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# PAYROLL TAX EFFECTS ON WAGE GROWTH

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The social security payroll tax rate is scheduled to increase by almost one percent each on employees and employers between 1983 and 1990. One of the major elements of the recently adopted social security package was an acceleration of the timing of this increase.[1] A number of economists have recommended that, as an anti-inflationary policy, scheduled increases be avoided or even that the current rates be rolled back. (Crandall, 1978; Gordon, 1984).

The rationale for these proposals was stated by Okun and Perry (1978, p. 13):

> On both empirical and analytical grounds, most economists conclude that payroll taxes levied on employers are passed on to the consumer in the form of higher product prices, just like other elements in the business costs of labor compensation.

While employee payroll tax increases reduce net wages, it is assumed that due to institutional rigidities, employer tax increases are not shifted backwards to lower nominal wages (or slow growth). Thus unit labor costs go up and profit margins are maintained by increasing prices. But neither the theory nor the evidence are as clear as Okun and Perry assert.

Most of the theoretical analysis of payroll tax effects does conclude that labor, not capital, bears the tax in real terms e.g. Feldstein, 1974) but does not distinguish between backward shifting via reduced nominal compensation or forward shifting via increased prices. Brittain (1972, p. 44) is very explicit on this:

> Neither this analysis nor the statistical case presented later takes a position in the debate between those who think labor pays the tax and those who think consumers pay it . . . Such a distinction is analytically impossible.

This theoretical ambiguity, or impossibility, implies that the effect of payroll tax increases on wages, prices and profits is an empirical question.

Evidence on the direction of shift of the employers' share is mixed. With several important exceptions, including a recent paper in this Journal (Hagens and Hambor, 1980), most of the empirical studies, have indeed suggested that payroll tax increases are inflationary; but all of the macro studies consistent with Okun and Perry's conclusion

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make an important error in the measurement of the crucial payroll tax variable. This paper develops a corrected measure of payroll tax changes. When that measure is used to reestimate equations based on two of the apparently conflicting studies, the results converge and suggest that a substantial portion of the employer tax is backward shifted. This evidence greatly weakens the payroll tax-inflation link.[2]

## EXISTING EVIDENCE[3]

An increase in payroll taxes can result in decreased nominal labor earnings, decreased profits, or increased product prices.[4] Any single equation estimation can isolate only one of these three effects and will not distinguish between the other two. As noted, the classic study by Brittain (1972) analyzed cross-country differences in real wages, but was expressly unable to distinguish between nominal wage differences and price differences. None of the studies which use a real wage measure (e.g. Vroman, 1972; Leuthold, 1972) can be used to get at the crucial inflation issue. Most other authors focus on the effects of payroll tax changes on nominal wages and infer the residual is shifted forward to prices--but they cannot rule out an effect on profits.[5]

The two recent micro studies of payroll tax effects (Hammermesh, 1979; Neubig, 1980) offer very inconclusive evidence on the crucial inflation question. Both studies, in effect, test whether payroll taxes disturb the vertical earnings contours of those below the taxable maximum compared to those above the taxable maximum, and therefore do not capture any across the board backshifting to all labor. (See also Asher, 1984; and Neubig, 1982).

The general technique of the macro time-series studies of payroll tax effects is to add a measure of payroll tax changes to a set of Phillips curve variables. Most of the studies use a tax measure which they call "social security" but is really the more inclusive "contributions for social insurance." In wage growth equations Perry (1970), Gordon (1971), and Baily (1980) find no backshifting of employer payroll tax increases while Vroman (1974) reports a wide range of estimates.

In price inflation equations Frye and Gordon (1981) find that increases in employer taxes are shifted forward completely to increased prices. However, since this is a reduced form estimate, the coefficient is not a structural shift estimate but includes the effect of the wage-price spiral. Also, having wages in the denominator of the effective tax rate makes the coefficient particularly sensitive to misspecification of wage change determinants. This might explain why, in a follow-up study (Gordon, 1982) which substitutes unemployment variables for the output variables used in Frye and Gordon, the estimated inflationary effects are insignificant. In both these studies the denominator of the effective tax rate variable does not include employer contributions for social insurance nor other labor income, as would be required by their interpretation of the tax shift coefficient.[6]

The two studies which narrow their payroll tax measure to only social security (Hagens and Hambor, 1980; Halpern and Munnell, 1980) find substantial to complete backward shifting of employer tax increases. Even with this improvement in the tax variable, several problems remain. First, their inclusion of a contemporaneous price inflation variable as an explanator of wage growth has a potential for simultaneity (reverse causation) bias since current price inflation may, in turn, depend on current wage growth. Second, their techniques for narrowing the tax measure are only approximately correct.



## THE TAX MEASURE

Most authors of macro studies of payroll tax effects are careful to construct or select an index of hourly compensation which excludes the government sector and usually the farm sector as a dependent variable. But Perry (1970), Gordon (1971), Baily (1980), Frye and Gordon (1981), and Gordon (1982) are not as careful in constructing the tax variable. Generally, the effective tax rate is the ratio of the National Income Accounts' measures for "Total (or employer only) Contributions for Social Insurance" to "Total Wages, Salaries, and (in some cases) Supplements." There are problems with both the **sectors** covered and with the **types** of contributions for social insurance included. The government sector is special because federal civilian employees are not covered by social security,[8] federal military employees were covered starting only in 1957, and state and local employees have optional coverage--options which have changed over time. Similarly, the farm sector is special because of incomplete and changed coverage. The self-employed have had changed coverage and a special rate which has varied between 132 percent and 150 percent of the employees OASKHI tax rate.[9] Because of these features and because the dependent variable is private, non-farm compensation, this paper argues that studies using an all-sectors total contributions ratio tax variable are seriously in error. Accordingly, the tax variable used in this paper is adjusted to remove the government, farm, and self-employed sectors.

The types of social insurance contributions are also narrowed to only social security (OASDHI), railroad retirement, and unemployment insurance contributions. Elimination of the government sector has already circumvented the potential problem inherent in treating government civilian employees retirement contributions (federal, state and local) as a payroll tax, or as similar in impact to social security taxes. The current analysis also excludes workers' compensation paid to government administered funds,[10] veterans life insurance, cash sickness compensation, and supplemental medical insurance, all of which are included in the NIA total.

In the empirical analysis of this paper, nonfarm employer contributions for social security are treated separately from unemployment insurance contributions. In any given year social security coverage and rates uniformly apply across firms, but unemployment tax rates vary widely across states and across firms with different experience ratings. These and other differences may lead to different effects on wage growth or price inflation. Also, at issue for policy purposes is the scheduled change in social security tax rates, not unemployment or other contributions for social insurance.

For a number of reasons the authors of the macro time-series studies of payroll tax effects choose an average effective tax rate variable as opposed to the statutory OASDHI rate: This permits the inclusion of other (non-wage) labor income as well as income above the taxable maximum in the effective tax base; in some years the OASDHI statutory tax **base** is changed--either by increases in the taxable maximum or by changes in the sectoral coverage of social security; and, there has been little variation over time in the statutory rate. The use of an effective tax rate variable has two important problems. First, this forces the theoretically different effects of rate changes and base changes to be statistically the same.[11] Second, since the denominator of the effective tax rate is closely related to the dependent compensation variable, there is the possibility of simultaneity bias which might be confused with an effect of taxes on compensation. In the empirical work which follows, the statutory OASDHI rate is examined as an alternative to the effective rate.

## EMPIRICAL ANALYSIS

This section presents estimates of annual wage growth equations for the 1954-1979 time period using the improved measure of private nonfarm employer payroll tax changes. The robustness of the tax effect estimate is examined by using two different dependent variables and two different forms of the wage growth equation--a price-wage model and a wage-wage model. With a price-wage specification Hagens and Hambor (1980) found substantial backshifting of payroll tax changes. But, Baily (1980), using a wage-wage specification, found little or no backshifting. By running both models with common variable definitions and common time period, this apparent disagreement can be attributed to the overly inclusive sectoral and contribution-type coverage of Baily's tax variable.

Dependent Variables:

The desired dependent variable is an index of private, nonfarm hourly labor compensation. The measure should include non-wage compensation. There are two imperfect approximations for the desired index. The first is the BLS index of private nonfarm wages, salaries and supplements (IWSSNF). Unfortunately this is actually the ratio of one index for total hours worked (U.S. Department of Labor, 1980, pp. 203-208). The second measure (IAHESNF) starts with the BLS index of adjusted private nonfarm average hourly earnings and then adds in supplements by multiplying by the ratio of aggregate private nonfarm wages, salaries and supplements to aggregate private nonfarm wages and salaries.[12] Note, for purpose of interpreting the tax shift coefficients, that both of these dependent compensation measures are inclusive of employer payroll tax contributions.

Phillips Curve Variables:

The price-wage specification includes lagged values of price inflation to represent inflationary expectations. Specifically, the annual rate of inflation in the GNP deflator[13] is lagged one-quarter ($\dot{P}_{-(1/4)}$) and five-quarters ($\dot{P}_{-(5/4)}$).[14]

On the theory that wage setting depends most importantly on recent wage growth in other firms or industries, the wage-wage specification includes two lagged values of the dependent variable. The lagged value of the CPI inflation rate[15] is included measured as a residual from three years of change in the dependent variable ($R\dot{C}PI_{-1}$).[16]

The unemployment measure in both models is the difference between the aggregate unemployment rate and the natural rate of unemployment ($U-U^N$).[17]

Thus the basic specifications are (with C = compensation index, and t = effective employer tax rate):[18]

$$\dot{C} = \alpha + \beta(1/\dot{(1-t)}) + \lambda_1(U-U^N) + \lambda_2\dot{P}_{-(1/4)} + \lambda_3\dot{P}_{-(5/4)} + \varepsilon$$

$$\dot{C} = \alpha + \beta(1/\dot{(1-t)}) + \lambda_1(U-U^N) + \lambda_2\dot{C}_{-1} + \lambda_3\dot{C}_{-2} + \lambda_4 R\dot{C}PI_{-1} + \varepsilon$$

Tax Variables:

The tax variables are described in detail elsewhere in the paper. The transformation of the effective tax rate (t) to $(1/\dot{(1-t)})$ yields β as an estimate of the fraction by which tax increases raise employer compensation costs. To see this, note that the coefficient of the tax measure is the partial relationship between the dependent variable and the tax variable:



$$\beta = \partial\dot{C}/\partial(1/\dot{(1-t)})$$

Defining: C = compensation
T = employer taxes
t = T/C = effective tax rate
N = C - T = net of tax compensation

Thus: $C = N(1/(1-t))$

and: $\dot{C} = \dot{N} + \dot{(1/(1-t))}$

For a given change in T and the associated $\dot{(1/(1-t))}$, if workers in the aggregate can avoid the tax (no backshift) all of the change goes to $\dot{C}$ and $\dot{N} = 0$, so β = 0. While if firms in the aggregate can avoid any income in compensation costs (full backshift) all of the change goes to N and C = 0, so

When the statutory tax rate variable (s) is used the appropriate transformation to get a shifting coefficient is (1+s). As before, a coefficient of Zero represents full backshift, but since the statutory tax base is narrower than full compensation and the value of β for no backshift case is less than one.

Here: $\beta = \partial C/\partial\ (1+s)$

Definitions: C = compensation
W = taxable wages
T = employer taxes = sW
X = other labor income plus wages above the taxable maximum

Thus: $C = W + T + X$

then: $C = W + T + X$

and: $\dot{C} = \frac{W(1+s)}{C}\dot{W} + \frac{W(1+s)}{C}\dot{(1+s)} + \frac{X}{C}\dot{X}$

If, for a given tax change, thee is full backshift then C = 0 and β = 0. But if workers avoid the tax completely then both W = 0 and X = 0 yielding

$$\beta = W(1+s)/C$$

The average value of the fraction W(1+s)/C for the period from 1954 to 1977 is 0.76.[19]

Findings:

Table 1 presents the tax shift coefficients for several alternative tax variables (rows) for the two basic models and the two dependent variables (columns).

Table 1: TAX SHIFT COEFFICIENTS FOR EMPLOYER PAYROLL TAXES[a]

| TAX RATE VARIABLE(S)[b] | | MODEL AND DEPENDENT VARIABLE[c]: PRICE-WAGE IAHESNF (1) | PRICE-WAGE IWSSNF (2) | WAGE-WAGE IAHESNF (3) | WAGE-WAGE IWSSNF (4) |
|---|---|---|---|---|---|
| (1) | ECSI/WSS | .89 (.59) | .67 (.54) | .64 (.67) | 1.04 (.99) |
| (2) | SSRRNF/WSSNF | .42 (.66) | .47 (.60) | -.15 (.72) | .33 (1.08) |
| (3) | SSRRNF/WSSNF | .46 (.60) | .48 (.59) | -.10 (.70) | .37 (1.10) |
| | UI/WSSNF | 2.27 (.92) | 1.14 (.90) | 1.62 (1.11) | 1.14 (1.85) |
| (4) | Statutory OASDHI | .40 (.61) | -.16 (.55) | -.28 (.69) | -.80 (.97) |

[a]Standard errors are shown in parentheses.

[b]In rows (1), (2), and (3) the tax variable in the estimating equations is the annual percentage change in the inverse of one minus the indicated effective tax rate. For the statutory tax rate in row (4) the variable in the estimating equations is the annual percentage change in one plus the tax rate.

[c]The basic specifications and compensation indexes are defined in the text. The dependent variables are the annual percentage changes in the indicated compensation indexes.

The tax variable in row (1) is the measure to which criticism is being directed. This variable is the ratio of total employer contributions for social insurance from all sectors (ECSI) to total wages, salaries and supplements from all sectors (WSS). Note that payroll tax changes appear to go mostly into increased nominal compensation with this measure.

The tax variable in row (2) narrows the types of taxes to employer contributions for social security (OASDHI), here denoted (SS) and railroad retirement (RR); it also narrows the sectors covered for both taxes and compensation to private nonfarm (NF).[20] Here the point estimates suggest that half or more of employer taxes are shifted backwards.[21] (The Appendix presents the complete equations for this tax variable in the four specifications). Note that with the properly narrowed tax measure the wage-wage model based on Baily (1980) shows even more backshift to reduced nominal compensation than does the price-wage model based on Hagens and Hambor (1980).



In row (3) the effective SSRRNF/WSSNF tax rate variable is accompanied by the effective employer rate of unemployment insurance (plus railroad unemployment insurance) taxes: UI/WSSNF. The large coefficients on the UI variable suggest that nominal compensation goes up by at least the full amount of changes in unemployment insurance rates. Note that the coefficients for the social security plus railroad retirement tax rate (SSRRNF/WSSNF) in row (3) are quite close to those in row (2) which excludes the UI variable.

The difference between the estimated effects of social security taxes and unemployment taxes in row (3) provides one possible explanation for the difference between shifting coefficients in rows (1) and (2). The numberator of the crude NIA ratio (ECSI/WSS) used by most authors may well be pooling social security--with a small effect on compensation--with other contributions, like UI, having much larger effects. Experimentation with other effective tax rates suggests that the difference is also partly attributable to the inclusion of the government and farm sectors in the wages, salaries, and supplements of the denominator.

Row (4) of Table 1 presents the estimated shifting effects of the statutory OASDHI employer payroll tax rate. This measure indicates even more backshifting than does the effective rate variable in row (2)--considerably more for the IWSSNF dependent variable in columns (2) and (4).[22] This result is important since the statutory OASDHI rate is exactly the variable which would be manipulated in the proposed policy attempt to slow inflation.

A number of specifications which included one and two year lagged values of the tax variable are not shown here. While the estimates of the same year tax effect continue to show half or more backshifting, the estimates of the lagged effects vary widely in magnitude and sign across the two dependent variables. While these results are puzzling, the fact that social security tax rate and base changes are announced well in advance provides strong justification for including only the contemporaneous tax change variable.

## CONCLUSION

The relatively large standard erros on the tax shift coefficients in Table 1 mean that formal significance tests would reject neither of the competing hypotheses: that changes in the employer's share of social security taxes are nominally borne by employers ($\beta = 1.0$), or are borne by employees ($\beta = 0$). The purpose of this exercise is not to present conclusive evidence of backshifting, but rather to invite skepticism of other's results which imply no backshifting. The measure of "social security" used in those studies which showed the least backshifting which implies the greatest likelihood that tax changes will affect prices, is not social security but the more inclusive "total contributions for social insurance." The total contributions measure is shown here to overstate the amount by which social security tax changes increase nominal compensation. The potential for social security tax rollbacks to slow inflation is thus highly speculative.

## NOTES

1. In 1983 the social security (OASDHI) tax rate was 6.7 percent on both employees and employers. The tax base was the first $35,700 of earned income (the "taxable maximum"). The OASDHI rate is 7.05 percent in 1985, and is scheduled to icnrease to 7.15 percent in 1986, 7.51 percent in 1988, and 7.65 percent in 1990. The taxable maximum increases each year with the growth in average earnings.

2. Moreover, when the potential inflationary impact of alternatives to the payroll tax is considered, the prospects for slowing inflation with payroll tax rollbacks becomes very questionable. Hagens and Hambor (1980) provide a theoretical framework for examining the price and output effects of payroll tax alternatives (income taxes, debt finance, etc.) and then simulate a number of policy substitutions using macro forecasting models. For the inflation potential of the income tax alternative see Auld (1977).

3. A longer version of this paper with a more detailed literature review and technical appendices (Dye, 1984) is available from the author.

4. These possibilities are not exhaustive. It is also possible for **horizontal** shifting to affect wages outside the taxed sector, or wages above the taxable maximum. This can be accomplished by mobility of labor or by other wage-wage links such as the "comparability" studies used to set federal salaries. Shifting to other taxes is also possible, e.g., decreased wages will decrease wage earners' **income** taxes, or decreased profits will decrease corporate income taxes.

5. Unfortunately, the study which does attempt separate estimates of an effect on profits (Baily, 1980) and the two studies which present direct estimates of inflation effects (Frye and Gordon, 1981; and Gordon, 1982) all err in measuring the tax variable as explained below.

6. Gordon (1971), Baily (1980), Frye and Gordon (1981), and Gordon (1982) commit the additional error of including the taxes of the self-employed in the numerator of their effective tax rate variable without including the income of the self-employed in the denominator.

7. Hagens and Hambor (1980) incompletely adjust their tax rate for the farm and government sectors. Halpern and Munnell (1980) remove the taxes of these sectors by assuming that they correspond to ratios of various published aggregates for other measures.

8. Starting in 1984, however, all newly hired federal employees are covered.

9. Starting in 1984 the self-employed rate is 200 percent of the employee's rate.

10. About 70 percent of total workers' compensation goes to privately-administered funds and is already excluded from the NIA contributions measure (Price, 1980). Also the government-private mix has changed over time.

11. Increases in the taxable maximum will raise the taxes of high earners only, and since the amount of taxable earnings is used to calculate future benefits, will raise expected benefits for those affected. Increases in tax rates are more of a pure tax since with a given benefit formula there is no change in future benefits. Increases in tax rates should also affect high and low earners differently. For those below the taxable maximum a higher tax rate results in an income loss (at the same number of hours supplied) which should encourage work effort. For those above the taxable maximum there is only the income effect without the opposing substitution effect. This point is made in MacRae and MacRae (1976).

12. The IWSSNF is Baily's (1980) compensation measure, except for a difference in treatment of the self-employed--here excluded. The IAHESNF is similar to the construct of Hagens and Hambor (1980).



13. Additional estimates with a CPI inflation measure yielded much the same tax effects as those reported and are not presented.

14. These are **annual** rates of inflation calculated to end in the third quarter of the current year and the third quarter of the prior year. In their estimates Hagens and Hambor had the contemporaneous rate of price inflation (and price inflation lagged one year). The extra one-quarter lag on the price inflation terms is intended to reduce the potential for simultaneity bias.

15. Additional estimates with a GNP deflator yielded slightly greater backshifting of payroll taxes but are not presented here.

16. For each of the dependent compensation (C) variables the variable RCPI was obtained as the residual from the regression:

$$\dot{CPI} = a + b\dot{C} + c\dot{C}_{-1} + d\dot{C}_{-2} + RCPI$$

Baily (1980, p. 35) justifies this as follows: "[T]he wage-wage feedback process should be given as much scope as possible, with the feedback of prices on wages playing a secondary role....Thus [RCPI] consists of 'wage-purged' changes in the cost of living."

17. The natural rate of unemployment is that presented in Gordon (1982). A variety of alternative measures and transformations of the unemployment rate did not markedly affect the coefficient of the tax variable and are not presented.

18. Not included here are dummy variables for the Kennedy-Johnson guidepost period and for the Nixon controls period. Hagens and Hambor (1980) included these variables while Baily (1980) did not. Preliminary estimates included these variables but the coefficients were always insignificant and frequently changed sign across specifications.

19. This is calculated as one plus the statutory OASDHI employers' tax rate times the ratio of non-farm non-government wages and salaries and supplements from the national Income Accounts times the ratio of taxable wages and salaries to total wages and salaries in covered employment from Social Security Administration (1980, p. 85).

20. The adjustment of the National Income Accounts (NIA) data to remove the government and farm sectors extends a method developed by John Hagens. Unpublished Social Security Administration estimates were obtained for OASDHI taxable wages for farm workers, federal civilian employees (a small fraction are covered), military members, and state and local government employees. (The federal civilian series starts in 1957, so the 1953-1956 numbers were extrapolated from 1957 as proportions of the corresponding NIA totals for federal civilian wages and salaries). The total of taxable wages from these sectors is then multiplied by the statutory OASDHI tax rate for each year to yield a dollar tax amount. This amount is then subtracted from the NIA total of employer OASDHI taxes to yield a measure of private nonfarm OASDHI taxes. Finally, the NIA amount for employers contributions to railroad retirement insurance is added in to yield an amount for private nonfarm social security and railroad retirement taxes (SSRRNF). The denominator in the effective tax rate variables is accordingly the NIA total for private nonfarm wages, salaries and supplements (WSSNF). Estimates (not shown) for social security alone (SSNF), without railroad retirement, resulted in shifting coefficients very close to those in Table 1.

21. Estimates (not shown) for social security alone (SSNF), without railroad retirement, resulted in shifting coefficients very similar to those in Table 1.

22. Equations with an additional variable measuring the growth of the statutory OASDHI taxable maximum base caused the OASDHI rate variable to show slightly more backshifting than row (4). A number of two-stage and instrumental variable specifications with the statutory rate and base used as exogenous predictors of the effective rate yielded similar results.

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## APPENDIX

Complete Regression Results for the SSRRNF Tax Variable
(Equation numbers correspond to columns in Table 1)

Equation (1), $\bar{R}^2 = .91$, D.W. = 1.70:

$$IAHESNF = \underset{(.27)}{2.28} + \underset{(.66)}{.42}\ (1/(1-(\dot{SSRRNF/WSSNF})))$$

$$\underset{.13)}{-.29}\ (U-U^N) + \underset{(.10)}{.46}\ \dot{P}_{-(1/4)} + \underset{(.12)}{.44}\ \dot{P}_{-(5/4)}$$

Equation (2), $\bar{R}^2 = .93$, D.W. = 2.76:

$$IWSSNF = \underset{(.24)}{2.42} + \underset{(.60)}{.47}\ (1/(1-(\dot{SSRRNF/WSSNF})))$$

$$\underset{(.12)}{-.33}\ (U-U^N) + \underset{(.09)}{.67}\ \dot{P}_{-(1/4)} + \underset{(.11)}{.22}\ \dot{P}_{-(5/4)}$$

Equation (3), $\bar{R}^2 = .90$, D.W. - 2.13:

$$IAHESNF = \underset{(.47)}{-.59}\ \ \underset{(.72)}{-.15}\ (1/(1-(\dot{SSRRNF/WSSNF})))$$

$$\underset{(.13)}{-.59}\ (U-U^N) + \underset{(.15)}{.85\ \dot{IAHESNF}_{-1}} + \underset{(.17)}{.28\ \dot{IAHESNF}_{-2}} + \underset{(.11)}{.41\ \dot{RCPIA}_{-1}}$$

Equation (4), $\bar{R}^2 = .77$, D.W. = 2.03:

$$IWSSNF = \underset{(.76)}{-.70} + \underset{(1.08)}{33}\ (1/(1-(\dot{SSRRNF/WSSNF})))$$

$$\underset{(.21)}{-.71}\ (U-U^N) + \underset{(.17)}{.79\ \dot{IWSSNF}_{-1}} + \underset{(.18)}{.35\ \dot{IWSSNF}_{-2}} + \underset{(.23)}{.54\ \dot{RCPIW}_{-1}}$$