced in its industry detail; with the exception of a few cases the same level of industry aggregation is used for outputs, employment, manhours, investment, wages and prices[1].

In CANDIDE 2.0 the aggregate wage rate is derived as a weighted sum of sectoral wage rates. For each industry an inflation augmented Phillips Curve of the following type is estimated:

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1 For a detailed description of CANDIDE 2.0, see CANDIDE 2.0 Model Description Vol 1 and Vol 2, Economic Council of Canada.

$$\dot{W}_i = \alpha_i + \beta_i \frac{1}{DMURATE25.54(-1)} + \gamma_i \dot{P}_E + \delta_i \dot{PROD}_i + \theta_i \dot{WUS}_i \qquad (2.1)$$

where $\dot{W}_i$ is the percentage change in the ith industry's wage rate in Canada,

DMURATE25.54 is the prime age of male unemployment rate,

$\dot{P}_E$ is the inflation expectations,

$\dot{PROD}_i$ is the percentage change in the ith industry's labour productivity (output per manhour) and

$\dot{WUS}_i$ is the percentage change in the ith industry's wage rate in the U. S.

As seen from equation (2.1) percent change in each sector's wage rate is essentially determined by two macro varaibles (labour market tightness and inflation expectations) and two sector specific variables (productivity growth and rate of change of wage rate in that sector in U.S.A.). However, the sector specific variables did not come through in most of the industries. Productivity growth rate enters only in the following four industries: finance, insurance and real estate, coal mining, metal mining and nonmetal mining. Similarly, the U. S.wage rate has a significant influence only in the food and beverage, motor vehicles parts and accessories and crude petroleum and natural gas mining industries[2].

In view of the dramatic shifts in the composition of labour force over time, the aggregate unemployment rate is not a reliable indicator of the labour market tightness variable[3].

In an effort to overcome this problem, we have used the prime age male unemployment rate as the indicator of

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2 For a listing of the estimated wage equations, see CANDIDE 2.0 Model Description, Vol. 1.

3 Perry (1970), Gordon (1976), and Santomero and Seater (1978).

labour market tightness[4]. In CANDIDE 2.0, prime age male unemployment rate is determined as a nonlinear function of aggregate unemployment rate and the ratio of prime age male labour force to the total labour force.

In CANDIDE 2.0, price expectation variable is constructed as a weighted average of past years' inflation rate and the rate of growth of money supply over the past two years. The weights are chosen by regression analysis -- the historical time-series data on the actual rate of growth of consumer prices is explained in terms of lagged inflation rate and the past two years' money supply. The sum of estimated weights on these two variables is very close to unity; the weight of past inflation is 0.7 and the weight associated with the monetary growth is 0.27. This innovation allows the inflationary expectations to be formed by a more "rational" process than does the traditional approach of proxying inflationary expectations by a distributed lag of past inflation rates. The traditional expectation process can be viewed as " naive expectations", where economic agents are assumed to base their expectations solely on past inflation rates and therefore assumed to be

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4 One could also correct the measured unemployment rate for these demographic changes over time, see Perry (1970). Alternatively one could also use the help wnated index as a proxy for the labour market tightness variable.

ignorant of the variables that drive the inflationary process. At the other end of the spectrum, we have the perfect foresight models of "ratio expectations", where inflationary expectations are assumed to be determined only by the expected growth of money supply. Here the economic agents are not only assumed to know all the parameters of the economic model that generates inflation but also assumed to anticipate the future monetary expansion with certainity. The inflationary expectation process of CANDIDE 2.0 can be viewed as a "semi-rational" approach since the inflationary expectations variable is a weighted sum of both " naive " and "rational" elements[5]. The coefficients of price expectation variable in most of the equations is not significantly different from unity. This supports the Phelps-Friedman view that in the long-run there is no trade-off between inflation and unemployment rate.

In CANDIDE 2.0, money supply is demand determined, for the case where the Bank of Canada's policy is directed towards maintaining the interest rate targets. On the other hand if the Bank of Canada's policy is directed towards

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5 See Gordon (1976) and Maital (1979). According to Maital (1979) monetary growth has a much larger or about equal impact on expected rate of price change among laymen than it does in experts expectations.

maintaining monetary growth targets, interest rate is market-determined. However, in both these cases, there is a direct link between the rate of growth of money supply and wages and prices through price expectations. Inflationary expectations also affect the wages and prices through its impact on exchange rate. In summary, the rate of growth of money supply influences wages and prices in the system via its impact on price expectations. The constant term in the wage equations (2.1) picks up the rate of growth of real wages due to long term trends in productivity growth.

In CANDIDE 2.0 aggregate wage rate is determined as a weighted sum of sectoral wage rates. These sectoral wage rate changes are primarily determined by trend rate of growth of productivity, inflation expectations and labour market tightness indicator. In some cases, U. S. industry-specific wage rates and industry-specific rates of growth of productivity are introduced as additional arguments.

b) Sector Prices

In CANDIDE 2.0, wage rate changes are caused by either pressure in the labour market and/or changes in inflation expectations and they are transmitted to final demand prices via sector deflators. This process consists of four steps a) determination of sector prices; b) conversion of these sector prices into commodity output prices utilizing the 1971 input-output relationships (industry technology matrix, market share matrix and the import content of the domestic supply); c) conversion of these commodity output prices into final demand component prices (consumption, investment, government expenditures, inventories, using the "Bridge Matrix" and indirect tax rates and finally d) adjusting these "pseudo" final demand prices for the constancy of input-output coefficients.

Like the aggregate wage rate, the aggregate GDP deflator is derived as a weighted average of sectoral deflators. In CANDIDE 2.0, each industry's value-added deflator is explained primarily as a mark-up over average unit cost (labour and capital with the exception of noncommercial industries). However, import prices, labour productivity and rate of growth of output are also entered as additional arguments to capture the variations in the mark up over time. To get a handle on the short and long run elasticities of sector

deflators with respect to costs, the distributed lags of independent variables are introduced. A typical industry's value-added deflator equation can be represented as follows:

$$\dot{PX}_{it} = \Sigma\alpha_j \dot{W}_{it-j} + \Sigma\beta_j \dot{PROD}_{it-j} + \Sigma\gamma_j \dot{IUC}_{it-j} + \Sigma\delta_j \dot{PXM}_{it-j} + \Sigma\theta_j \dot{X}_{it-j} \qquad (2.2)$$

where $\dot{PX}_i$ is the percentage change in the ith industry's value-added deflator,

$\dot{W}_i$ is the percentage change in the ith industry's wage rate,

$\dot{PROD}_i$ is the percentage change in the labour productivity of the ith industry,

$\dot{IUC}_i$ is the percentage change in the user cost of capital of ith industry,

$\dot{PXM}_i$ is the percentage change in the ith industry's value-added deflator in the competiting country, and

$\dot{X}_i$ is the percentage change in the output of the ith industry.

As seen from equation (2.2), percent change in the industry-specific output is introduced as a very rough proxy for capacity pressure[6]. In CANDIDE 2.0 each industry's user cost of capital is calculated as a weighted average of user cost of capital on machinery and equipment and structures. The user cost of capital for the two types of capital stocks are calculated endogenously incorporating the long term industrial bond yield, industry specific investment deflators, effective tax rates, depreciation rates, tax credits, and capital cost allowances[7]. Therefore, the increases in capital costs either due to government policy or due to pressure in the financial markets are eventually transmitted into higher wage-price inflation through the sector deflators. Since the output of noncommercial industries is measured in terms of labour input, the sector deflators of these industries should be modelled as wage rate equations. Accordingly, in CANDIDE 2.0 the value-added deflators of these industries (industries #38 through #44)* are explained in terms of inflation expectations or distributed lag of percent change in CPI, and prime age male unemployment rate.

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6 In some of the industries, changes in average weekly hours are introduced as surrogates for capacity utilization.

7 For a detailed explanation on the calculation of user cost of capital, see CANDIDE 2.0, Model Description Vol 1 and 2.

* Listing of the CANDIDE Model 2.0 industries is given in Table 2.1.

Table 2.1

Aggregation Levels for Production, Wages, Wagebill, Industry prices, Investment, User Cost, Capital Stock, Manhours, Hours and Employment

Industry	Items
1	Agriculture, Fishing and Trapping
2	Forestry
3	Metal Mining
4	Coal Mining
5	Crude Petroleum, Natl Gas & Serv incid. to Mining
6	Nonmetal Mining (except coal)
7	Food & Beverage
8	Tobacco Products
9	Rubber and Plastics Products
10	Leather
11	Textile
12	Knitting Mills and Clothing
13	Wood
14	Furniture and Fixtures
15	Paper and Allied
16	Printing, Publishing and Allied
17	Iron and Steel
18	Nonferrous metal
19	Metal Fabricating
20	Machinery (ex elec mach)
21	Motor Vehicle (ex parts & Accessories)
22	Motor Vehicle Parts & Accessories
23	Nonauto Transport Equipment
24	Electrical Products
25	Nonmetallic mineral products
26	Petroleum and coal products
27	Chemical and Chemical products
28	Miscellaneous Manufacturing
29	Construction
30	Transportation
31	Communication
32	Utility
33	Wholesale and Retail Trade
34	Owner Occupied Dwellings
35	Finance, Insurance & Real Estate
36	Commercial Services
37	Other Noncommercial Services
38	College and University Education
39	Hospitals
40	Primary, Secondary & Non University Post Sec Education
41	Federal Defence
42	Federal nondefence
43	Local Government
44	Provincial government
45	Noncompetiting imports
46	Indirect taxes, Commodities
47	Indirect taxes, noncommodities
48	Subsidies

In summary, variations in commercial industries' value-added deflators are explained in terms of variations in industry specific wage rates, user cost of capital, labour productivity, import prices and capacity utilization. Noncommercial industries value-added deflators are explained in terms of inflation expectations and labour market tightness variables.

c) Final Demand Prices

In CANDIDE 2.0, sector prices (value-added deflators) are converted into final demand prices using the price-conversion approach of the earlier versions of CANDIDE model [8]. This price conversion procedure involves the following five steps:

Step 1

Time series data on industry value-added deflators and import prices by commodity [9] are converted into commodity

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8 For a detailed exposition of the price conversion technique, see Preston (1972) and Lodh (1979).

9 We remind the reader that in CANDIDE 2.0 both the industry and commodity disaggregation levels are identical. Hence then both the industry technology and the market-share matrices are the same.

prices with the help of price conversion weights, calculated using the 1971 input-output relationships. These price conversions weights are calculated by using the industry technology matrix, market-share matrix, and the import content vector by commodity:

$$\underset{\sim}{PQ} = \underset{\sim}{\alpha}\ \underset{\sim}{PX} + (1 - \underset{\sim}{\alpha})\ \underset{\sim}{PM} \qquad (2.3)$$

where $\underset{\sim}{\alpha}$ is the vector of price conversion weights associated with the value-added deflators.

$\underset{\sim}{PQ}$ is the vector of commodity prices computed in the first step,

$\underset{\sim}{PX}$ is the vector of industry value-added deflators, and

$\underset{\sim}{PM}$ is the import price vector by commodity.

Step 2

In the second step, commodity prices computed from the first step are adjusted for manufacturing and noncommodity taxes:

$$\hat{\underset{\sim}{PQ}} = (1 + \underset{\sim}{T}_{MS}) * \underset{\sim}{PQ} \qquad (2.4)$$

where $\underset{\sim}{T}_{MS}$ is the vector of manufacturing (federal manufacturing sales tax) and other noncommodity tax rates and $\hat{PQ}$ is the vector of commodity prices adjusted for manufacturing sales taxes.

Step 3

Using the bridge matrix, these commodity prices are then converted into final demand prices by commodity:

$$\underset{\sim}{PF} = E\ \hat{\underset{\sim}{PQ}} \qquad (2.5)$$

where E is a matrix of coefficients , representing the expenditures on commodities of GNE components, classified by commodity and finald demand category. This is referred to as the Bridge Matrix, and $\underset{\sim}{PF}$ is the estimated vector of final demand prices.

Step 4

In this step, estimates of the final demand prices are adjusted for provincial sales tax rates. Some of the final demand prices are also adjusted for special excise taxes (federal) for liquor, and tobacco, and for provincial taxes on gasoline and federal taxes on building construction materials.

$$\hat{\underset{\sim}{PF}} = (1 + t^{*}) \underset{\sim}{PF} \qquad (2.6)$$

where $\hat{\underset{\sim}{PF}}$ is the vector of final demand prices adjusted for provincial sales taxes, and other special taxes. These prices are referred to as "pseudo" final demand prices. $\underset{\sim}{t}^{*}$ is the vector of provincial and other special tax rates.

Step 5

In the final step, these "pseudo" final demand prices are adjusted for the constancy of input-output relationships,

using the "error modelling"[10] techniques; the difference between the actual and "pseudo" final demand prices is explained in terms of autoregressive terms and a time trend.

$$(\underset{\sim}{PF}_A - \underset{\sim}{\hat{PF}}) = F((\underset{\sim}{PF}_A - \underset{\sim}{\hat{PF}})_{-1}, (\underset{\sim}{PF}_A - \underset{\sim}{\hat{PF}})_{-2}, T) \qquad (2.7)$$

where $\underset{\sim}{PF}_A$ is the actual final demand price vector (times-series data) and T is the time trend.

In summary, the final demand prices are a weighted average of domestic and imported prices. Sector value-added deflators are converted into "pseudo" final demand prices, using the following information from 1971 input-output relationships, import content vector, times-series data on

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10 For a detailed explanation of error modelling techniques, see Preston (1972).

import prices, and various taxes (federal manufacturing sales taxes, provincial sales taxes, federal excise taxes on liquor and tobacco, provincial taxes on gasoline and federal taxes on building construction materials). These "pseudo" final demand prices are in turn adjusted for variations in input-output relationships over time, by regressing the residuals (the difference between actual and"pseudo" prices) on the autoregressive terms, and a time trend.

d) Dynamics of Output,Employment, Wages and Prices

As mentioned above, the wage-price dynamics of a model,through its impact on real wage,determines the division of nominal increases in GNE between prices and output, both in the short- and long-run. Here, using the parameters of aggregated equations for wage, sector price and CPI, we will determine the movements of real wage in terms of variations in variables exogenous to the wage-price block. We will also analyze the implications of these movements in real wages to labour supply, labour demand and unemployment rate and for the wage-price flexibility in subsequent rounds.

The following four aggregate equations determine the long term movements of real wage in CANDIDE 2.0. These equations are written in percentage change form, so that the aggregate elasticities of sector prices to wages, CPI to sector prices, and wages to CPI, et cetera can be seen easily. As mentioned above, in sector price equations all the exogenous variables enter with distributed lags. Therefore, the short run wage-price flexibility will be considerably less than the long run dynamics given here. However within three years most of the sector prices reach their long run equilibrium values.

Aggregate Wage Equation [11]

$$\dot{W} \simeq 1.366 + 0.950\ .CPIE + 10.75\ \frac{1}{DMURATE25.54} + \beta\ \dot{PROD} + \gamma\ \dot{W}_{US} \qquad (2.8)$$

11 For the derivation of this aggregate wage relationship, see Dungan and Wilson (1979). Dungan and Wilson in aggregating the individual wage equations have ignored the influence of productivity and the U. S. wages on the macro-wage Phillips Curve. However, since these variables have been found significant only in a couple of industries their effect is expected to be quite small.

where $\dot{W}$ is the percentage change in the aggregate wage rate,

.CPIE is the expected rate of inflation,

DMURATE25.54 is the prime age male unemployment rate,

$\dot{PROD}$ is the percentage change in the aggregate labour productivity (output per manhour) and

$\dot{W}_{US}$ is the percentage change in the aggregate U.S. wage rate.

As seen from (2.8), the coefficient on price expectations variable is very close to unity, this implies that for Canada there is no long run trade-off between inflation and unemployment. The size of the constant term implies a 1.5% trend growth in real wages due to long term productivity growth. The coefficient on labour market tightness variable implies an equilibrium value of 5.57% for the prime age male unemployment rate (old labour force survey basis)[12].

Aggregate Value-Added Deflator[13]

$$\dot{PX} \simeq 0.65\,\dot{W} - 0.52\,\dot{PROD} + 0.10\,\dot{PM} + 0.03\,\dot{PTE} + 0.15\,IUC \qquad (2.9)$$

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12 In solving the equation (2.8) for the equilibrium unemployment rate, we have assumed a steady state rate of inflation of 6% and a real wage growth rate of 3% per annum.

13 This equation is taken from Lodh (1979).

where $\dot{PX}$ is percentage change in the aggregate value-added deflator,

$\dot{PM}$ is percentage change in the aggregate import price index,

$\dot{PTE}$ is percentage change in the aggregate export price index and

$\dot{IUC}$ is the percentage change in the aggregate user cost of capital.

Equation (2.9) implies that the long run elasticity of sector prices to wages and capital cost in CANDIDE 2.0 are 0.65, and 0.15 respectively. In CANDIDE 2.0, both the export and import prices are exogenous (in U. S. funds). However, these prices in Canadian funds are proportionally affected by variations in the exchange rate. Hence the exchange rate variations caused either by government interventions and/or by variations in trade balance and monetary growth will directly influence the value-added deflator; a 1% depreciation of the Canadian dollar will increase the aggregate value-added deflator by 0.15% directly.

CPI Equation

In CANDIDE 2.0 CPI is derived as a weighted sum of final demand (consumption) deflators and home ownership

price index. Home ownership price index in turn depends upon construction cost, the noncommodity indirect business tax proxy (property taxes), and an average of conventional and NHA mortgage rates (distributed lag). As mentioned above, the final demand prices depend upon sector prices, prices of imported goods, and various tax rates. Therefore, we can explain the percentage change in CPI in terms of percentage change in GDP deflator, import deflator, taxes and the mortgage rate[14].

$$\dot{CPI} \simeq 0.660\,\dot{PX} + 0.157\,\dot{PM} + 0.108\,\dot{PT} + 0.075\,\dot{FRMC} \qquad (2.10)$$

where $\dot{CPI}$ is percentage change in the consumer price index,
$\dot{PX}$ is percentage change in the GDP deflator,
$\dot{PM}$ is percentage change in the import price index,
$\dot{PT}$ is percentage change in the indirect tax rate, and
$\dot{FRMC}$ is percentage change in the average mortgage rate.

Equation (2.10) implies that other things remaining constant, a 1% increase in GDP deflator will raise CPI

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14 This equation is also taken from Iodh (1979).

by only 0.66%, the remaining 0.34% of passthrough is lost to import prices, indirect taxes and the mortgage rate. Equation (2.10) also implies that a 10% depreciation of the Canadian dollar will increase CPI by 1.6% directly. Similarly a 10% increase in the mortgage rate will increase the consumer price index by 0.75% in the first round.

Inflationary Expectations

As mentioned in the beginning of this section in CANDIDE 2.0, inflationary expectations depend upon past years inflation rate and the rate of growth of money supply in the past two years[15].

$$.CPIE \simeq 0.70\ \dot{CPI} + 0.27\dot{M} \qquad (2.11)$$

where .CPIE is expected rate of inflation and $\dot{M}$ is the rate of growth of money supply (M1).

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15 As we are here interested mainly in the long-run dynamics of the wage-price block, we have written the .CPIE equation without consideration for lags on the independent variables. For the actual .CPIE equation, see CANDIDE 2.0 Model Description, Vol 1., Section 16.

$$\dot{CPI} \simeq \frac{(-0.476 + \beta(0.43))}{0.714}\dot{PROD} + 0.313\dot{PM} + 0.03\dot{PTE} + 0.14\dot{IUC} + 0.153\dot{PT} + 0.105\dot{FRMC} + 0.157\dot{M} + 6.25\frac{1}{DMURATE25.54} + \frac{0.43(\gamma)}{0.714}\dot{WUS} \quad (2.11)^*$$

$$\dot{W} \simeq \frac{1.366}{0.714} + \frac{(-0.317 + \beta)}{0.714}\dot{PROD} + 0.207\dot{PM} + 0.02\dot{PTE} + 0.094\dot{IUC} + 0.101\dot{PT} + 0.070\dot{FRMC} + 0.365\dot{M} + 14.53\frac{1}{DMURATE25.54} + \frac{\gamma}{0.714}\dot{WUS} \quad (2.8)^*$$

Equation (2.11) implies that in the steady state, a 1% increase in money supply will increase the inflation rate by 0.9%.

Real Wage Rate Equation

Using the equations (2.8-2.11), we first derive the reduced form equations for the wage rate and the consumer price index. These equations in turn will enable us to write the aggregate real wage rate equation in terms of the variables exogenous to the wage-price block.

$$\dot{RW} \equiv \dot{W} - \dot{CPI} \simeq$$

$$\frac{1.366}{0.714} + \left(0.223 - \beta\frac{(1-0.43)}{0.714}\right) \dot{PROD}$$

$$- 0.106\,\dot{PM} - 0.01\,\dot{PTE} - 0.046\,\dot{IUC} - 0.052\,\dot{PTE}$$

$$- 0.035\,\dot{FRMC} + 0.207\,\dot{M} + 8.28\,\frac{1}{DMURATE25.54}$$

$$+ \frac{\gamma(1-0.43)}{0.714}\,\dot{WUS} \qquad (2.12)$$

Equation (2.12) says that a 1% increase in labour productivity increases the real wage rate by little more than 0.25%. However, we should remind the reader that this is in addition to the trend rate of growth of real wages, (capturing long-term productivity gains) represented by the constant term in the wage rate equation (2.12). Other things remaining constant, a 1% depreciation of Canadian dollar will depress the real wage growth in the long-run by 0.11%. Similarly, increases in the user cost of capital, indirect tax rate, and mortgage rate will also depress the real wage rate. In constrast, monetary growth, increases in labour market tightness and increases in U.S. wages will increase the real wage rate, by increasing output and labour productivity in the case of monetary growth and by increasing the real price of labour input for the other two cases.

Equation (2.12) clearly shows that a restrictive monetary policy will depress the real wage both directly and indirectly through interest rates and the user cost of capital. However, the general equilibrium effects of monetary policy on real wage depends upon the sensitivity of wages to the unemployment rate (caused by restrictive monetary policy), and the sensitivity of exchange rate to domestic monetary growth. Therefore, the division of money expenditure between prices and output critically depends upon the sensitivity of exchange rate equation.

If the exchange rate is fairly sensitive to the expected inflation rate, there may not be any significant gain in real wage rate. On the other hand, if the exchange rate is not very sensitive to domestic wage-price cost developments, the above mentioned first round effects might be reinforced by the developments in the labour market.

In CANDIDE 2.0, both labour supply and labour demand are sensitive to variations in real wage rate. Increases in real wage rate caused by either lagged adjustment of prices to wages and/or insensitivity of exchange rate to wage-price developments, will have a tendency to increase the labour supply and labour demand. Real wage also influences the employment through both substitution and income effects. The net impact on employment depends on the relative size of these two effects. In CANDIDE 2.0, income effect dominate the substitution effect, resulting in a net increase in employment. However, due to increase in labour supply, the impact on unemployment rate is either quite small or positive. This in turn will weaken the wage-price flexibility and reinforces the initial increases in real wage.

In summary, in CANDIDE 2.0, sector wages are influenced by prime age male unemployment rate, inflationary expectations, long term productivity growth (sector specific) and U. S. wages. Sector value-added deflators are influenced by sector specific wage rates, productivity growth, import and export prices, and user cost of capital. However, the full adjustment of sector prices to these variables takes two to three years. These sector prices are then converted into final demand prices, using the information on 1971 input-output relationship, import content vector, import prices and various tax rates.

Using the parameters of industry specific equations, we have derived the aggregate wage-price relationships. These aggregate equations in turn are used to write the aggregate real wage rate equation in terms of variables exogenous to the wage-price block. In CANDIDE 2.0, restrictive monetary policy will increase the real wage rate, unless the lags in sector price equations are shortened and/or the exchange rate is fairly sensitive to monetary growth (expected inflation rate variable should enter with a coefficient of unity in the expected exchange rate equation)[17]. The opposite is true in the case of expansionary monetary policy.

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17 For a detailed discussion of the interrelationships between the real and financial sectors of CANDIDE 2.0, see Rao and Whillans (1979).

III Wage-Price Controls and Wage Indexation

In this section, we will analyse the impact of wage-price controls and wage indexation on some of the key macro-economic variables: inflation, unemployment rate, economic growth, government budget position, trade balance, et cetera.

Before proceeding with the discussion of simulation results, we will first give a brief outline of the various scenarios developed. Using the new CANDIDE Model, we have developed the following five scenarios to study the impact of mandatory income policies, and various forms of wage-indexation schemes on the Canadian economy.

(1) Wage-Price Controls

In this scenario, starting in 1978, all sector price growth rates are reduced by 2% per annum for three years. Consistent with these price reductions,all the sector wage rates are reduced by 3% per annum for the period 1978 - 1980[18].

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18 We remind the reader that the labour share in GDP is around 70%.

Here we are implicitly assuming that the government is imposing mandatory wage-price controls for three years, starting 1978, and these policies are 100% effective in controlling wages and prices. At the end of three years, wage-price dynamics is assumed to work as usual.

(2) Full Wage Indexation - CPI

As discussed in the last section, in CANDIDE 2.0, sector wage rates are primarily influenced by inflation expectations and labour market tightness, and the coefficient on inflationary expectations variable in the aggregate wage equation is very close to unity. This in turn has allowed us to implement the wage-indexation scheme through the price expectations variable. However, in developing the various indexation scenarios, we have used the following two alternate equations for the price expectations variable:

Alternate 1

$$.CPIE = \alpha \dot{CPI} + \beta \dot{CPI}(-1) + \gamma \dot{CPI}(-2) \qquad (3.1)$$

Alternate 2

$$.CPIE = \delta \dot{PX} + \varepsilon \dot{PX}(-1) + \theta \dot{PX}(-2) \qquad (3.2)$$

where .CPIE is the percentage change in expected inflation, $\dot{CPI}$ is the percentage change in consumer price index and $P\dot{X}$ is the percentage change in GDP deflator.

In alternate equation 1, indexation formula is a weighted sum of present and past growth rates in the consumer price index.

In the second equation, indexation formula links wages to the GDP deflator rather than the consumer price index.

In summary, wage-indexation scheme is implemented with the help of inflation expectations variable.

In this scenario, workers are assumed to be fully compensated for increases in the consumer price index without any lag. This scenario is implemented by constraining the coefficient on the current inflation rate (α) (in the first alternate equation for inflationary expectations) to be unity and the coefficients on the past inflation rates (β and γ) assumed to be zero.

(3) Full Wage Indexation - Lag CPI

In this scenario, wages are fully compensated for changes in the consumer expenditure, but with a one year lag. This is implemented by constraining the coefficient on last year's inflation rate (β) to be unity, and the other two coefficients are (α and γ) given zero values, in equation (3.1).

(4) Full Wage Indexation - GDP Deflator

Here wages are fully compensated for changes in GDP deflator, rather than the consumer price index, without any lag. This scenario is implemented by using the alternate equation 2 for price expectations variable. The coefficient on current inflation rate (δ) is constrained to unity and the other two coefficients are (ε and θ) constrained to zero.

(5) Full Wage Indexation - Lag GDP Deflator

In this scenario, wages are fully compensated for changes in the GDP deflator, with a one year lag. To

implement this scenario, the coefficient on PX(-1) (ε) is constrained to unity and the remaining two coefficients in equation (3.2) (δ and θ) are assumed to be zero.

In summary, we have developed four different indexation formulas. In the first two indexation formulas, wages are linked to CPI. In the other remaining two formulas wages are indexed on the basis of GDP deflator rather than the CPI. However, in all the four scenarios wages are assumed to be fully compensated for changes in the appropriate price index. But in two of the scenarios the indexation formula is based on the past year's changes in the chosen price index. This in turn could result in temporary losses (gain) in real wages due to any unexpected increases (reductions) in inflation rates, caused by either external environment and/or supply shocks.

Simulation Results

Wage-price controls programme will reduce the inflation rate (at least for the control period), which in turn will increase the final demand through its impact on real income. Wage-price controls programme will also improve the trade balance by increasing exports and reducing imports, since the domestic costs are reduced considerably vis-a-vis the foreign competitors. The impact of wage-price controls on the unemployment rate depends upon the movement of real wage rate. As shown in section two, if the controls programme increases the real wage, labour supply will also increase, and the net impact on unemployment rate might be negligible. On the other hand, if the controls programme reduces the real wage, unemployment rate will be reduced significantly. The net impact of controls programme on the government budget position cannot be predicted a priori unambiguously since the lowering of the inflation is expected to reduce both the tax revenue and the government expenditure on transfers, debt servicing charges, and current expenditure on goods and services. Of course, the medium-to long-run impact of the controls programme cannot be predicted a priori. The net impact of controls programme on the inflation rate during the post-control period critically depends on the movement of price expectations variable. If the controls programme is successful in lowering the inflationary expectations, the inflation rate in the post-controls period will be less than the base case value and the the opposite is true if the post-

controls period value of inflationary expectation is bigger than the base case values (absence of controls). In constrast to the wage-price controls scenario, wage-indexation is expected to increase the inflation rate in the short-run, since it increases the wage-price flexibility in the system, compared to the base case. Since wages are fully compensated for increases in prices, the real wage rate in the indexation scenarios will be bigger than the base case values. This increase in real wage in turn will increase the constant dollar GNE expenditure by increasing the real income. Similarly, the increase in real wage will also increase the share of wages in national income, unless the elasticity of substitution between capital and labour is greater than unity. The net impact of indexation programmes on the unemployment rate depends on the relative sensitivity of labour supply and labour demand to changes in real wage.

Due to increases in both the economic activity, and the domestic costs vis-a-vis the competiting countries, both the trade balance and the exchange rate are expected to deteriorate, compared to the base case. These are some of the important short-run macroeconomic responses expected, based on the structure of CANDIDE 2.0.

Simulation results of the wage-price controls, and the four indexation scenarios are recorded in Tables 1 to 7. In view of the above discussion on some of the important

macro-economic impacts, all the results are self-explanatory. However, we will analyze these results in some detail under the following seven major headings:

a) wages and prices
b) GNE growth
c) labour supply and labour demand
d) functional distribution of income
e) trade balance and exchange rate
f) government budget position
g) interest rates

Wages and Prices

Tables 1- and Chart I and II* summarizes the impact of wage-price controls and indexation on wages, prices, inflation rate, price expectations and real wage rate. As seen from Table 1 for the control scenario both wages and prices are below the control values over the whole simulation period. However, by the end of the simulation period, the
is reduced considerably, implying a higher inflation rate for post-control period. In contrast to a 3.7% reduction in inflation rate in 1979, rate of growth of consumer price index is 2.10% above the control value in 1985. Similarly, the price expectations variable is also above the control value in 1985. This result strongly supports the view that the wage-price controls are not effective in lowering the prices in the long run and might even produce an inflationary bubble in the

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* All varaibles in the charts are measured as percent differences from the base case values. In the charts we have used the CANDIDE 2.0 mnemonics. A listing of the description of these mnemonics is given in Table 2.2

Table 2.2

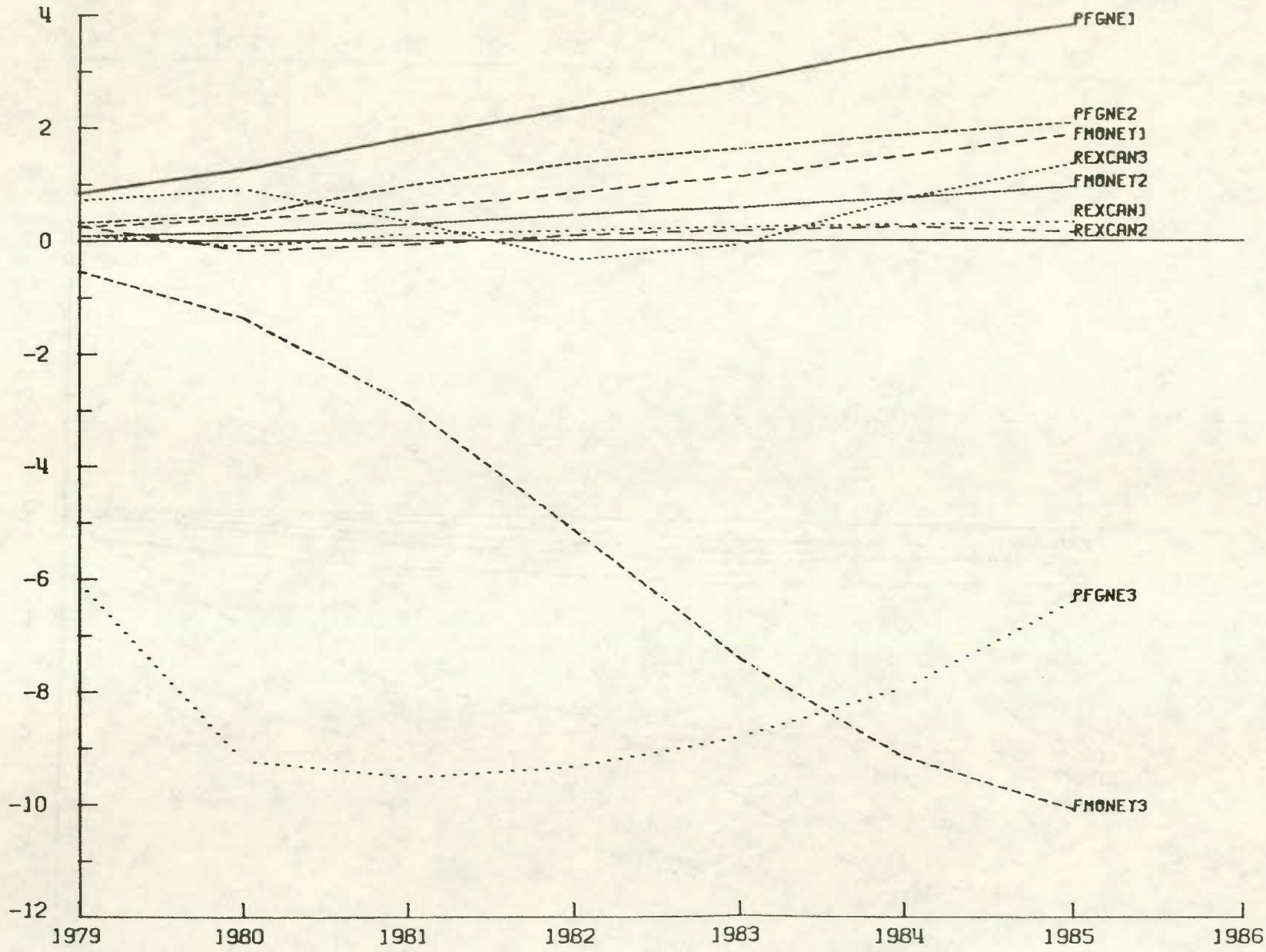
Description of Mnemonics Used in the Charts*

Mnemonics	Description
Nominal Variables	
PFGNE	GNE deflator
FMONEY	Money Supply ($ Millions)
REXCAN	Exchange rate - value of the Canadian dollar measured in terms of U. S. currency
Real Variables	
W/CPI	Real average hourly earnings ($)
GNE	Gross National Expenditure ($ millions)
NE	Total employment (thousands)

* All variables in the charts are measured as percent differences from the base case values (absence of wage-price controls and wage-indexation).

CHART I

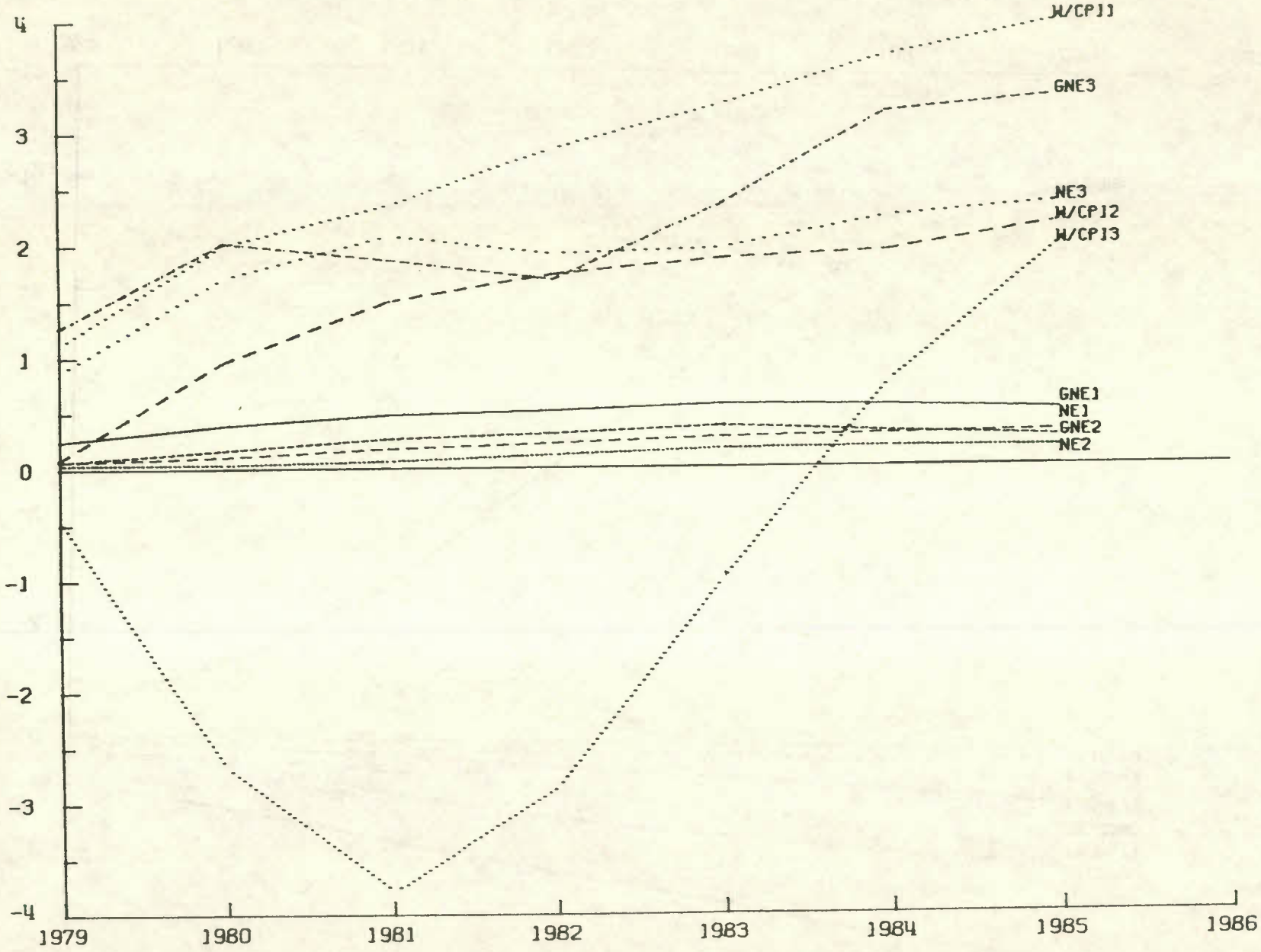
INDEXATION - NOMINAL VARIABLES



1 - LAGGED CPI
2 - LAGGED PXROP
3 - WAGE PRICE CONTROLS

CHART II

INDEXATION - REAL VARIABLES



1 - LAGGED CPI
2 - LAGGED PXROP
3 - WAGE PRICE CONTROLS

Table 1

Wages and Prices

	1979	1982	1985
Wage-Price Controls			
% Difference in average hourly earnings	-5.87	-10.45	-1.60
% Difference in GNE deflator	-6.07	-9.31	-6.37
% Difference in CPI	-5.42	-7.60	-3.57
% Difference in real wage rate	-0.45	-2.85	1.97
% Difference in inflation rate (CPI)	-3.7	0.6	2.10
% Difference in inflation expectations	-1.6	-0.3	0.4
Full Indexation (CPI)			
% Difference in average hourly earnings	3.98	6.79	8.52
% Difference in GNE deflator	1.56	3.14	4.28
% Difference in CPI	1.32	2.65	3.36
% Difference in real wage rate	2.66	3.65	4.24
% Difference in inflation rate (CPI)	0.9	0.5	0.0
% Difference in inflation expectations	1.6	1.1	0.2

Table 1 cont'd

Full Indexation (lag CPI)	1979	1982	1985
% Difference in average hourly earnings	1.85	4.82	7.00
% Difference in GNE deflator	0.85	2.33	3.82
% Difference in CPI	0.73	1.98	3.05
% Difference in real wage rate	1.12	2.84	3.95
% Difference in inflation rate	0.4	0.4	0.3
% Difference in inflation expectations	0.2	1.1	0.9
Full Indexation (lag PXRDP)			
% Difference in average hourly earnings	2.37	5.14	5.85
% Difference in GNE deflator	1.29	2.78	2.56
% Difference in CPI	1.08	2.36	2.56
% Difference in real wage	2.38	3.06	3.21
% Difference in inflation rate	0.8	0.2	-0.1
% Difference in inflation expectations	1.9	0.5	0.1

Table 1 cont'd

Full Indexation (lag PXRDP)	1979	1982	1985
% Difference in average hourly earnings	0.39	2.90	3.85
% Difference in GNE deflator	0.33	1.17	1.68
% Difference in CPI	0.30	1.17	1.68
% Difference in real wage	0.09	1.73	2.17
% Difference in inflation rate	0.1	0.4	0.3
% Difference in inflation expectations	-0.9	0.7	0.6

post-control period[19].

During the control period, the reduction in wages are bigger than the reduction in prices, resulting in a real wage loss: in 1982 real wages are 2.85% below the control value. However, during the post-control period the reduction in wages is much less than the reduction in prices, resulting in real wage gain. In 1985 real wage rate is 1.97% above the control value. Increased labour market tightness (reduction in unemployment rate) and increased price expectations are mainly responsible for the real wage gain, during the post-control period.

As expected, in all the four indexation scenarios, both wages and prices are above the control values, throughout the simulation period. However, the rate of growth of prices has decelerated over the simulation period in all the four scenarios. Even when wages are fully indexed to changes in the consumer price index without any lag, the inflation rate has not accelerated over time. On the contrary, in 1985, the inflation rate is identical to the base case value (see Full Wage Indexation - CPI Scenario). As predicted, in all the four scenarios, wage increases are bigger than the price increases, resulting in a real wage gain. As expected,

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19 Lipsey (1977), Lipsey and Parkin (1970), and Walker (1976).

the increase in wages and prices for the full indexation CPI scenario is bigger than the other three scenarios. Similarly, these increases are less for the full indexation -- lag PXRDP scenario. Since the GDP deflator does not contain the imported (finished) goods, the increase in wages and prices for the GDP deflator-linked indexation scenarios is less than the increases for the CPI linked indexation scenarios.

In summary, our results show that wage-price controls do not have a significant influence on wages and prices in the long-run and will result in an inflationary bubble immediately after the controls are removed[20]. In contrast in all the four indexation scenarios, both wages and prices are above the control values. However, our results strongly suggest that wage-indexation (even in its extreme form) does not result [21] in an accelerating inflation over time.

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20 This result if consistent with the findings of Schweitzer (1976)

21 On this point, see Friedman(1974), Goldstein (1975), Morley (1977) and Heller (1974).

Economic Growth

As expected, GNE is above the control values throughout the simulation period, for the wage-price controls scenario. (See Table 2). However, the composition of additional GNE is not the same over the simulation period. In 1982, almost all of the increase in GNE has come from the increases in investment, and exports and reduction in imports, whereas in 1985, most of the increase has come from the consumption. As discussed above, in 1982 real wage rate has declined by 2.85%, whereas in 1985 real wage is 1.97% above the control value. This pattern in real wage is mainly responsible for changes in the composition of additional GNE over the simulation period.

As seen from Table 2, in all the four indexation scenarios, GNP is above the control values, and not surprizingly most of this increase has come from the increase in consumer expenditure. These increases in consumer expenditure are mainly caused by increases in the real wage. Increased economic activity in turn has increased real imports in all the scenarios. Moreover, GNE-based ranking of the scenarios is identical to the real wage-gain ranking;the percent difference in GNE for CPI linked indexation scenarios is bigger than the GDP deflator based formulas.

Table 2

GNE Growth

Wage-Price Controls	1979	1982	1985
% Difference in GNE	1.27	1.68	3.29
% Difference in Consumer expenditure	1.70	0.07	2.70
% Difference in investment expenditure	1.16	3.02	2.82
% Difference in exports	0.18	0.59	0.44
% Difference in imports	0.31	-3.95	-1.84
Full Indexation (CPI)			
% Difference in GNE	0.54	0.65	0.47
% Difference in Consumer expenditure	0.86	1.76	1.99
% Difference in investment expenditure	0.95	0.85	0.39
% Difference in exports	-0.05	-0.04	-0.04
% Difference in imports	1.36	2.81	3.46
Full Indexation (lag CPI)			
% Difference in GNE	0.25	0.51	0.50
% Difference in Consumer expenditure	0.42	1.26	1.75
% Difference in investment expenditure	0.51	0.70	0.53
% Difference in exports	-0.03	-0.03	-0.05
% Difference in imports	0.70	1.99	2.98

Table 2 cont'd

	1979	1982	1985
Full Indexation (PXRDP)			
% Difference in GNE	0.45	0.59	0.29
% Difference in Consumer expenditure	0.71	1.61	1.49
% Difference in investment expenditure	0.72	0.83	0.11
% Difference in exports	-0.05	-0.03	-0.04
% Difference in imports	1.08	2.56	2.63
Full Indexation (lag PXRDP)			
% Difference in GNE	0.07	0.31	0.26
% Difference in consumer expenditure	0.13	0.70	0.97
% Difference in investment expenditure	0.27	0.48	0.25
% Difference in exports	-0.01	-0.02	-0.03
% Difference in imports	0.29	1.12	1.66

In summary, for both the wage-price controls and the wage indexation, GNP is above the control values over the simulation period. However, the composition of additional GNP is different for the two scenarios.

Labour Supply and Labour Demand

As shown in Table 3, by the end of the simulation period, both labour supply and labour demand are above the base values for the controls scenario. However, the increases in employment are much bigger than the increase in labour supply, resulting in a lower unemployment rate. In 1985 the unemployment rate is reduced by 1.7 percent. During the control period, reduction in the real wage has reduced the labour supply, resulting in an even bigger reduction in the unemployment rate -- in 1982 labour supply is 0.6% below the base value, resulting in a 2.4% reduction in unemployment rate.

In all the four indexation scenarios, increase in labour supply are bigger than the increases in employment resulting in additional unemployment; for example, in the full indexation -- CPI scenario, unemployment rate is 0.7 percent above the control value in 1985.

Table 3

Labour Demand and Labour Supply

Wage - Price Controls	1979	1982	1985
% Difference in labour supply	0.03	-0.60	0.59
% Difference in labour demand	0.87	1.91	2.35
Change in unemployment rate	-0.8	-2.4	-1.70
Full Indexation (CPI)			
% Difference in labour supply	0.50	0.86	1.07
% Difference in labour demand	0.12	0.33	0.36
Change in unemployment rate	0.3	0.5	0.7
Full Indexation (lag CPI)			
% Difference in labour supply	0.24	0.66	0.93
% Difference in labour demand	0.07	0.22	0.31
Change in unemployment rate	0.2	0.5	0.6
Full Indexation (PXRDP)			
% Difference in labour supply	0.42	0.77	0.81
% Difference in labour demand	0.09	0.31	0.26
Change in unemployment rate	0.3	0.4	0.5
Full Indexation (lag PXRDP)			
% Difference in labour supply	0.07	0.40	0.51
% Difference in labour demand	0.04	0.12	0.17
Change in unemployment rate	0.0	0.3	0.3

Our simulation results imply that the elasticity of labour supply to real wage is approximately 0.20 a 10% increase in the real wage will increase the labour supply by 2%.

Functional Distribution of Income

As seen from Table 4, wage share in the national income raises above the control values, for both the control and indexation scenarios. However, for the control scenario, the increase in wage share is very small initially, mainly due to a decline in the real wage. In all the indexation scenarios, increases in real wage has resulted in raising the wage share and reducing the profit share. In full indexation (CPI) scenario wage share is 1.5 percent above the control value in 1985. This in turn implies that the elasticity of substitution between capital and labour is well below unity in CANDIDE 2.0.

Trade Balance and Exchange Rate

As seen from Table 5, in the wage-price controls scenario, the current account balance has improved considerably -- by the end of simulation period, the current account deficit is reduced by 2.74 billion dollars (20.45%), compared to the

Table 4

Trade Balance and Exchange Rate ($ millions)

I Wage-Price Controls	1979	1982	1985
ΔCurrent account (%) balance	-105.7 (1.65)	4316.4 (53.0)	2737.0 (20.45)
ΔMerchandise trade (%) balance	-519.9 (-14.0)	2035.0 (41.8)	-630.20 (39.54)
ΔService account (%) balance	429.2 (4.10)	2296.4 (16.7)	3434.5 (22.1)
% Difference in exchange rate	0.72	-0.34	1.38
II Full Indexation (CPI)			
ΔCurrent account balance (% difference)	-1008.8 (15.77)	-2723.9 (33.46)	-4495.9 (33.60)
ΔMerchandise balance (% difference)	- 782.1 (21.19)	-1938.6 (39.78)	-2800.7 (175.74)
ΔService account balance (% difference)	- 207.6 (1.97)	- 758.5 (5.52)	-1649.7 (10.68)
% Difference in exchange rate	- 0.16	0.30	0.46
III Full Indexation (lag CPI)			
Δ Current account balance (% difference)	-535.6 (8.4)	-1947.1 (23.92)	-3908.8 (29.21)
Δ Merchandise trade balance (% difference)	-412.8 (11.2)	-1405.1 (28.83)	-2547.4 (-159.9)
Δ Service account balance (% difference)	-114.2 (1.08)	-519.8 (3.8)	-1317.8 (8.5)
% Difference in exchange rate	1.09	0.18	0.35

Table 4 (cont'd)

IV Full Indexation (PXRDP)	1979	1982	1985
Δ Current account balance	-795.3	-2490.3	-3420.2
(% difference)	(12.43)	(30.6)	(25.96)
Δ Merchandise trade balance	-617.1	-1777.1	-2069.8
(% difference)	(16.72)	(36.5)	(129.9)
Δ Balance on Service	-161.4	-690.8	-1314.1
(trade sections)	(1.53)	(5.03)	(8.47)
% Difference in exchange rate	-0.28	0.39	0.32
V Full Indexation (lag PXRDP)			
Δ Current account balance	-234.7	-1097.4	-2150.3
	(3.7)	(13.5)	(16.1)
Δ Merchandise trade balance	-178.2	-800.4	-1412.8
	(4.8)	(16.4)	(76.7)
Δ Balance on Service trade sections	-54.7	-282.5	-714.6
	(0.50)	(2.10)	(4.60)
% Difference in exchange rate	0.26	0.10	0.16

Table 5

Functional Distribution of Income ($ millions)

I Wage - Price Controls	1979	1982	1985
Δ in wage bill (%)	-7272.3 (4.99)	-16389.7 (7.99)	1241.3 (0.42)
Δ in corporate profits (%)	-3399.3 (10.89)	-4375.2 (9.62)	-10764.2 (20.39)
Δ Wage share (%)	0.3	0.2	3.0
Δ Profit share (%)	-0.9	-0.2	-2.3
II Full Indexation (CPI)			
Δ in wage bill (%)	5379.9 (3.70)	12505.5 (6.10)	21493.3 (7.34)
Δ in corporate profits (%)	-740.3 (-2.40)	-1825.6 (-4.01)	-3764.1 (7.13)
Δ Wage share (%)	1.0	1.4	1.7
Δ Profit share (%)	-0.7	-1.2	-1.5
III Full Indexation (PXRDP)			
Δ in wage bill (%)	4623.7 (3.20)	10821.1 (5.27)	16192.9 (5.53)
Δ in corporate profits (%)	-782.4 (2.51)	-1432.0 (3.15)	-3034.1 (†5.75)
Δ in wage share (%)	0.9	1.2	1.3
Δ in profit share (%)	-0.7	-1.0	-1.2

Table 5 (cont'd)

IV Full Indexation (Lag CPI)	1979	1982	1985
Δ in wage bill (%)	2556.2 (1.75)	9444.9 (4.60)	19715.9 (6.73)
Δ in corporate profits (%)	-148.5 (-0.48)	-1311.2 (-2.88)	-3069.5 (-5.81)
Δ in wage share (%)	0.4	1.1	1.5
Δ in profit share (%)	-0.3	-0.9	-1.3
V Full Indexation (lag PXRDP)			
Δ in wage bill (%)	627.6 (0.43)	5621.9 (2.74)	10760.4 (3.67)
Δ in corporate profits (%)	235.0 (0.75)	-693.7 (-1.53)	-1793.6 (-3.40)
Δ in wage share (%)	0.0	0.7	0.9
Δ in profit share (%)	0.1	-0.5	-0.8

control value. Increased exports and reduction in imports, caused by reduction in domestic costs, has resulted in a much bigger improvement in trade balance initially. In 1982, current account balance is improved by 4.3 billion dollars. However, the increases in consumer expenditure has sucked in alot of merchandise imports by the end of the simulation period, resulting in a slight deterioration of merchandise trade balance -- in 1985, merchandise trade balance has deteriorated by 0.63 billion dollars.

In contrast to the control scenario, the current account balance has worsened in all the four indexation scenarios. Increased economic activity and increased domestic costs have resulted in the deterioration of two components of current account balance (merchandise and service account balance). This deterioration of current account balance in turn has resulted in the depreciation of the Canadian dollar. In 1985, the Canadian dollar value is 0.50% below the control value for the full indexation (CPI) scenario.

Government Budget Position

Tables 6A and 6B summarises the impact of wage-price controls and the indexation scenarios on the budget position of both federal and provincial governments. As seen from

Table 6A, wage-price control programme worsens the budget position of federal government considerably in the long-run. In 1985, the federal government budget deficit has increased by 3 billion dollars. This is mainly because the reduction in tax revenue (both personal and corporate taxes) are not matched by the reductions in the government expenditure - - federal government revenue has declined by about 5 billion dollars, whereas the federal government expenditure is cut only by 1.9 billion dollars. In spite of big reductions in the transfer expenditure, the total government expenditure is only reduced marginally, as the other two major components of government expenditure (interest payments and the current expenditure on goods and services) are actually above the control values by the end of the simulation period. These two components have increased mainly due to increases in both the interest rates (caused by higher inflation rates in the post-control period) and the real wage rate.

In spite of a huge increase in the government deficit, the debt burden of the federal government has only increased marginally by the end of the simulation period -- in 1985 the federal government debt has increased by a mere 0.63 billion dollars. This small increase in government debt is mainly the result of improved budget position in the beginning of the simulation period (control period). In 1982 the reduction in government expenditure has exceeded the reduction in tax revenues by about a billion dollars.

Table 6A

Federal Government Budget Position ($ millions)

I Wage - Price Controls	1979	1982	1985
Δ Revenue			
Total	-2575.6	-6078.3	-5051.8
Direct taxes, persons	-1649.9	-3882.8	-1278.0
Direct taxes, corporations	-698.8	-932.6	-2527.4
Indirect taxes	-106.4	-545.7	-14.2
Δ Expenditures			
Total	-2420.6	-6998.1	-1900.1
Interest payments	-293.0	-1247.6	518.6
Current goods and services	-964.2	-1691.7	1130.4
Transfers to persons	-1082.8	-3889.4	-3483.3
Δ Deficit	-125.1	973.5	-3009.3
Δ Debt	253.3	-3633.7	630.2
II Full Indexation (CPI)			
Δ Revenue			
Total	1102.7	2760.8	4764.6
Direct taxes, persons	1157.8	2562.7	4608.0
Direct taxes, corporations	-195.9	-355.9	-873.9
Indirect taxes	125.9	367.7	569.0

Table 6A (cont'd) ($ millions)

Δ Expenditures	1979	1982	1985
Total	981.1	2398.9	3850.9
Interest payments	76.4	241.8	33.9
Current goods and services	355.4	803.0	1230.1
Transfers to persons	508.3	1254.8	2420.8
Δ Deficit	99.3	271.8	788.2
Δ Debt	-59.4	-181.6	-1707.0
III Full Indexation (lag CPI)			
Δ Revenue			
Total	578.6	2049.6	4332.4
Direct taxes, persons	562.8	1932.3	4171.6
Direct taxes, corporations	-71.9	-265.9	-710.4
Indirect taxes	72.5	269.7	519.1
Δ Expenditures			
Total	527.8	1826.3	3496.4
Interest payments	42.9	187.7	132.0
Current goods and services	198.8	59917	1119.1
Transfer to persons	265.6	964.4	2091.6
Δ Deficit	39.5	163.4	724.3
Δ Debt	-37.8	-90.1	-1284.0

Table 6A (cont'd) ($ millions)

IV Full Indexation (PXRDP)	1979	1982	1985
Δ Revenue			
Total	903.9	2423.5	3582.8
Direct taxes, persons	981.7	2210.6	3492.3
Direct taxes, corporations	-180.9	-299.6	-715.5
Indirect taxes	97.o	340.7	416.4
Δ Expenditures			
Total	798.6	2163.9	2864.2
Interest payments	62.2	239.2	-39.6
Current goods and services	280.6	716.2	913.8
Transfers to persons	421.4	1121.4	1866.3
Δ Deficit	87.0	179.1	624.4
Δ Debt	-36.4	-114.5	-1318.2
V Full Indexation (lag PXRDP)			
Δ Revenue			
Total	220.8	1224.3	2348.7
Direct taxes, persons	161.6	1161.1	2250.8
Direct taxes, corporations	7.3	-147.1	-383.4
Indirect taxes	36.3	156.1	284.6

Table 6A (cont'd) ($ millions)

Δ Expenditures	1979	1982	1985
Total	213.1	1099.4	1901.8
Interest payments	18.8	103.8	82.8
Current goods and services	92.9	366.4	594.4
Transfers to persons	95.0	585.2	1141.0
Δ Deficit	3.9	93.5	381.6
Δ Debt	-23.9	-75.6	-691.7

In contrast to the control scenario, the budget position of federal government has improved consistently in all the four indexation scenarios. In all the four scenarios the increases in tax revenue are bigger than the increases in government expenditure, resulting in a net improvement of the budget position. This in turn has reduced the debt burden of the federal government. In the full indexation (CPI) scenario, federal government debt is reduced by 1.7 billion dollars by the end of the simulation period. In view of the decline of the profit share in the national income, the reduction of corporate tax revenue for the indexation scenarios is hardly surprising. Again, the ranking of indexation scenario's on the basis of improvement in the budget position of the federal government is identical to the real wage ranking. The budget position improvement is big for the CPI linked indexation scenarios, compared to the GDP deflator based indexation formulas.

As seen from Table 6B, in contrast to its impact on federal budget position, control programme improves the budget position of provincial government considerably. In 1985, the budget surplus of the provincial government has increased by almost 6.8 billion dollars.

As opposed to the control scenario, the budget position of provincial government has deteriorated in all the four indexation scenarios. In all the scenarios the increases

Table 6B

Provincial Govt' Budget Position ($ millions)

I Wage - Price Controls	1979	1982	1985
Δ Revenue			
Δ Expenditures			
Δ Deficit	1135.4	3662.4	6799.5
II Full Indexation (CPI)			
Δ Revenue	1021.8	2480.1	4188.2
Δ Expenditures	1313.9	3363.8	6418.5
Δ Deficit	-313.7	-914.7	-2414.0
III Full Indexation (lag CPI)			
Δ Revenue	510.4	1862.5	3882.8
Δ Expenditures	665.3	2483.1	5628.6
Δ Deficit	-165.0	-653.8	-1879.5
IV Full Indexation (PXRDP)			
Δ Revenue	859.3	2169.9	3123.2
Δ Expenditures	1099.5	2938.7	4979.6
Δ Deficit	-260.6	-787.4	-2022.9

Table 6B (cont'd)

V Full Indexation (lag PXRDP)	1979	1982	1985
Δ Revenue	159.7	1107.9	2121.2
Δ Expenditures	219.3	1467.0	3079.4
Δ Deficit	-60.5	-387.5	-1017.1

in government expenditure are bigger than the increases in tax revenue, resulting in the reduction of provincial government budget surplus. In 1985, provincial government budget surplus is reduced by 2.4 billion for the full indexation (CPI) scenario.

In summary, the simulation results suggest that the wage-price control programme will worsen the budget position of federal government in the long run, which in turn will increase the debt burden of the federal government. However, the control programme improves the budget position of provincial governments. In contrast to the control scenario, wage indexation scenarios improve the budget of federal government by reducing the budget surplus of provincial governments.

MONEY SUPPLY AND INTEREST RATES

As seen from Table 7, both the wage-price controls and the wage indexation scenarios have increased the interest rates in the long run by raising the inflation rate. In the wage-price control scenario, the short rate is 80 basis points above the control value in 1985. This is mainly caused by acceleration in inflation in the post-control period. However, due to reductions in both inflation and government debt, interest rates have declined in the earlier period. In 1982, the short rate is 110 basis points

Table 7

Interest Rates (percent)

I Wage - Price Controls	1979	1982	1985
Δ Short rate	-0.9	-1.1	0.8
Δ Govt' bond rate (long term)	-0.2	-0.4	0.1
Δ Industrial bond rate	-0.2	-0.5	0.2
II Full Indexation (CPI)			
Δ Short rate	0.2	0.3	0.2
Δ Govt' bond rate (long term)	0.0	0.1	0.1
Δ Industrial bond rate	0.0	0.1	0.1
III Full Indexation (lag CPI)			
Δ Short rate	0.1	0.3	0.2
Δ Govt' bond rate (long term)	0.0	0.1	0.1
Δ Industrial bond rate	0.0	0.1	0.1
IV Full Indexation (PXRDP)			
Δ Short rate	0.2	0.3	0.0
Δ Govt' bond rate (long term)	0.0	0.1	0.0
Δ Industrial bond rate	0.0	0.1	0.0

Table 7 (cont'd)

V Full Indexation (lag PXRDP)	1979	1982	1985
Δ Short rate	0.1	0.2	0.1
Δ Govt' bond rate (long term)	0.0	0.0	0.0
Δ Industrial bond rate	0.0	0.1	0.1

below the control value.

Due to increases in inflation rate all the three interest rates (short-rate and the two long rates) have increased in the indexation scenarios. However, this increase is somewhat offset by reductions in the government debt level.

IV Monetary Policy and Wage Indexation

Friedman and the other supporters[22] of wage indexation have argued that the wage indexation will make the government's fight against inflation much more easy by reducing the output and employment losses associated with anti-inflationary policies -- that is, a slowdown in monetary growth. They argue that it is changes in relative prices that cause economic distortions. When inflation decelerates, wages which were set on the basis of price expectations end up being too high relative to the actual price level. This rise in the real real wage in turn generates more unemployment, since in their model, prices are assumed to adjust instantly to clear the output market and a shift in aggregate demand can affect output only through its effects on real wage, because then only the supply of output can be altered. In contrast, in an indexed economy real wage rate

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22 Friedman (1974), Gray (1976), Morley (1977)

is insulated from the monetary shocks (and thereby leaves the supply of output unaffected), which in turn makes the fight against inflation much less painful, compared to a nonindexed economy.

The opponents of wage-indexation[23] on the other hand have argued that there is a long-run trade off between inflation and unemployment, and the Phillips Curve is vertical in a regime in which wages are indexed. This implies that wage-indexation will alter the optimum combination of unemployment and inflation. They argue that prices do not adjust immediately to the level that equilibrates supply and demand for output. Therefore, a monetary shock can have real effects, even if the real wage is constant -- indexation cannot completely remove the effects of a monetary shock. Therefore, the superiority of wage indexation under a monetary shock cannot be decided a priori.

In this section, using CANDIDE Model 2.0, we will analyze the impact of monetary shock in regimes with or without wage indexation. For this purpose, we have run the following three scenarios .

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23 Cukierman (1977), Heller (1974), and others.

a) monetary policy without indexation

b) monetary policy with full wage indexation based on lagged CPI

c) monetary policy with full indexation based on lagged GDP deflator

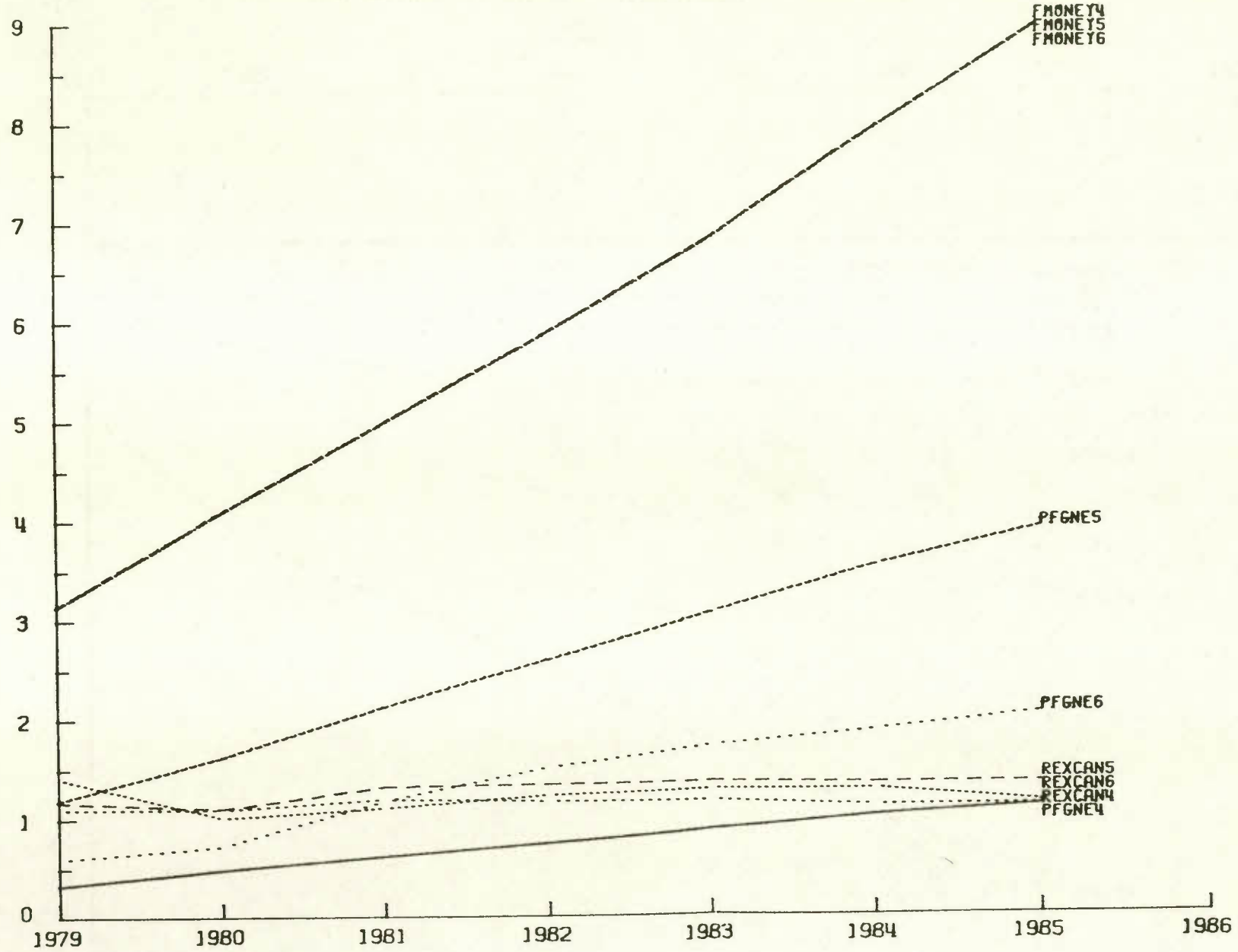
In the first simulation, starting 1978, money supply growth is kept one percent (per annum) above the control values. Here, the wage-price dynamics of the CANDIDE model (as explained in Section II) is allowed to work as usual -- wage rates react to the expected inflation, prime age male unemployment rate, labour productivity and U. S. wages.

In simulation 2, in addition to the one percent increase in money supply growth, wages are assumed to be fully compensated for changes in consumer price index. However, the indexation formula is assumed to depend on the past year inflation rate.

In the last simulation, instead of CPI, wages are linked to the past year's growth in the GDP deflator. Here, too, money supply growth is increased by one percent per annum.

CHART III

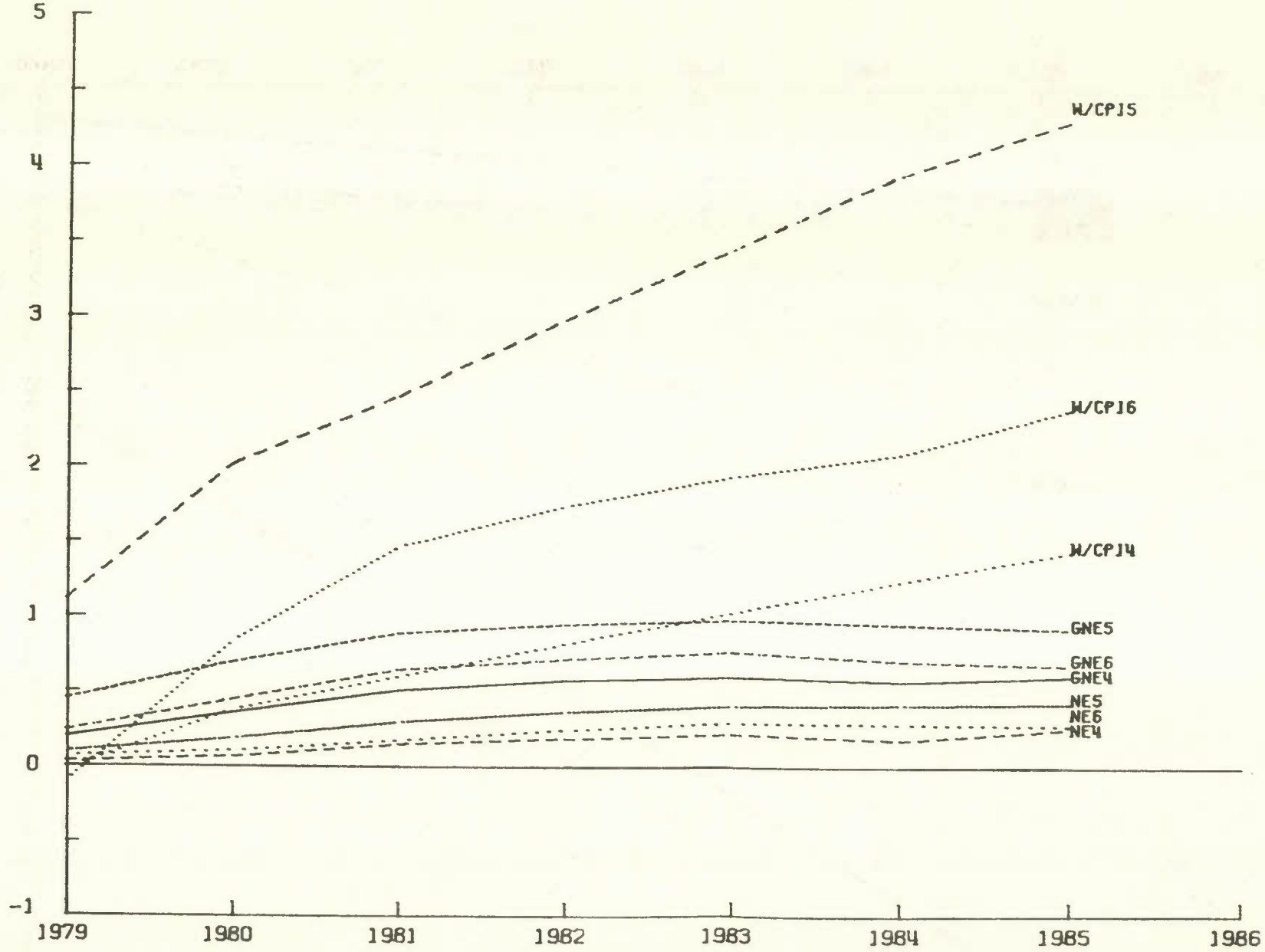
MONETARY POLICY - NOMINAL VARIABLES



4 - WITHOUT INDEXING
5 - LAGGED CPI
6 - LAGGED PXROP

CHART IV

MONETARY POLICY - REAL VARIABLES



4 - WITHOUT INDEXING
5 - LAGGED CPI
6 - LAGGED PXRDP

Simulation Results

Table 8 through 11 and Chart III and IV summarises the impact of monetary policy in regimes with or without wage indexation. Before proceeding with the discussion of simulation results, we will briefly outline the channels through which monetary policy impacts both the real and nominal variables in CANDIDE 2.0. This in turn will enable the reader to appreciate fully the discussion of simulation results of a monetary shock both in indexed and nonindexed scenarios.

In CANDIDE 2.0, an increase in money supply will reduce the short rate, which in turn will lower the long rates by a lesser magnitude (due to the influence of foreign long rates). This in turn will increase the business investment by lowering the user cost of capital.

The cost of credit channel also operates on the housing market as well. A reduction in the mortgage rate (due to term structure relationships) will increase the housing starts, and thus causing an increase in residential investment and GNP. Monetary policy also affects the residential investment via the credit availability channel. An increase in money supply, will increase the mortgage availability by increasing the earning assets of financial intermediaries (especially the

chartered banks). This in turn will increase the residential investment and GNE by increasing the housing starts.

Thus in the short-run, an expansionary monetary policy operating through the cost of credit and credit availability channels will increase investment. This in turn will raise the GNP via the standard multiplier process.

This increase in GNP growth, coupled with the reduction in capital costs will put a downward pressure on sector prices. As mentioned in Section II , sector prices are negatively related to labour productivity and positively related to labour and capital costs. An investment led growth will increase the labour productivity not only by increasing the short-run returns to labour but also by substituting capital for labour. Therefore, the increased labour productivity, coupled with the reduction in capital costs (user cost of capital) will dampen the sector prices in the very short run. However, the net impact of monetary policy on prices in the short run depends upon the movements in the labour market and the sensitivity of exchange rate to the expected inflation.

The full impact of money supply increase on price expectations will build up over two years. These increases in price expectations will cause wages to rise. This in turn will increase the final demand prices via sector prices. As discussed in Section II,

price expectations driven by monetary growth

will increase the real wage, which in turn will increase the consumer expenditure and GNP by raising the real personal disposable income.

Increased price expectations will also raise wages and prices by raising the prices of traded goods. An increase in inflationary expectations will depress the value of Canadian dollar, which in turn will raise the price of traded goods proportionately. This increase in traded goods price (exports and imports) will raise the final demand prices in the system.

The depreciation of the Canadian dollar will increase exports and reduce imports. However, the higher level of activity (induced by investment and real wage gain) sucks in imports. Thus the net impact of monetary policy on imports and current account balance cannot be predicted a priori, and depends on the size of relevant elasticities.

Increased economic activity lowers unemployment rate by increasing the employment. However, the initial increase in real wage will increase the labour supply and slightly reduce the employment. Again the net impact on unemployment rate cannot be predicted a priori. If the activity effects dominate the real wage effect(labour supply), which in turn will reduce the unemployment rate. This in turn will increase

the wage-price flexibility in the system via the Phillips Curve. On the other hand, if the real wage effect offsets the income effect, monetary policy counter to the traditional argument, might even increase the unemployment rate, if the real wage rate effect dominates the activity effect. This in turn will weaken the wage-price dynamics (absence of Phillips Curve effect).

This fall in interest rates should also increase capital inflows.

In summary, an increase in money supply will depress interest rates and increase economic activity in the short-run. Initially there might even be a downward pressure on all the prices, due to increases in labour productivity and reductions in capital costs. However, through price expectations,wages and prices rise in the medium run. Increased economic activity and reductions in interest rates will improve the budget position of the federal government by increasing tax revenue, and lowering the expenditures. The long-run impact of monetary policy on output and prices critically depends upon the sensitivity of exchange rate to domestic costs and prices, and the sensitivity of labour supply and labour demand to the initial increase in real wages caused by the lagged adjustment to sector prices to sector wages.

In view of the above discussion, the simulation results are self-explanatory. However, we will discuss the results in detail. Here, too we will organise the discussion of results under the following four major headings:

a) GNP growth

b) wages and prices

c) labour supply and labour demand

) money supply and interest rates

GNP Growth[24]

As expected, in all three scenarios both investment and GNE are above the control values throughout the simulation period (See Table 8). However, the GNP increase for the CPI linked wage scenario is much bigger than the increase in the absence of indexation -- in 1985 GNP increase is almost one and half times bigger than the increase in the nonindexation scenario. This difference can be attributed to the differences in real wage gain. Due to increase in money supply, the real wage rate in the CPI linked indexation is 4.3% above the control values in1985, whereas in the nonindexation scenario it has increased only by 1.5%.

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24 In all the tables, all the variables are measured as either first differences or percent differences between the shock and control solutions.

Table 8

Economic Growth ($ millions)

I Without Indexation	1979	1982	1985
Δ Difference in GNP (%)	255.6 (0.20)	851.6 (0.58)	977.1 (0.61)
Δ Difference in investment expenditure (%)	113.5 (0.41)	457.7 (1.39)	416.6 (1.14)
Δ Difference in exports (%)	56.0 (0.18)	72.7 (0.21)	71.4 (0.18)
Δ Difference in imports (%)	-189.7 (-0.53)	3.5 (0.01)	163.5 (0.37)
II Full Indexation (lag CPI)			
Δ Difference in GNP (%)	590.1 (0.45)	1387.5 (0.95)	1477.3 (0.92)
Δ Difference in investment expenditure (%)	258.9 (0.93)	610.7 (1.86)	520.0 (1.42)
Δ Difference in exports (%)	47.4 (0.15)	64.3 (0.18)	58.2 (0.15)
Δ Difference in imports (%)	64.3 (0.15)	645.5 (1.61)	1118.0 (2.50)
III Full Indexation (lag PXRDP)			
Δ Difference in GNP (%)	315.1 (0.24)	1045.6 (0.72)	1084.8 (0.68)
Δ Difference in investment expenditure (%)	182.6 (0.65)	527.9 (1.61)	430.8 (1.18)
Δ Difference in exports	54.2 (0.17)	69.4 (0.20)	67.7 (0.17)
Δ Difference in imports	-99.3 (-0.28)	242.2 (0.60)	479.8 (1.07)

In summary our results imply that the money supply shock influences the real output both in the short and medium run with or without indexation and this impact is bigger for the indexed case. However, the differences between the GDP deflator-based indexation and nonindexation scenarios are quite small. Our results imply that a restrictive monetary policy will produce bigger output losses (at least in the medium run) in a CPI linked indexation scheme, compared to the nonindexation scenario. This result is exactly opposite to the prediction of Friedman and his associates. In CANDIDE model, prices do not adjust instantly to clear the output market. Therefore an increase in aggregate demand do influence the supply of real output independent of the real wage effect.

WAGES AND PRICES

As seen from Table 9, an increase in money supply has increased both wages and prices in all three scenarios . However, as expected these increases are bigger for the wage-indexation scenarios. Similarily in all three scenarios scenarios, real wage rate is above the control values. In the non-indexation scenario, the real wage is 1.5% above the control value in 1985. For the two indexation scenarios, the real wage gain is bigger than the increase in the nonindexation world. This result is consistent with the prediction of the supporters of wage indexation.

Table 9

Wages and Prices

I Without Indexation	1979	1982	1985
% Difference in average hourly earnings	0.34	1.51	2.38
% Difference in GNE deflator	0.33	0.74	1.10
% Difference in CPI	0.36	0.69	0.94
% Difference in real wage	-0.02	0.82	1.46
% Difference in inflation rate	-0.0	0.1	0.1
% Difference in inflation expectations	0.4	0.3	0.3
II Full Indexation (lag CPI)			
% Difference in average hourly earnings	2.22	5.24	7.48
% Difference in GNE deflator	1.19	2.59	3.90
% Difference in CPI	1.10	2.26	3.18
% Difference in real wage	1.12	2.98	4.30
% Difference in inflation rate	0.4	0.4	0.3
% Difference in inflation expectations	0.6	1.0	0.9

Table 9 (cont'd)

III Full Indexation (lag PXRDP)	1979	1982	1985
% Difference in average hourly earnings	0.54	3.08	4.09
% Difference in GNE deflator	0.60	1.51	2.04
% Difference in CPI	0.62	1.34	1.70
% Difference in real wage	-0.10	1.74	2.39
% Difference in inflation rate	0.0	0.3	0.1
% Difference in inflation expectations	-0.8	0.6	0.5

Labour Supply and Labour Demand

In all three scenarios, activity effect on employment has dominated the real wage effect, resulting in increased employment. However, in all three scenarios, increases in labour supply, due to increases in the real wage, are bigger than the increases in employment, resulting in an increase in unemployment rate -- for the nonindexed case, the unemployment rate is 10 basis points above the control solution. Due to bigger gains in real wage, the labour supply effects for the indexed scenarios are much bigger than the increase for the nonindexed cases.

Money Supply and Interest Rates

Money supply is 9% above the control value in 1985 (see Table 11) in all three scenarios. As expected, in all the scenarios the increase in money supply has reduced the interest rates -- in the nonindexed case, the short rate is 80 basis points below the control value in 1985. As mentioned above, due to the influence of foreign long rates, the reduction in the long rates is not as big as the reduction in short rate. In spite of increases in the inflation rates, the reduction in interest rates has not decelerated over the simulation period. This is mainly due to the reduction in the stock of government debt caused by improvements in the budget position of the federal government.

Table 10

Labour Supply and Labour Demand

I Without Indexation	1979	1982	1985
% Difference in labour supply	-0.02	0.19	0.35
% Difference in labour demand	0.03	0.19	0.26
Δ in unemployment rate	0.0	0.0	0.1
II Full Indexation (lag CPI)			
% Difference in labour supply	0.22	0.70	1.02
% Difference in labour demand	0.10	0.37	0.43
Δ in unemployment rate	0.1	0.3	0.6
III Full Indexation (lag PXRDP)			
% Difference in labour supply	0.02	0.40	0.58
% Difference in labour demand	0.07	0.25	0.28
Δ in unemployment rate	0.0	0.2	0.3

Table 11

Money Supply and Interest Rates

I Without Indexation	1979	1982	1985
% Difference in money supply	3.14	5.87	8.93
Δ Short rate	-0.5	-0.7	-0.8
Δ Long term bond rate	-0.1	-0.2	-0.3
Δ Industrial bond rate	-0.2	-0.3	-0.3
II Full Indexation (lag CPI)			
% Difference in money supply	3.14	5.87	8.93
Δ Short rate	-0.4	-0.5	-0.6
Δ Long term bond rate	-0.1	-0.2	-0.2
Δ Industrial bond rate	-0.2	-0.2	-0.2
III Full Indexation (lag PXRDP)			
% Difference in money supply	3.14	5.87	8.93
Δ Short rate	-0.5	-0.7	-0.8
Δ Long term bond rate	-0.1	-0.2	-0.2
Δ Industrial bond rate	-0.2	-0.2	-0.3

In summary, our results suggest that the monetary policy affects real output and employment both in the short and medium run with or without the institution of wage-indexation and these impacts are bigger for the indexed regimes. Our results also suggest that the monetary policy will be more effective in controlling inflation when wages are fully compensated for changes in prices. In all the scenarios, labour supply effects dominate the employment effects resulting in an increase in the unemployment rate.

V Devaluation and Wage Indexation

In the last section, we have analyzed the impacts of a monetary shock on the Canadian economy with and without wage indexation. In this section, we will examine the efficiency of exchange rate policies in an economy with wage-indexation, as opposed to no indexation. Further, since much of the discussion in the literature has been addressed to the impact of wage indexation on the effectiveness of devaluation to promote the current account adjustment, here we will study the impact of devaluation on the Canadian economy with and without wage indexation.

For this purpose, we have run the following three simulations:

a) devaluation - without wage indexation

b) devaluation with full wage indexation - lagged CPI

c) devalution with full wage indexation - lagged GDP deflator

In the first scenario, we have kept the value of Canadian dollar vis-a-vis the U. S. dollar 10% below the control value throughout the simulation period (level adjustment). However, both the money supply and the exchange rate are allowed to react to the changes in the economy over the simulation period.

In the second scenario, in addition to a 10% devaluation, wage indexation is introduced. In this scenario, wages are fully compensated for changes in the cost of living index but with one year lag. Here too, both the money supply and the exchange rates are treated as endogenous variables.

In the last scenario, wages are fully indexed to changes in GDP deflator with a one year lag. Therefore, the difference between this scenario and the second scenario is only in the use of price index.

Before proceeding with the discussion of simulation results, we will briefly outline the channels through which devaluation might impact the Canadian economy in CANDIDE 2.0. In CANDIDE 2.0, devaluation of the Canadian dollar will proportionately increase the prices of traded goods (both exports and imports) as these prices are exogenous to the model and are measured in U. S. currency. This increase in import prices in turn produces a wage-price spiral via their impact on the cost of living. Devaluation will reduce the relative price of Canadian traded goods. This in turn will increase exports and reduce imports. However, the net impact of devaluation on current account balance depends both on the size of effective changes in relative prices and on the magnitude of export and import elasticities. As pointed out in Section II, a devaluation of the Canadian

dollar will reduce real wage rate in the CANDIDE Model. This in turn will depress the economic activity by reducing the real consumer expenditure. This reduction in economic activity will also improve the current account balance by reducing the total volume of imports.

Simulation Results

Table 12 and 16 and Chart V and VI summarizes the impact of devaluation on Canadian economy for the three scenarios. In light of the above discussion on general macro-economic impacts of devaluation, all the results are self-explanatory. However, here too we will analyze the simulation results in detail under the following five important headings:

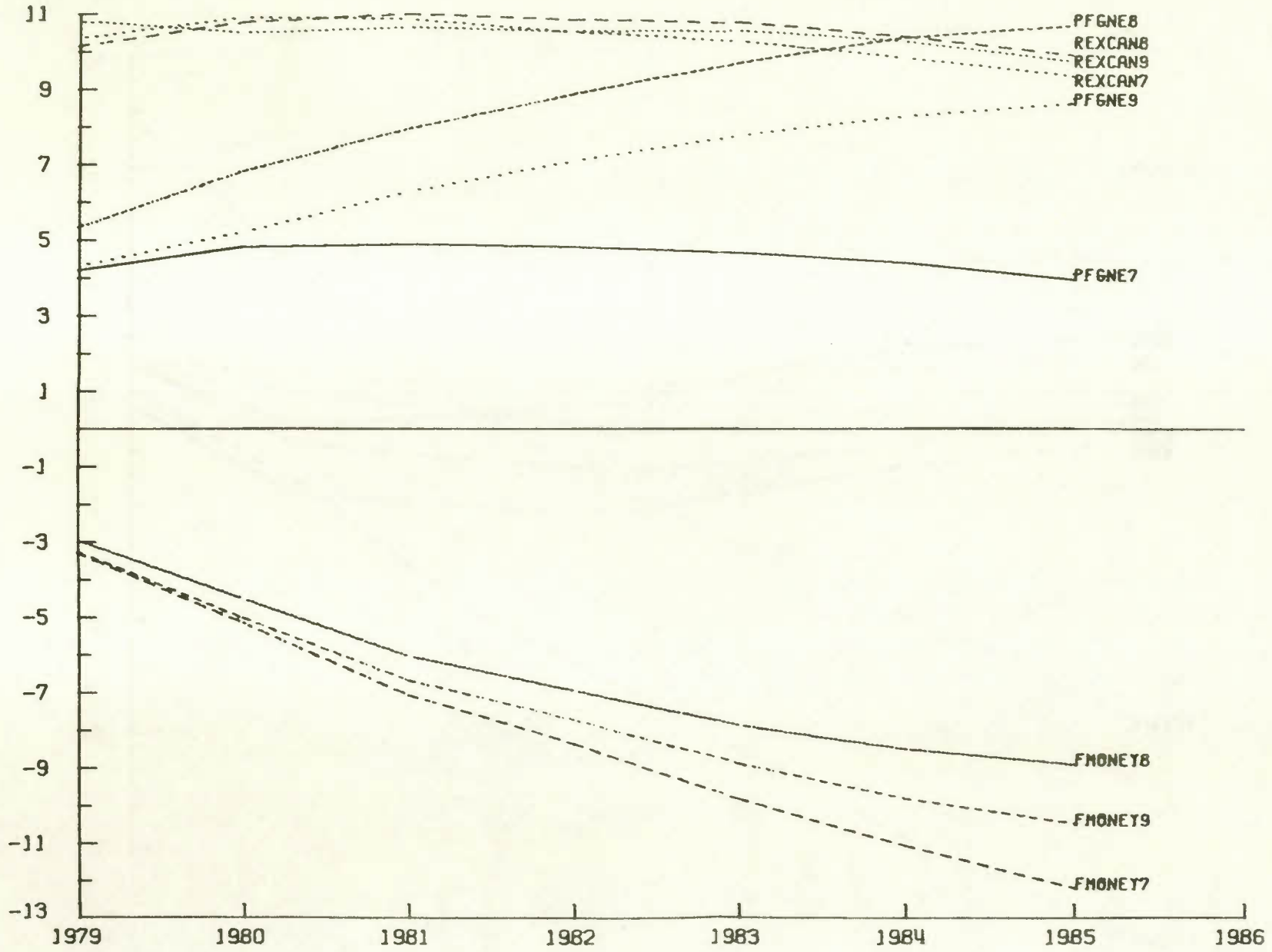
a) wages and prices
b) labour supply and labour demand
c) GNP growth
d) trade balance and exchange rate
e) money supply and interest rates

WAGES AND PRICES

Table 12 summarizes the impact of devaluation and wage indexation on both wages and prices in the system. As expected, in all three scenarios, a devaluation

CHART V

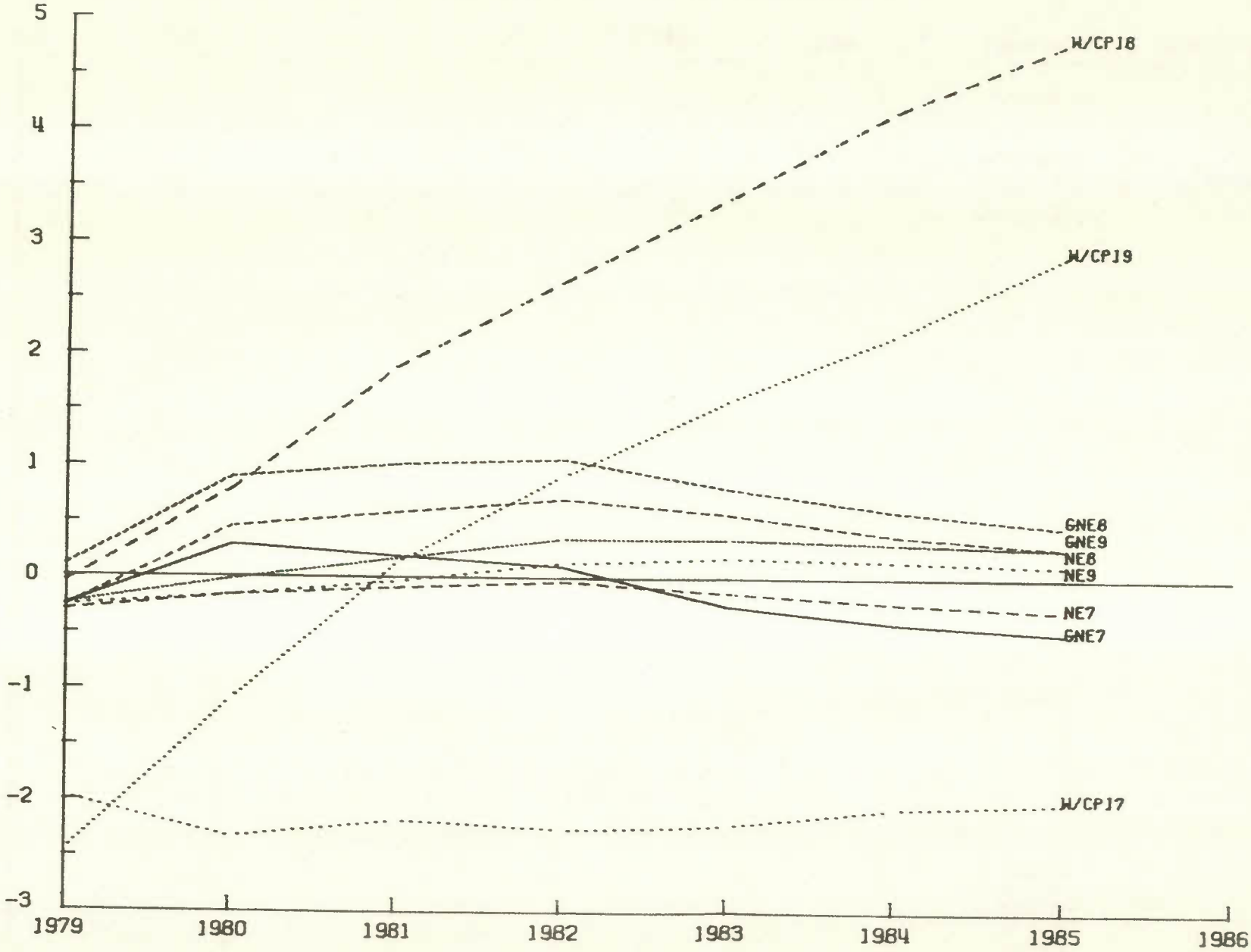
DEVALUATION - NOMINAL VARIABLES



7 - WITHOUT INDEXING
8 - LAGGED CPI
9 - LAGGED PXROP

CHART VI

DEVALUATION - REAL VARIABLES



7 - WITHOUT INDEXING
8 - LAGGED CPI
9 - LAGGED PXROP

Table 12

Wages and Prices

I Without Indexation	1979	1982	1985
% Difference in average hourly earnings	2.59	2.81	2.06
% Difference in GNE deflator	4.21	4.81	3.95
% Difference in CPI	4.57	5.06	4.06
% Difference in real wage rate	-1.98	-2.25	-2.00
Δ in inflation rate	0.6	-0.1	-0.5
Δ in inflationary expectations	3.0	-0.6	-0.7
II Full Indexation (lag CPI)			
% Difference in average hourly earnings	5.31	11.24	15.49
% Difference in GNE deflator	5.35	8.87	10.68
% Difference in CPI	5.56	8.58	9.51
% Difference in real wage rate	-0.04	2.66	4.81
Δ in inflation rate	1.3	0.7	0.0
Δ in inflationary expectations	4.5	1.5	0.9
III Full Indexation (lag PXRDP)			
% Difference in average hourly earnings	2.27	7.97	10.83
% Difference in GNE deflator	4.33	7.09	8.63
% Difference in CPI	4.72	7.05	7.92
% Difference in real wage rate	-2.45	0.92	2.91
Δ in inflation rate	0.5	0.7	0.1
Δ in inflationary expectations	1.1	1.4	1.0

of the dollar has pushed up all the wages and prices above the control values by increasing the prices of traded goods. However, the impact of import prices on the wage-price spiral is severe for the two indexation scenarios -- in the full wage indexation -- CPI scenario, CPI is 9.5% above the control value in 1985, compared to a 4% increase in the nonindexation scenario. As predicted in Section II, devaluation of the dollar has reduced the real wage rate below the control value, in the absence of any form of wage indexation. In contrast to this, real wage rate is above the base case value in the two indexation scenarios and this gain in real wage accelerates over the simulation period. In the non-indexation scenario. both the actual and expected inflation rates are above the base values initially, but by the end of the period they are below the control values. Opposed to this, both actual and expected inflation rates are above the control values throughout the simulation period in the two indexation scenarios. This in turn implies that the impact of devaluation on the wage-price spiral is worse in the case of wage indexation. However, this problem is somewhat less severe, when wages are linked to the GDP deflator rather than to the CPI.

In summary, devaluation increases the wage-price spiral in the economy with or without indexation. However,

wage-price spiral is much worse for the two indexation scenarios. As expected, between the two indexation scenarios, wage-price spiral problem is less severe for the GDP deflator based indexation scenario.

Labour Supply and Labour Demand

As seen in Table 13, the reduction in real wage has reduced both labour supply and labour demand initially in all three scenarios. The net impact of real wage on employment depends upon the relative magnitudes of income and substitution effects. The results suggest that in CANDIDE 2.0 the income effect dominates the substitution effect, resulting in a positive relationship between real wage and employment. As seen from Table 13, in all three scenarios, throughout the simulation period, labour supply effects are bigger than the employment effects, resulting in a positive relationship between the real wage and the employment rate: an increase in the real wage increases the unemployment rate and vice-versa. As a result of reduction in real wage, unemployment rate is below the control values throughout the simulation period for the nonindexed regime. Opposed to this, unemployment rate is well above the control values in 1985, for the two indexation scenarios -- due to increases in real wage, unemployment rate is 80 basis points above the control value in 1985, for the full wage indexation - lag CPI scenario.

Table 13

Labour Supply and Labour Demand

I Without Indexation	1979	1982	1985
% Difference in labour supply	-0.60	-0.58	-0.45
% Difference in labour demand	-0.30	-0.03	-0.29
Δ in unemployment rate	-0.3	-0.5	-0.2
II Full Indexation (lag CPI)			
% Difference in labour supply	-0.25	0.55	1.16
% Difference in labour demand	-0.24	0.36	0.28
Δ in unemployment rate	-0.0	0.2	0.8
III Full Indexation (lag PXRDP)			
% Difference in labour supply	-0.61	0.10	0.70
% Difference in labour demand	-0.26	0.14	0.12
Δ in unemployment rate	-0.3	0.0	0.5

In summary, the impact of devaluation on unemployment rate works via the real wage rate. In the nonindexation scenario, real wage rate is below the control value by the end of the simulation period, resulting in the reduction of unemployment rate. In contrast, in the two indexation scenarios unemployment rate is well below the base case values, mainly due to increases in the real wage.

Economic Growth

Table 14 summarizes the impact of devaluation on the final demand components and economic growth for all three scenarios. As expected, due to reduction in relative price of Canadian traded goods in all the three scenarios, the volume of exports have increased and imports have declined. However the real wage reduction has resulted in the reduction of other components of final demand for the nonindexation scenario, resulting in a reduction of real GNP -- in 1985, GNP is 0.49% below the control value. Opposed to this, in two indexation scenarios, both the relative price effect and the real wage effects have increased the real GNP above the control values -- in 1985 GNP is 0.50% above the control value for the full indexation -- lag CPI scenario. In the two indexation scenarios, by the end of the simulation period the "activity effects" on imports dominated the price effect

Table 14

Economic Growth ($ millions)

I Without Indexation	1979	1982	1985
Δ in GNP (%)	-321.9 (0.25)	151.2 (0.10)	-780.1 (0.49)
Δ in investment expenditure (%)	-676.7 (2.42)	-705.7 (2.15)	-807.1 (2.21)
Δ in Exports (%)	477.8 (1.53)	551.0 (1.57)	515.8 (1.30)
Δ in Imports (%)	-1652.5 (4.63)	1478.7 (3.69)	-1552.3 (3.47)
II Full Indexation (lag CPI)			
Δ in GNP (%)	148.0 (0.11)	1560.2 (1.07)	749.0 (0.47)
Δ in investment expenditure (%)	-515.0 (1.84)	-247.4 (0.75)	393.3 (1.08)
Δ in Exports (%)	465.7 (1.49)	534.9 (1.52)	482.6 (1.22)
Δ in Imports (%)	-1346.6 (3.78)	-156.0 (0.39)	742.2 (1.66)
III Full Indexation (lag PXRDP)			
Δ in GNP (%)	-335.7 (0.26)	1029.4 (0.71)	444.4 (0.28)
Δ in investment expenditure (%)	-620.7 (2.22)	-405.3 (1.23)	0444.4 (1.22)
Δ in Exports (%)	478.2 (1.53)	543.0 (1.54)	494.6 (1.25)
Δ in Imports (%)	-1600.7 (4.50)	-802.5 (2.00)	45.4 (0.10)

resulting in a net increase in imports. In 1985, total imports are 1.66% above the control values. However, for the GDP deflator based indexation scenario this increase in imports is very small -- imports are 0.10% above the control value in 1985.

TRADE BALANCE AND THE EXCHANGE RATE

The impact of devaluation on trade balance and the induced effects on the exchange rate for all the three scenarios are given in Table 15. In all the three scenarios, as expected ,devaluation has improved the current account balance initially. However, due to the acceleration of wages and prices, by the end of simulation period there is a turn around in the current account balance. In the full indexation lagged CPI scenario, a 3.5 billion dollars improvement in 1979 has been reduced to 1.1 billion in 1982, and to a -1.9 billion in 1985. As seen from Table 15, when wages are indexed on the basis of GDP deflator, even by the end of the simulation period devaluation improves the current account. However, like the CPI linked indexation, the improvement in the current account balance diminishes over the simulation period. In all the three simulations due to improvements in the current account balance exchange rate has appreciated over time.

Table 15

Trade Balance and Exchange Rate

I Without Indexation	1979	1982	1985
Δ in current account balance (%)	4241.6 (66.29)	461.8 (57.02)	5374.5 (40.20)
Δ in merchandise trade balance	3645.8	4233.9	4681.9
Δ in service account balance	540.2	320.8	580.2
% difference in exchange rate (induced)	10.35	10.49	9.34
II Full Indexation (lag CPI)			
Δ in current account balance (%)	3527.9 (55.14)	1069.0 (13.13)	-1925.7 (14.40)
Δ in merchandise trade balance	3083.1	1584.4	-246.6
Δ in service account balance	403.2	-561.0	-1710.0
% difference in exchange rate (induced)	10.15	10.82	9.89
III Full Indexation (lag PXRDP)			
Δ in current account balance (%)	4118.0 (64.36)	2799.9 (34.40)	315.9 (2.36)
Δ in merchandise trade balance	3550.0	2838.6	1126.1
Δ in service account balance	510.7	-96.5	-867.0
% difference in exchange rate (induced)	-10.81	10.51	9.72

Money Supply and Interest Rates

Table 16 summarizes the impact of devaluation on money supply and interest rates in all three scenarios. In all the three scenarios, the increases in federal government revenue are bigger than the increases in expenditure, resulting in a budget surplus. This in turn has helped the federal government to reduce its debt burden over the simulation period -- for the nonindexation scenario, the federal government debt is 18.5 billion below the control value in 1985. This reduction in the stock of federal government debt has reduced the money supply below the control values in all three scenarios -- in 1985 money supply is 12% below the control value for the nonindexation scenario.

In spite of reduction in the stock of federal government debt in all the three scenarios, higher inflation rates have pushed up the rates of interst (short rate and the two long rates) above the control values in all three scenarios.

Table 16

Money Supply and Interest Rates

I Without Indexation	1979	1982	1985
% Difference in money supply	-3.30	-8.36	-12.20
Δ in short rate	0.7	0.2	-0.2
Δ in Long Term Govt' Bond Rate	0.1	0.0	-0.1
Δ in Industrial Bond Rate	0.2	0.2	0.0
II Full Indexation (lag CPI)			
% Difference in money supply	-2.95	-6.94	-8.91
Δ in Short Rate	0.9	0.7	0.2
Δ in Long Term Govt' Bond Rate	0.1	0.1	0.0
Δ in Industrial Bond Rate	0.2	0.3	0.1
III Full Indexation (lag PXRDP)			
% Difference in money supply	-3.27	-7.72	-10.47
Δ in Short Rate	0.7	0.5	0.2
Δ in Long Term Govt' Bond Rate	0.1	0.1	0.0
Δ in Industrial Bond Rate	0.2	0.3	0.1

VI Conclusions

The objective of this paper has been to study the impact of wage-price controls and various forms of wage indexation on price stability and economic growth both in the short and medium run, using the CANDIDE Model 2.0. The following are some of the important findings of our study.

1. Our simulation results imply that the wage-price controls would not have a significant effect on wages and prices in the long run and instead result in an inflationary bubble once the controls are removed.

2. Our results also strongly suggest that wage-indexation (even in its extreme form) will not result in the acceleration of inflation over time.

3. During the control period, the reduction in wages are bigger than the reduction in prices, resulting in a real wage loss. However, once the controls are removed, wages grew much faster than prices, resulting in a real wage gain. In contrast, in all the indexation scenarios, throughout the simulation period, the rate of growth of wages is bigger than the growth in prices, resulting in a real wage gain.

4. For both the wage-price controls and the wage indexation scenarios, GNP is above the control values over the simulation period. However the composition of additional GNP is quite different for the two scenarios.

5. Our results show that the wage-price control programme will reduce both inflation and unemployment, when the controls are in operation. However, once the controls are removed, the inflation rate is well above the base case value. This implies that the control programme will not reduce the problems of stagflation permanently.

6. In all the indexation scenarios, the increases in labour supply are bigger than the increases in employment, resulting in a net increase in unemployment rate.

7. For both the incomes policies and wage-indexation scenarios, wage share in the national income has risen above the control values.

8. In the wage-price control scenario, due to reduction in the domestic costs, the current account balance has improved considerably. In contrast to the control scenario, the current account balance has worsened in all the four wage indexation scenarios.

9. Our results suggest that the control programme will worsen the budget position of federal government in the long-run. In contrast to the control scenario, wage-indexation scenarios improves the budget position of the federal government.

10. Our results imply that a restrictive monetary policy will produce bigger output losses in a CPI linked indexation scheme, compared to the nonindexation scenario.

11. Our results also suggest that the monetary policy will be more effective in controlling inflation when the wages are fully compensated for changes in the cost of living.

12. A devaluation of the Canadian dollar will increase the wage-price spiral in the economy with or without indexation. However, the wage-price spiral is much worse for the indexation scenarios. This also implies that with wage-indexation, the wage price spiral problem will be much more severe to shocks in energy prices, and the other supply shortages than without indexation.

13. Devaluation of the dollar has improved the current account balance initially in all three scenarios. However due to the acceleration of wages and prices, the improvement in current balance deteriorates over the simulation period, and this deterioration is severe, when the wages are indexed. As a matter of fact,

in the full indexation-lag CPI scenario the current account deficit has increased by 1.9 billion dollars in 1985. In contrast to this, when wages are indexed on the basis of GDP deflator, even by the end of simulation period devaluation has a positive impact on the current account balance.

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