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Working Paper

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Queen's Economics Department Working Paper, No. 42

Provided in Cooperation with:
Queen's University, Department of Economics (QED)

Suggested Citation: Wilton, D.A. (1972) : An Econometric Evaluation of the Effects of the Canada-United States Automobile Agreement of the Canadian Automotive Manufacturing Industry, Queen's Economics Department Working Paper, No. 42, Queen's University, Department of Economics, Kingston (Ontario)

This Version is available at:
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AN ECONOMETRIC EVALUATION OF THE EFFECTS OF THE CANADA-UNITED STATES AUTOMOBILE AGREEMENT OF THE CANADIAN AUTOMOTIVE MANUFACTURING INDUSTRY

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4-1972

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Discussion Paper No. 42

On January 16, 1965, the Canadian and United States governments initiated an Automotive Products Agreement, permitting "controlled" free trade in automotive products between their respective countries. This Agreement represented "an effort by both countries to achieve mutual benefits through an arrangement designed to increase efficiency and lower costs in a basic industry joined by economic and financial ties but separated by tariffs and other barriers" [4, page 1]. With most government policy directed toward a multilateral approach to freer trade, this recent bilateral policy decision represents a substantially different approach to trade "liberalization" and the rationalization of industry. The success or failure of this particular sectoral free trade pact may greatly affect the course of future government policy.

The purpose of this paper is to present a set of estimates designed to measure the economic impact of the Agreement on the Canadian automotive manufacturing industry. This modest objective not only totally ignores the impact of the Agreement on the United States industry, it also ignores the impact on the rest of the Canadian economy. In other words, this partial equilibrium analysis of the effects of the Agreement on one particular industry fails to consider the effects on the myriad of small to medium sized firms engaged in the production of parts and accessories, the effects on other input-output connected industries, and the usual multiplier effects on the economy.

The analytical tool employed is that of simulation experiments performed on an econometric model of the Canadian automotive manufacturing industry. While there have been a number of appraisals and analyses of

certain aspects of the Agreement (see for example [1], [2], [4], and [10]), this study represents the first attempt to measure systematically the effects of the Agreement on the major structural variables in the Canadian industry. Part I sketches out the terms of the Agreement and the events leading up to this policy decision. The research strategy, including a brief description of the econometric model, is then outlined, followed by a presentation and discussion of the simulation results in Part III.

I

The evolution of this Agreement can be traced back at least to the late 1950's when the rapid rise of European automotive imports prompted the Canadian government to appoint a royal commission to study the automobile industry. By the time the Bladen Report [8] was released (1961), European imports were declining and the Report, with its various export incentives and content requirements, was shelved. However, through an unlikely chain of events, a number of the Report's recommendations were implemented. During the Canadian currency crisis of 1962, the Canadian government received financial support from the International Monetary Fund agreeing, in turn, to undertake remedial structural measures to solve her currency problems. Recalling the various recommendations in the Bladen Report and the staggering imbalance in U.S.-Canada automotive trade, the Canadian government made the remission of the 25% import duty on automatic transmissions conditional on increased exports of vehicles as well as parts. More important, an "auto parts export incentive" program was introduced which extended duty remissions to <u>all</u> parts imported for domestic production.

The international ramifications were soon apparent. These uni-

lateral policy actions could be interpreted as export bounties, and thus the U.S. government would be required under G.A.T.T. to impose countervailing duties. In fact, a number of American parts manufacturers began pressing the U.S. Treasury Department for such an action. In the face of the unacceptability of the Canadian export provisions and the fear of a mounting series of trade restrictions, the U.S. government reluctantly began discussions with the Canadian government on various alternative proposals.[1] Thus, the signing of the Agreement emerged not from a clear blue sky, but from beneath a threatening cloud of restrictive actions.

In essence, this Agreement sought to rationalize the production of automotive products. A few makes and models would be produced in Canada (at much greater efficiency) and exported, in part, to the U.S. market, while a great variety of automobiles could enter Canada duty-free from the larger U.S. industry. The Agreement does not, however, provide for complete free trade in automotive products between Canada and the United States. While the U.S. authorities permitted unconditional duty free Canadian automotive imports (providing they were at least 50% North American content), the Canadian government feared that such a provision might totally submerge the small local industry. Consequently, Canada permitted duty free imports of automotive products only when ordered or purchased by Canadian automobile manufacturers. Free trade is, therefore, accorded only to manufacturers, not to consumers. Furthermore, certain qualifications and restrictions were also imposed on these manufacturers.

---

1. An illustration of the reluctance of the U.S. government to accept such an Agreement concerns the pressure exerted on the Canadian government to exempt two American owned magazines from a new law restricting foreign control in the news media. (See W.L. Gordon, *A Choice for Canada*, McClelland and Stewart (Toronto), 1966, pages 96-97).

> "To qualify as a motor vehicle manufacturer for purposes of the new tariff treatment, a producer must continue to manufacture vehicles in the same ratio to his vehicle sales in Canada as he achieved during the 1964 model year. He is also required to maintain Canadian value-added in his Canadian vehicle production in an amount not less than that attained during the same year." [6, page 7]

Perhaps more important, the Canadian government received assurances ("letters of intent") from the Canadian automotive subsidiaries that they would not only maintain their existing share of the expanding market, but also that they would expand domestic production from 4% of the North American total to 7.5%. More specifically, assurances were given that by 1968 production in Canada would be increased by $260 million per year over the 1964 production level. Thus, the Canadian automotive industry is given relief from import duties and tariffs provided that the total Canadian automotive industry supply a larger share of the North American market.

The possibility of negotiating such a sectoral trade pact owes much to the two most obvious features of the North American automotive industry. Not only is the industry dominated by a few producers, parent U.S. firms exercise complete control over the Canadian industry. Secondly, the manufacture of automobiles is characterized by a high degree of continuous, automatic production with a well-developed division of labour. Such technology places a heavy emphasis on lengthy assembly lines and the capturing of economies of scale. Given the tight, oligopolistic nature of this U.S. controlled industry, the only major obstacles to such a profitable rationalization of industry would appear to have been the respective governments; and in this case, the governments actually proposed such a treaty.

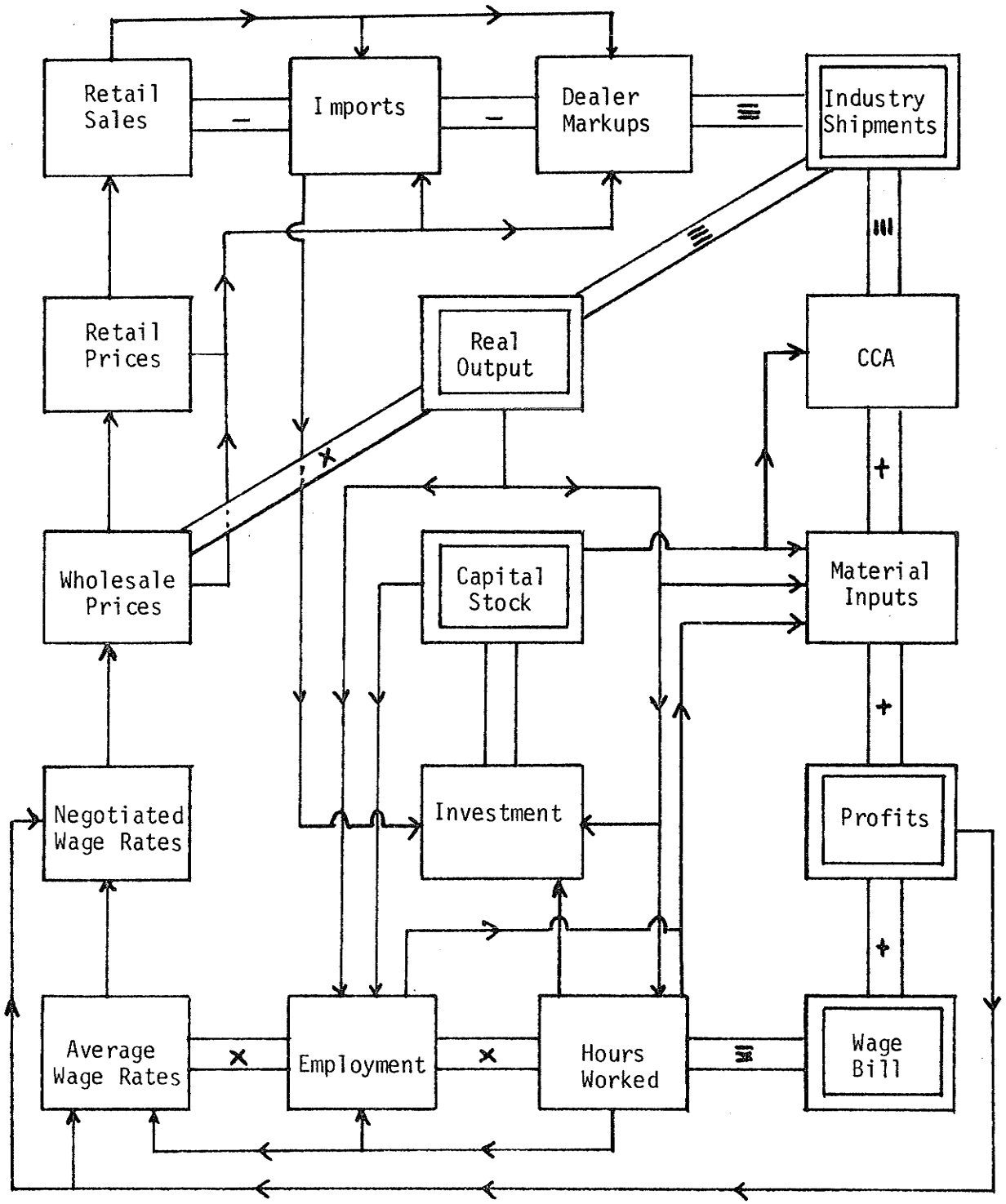
II

An econometric model of the Canadian automotive manufacturing industry is utilized to quantify the impact of this Agreement on the Canadian industry. This model describes the annual economic behaviour of the industry in the period immediately preceding the Agreement (1948-1964). By inserting actual values for exogenous variables over the 1965-1968 period and initial conditions for lagged endogenous variables, the simultaneous system can be solved year by year to generate a time path for all endogenous variables. Subject to structural errors in the model, such simulated values should depict the economic behaviour existing over the 1965-1968 period under the assumption of no change in structure, i.e. the Agreement had not been signed. Thus, a comparison of these simulated values to actual historical data, with due regard for structural errors, should produce a set of estimates which quantify the economic effects of the Agreement on the Canadian automotive manufacturing industry.

Since a description of this econometric model of the Canadian automotive manufacturing industry has been presented elsewhere [11], only a brief sketch of the model will be given. As portrayed in Chart 1, two fundamental demand and supply relationships completely unify the entire industry system. On the demand side, retail sales are the starting point for the analysis, with domestic shipments (output) being derived from retail sales, imports, and retail value-added (i.e. dealer's commissions). The key relationship on the supply or production side of the model is the cost schedule. Since this relationship is viewed as the sum of a number of stochastic cost components, the statistical analysis of wages, employment, material inputs, prices, and investment are all linked together by this

CHART I

A Condensed Flow Diagram
Of the Model



one fundamental output or supply relationship. Profits are residually determined.

The high degree of simultaneity in the system (see Chart 1) necessitates the use of an estimation technique which will give consistent parameter estimates. In view of the limited degrees of freedom imposed by the annual nature of the model, principal components are extracted from the excluded set of predetermined variables for each equation and utilized in the context of two-stage least squares (PC2SLS). For one equation an autoregressive transformation suggested by Fair [3] is employed to correct for severe autocorrelation in the residuals (p* is used to signify the autoregressive factor). Standard errors are shown below the PC2SLS coefficient estimates of the model in Table 1.

As described in the previously cited paper, this system of behavioural, technological and definitional equations performs quite satisfactorily. Control simulations demonstrate that the dynamic and structural characteristics of the model tend to keep the endogenous variables relatively closely on track. Even though there are individual discrepancies, root-mean-square (R.M.S.) errors are reasonably similar to the standard error of estimate from PC2SLS (see Table 2). Perhaps even more important, particularly in view of the cyclical nature of the industry and the widely varying economic conditions over the sample period, about three quarters of all turning points in individual data series are predicted in control simulations.

Before generating a set of simulation values for the Agreement years, three modifications are necessary. First, Canadian automotive exports are considered exogenous in the model, primarily because the basic

TABLE 1

Two-Stage Least Squares Estimates Employing Principal Components

$$\frac{RSA}{POP*RPA} = \underset{(78.11)}{83.03} + \underset{(.0467)}{.1093}\ (YDPC/POP) - \underset{(63.58)}{166.79}(RPA/PCED) - \underset{(.0941)}{.1183}\ (STKA/POP)_{-1}$$

S.E.E. = 4.395
R^2 = .90
D.W. = 2.18
P* = .25

$$\frac{RSTR}{RPTR} = \underset{(353.1)}{793.7} + \underset{(.002905)}{.006973}\ GNEC - \underset{(346.6)}{636.6}\ (RPTR/PME) + \underset{(18.03)}{53.40}\ DUMKW - \underset{(.0845)}{.1200}\ (STKTR)_{-1}$$

S.E.E. = 26.31
R^2 = .69
D.W. = 1.84

$$\frac{USMT/WPTUSK}{DSH/WPT} = \underset{(.1454)}{.9144} + \underset{(.0578)}{.1358}\ [RSACDV/(RSA/RPA)] - \underset{(.1433)}{.8188}\ USCUR$$

S.E.E. = .02298
R^2 = .70
D.W. = 1.54

$$\frac{COMMIS}{\left(\frac{RSA}{RPA} + \frac{RSTR}{RPTR}\right)} = \underset{(.0513)}{-.1261} + \underset{(.1628)}{1.1715}\ (RPT - .65\ WPT) + \underset{(.001193)}{.005597}\ T$$

S.E.E. = .02293
R^2 = .88
D.W. = 1.94

$$WPT = \underset{(.228)}{-1.197} + \underset{(2.332)}{6.271}\ (NEGAV/PRODT) + \underset{(.034)}{1.137}\ WPTUS + \underset{(.0928)}{.3952}\ USCUR$$

S.E.E. = .01286
R^2 = .99
D.W. = 1.66

$$RPA = \underset{(.0812)}{-.2053} + \underset{(.0622)}{.9927}\ WPT + \underset{(.122)}{1.037}\ TOTTAX$$

S.E.E. = .01745
R^2 = .96
D.W. = 1.96

$$RPTR = \underset{(.0941)}{-.5044} + \underset{(.072)}{1.449}\ WPT + \underset{(.1422)}{.2525}\ TOTTAX$$

S.E.E. = .02021
R^2 = .99
D.W. = 1.78

$$\frac{\Delta NEGAV}{NEGAV} = \underset{(7.83)}{-24.05} + \underset{(.1714)}{.3555}\left(\frac{\Delta CPI}{CPI}\right) + \underset{(10.89)}{53.25}\ (PROFIT/TSH)$$

$$+ \underset{(6.52)}{20.91}\ [DUMUS * (USW/NEGAV)_{-1}]$$

$$+ \underset{(8.40)}{26.57}\ [DUMCAN * (CANW/NEGAV)_{-1}]$$

S.E.E. = .4424
R^2 = .95
D.W. = 2.96
n = 8

$$AHE - NEGAV = \underset{(.139)}{-1.066} + \underset{(.001811)}{.008958}\ CPI$$

$$+ \underset{(.001357)}{.002014}\ [H * (NEGAV)_{-1}] + \underset{(.01723)}{.02807}\ DUMYRI$$

S.E.E. = .03331
R^2 = .95
D.W. = 1.22

$$AWWSNH = \underset{(85.27)}{-86.34} + \underset{(.6988)}{.4948}\ CPI + \underset{(42.25)}{36.06}\ (PROFIT/TSH)$$

$$+ \underset{(1214.5)}{2003.2}\ (NEGAV/AWWSNH)_{-1} + \underset{(.2225)}{.9269}\ (AWWSNH)_{-1}$$

S.E.E. = 2.290
R^2 = .99
D.W. = 2.36

$$EH = \underset{(37611)}{24007} + \underset{(16.52)}{31.30}\left(\frac{TSH}{WPT}\right) - \underset{(8.48)}{12.31}\left(\frac{TSH}{WPT}\right)_{-1} - \underset{(734.1)}{492.2}\ H$$

$$- \underset{(.3043)}{.2845}\ (TGKC * CUMW) + \underset{(.6529)}{.6420}\ (EH)_{-1}$$

S.E.E. = 1511
R^2 = .80
D.W. = 2.40

$$H = \underset{(3.01)}{33.32} + \underset{(2.046)}{6.405}\ RTSHC + \underset{(.0754)}{.1684}\ (H)_{-1}$$

S.E.E. = 1.321
R^2 = .56
D.W. = 1.02

$$ENH = \underset{(2636.5)}{-811.3} + \underset{(.1028)}{.1077}\ [.5 * (EH) + .5 * (EH)_{-1}]$$

$$+ \underset{(2.170)}{1.809}\ TGKC + \underset{(.2051)}{.7027}\ (ENH)_{-1}$$

S.E.E. = 566.1
R^2 = .90
D.W. = 2.17

$$\frac{TSH}{WPT} = \underset{(235.1)}{-641.9} + \underset{(.00329)}{.01528}\ EH + \underset{(6.15)}{12.17}\ H$$

$$+ \underset{(.002700)}{.006923}\ (TGKC * CUMW) + \underset{(.1868)}{.5789}\ (MATR/PMAT)$$

S.E.E. = 24.83
R^2 = .99
D.W. = 1.43

$$CCA = \underset{(2.917)}{-3.082} + \underset{(.0684)}{.1418}\, I + \underset{(.0088)}{.0684}\,(TGKC/REVAL)_{-1}$$

S.E.E. = 4.225
R^2 = .87
D.W. = 2.25

$$\frac{I}{IDEFL} = \underset{(13.10)}{-29.15} + \underset{(.0307)}{.1806}\, TSHC3 + \underset{(.387)}{1.325}\, USMTC3 + \underset{(3.92)}{11.26}\,(H - 40) - \underset{(.0767)}{.3488}\,(TGKC)_{-1}$$

S.E.E. = 8.71
R^2 = .75
D.W. = 2.34

Structural Identities

$$TSH \equiv RSA + RSTR - COMMIS - USMT - EMT + XSH$$

$$PROFIT \equiv TSH - MATR - WB - CCA - RESID$$

$$WB \equiv [(AHE * EH * H) + (AWWSNH * ENH)] * 52$$

$$TGKC \equiv .9836\,(TGKC)_{-1} + (I/IDEFL)$$

SYMBOL TABLE FOR MODEL

Endogenous Variables

AHE : average hourly earnings, hourly-rated employees
AWWSNH : average weekly wages and salaries, non-hourly-rated employees
CCA : capital cost allowances, millions of dollars
COMMIS : dealer markup or retail value-added, millions of dollars
CUMW* : capacity utilization rate
DSH : total shipments to the domestic market, millions of dollars
EH : number of hourly-rated employees
ENH : number of non-hourly-rated employees
H : average hours worked per week
I : investment in buildings, machinery and equipment, millions of dollars
MATR : material inputs, millions of dollars
NEGAV : base wage rate as negotiated in collective bargaining sessions
PRODT* : trended productivity (real output per man-hour)
PROFIT : total corporate profits, millions of dollars
RPA : retail price index of automobiles, 1957 = 1.0
RPT* : retail price index of total motor vehicles, 1957 = 1.0
RPTR : retail price index of commercial vehicles, 1957 = 1.0
RSA : retail sales of automobiles, millions of dollars
RSACDV* : deviation of retail sales of automobiles from a linear trend, millions of 1957 dollars
RSTR : retail sales of commercial vehicles, millions of dollars
RTSHC* : rate of change of total automotive shipments measured in 1957 dollars
STKA* : total stock of automobiles, millions of 1957 dollars
STKTR* : total stock of commercial vehicles, millions of 1957 dollars
TGKC : total gross capital stock, millions of 1957 dollars

Endogenous Variables (Continued)

TSH:	:	total shipments by the automobile industry, millions of dollars
TSHC3*	:	three year moving average of total automotive shipments, millions of 1957 dollars
USMT	:	imports of motor vehicles from the United States, millions of dollars
USMTC3*	:	three year moving average of U.S. automotive imports, millions of 1957 Canadian dollars
WB	:	total wage bill, millions of dollars
WPT	:	wholesale price index of motor vehicles, 1957 = 1.0

* definitional endogenous variables

Exogenous Variables

CANW	:	average hourly earnings in Canadian durable manufacturing industries
CPI	:	Canadian consumer price index, 1949 = 100.0
DUMCAN	:	dummy variable for pre-wage parity era, one in 1948-58, zero elsewhere
DUMKW	:	dummy variable for Korean War period, one in 1950-53, zero elsewhere
DUMYRI	:	dummy variable for first year of given wage round, zero elsewhere
DUMUS	:	dummy variable for wage parity era, one in 1959-64, zero elsewhere
EMT	:	non-United States imports of motor vehicles, millions of dollars
GNEC	:	Canadian gross national expenditures, millions of 1957 dollars
IDEFL	:	deflator for investment expenditures, 1957 = 1.0
PCED	:	deflator for Canadian personal consumption expenditure, 1957 = 1.0
PMAT	:	price index of materials purchased, 1957 = 1.0
PME	:	price index of machinery and equipment in Canada, 1957 = 1.0
POP	:	population of Canada, millions
RESID	:	residual of unclassified expenditures in the automobile industry, millions of dollars
REVAL	:	implicit revaluer for gross capital stock
T	:	time trend, one in 1948, two in 1949, etc.
TOTTAX	:	total rate of federal sales and excise tax on motor vehicles
USCUR	:	Canadian dollars per United States dollar
USW	:	base wage rate at General Motors in the United States
WPTUS	:	wholesale price index of motor vehicles in the United States, 1957 = 1.0
WPTUSK	:	wholesale price index of motor vehicles in the United States, corrected for currency fluctuations, 1957 = 1.0
XSH	:	total export shipments by the Canadian motor vehicle industry, millions of dollars
YDPC	:	personal disposable income in Canada, millions of 1957 dollars

explanatory variables for these flows are either non-quantifiable or outside the general scope of the model.[2] However, given the recent rationalization of the industry, these export flows have increased from 2-3% of total Canadian production in the sample period to over 55% in 1968. Thus, it would be completely inappropriate to insert actual exports for 1965 through 1968 into the control simulation since these huge export flows to both U.S. and non-North American markets are directly attributed to the Agreement and would not have taken place under the old structure. The average level of total exports during the ten years immediately prior to the signing of the Automobile Agreement is employed as a proxy for export flows in the 1965-68 period.

The second problem concerns the specification of the Wharton-style capacity utilization index in the model. Such an index captures cyclical, non-linear increases in productive capacity between peak years by utilizing annual investment proportions (to total investment between peaks) to apportion the increase in capacity output between peaks. While real output has risen continuously since 1961, there is a definite deceleration in the rate of change in 1964; and consequently, 1964 is arbitrarily selected as the previous peak year for the construction of the index. On the other hand, the next peak year and investment proportions are unknown at any given time. An iteration technique is employed to generate an "endogenous" capacity utilization variable into the model simulations (as done in [11]). Actual capacity utilization rates are inserted into the first simulation run from which a new set of capacity utilization rates

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2. Much of Canadian automotive exports during the sample period go to underdeveloped countries, while other exports are determined by special international trade arrangements (e.g. Commonwealth Preferences).

are constructed and inserted into a second simulation run, etc.

The final modification concerns the treatment of the negotiated wage rate series. Since a realistic view of the wage process in this highly unionized industry must recognize the existence of wage rounds, observations for wage rate changes occur at non-uniform intervals. Furthermore, once negotiated, wage rates are locked in place for a number of years (usually three). Since wage rate negotiations took place in 1964, the introduction of an endogenous wage rate variable is only a problem in the latter part of the simulation period. To introduce such an endogenous wage rate variable, again an iteration technique is employed (simultaneously with the above-mentioned capacity-utilization correction). Estimates for the endogenous explanatory variables in the wage rate equation are obtained from a control simulation using actual wage rate levels, and utilized to generate the 1967 wage round increase. This simulated wage rate is then inserted into a second simulation run from which another wage estimate is obtained, etc. Such wage and capacity estimates converge rapidly, and thus the following set of simulation results actually represent the second iteration of a process designed to "endogenize" these two structural variables.

III

Chart 2 graphically depicts the "no change in structure" simulations contrasted to the observed values for the major structural variables over the 1965-1968 period. In addition, the prediction error (i.e. actual minus simulated values) for each year is presented in Table 2. Since there are no well developed significance tests for simulation results within the framework of finite sample distributions, the following descriptive statistics

CHART 2

ACTUAL AND SIMULATED VALUES FOR MAJOR STRUCTURAL VARIABLES

(1965-1968)

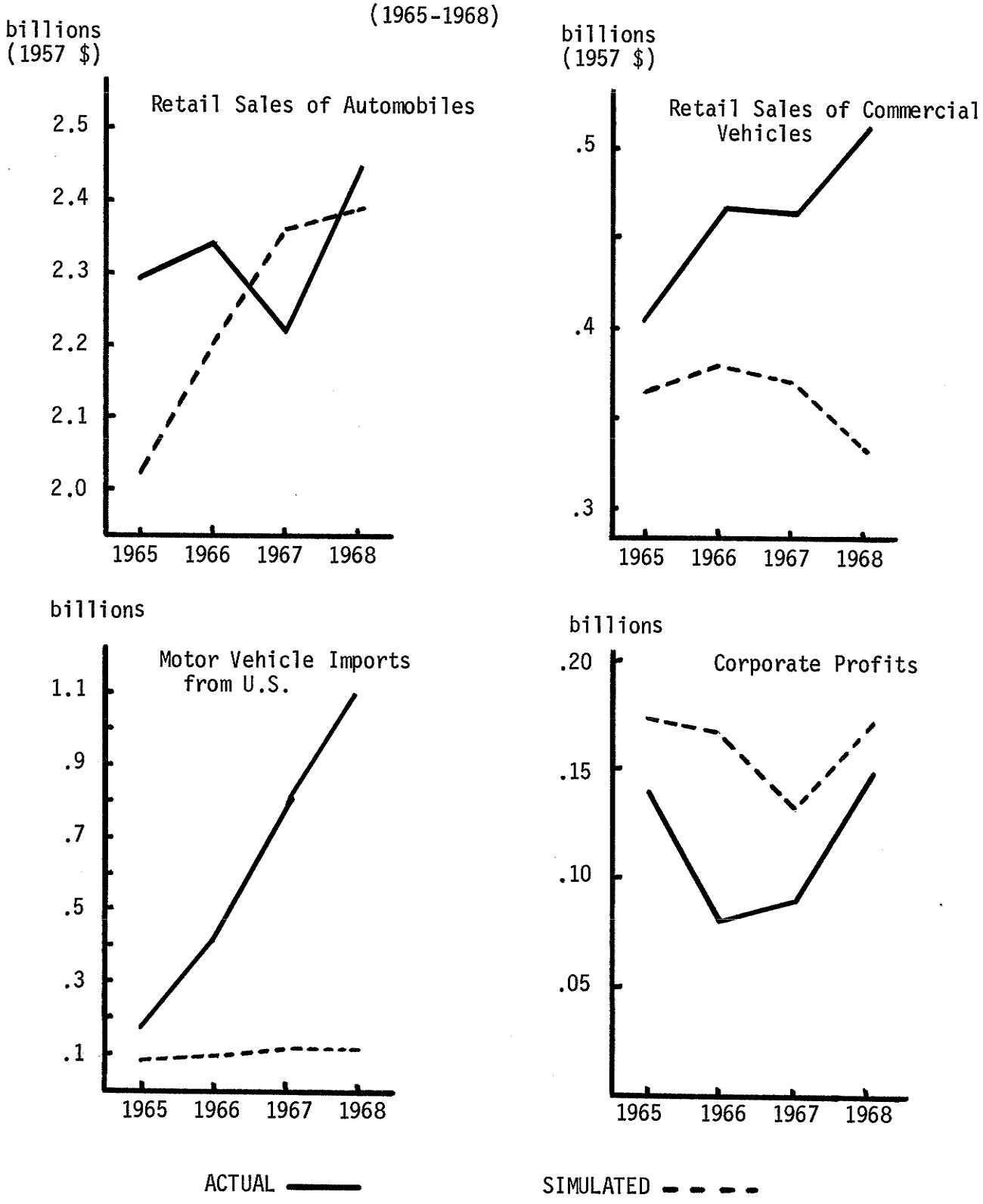

CHART 2 (Cont'd)

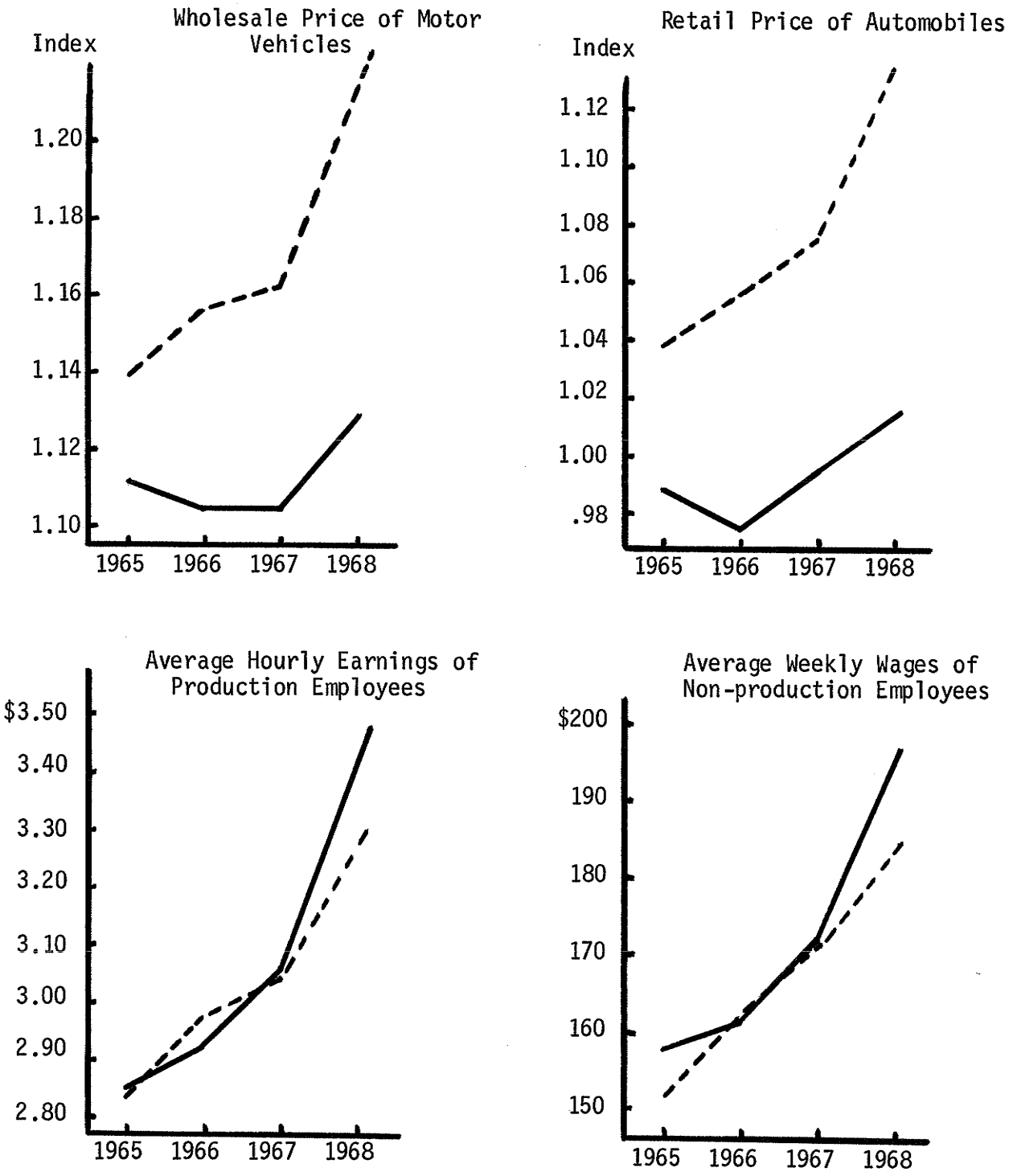

CHART 2 (Cont'd)

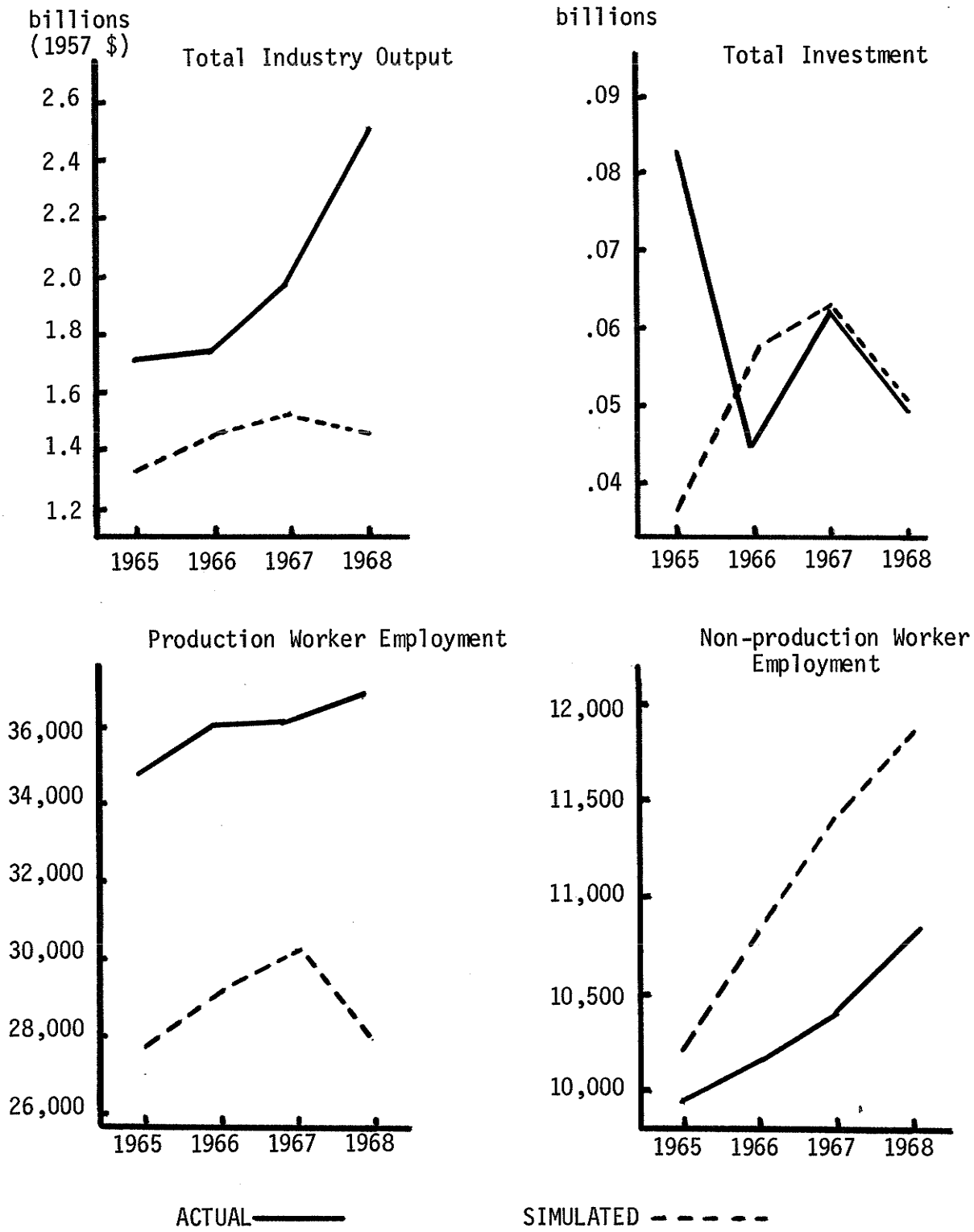

TABLE 2

SUMMARY OF SIMULATION RESULTS

	IMPACT OF AGREEMENT (Actual - Simulated)				S.E.E. from PC2SLS	R.M.S. Errors		Theil Inequality Coefficient		Janus Quotient
	1965	1966	1967	1968		1950-1964	1965-1968	1950-1964	1965-1968	
RSA/RPA	272	138	-149	44	71	83	171	.034	.037	4.3
RSTR/RPTR	41	87	96	175	26	24	111	.042	.135	21.4
USMT	92	315	702	982	--	17	625	.115	.778	1284.2
WPT	-.027	-.053	-.058	-.092	.013	.011	.062	.006	.027	34.5
RPA	-.053	-.083	-.079	-.116	.017	.023	.086	.012	.041	14.4
AHE	.02	-.05	.02	.17	.033	.030	.087	.007	.007	8.7
AWWSNH	6.00	-.24	.73	13.11	2.29	3.23	7.22	.015	.021	5.0
EH	6820	6770	5785	8753	1511	2628	7114	.057	.110	6.9
ENH	-299	-578	-991	-1048	566	809	791	.051	.037	.9
I/IDEFL	46.1	-12.7	-.2	-.5	8.7	16.6	24.1	.209	.211	2.0
TSH/WPT	383	313	456	991	--	65	599	.037	.174	84.2
PROFIT	-31	-89	-49	-28	--	41	55	.459	.195	1.6

are also presented: the standard error of estimate (S.E.E.) from PC2SLS, root-mean-square (R.M.S.) errors for the sample and prediction periods, Theil inequality coefficients[3] for the sample and prediction periods, and Janus quotients.[4]

Before analyzing results for the major structural variable, a number of general comments are in order. First, the prediction errors are highly autocorrelated in the sense that errors for eight of the twelve variables show no change in sign pattern during the entire prediction range. Second, as pointed out above, R.M.S. errors in the sample period are very similar to the standard error of estimate for PC2SLS. In general, however,

---

3. Denoting simulated values by P_i and actual values by A_i, the Theil inequality coefficient can be represented by the following expression:

$$T.I.C. = \frac{\sqrt{1/n \; \Sigma (P_i - A_i)^2}}{\sqrt{1/n \; \Sigma \; P_i^2} + \sqrt{1/n \;\; A_i^2}}$$

where $0 \leq T.\ I.\ C. \leq 1$

A value of zero would represent a perfect prediction while a value approaching unity would represent a very poor prediction. For further details see [9, pages 31-32].

4. Using similar notation and letting "n" represent the number of observations in the sample period and "m" represent the number of observations in the prediction period, the Janus quotient is defined in the following manner:

$$J^2 = \frac{1/m \; \sum_{}^{m} (P_i - A_i)^2}{1/n \; \sum_{}^{n} (P_i - A_i)^2}$$

where $0 \leq J^2 \leq \infty$

If the structure remains the same in the prediction period, then $J^2 \simeq 1.0$. For further details see [5, pages 229-232].

R.M.S. errors for the prediction period are far in excess of those obtained for the sample period simulation. In nine out of the twelve cases, the prediction period R.M.S. error is at least double that of the sample period R.M.S. error. Furthermore, it is largely these cases which are characterized by common sign patterns in prediction errors. Since the Janus quotient is simply the ratio of mean square errors in prediction and sample periods, its value depicts a similar picture. Finally, Theil inequality coefficients are likewise substantially larger for these particular variables in the prediction period.

An analysis of price effects is a natural starting point for an examination of a change in tariff policy. In view of the manufacturer-controlled franchise system for the retailing of motor vehicles, the level of wholesale prices is the critical price variable in the model. The simulated values for prices consistently exceed actual values, with the deviations growing larger through time. Such deviations, as measured by the R.M.S. error, are more than five times as great as the R.M.S. error in the sample period. Since retail prices are primarily "marked-up" wholesale prices, ignoring governmental taxes, it is not surprising that a similar pattern is found for retail motor vehicle prices. Large negative deviations, almost four times as great as the R.M.S. error in the sample period, culminate in an actual price of 10.2% less than the simulated 1968 level.

While the evidence on lower (than expected) vehicle prices in Canada is unambiguous, the more important question of whether Canadians have received the full benefit of industry rationalization in the sense of international prices (i.e. free trade for consumers as well as producers) is left largely unanswered in the simulations. The Wonnacotts [10, pages

227-230] and Beigie [1, pages 21-31, and 116] report that Canadian retail automobile prices were typically 9½ to 10% higher than U. S. retail prices for 1964, the year immediately preceding the signing of the Automobile Agreement. Thus, indirect evidence from the model simulations suggests that most of the gap between Canadian and U. S. automobile prices may be closed, particularly when one looks at retail prices.[5]

Such price effects generate "predictable" results for retail sales. Given an overprediction in actual prices, actual retail sales are substantially underpredicted in the initial year, an error exceeding the sample period R.M.S. error and S.E.E. by about threefold. However, the stimulation to actual sales from lower prices is gradually offset by increased stocks, resulting in only a moderate increase in actual automobile sales (over simulated sales) during the four year period of about 3½% annually.

Perhaps the greatest change in the Agreement years has been the tremendous growth in automotive trade flows between Canada and the United States. Exports of motor vehicles to United States by Canadian firms were almost negligible in the sample period (well under one million dollars per year), a direct contrast to the $800 million average in the Agreement years. Similarly, Canadian imports of motor vehicles from the United States have likewise increased, although starting from a higher base level in 1964. Simulated predictions for Canadian imports of U. S. produced motor vehicles are over $500 million (on average) under actual import flows. The change in industry structure toward greater model specialization is dramatically

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5. Beigie [1, pages 115-116], on the other hand, finds that a 4% margin still exists between Canadian and U.S. automobile prices.

revealed by an increase in the R.M.S. error of over 36 fold in the prediction period.

Given the structural identity for total shipments, simulation results for real automotive output in Canada are simply a reflection of sales, imports, exports, and price behaviour. Total shipments are consistently underestimated, with deviations ranging from six to fifteen times as large as the R.M.S. error in the sample period.

The response of production worker employment to increased actual output is as expected. Simulated values underpredict actual employment by approximately 7,000 during the Agreement years. While this equation is characterized by somewhat large structural errors in the sample period, in no case did the errors approach this level. The Theil inequality coefficient has doubled in the prediction period, while the R.M.S. error has almost tripled.

In contrast, the effects of the Agreement on non-production employment are much less substantial as the prediction error is directly comparable to the sample period error. Furthermore, simulated values consistently overpredict actual values, albeit by small amounts. Since this category of workers is largely comprised of managers, administrators, and technicians; such results are presumably a manifestation of the "branch plant" nature of the Canadian industry. Even though output and production employment increase substantially, managerial and technical functions appear to be increasingly centralized in the head office.

While the R.M.S. errors and Theil inequality coefficients for investment expenditures are comparable in the sample and prediction periods, actual investment greatly exceeds simulated investment in 1965. Given the

previous output and employment results, one would expect that the investment necessary for industry rationalization would normally take place in the initial part of the new structural period.

Prediction errors for average hourly earnings are similar to those obtained in the control period over the 1965-1967 period. This can be attributed to the fact that negotiated wage rates were determined in the latter part of 1964 and locked in place for the following three years. Only in 1968 do actual earnings exceed simulated earnings by a substantial amount (approximately six times the expected error), the initial year of the first contract signed under the Automobile Agreement. Wage results for non-hourly-rated workers are similar, although less pronounced.

Finally, the simulation results for profits are largely inconclusive with comparable R.M.S. errors in sample and prediction periods. However, it is interesting to note that in all cases profits are overpredicted, i.e. actual profit levels under the Agreement are lower than that predicted by the pre-Agreement model. Thus, there is little direct simulation evidence to substantiate claims that the industry has used the Agreement to increase its profit position by "over-charging" consumers for "tariff-free" automobiles.

In summary, simulated "no change in structure" results for many of the major structural variables in the model are characterized by substantial deviations from actual levels during the Agreement years. Such deviations are far in excess of structural errors in the sample period. Utilizing point estimates for 1968, the Automobile Agreement has resulted in the following:

(i) retail automobile prices are 10% lower than expected in Canada

(ii) industry output is 68% higher than expected in Canada

(iii) production worker employment is 32% higher than expected in the Canadian automobile industry

(iv) U. S. produced imports are 993% higher than expected in Canada.

In absolute terms, one can attribute almost 9,000 new production jobs and almost one billion dollars worth of additional annual output in the Canadian automobile industry to the signing of the Agreement. While such model simulation estimates fail to include the effects on other related industries and the multiplier effects throughout the rest of the economy, they do suggest that this bilateral "controlled" free trade scheme has had substantial positive effects on the Canadian automobile manufacturing industry and the Canadian economy. The only reservation would appear to be the failure of managerial-technical employment to keep pace with the accelerated growth in the Canadian subsidiary industry.

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