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Social Security Tax Reform and Unemployment: A General Equilibrium Analysis for France

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Abstract

This paper develops and calibrates a simple general equilibrium model with two types of labor and capital for the French economy. The simulation results indicate that targeted reductions in employer social security taxes have six times as large an effect on employment as untargeted reductions for equal initial budgetary cost, while employee social security tax reductions have a negative effect on employment. They also point to the presence of "self-financing," whereby reductions in various tax rates lead to lower budget deficits in the long run, as a result of an expanding tax base and lower unemployment insurance outlays.[1]

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Contents

SUMMARY

The French authorities have introduced a number of reforms to their social security tax system that are designed to increase employment. In particular, social security contributions paid by employers for low-income workers were cut sizably. Currently, they are planning to reduce employee contributions for health care (which is to be financed by increasing a broad-based income tax), although the primary objective of this measure is not to increase employment.

To shed light on the impact of such measures, this paper develops a simple general equilibrium model. The main results are as follows:

Employer social security tax reductions **targeted** to unskilled (low-income) workers and **financed** by a broad-based income tax result in positive employment growth and a positive contribution to the budget in the long run. This employment effect is six times as large as the effect of an **untargeted** reduction (for equal initial budgetary cost), but is associated with a reduction in after-tax wages of unskilled workers and a decline in returns to skills.

Employee social security tax reductions financed by a broad-based income tax, in contrast, have a negative effect on employment and on the budget, because higher taxes on income from capital act as a disincentive to investment, while the labor costs of unskilled workers are not reduced. To the extent that taxation of capital was less comprehensive and that of transfers more comprehensive, as would indeed be the case under the envisaged reform of health care financing, or if minimum wages evolved differently, these long-run costs would be mitigated.

Social security tax reductions that are **not financed** have positive effects on the budget in the long run. This finding of **self-financing** (also obtained by Laffargue 1996) results as much from lower unemployment insurance outlays—an aspect which has not received much attention—as from a higher tax base.

It should be known that at the beginning of a dynasty, taxation yields a large revenue from small assessments. At the end of the dynasty, taxation yields a small revenue from large assessments.

Ibn Khaldûn, **An Introduction to History**, 1377.

I. Introduction

In recent years, industrial countries have come to see high social security taxes as a significant impediment to employment creation. As a consequence, a number of countries have reformed the financing of their social security systems. France, in particular, has since 1993 taken an active stance in reducing social security contributions, notably for unskilled workers.[2] In France today, labor cost reductions at the level of the minimum wage based on exemptions from employer social security contributions range from 12 percent to 21 percent for the long-term unemployed. For part-time workers, the reduction in labor costs can be as high as 19 percent. Workers earning as much as 1.33 times the minimum wage benefit from partial exemptions. All together, more than five million persons benefited from social security tax reductions in 1995.

French economists have noted that these policies may be bearing fruit: the number of long-term unemployed declined by 6.4 percent between end-1994 and end-1995, notwithstanding the economic slowdown. Also, since 1993 low-wage employment has been growing more rapidly than expected based on output developments (Duchêne, et. al. 1996). A precise estimate of effects cannot be obtained empirically, however. While many countries have carried out social security reforms, the modalities of these reforms have varied (targeted versus across the board cuts, cuts in employer versus employee contributions, various financing methods) so that there are few observations for specific types of reforms. It is also difficult to control for many other factors, including cyclical effects, technological change biased against unskilled labor, and competition from low-income countries.[3]

In view of the above, this paper takes a modeling strategy to assess the effects of past and prospective reforms of social security taxation. It follows a long tradition of general equilibrium analysis of taxation pioneered by Harberger in the 1950s and 1960s and the **computable** general equilibrium analysis first applied by Shoven and Whalley in the early

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[2]The United Kingdom, the Netherlands, and Belgium have introduced social security tax exemptions for low-income workers. In the case of the Netherlands and Belgium these exemptions amount to reductions in labor costs of 5 and 10 percent, respectively, at the level of the minimum wage. Germany has focused on providing temporary exemptions from social security taxes to the long-term unemployed (Conseil Supérieur de l'Emploi, des Revenus, et des Coûts, 1996). See also OECD (1995).

[3]The survey of empirical work in this area by Zee (1996) indicates that there is considerable uncertainty surrounding the magnitude of effects of tax changes (see also below).

1970s.[4] Such models capture interactions between various markets, unlike partial equilibrium models, where (most) prices are taken as given.[5] The model has the simplest structure compatible with the need to study the effects of tax reform on the labor market. It assumes an open, price-taking economy, with three factors of production (skilled labor, unskilled labor and capital), involuntary unemployment, and capital mobility. There is only one (competitive) sector—thus the model does not contain an input-output matrix as do many computable general equilibrium models.[6] The labor market is characterized by both "wage curves" (a sort of "surrogate labor supply curve" which can be rationalized by a variety of models, including bargaining, efficiency wage, and implicit contract models) and minimum wages.[7] Unemployment is "classical" in the model, in the sense that it can be reduced through reductions in labor costs. Long run equilibrium is achieved when after-tax domestic and foreign rates of return achieve a certain balance, thus removing any incentive for capital flows. The demand side need not be specified, as this equilibrium condition is consistent with any behavior for consumption (e.g., Keynesian or optimizing).

The basic set-up of the model follows van de Klundert (1983), who linearized a one-sector, three factor model of a price-taking economy (with a competitive labor market) to analyze the effect of energy price increases. The modelling of the labor market follows Agénor and Aizenman (1996), which introduces unemployment by stipulating a surrogate labor supply curve for skilled laborl. This stipulation permits one to move away from the standard analysis of incidence of social security taxation which assumes an inelastic labor supply, and inevitably concludes that the burden of social security taxation is on wages.[8] Specific functional forms are adopted here in order to obtain numerical results.[9] The paper is also similar to recent

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[4]See Shoven and Whalley (1992) and Derviş, de Melo, and Robinson (1982) for literature surveys.

[5] Hamermesh (1993) provides an overview of partial equilibrium studies of the effects of social security taxes (pp. 166-182).

[6] More sectors could be introduced should the focus be on consequences of tax reform on individual sectors or on foreign trade. See Lenjosek and Whalley (1986).

[7] See Blanchflower and Oswald (1994) for a good survey of the empirical and theoretical literature on equilibrium wage curves and a formal exposition of various models generating wage curves.

[8] See Hamermesh (1993), pp. 172-173, for example.

[9] The model developed by Agénor and Aizenman is more suitable for qualitative analysis. The model developed in this paper also differs from Agénor and Aizenman in that the long-run equilibrium condition for the rate of return of capital is determined by an interest parity condition, whereas Agénor and Aizenman rely on the optimality condition for consumption in an intertemporal optimization model of a closed economy. The qualitative effects of social

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French work by Laffargue (1996) and by Germain (1996) in a number of respects, notably the computable general equilibrium approach, the absence of labor market clearing, and the assumption of an open capital account. The three models are complementary in the sense that they build on different characterizations of production and the labor market (see below). A contribution of the present model is that it provides a direct link to the empirical literature on the wage curve, while also being transparent in its effects and solvable using the simple log-linearization method.

The model is used to explore the impact of a reform package in which a cut in employer social security taxes is offset by an increase in a broad-based income tax to avoid any short-run loss of revenue. This broad-based income tax covers all income from labor (without income threshold) and capital. In an alternative scenario, social security tax reductions are **targeted** on low-income workers. In a third scenario, which mimics the current proposals for the reform of health care financing, a reduction in **employee** social security taxes is financed by a broad-based income tax.[11] For each scenario, the budgetary implications without offsetting financing are also examined. The results are compared and contrasted with the results obtained from other models of the French economy constructed by Laffargue (1996) and by Germain (1996).

II. The Model

A one-sector, three-factor general equilibrium model with different wage-setting mechanisms for skilled and unskilled labor is developed (see Appendix I for more details). The model is solved for both the short run and the long run, in which capital has adjusted to its new equilibrium and elasticities of substitution have reached their long-run levels. Wages of the unskilled are determined by the minimum wage and wages of the skilled are determined according to a surrogate labor supply curve as a function of unemployment.[12] The formulation assumes that surrogate labor supply is a function of after-tax net wages. This implies that taxes paid by employers and government expenditures do not affect labor

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[10](...continued)
security tax reductions are also examined by Artus (1995) in a two-sector, two-factor (skilled and unskilled labor) theoretical model.

[11] The extent to which capital will be taxed under current French proposals for the reform on health care financing is smaller than modeled here. This mitigates the negative long run effects obtained in the simulations of this paper.

[12] In the case of France, the minimum wage covers about 10 percent of employees (Moghadam, 1995), so that the labor supply of low-wage earners can be considered to be elastic.

supply.[13] Minimum wages are assumed constant, reflecting the leeway of the government in according annual increases in line with economy-wide developments.[14]

In a nutshell the model functions as follows. Employment and output respond to tax reform through the interaction of labor demand and (surrogate) labor supply; hence employment effects depend critically on the elasticities of labor demand and (surrogate) supply. The more inelastic the (surrogate) labor supply, the more labor appropriates the "room" created by, say, a reduction in social security taxes, through higher wages (and the smaller the employment impact and increase in rate of return on capital).[15] The elasticity of demand for various types of labor, in turn, is a function of the degree of substitution between factors (the substitution effect), as well as of the slope of the marginal cost function (the expansion effect).[16]

What distinguishes the approach taken here from the **partial** equilibrium approach, is the interactions between various labor markets. In **partial** equilibrium the effects on employment of skilled and unskilled workers of, for example, a reduction in social security taxes of unskilled workers, are calculated assuming that wages of skilled workers remain constant. Here, there will be a partial offset to the substitution of unskilled for skilled labor (induced by lower relative costs of unskilled workers) through the effect of higher unemployment among skilled workers on their wages. Substitution and expansion effects are also simpler to calculate.[17]

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[13]See Cotis and Loufir (1990) for a formulation of labor supply which incorporates contributions to social security paid by employers.

[14] Minimum wages are adjusted according to three mechanisms. First, a rise of 2 percent or more in the CPI automatically triggers an equivalent rise in the SMIC; second, on July 1 of each year, the SMIC is adjusted by half the change in real hourly wages in industry; third, the Government can accord discretionary increases.

[15]This corresponds to the usual result ("Dalton's Law") according to which a factor which is provided inelasticically bears the full burden of a tax (in this case, the full benefit of a tax reduction). For a formalization of "Dalton's Law" of proportionality between incidence and relative elasticities of demand and supply of various factors see Keller (1980), p. 17.

[16] See Johansen (1972), p. 125, for a derivation of the elasticity of factor demand in terms of expansion and substitution effects.

[17] Knowledge of the direct elasticities of substitution (the percent change in relative quantities demanded corresponding to the percent change in relative factor costs) is sufficient, as these correspond to the partial elasticities in the nested CES function, in whose terms the model's solution is expressed. In **partial equilibrium** analysis, substitution effects are expressed in terms of Allen elasticities (the percent change in factor demand corresponding to a one

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The factor price frontier plays a critical role in the model. In the short run, capital is constant. The rate of return on capital is determined residually by the factor price frontier. If the net rate of return on capital increases as a result of tax reform, capital accumulation receives positive impetus. In the long run, capital adjusts so as to eliminate any excess returns. The gross rate of return on capital adjusts so as to offset any changes in taxation of capital, while the labor cost of unskilled workers adjusts mechanically to changes in employer social security taxes on unskilled labor. The factor price frontier in turn determines the labor cost of skilled workers. Employment of skilled workers adjusts so as to ensure compatibility between unemployment and wages, as determined by the surrogate labor supply curve.

III. Simulation Results

Three types of simulations were conducted. The first involves reducing various social security taxes in a number of ways without requiring a balanced budget, i.e., without altering the broad-based income tax. The second involves a balanced budget reduction in various social security taxes. The third is a sensitivity analysis to gauge the impact of critical parameters, notably those capturing (a) the effect of unemployment on wages and (b) the effect of the unemployment insurance replacement ratio on budgetary expenditures. In interpreting the results it should be recalled that certain complexities of the French tax system and economy are not taken into account in the model.[18]

A. Social Security Tax Reduction Without Offsetting Tax Increases

Employer social security taxes

Table 1 presents the results of two simulations. The first simulation reflects the effect of a one point reduction in the social security tax which does not distinguish between skilled

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[17](...continued)
percent change in the cost of a factor, at constant output), which are more difficult to calculate from the basic parameters of the production function. For a derivation of Allen elasticities from the partial elasticities in the nested CES function, see Keller (1980), pp. 79-84.

[18]The broad-based income tax is close in spirit to the French flat-rate taxes "Contribution Sociale Généralisée" (CSG) and "Remboursement de la Dette Sociale" (RDS). Its coverage of capital income is somewhat broader than of the RDS and in particular the CSG. The broad-based income tax of the model does not cover unemployment benefits, pensions, or family allowances. This is of limited consequence in estimating the effects of the Government proposal for reforming health care financing, as the introduction of the new broad-based health tax on unemployment benefits and pensions will be offset in large part by reductions in social security contributions levied on these incomes. Consumption, labor force participation, and tax evasion are also not modeled.

and unskilled workers. In the second simulation the social security tax is reduced only for unskilled workers, by an amount which has the same short run budgetary cost as the first policy experiment (that is, by six points). Results are presented both in the short run and the long run.

The first striking finding is that a reduction in social security taxes actually leads to budgetary savings in the long run. This finding amounts to a type of Laffer curve result, perhaps first noted by the social historian Ibn Khaldûn in his **An Introduction to History** in 1377 and also observed by Adam Smith in 1776 and Jules Dupuit in 1844.[19] Here the budgetary savings result from the combination of increases in the tax base (the focus of most previous work) and savings on outlays for unemployment insurance. The latter are quite important in a country such as France, given high replacement ratios in the first year of unemployment. The relationship uncovered here is in fact not a Laffer curve, as a reduction in tax rates (from the current rate of 69 percent of gross wages) does lead to a decline in tax revenues, notwithstanding the expanding tax base.[20] [21]

In the first policy experiment, employment growth on average is 0.2 percent in the short-run and 1 percent in the long-run. Employment of skilled workers increases by 0.2 percent, while employment of the unskilled increases by more, by 0.3 percent, reflecting the fact that wages of the unskilled remain constant at the minimum wage. Wages of skilled workers increase, as part of the reduced tax burden on employers is shifted to employees, ensuring a balance between higher wages and higher employment. The rate of return on capital increases in the short run, leading to increased investment and a higher capital stock (+0.8 percent) in the long run.

The second policy experiment leads as expected to a stronger growth of employment of the unskilled (1.7 percent in the short run and 7.9 percent in the long run). The capital stock and output also increase by more in the long run than under the first experiment, while net wages of skilled (i.e., after-tax wages) increase by equal amounts in both experiments in the long run. The long run budgetary savings are also higher under the second experiment.

Finally, note that returns to skills, as captured by differentials in labor incomes between skilled and unskilled (including unemployment benefits) increase under the first policy experiment, but decline under the second experiment (in both the short and long run),

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[19]The references to Smith and Dupuit are from Fullerton (1982).

[20]The tax rate which maximizes revenue is 74 percent in the simulations.

[21] These results are sensitive to the assumed relationship between wages and unemployment. For a discussion of the sensitivity of the finding of self-financing to the assumptions on (a) the relationship between wages and unemployment and (b) the effective unemployment replacement ratio, see the sensitivity analysis below.

Table 1. Response to Employer Social Security Tax Reduction without Offsetting Tax Increases

(Percent change, unless indicated otherwise)

	Short Run		Long Run	
	Overall 1 percent (1)	Unskilled 6 percent (2)	Overall 1 percent (1)	Unskilled 6 percent (2)
Surplus (percent GDP)	-0.39	-0.39	0.32	1.19
Output	0.13	0.19	0.83	1.84
Capital stock	--	--	0.83	1.84
Total employment	0.21	0.51	1.00	2.80
Employment, skilled	0.18	-0.01	0.62	0.60
Employment, unskilled	0.29	1.73	1.87	7.92
Labor income, skilled	0.30	-0.01	1.03	1.02
Labor income, unskilled	0.06	0.38	0.41	1.73
Rate of return	0.95	1.34	--	--
Labor costs, skilled	-0.45	-0.01	0.14	0.82
Labor costs, unskilled	-0.69	-4.06	-0.69	-4.05
Wages, skilled	0.24	-0.01	0.83	0.82
Wages, unskilled	--	--	--	--
Net wages, skilled	0.24	-0.01	0.83	0.82
Net wages, unskilled	--	--	--	--
Investment/ net rate of return	0.95	1.34	--	--

reflecting the strong employment growth for unskilled when social security tax reductions are targeted to the unskilled.

Employee social security taxes

Table 2 presents the effects of a one point reduction in employee social security tax rates. The budgetary cost is 0.7 percent of GDP in the short run. Even in the short run, important increases in skilled employment, labor incomes, and the rate of return on capital are recorded (first column). In the long run, a cut in employee social security taxes by itself contributes to budgetary savings (as did a cut in employer social security taxes) and leads to an expansion of output and employment of 1 percent, and in labor incomes of over 1 percent, while income differentials between skilled and unskilled workers widen somewhat (second column).

B. Budgetarily Neutral Reduction of Social Security Tax

Employer social security taxes

The overall and targeted reduction in social security taxes are now examined assuming a broad-based income tax is levied so as to offset any short run budgetary losses.

The results of the balanced-budget experiments parallel those found in the experiments (see Table 1) where broad-based income taxes were not increased. Overall employment and employment of the unskilled increases markedly more when the social security tax reduction is targeted to the unskilled. In the short run, overall employment increases 0.4 percent in the second experiment compared to 0.1 percent in the first experiment (see first two columns of Table 3). Unskilled employment increases by 1.7 percent compared to 0.3 percent. However, skilled workers fare worse both in terms of employment (-0.1 versus +0.1 percent) and net wages (-0.2 versus 0.1 percent). For the unskilled the increase in income taxes involves a reduction in net (i.e., after-tax) wages of 0.4 percent.[22] Finally, note that the income tax increase required is 0.37 points, or markedly below the share of labor in GDP (0.67).[23]

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[22]Recall that the broad-based income tax covers unskilled workers.

[23]This reflects two factors: higher employment and higher gross wages. As long as (surrogate) labor supply is not fully elastic, a one for one shift from employer taxes to employee taxes (whether income or social security taxes) will lead to higher gross wages. Since gross wages constitute the tax base for both employer and employee taxes, a one for one shift from employer to employee taxes also has a positive effect on the budget. This turns out to account for 80 percent of the shortfall between labor's share of 0.67 and the required offset in income taxes of 0.37. Twenty percent of the shortfall is accounted for by the increase in employment (which is quite small in the short run because employment has not fully adjusted).

Table 2. Response to Employee Social Security Tax Reduction
(Percent change, unless indicated otherwise)

	Without Offsetting Taxes		With Offsetting Taxes	
	Short Run (1)	Long Run (2)	Short Run (3)	Long Run (4)
Income tax (points)	--	--	0.68	0.68
Surplus (percent GDP)	-0.73	0.12	--	-0.26
Output	0.19	0.99	0.06	-0.32
Capital stock	--	0.99	--	-0.68
Total employment	0.25	0.99	0.08	-0.22
Employment, skilled	0.35	0.99	0.11	-0.02
Employment, unskilled	-0.01	0.99	--	-0.70
Labor income, skilled	0.58	1.64	0.19	-0.04
Labor income, unskilled	1.06	1.28	0.34	0.19
Rate of return	1.37	--	0.44	0.73
Wages, skilled	-0.85	--	-0.27	-0.45
Wages, unskilled	--	--	--	--
Net wages, skilled	0.47	1.32	0.15	-0.03
Net wages, unskilled	1.21	1.21	0.38	0.38
Investment/ net rate of return	1.37	--	-0.30	--

In the long run, the above tax reforms lead to substantial employment gains and a positive budgetary contribution (see third and fourth column of Table 3). The negative effects of higher income taxes on capital accumulation fail to outweigh the positive effects of lower social security taxes. Note that the impetus to higher employment results in part from the fact that minimum wage is not compensated for higher income taxes (leading to a reduction in net wages of the unskilled of 0.4 percent). [24]

Employee social security taxes

The third and fourth columns of Table 2 give the results of the simulations of a cut in employee social security taxes which is neutral in budgetary terms in the short run. A first result is that a one point reduction in the social security tax requires an offsetting increase in the income tax of 0.68 points in the short run (column 3).[25] In the short run, overall employment increases by 0.1 percent, which is fully accounted for by increases in skilled employment. The mechanism which allows this to occur is a reduction in gross wages of skilled workers, who shift part of their reduced tax burden onto employers. Net incomes increase for both skilled and unskilled workers. Finally, the net rate of return on capital drops substantially and investment declines. In the long run, this tax reform has a negative impact on the budget (of 0.3 percent of GDP; see column 4), unlike the result observed for a reduction in **employer** social security taxes. This reflects the reduction in the net rate of return on capital, as labor costs for the unskilled remain rigid, and the resulting reduction in capital. Employment declines by 0.2 percent, with the brunt of the decline borne by unskilled labor. Income differentials between skilled and unskilled workers narrow.

C. Sensitivity Analysis

The first parameter which is investigated is the unemployment elasticity of wages in the surrogate labor supply curve. This parameter is critical as it determines the level of employment (and hence tax revenues) which is compatible with the new long run equilibrium wage (itself determined by the factor price frontier, the rate of return constraint, and the fixed

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[24]When minimum wages are compensated for higher income taxes, all variables remain essentially unchanged from the baseline in the long run. When the unskilled are exempt from the levy of (or increase in) the broad-based income tax, employment and output do expand in the long run, but at the cost of declining employment and net wages of skilled workers. These results are not reported here.

[25]Since one type of employee tax is being replaced by another of smaller magnitude (given taxation of capital), and some of the benefits are shifted to employers, gross wages of the skilled decline, thereby reducing the tax base. This is offset by the effects of higher employment on the budget, so that, overall, the required income tax increase just corresponds to labor's share in value added.

Table 3. Response to Employer Social Security Tax Reduction with Offsetting Tax Increases

(Percent change, unless indicated otherwise)

	Short Run		Long Run	
	Overall 1 percent (1)	Unskilled 6 percent (2)	Overall 1 percent (3)	Unskilled 6 percent (4)
Income tax (points)	0.37	0.37	0.37	0.37
Surplus (percent GDP)	--	--	0.12	0.99
Output	0.06	0.12	0.13	1.14
Capital stock	--	--	-0.06	0.95
Total employment	0.12	0.42	0.34	2.15
Employment, skilled	0.05	-0.14	0.08	0.07
Employment, unskilled	0.29	1.73	0.96	7.00
Labor income, skilled	0.09	-0.27	0.13	0.12
Labor income, unskilled	-0.32	-0.01	-0.18	1.11
Rate of return	0.45	0.84	0.39	0.39
Labor costs, skilled	-0.14	0.30	-0.10	0.58
Labor costs, unskilled	-0.69	-4.06	-0.69	-4.03
Wages, skilled	0.55	0.30	0.59	0.58
Wages, unskilled	--	--	--	--
Net wages, skilled	0.07	-0.18	0.11	0.09
Net wages, unskilled	-0.44	-0.44	-0.44	-0.44
Investment/ net rate of return	0.05	0.45	--	--

minimum wage).[26] The elasticity adopted in the base-line scenario corresponds to the estimate obtained by Blanchflower and Oswald (1994) for other European countries that a one point increase in the unemployment rate leads to at most a 0.1 percent reduction in the wage. While this estimate was obtained for a number of countries, there is uncertainty as to whether it reflects an equilibrium relationship or a supply relationship.

Other work, taking a different vantage point, indicates that the elasticity could be much higher than 0.1. The findings of Cotis and Loufir (1990) for France, for example, indicate that labor taxes are borne in full by labor. This is echoed by Zee (1996), who concludes that many studies do find "that the impact of taxes on unemployment and/or on their forward shifting into wage costs are strongest in the short run, and that the effect fades or even disappears in the longer run when the real wage level has adjusted to the tax change." These findings are compatible with a number of explanations, notably competitive labor markets with inelastic labor supply, strong substitutability of contributions and net wages, and insider-outsider wage-setting.[27] A first experiment is then to check the results when the unemployment elasticity of the wage is infinite.

The results are given in the first four columns of Table 4. A reduction in employer social security taxes now involves a budgetary cost in the long run (column 4), as (un-)employment of skilled workers remains constant, imparting a smaller increase in the tax base and a smaller reduction in outlays for unemployment benefits. Nevertheless, the negative budgetary impact diminishes over time (-0.35 percent of GDP in the short run and -0.17 percent of GDP in the long run) (columns 3 and 4). The contrast with the scenarios where the elasticity was 0.1 is less stark for the case of the balanced budget experiments. The same rate of income tax is required for a balanced budget; the positive contribution to employment is somewhat lower but of the same order of magnitude (columns 1 and 2 of Table 4 compared to columns 1 and 3 of Table 3).

The second variable to be examined is the unemployment benefit replacement ratio. Previous simulations assumed that, in line with existing evidence on job search, persons filling newly created jobs had been unemployed for only a short time. When tax reform is accompanied by active labor market measures, the long-term unemployed might come to fill these jobs. In that case, budgetary savings would be less, given the French system of lower replacement rates for the longer-term unemployed. The last column of Table 4 shows the long-run effects of assuming that unemployment benefit replacement rates are 30 percent for the skilled and 60 percent for the unskilled (compared to previous assumptions of 60 percent

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[26]See, for example Fullerton (1982), for work on the relationship between labor supply elasticities and tax revenues in the US.

[27]This assumes that the wage is initially sufficiently below the sum of the reservation wage and the cost to the firm of replacing insiders with outsiders (consisting of severance pay, training costs, and costs which insiders can inflict by withdrawing cooperation from new hires or by striking). See Lindbeck and Snower (1988) for further details.

Table 4. Sensitivity Analysis: Effect of a 1 Point Increase in Employer Social Security Tax

(Percent change, unless indicated otherwise)

	Balanced Budget		Without Offsetting Tax Increases		
	Short Run	Long Run	Short Run	Long Run	Long Run
	Inelastic labor supply				Low replacement
Income tax (points)	0.35	0.28	--	--	--
Surplus (percent GDP)	--	--	-0.35	-0.17	0.22
Output	0.03	0.09	0.03	0.21	0.83
Capital stock	--	-0.06	--	0.21	0.83
Total employment	0.09	0.29	0.09	0.38	1.00
Employment, skilled	--	--	--	--	0.62
Employment, unskilled	0.29	0.97	0.29	1.25	1.87
Labor income, skilled	0.21	0.27	0.66	0.79	1.23
Labor income, unskilled	-0.31	-0.08	0.06	0.27	0.67
Rate of return	0.23	0.30	0.23	--	--
Labor costs, skilled	-0.01	-0.04	-0.01	0.14	0.14
Labor costs, unskilled	-0.69	-0.65	-0.69	-0.69	-0.69
Wages, skilled	0.69	0.67	0.69	0.83	0.83
Wages, unskilled	--	--	--	--	--
Net wages, skilled	0.22	0.28	0.69	0.83	0.83
Net wages, unskilled	-0.43	-0.33	--	--	--
Investment/ net rate of return	-0.15	--	0.23	--	--

and 75 percent respectively). The striking finding is that a uniform social security tax reduction continues to generate some budgetary savings in the long run when effective unemployment benefit replacement rates are low. Apparently, tax rates are sufficiently close to revenue-maximizing rates (69 percent compared to 74 percent, as obtained from simulations) that even small savings related to lower expenditures for unemployment benefit suffice to generate self-financing. The savings are about two thirds of savings under the baseline scenario (column 3, Table 1). Otherwise the findings are identical, except for the fact that total labor incomes (including unemployment benefits) increase by more now that the transition from unemployment to employment involves larger increases in income.

D. Approximation Errors

Gauging the effects of tax reform of a large magnitude is subject to approximation errors as the linearization of the equations in the model is valid only for small changes. For example, the change in tax revenue is approximated by the sum of (1) the change in tax rates multiplied by the old tax bases and (2) the change in tax bases multiplied by the old tax rates. Thus the interaction between change in tax base and change in tax rate is missed. To capture this interaction would introduce non-linearities. Another approximation error results from the use of constant shares in the production function, whereas factor shares are not constant in CES production functions. The errors appear small, however. For example, a general social security tax reduction financed by an increase in income tax would really involve a positive contribution to the budget of about 0.02 percent of GDP, rather than budgetary neutrality, in the short run.[28]

IV. Alternative General Equilibrium Results

This section presents results of two recent general equilibrium models of the French economy designed to study the effects of social security tax reform. The labor market structure in these models allows for involuntary unemployment as above. The model by Laffargue (1996) is the most comprehensive. It includes modules for government debt dynamics, intertemporal optimization of consumption, bargaining, imperfect competition, and a complete specification of the French tax system, covering inter alia, social security, income, and profit taxes, taxation of returns to savings, VAT, investment taxes, and production taxes. Germain (1996) employs a simpler model, in which the surrogate labor supply is based on a relationship between labor's share in value added and unemployment. While the results of the three models are qualitatively similar—all models exhibit positive employment effects and small or no budgetary costs in the long run—the precise estimates of the employment and budgetary effects vary across the models.

The results—summarized in Table 5—can be understood in terms of the different assumptions of the models. First, employment effects of reductions in employer social security taxes are strongest in Germain, who assumes a relatively large response of wages to unemployment. Employment effects are weakest in Laffargue, apparently because of lower elasticities of substitution between skilled labor and capital and skilled and unskilled labor.

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[28]This result should not be surprising. Fullerton, Henderson, and Shoven (1982) report that approximation errors are small for the Harberger two-sector, two-factor model, based on a comparison of results based on linearization and Scarf algorithm.

Second, in both papers positive long run budgetary effects are smaller than in the model developed in this paper. While Laffargue also finds a positive effect on the budget, this effect is of a much smaller magnitude. Germain finds that tax cuts lead to a small budgetary **deficit**. He nevertheless finds important supply effects: without changes in the tax base and unemployment outlays, the negative budgetary effect would have been 10 times as high. The differences can be traced to the specification of the French tax system (Germain) and to effects on activity (and to a lesser extent assumed unemployment benefit replacement rates) (Laffargue). Germain models tax gains from higher activity as proportional to the overall increase in value added, whereas both Laffargue and this paper specify more complex relationships.

Given the uncertainty surrounding, inter alia, the appropriate formulation for both the production function (see Appendix I, section 1) and the surrogate labor supply curve, one set of estimates is not clearly superior to another. The results from the three models should rather be seen as spanning a range of estimates for the effects of social security tax reform.

As regards the effects of a financed reduction in employer social security taxes, Laffargue and Germain identify combinations of policies which lead to both net employment creation and positive budgetary contributions. In the case of Laffargue, one possible combination is that of a tax on output and a social security tax reduction. In the case of Germain, it is a combination of an income tax which covers pensioners (the CSG) and a social security tax reduction.

Table 5. Long-Run Effect of Employer Social Security Tax Reductions in Various Models

	Germain (1996)	Laffargue (1996)	This paper
Effect of 1 point targeted reduction			
Employment (percent)	0.71	0.16	0.48
Budget (percent of GDP)	-0.03	0.02	0.20
Effect of 1 point overall reduction			
Employment (percent)	1.83	0.70	1.00
Budget (percent of GDP)	-0.21	0.04	0.32
Assumptions	unskilled amount to 20 percent of employment	unskilled amount to 20 percent of employment	unskilled amount to 30 percent of employment
	for skilled and unskilled, the semi-elasticity of labor's share to the unemployment rate is -1.1 (a one point increase in the rate causes a 1.1 per-cent reduction in labor's share)	for skilled, the union share in the Nash bargain assumed to be 0.005 to obtain reasonable "supply" curve (the implied elasticity of after-tax skilled wage to the unemployment rate is -0.04); unskilled are paid the minimum wage	elasticity of after-tax skilled wage to the unemployment rate is -0.1 (a semi-elasticity of -1, at an unemployment rate of 10 percent; unskilled are paid the minimum wage
	interest rate determined from foreign interest rate and tax rate on income from capital	interest rate determined by risk-premium which develops as a result of the need to borrow abroad when savings decline in response to higher income tax rate	interest rate determined from foreign interest rate and tax rate on income from capital
	translog with 3 types of labor and capital	nested CES with intermediate aggregate consisting of unskilled labor and capital	nested CES with intermediate aggregate consisting of unskilled and skilled labor
	effect of higher tax base calculated by assuming GDP is subject to a tax rate of 54 percent	skilled unemployed subject to income and social security tax; unskilled not subject to income tax, but subject to employee social security tax; gross replacement rate is 60 percent	skilled unemployed subject to income and social security tax; unskilled not subject to income tax, but subject to employee social security tax; gross replacement rate is 75 percent for unskilled and 60 percent for skilled

V. Conclusion

The model developed in this paper produces both encouraging and sobering results. Budgetarily neutral reductions in **employer** social security taxes, whether global or targeted, that are **financed through a broad-based income tax** can generate positive employment effects, but not without reducing after-tax wages of unskilled workers. The simulation results indicate that, in the long run, the employment effects range from 0.3 percent for reductions in global employer social security taxes to 2.2 percent for targeted cuts with equal budgetary impact (reductions in tax rates of 1 and 6 points respectively). These reductions are associated with a decline in after-tax wages of unskilled workers of 0.4 percent. Reductions in **employee** social security taxes, while not involving a reduction in after-tax wages of unskilled workers, have a smaller effect on employment in the short run and negative effects on employment in the long run. These sobering results on budgetarily neutral tax reform follow from the negative impact of capital taxation on capital accumulation and the assumption that investment needs to meet a rate of return test on world capital markets, a reasonable assumption in the context of increasing capital market integration.

On the other hand, reductions in social security taxes **not** financed by a broad-based income tax generate powerful positive employment and income effects, and are self-financing in the long run. The finding of self-financing is also present in other recent work on the French economy, notably by Laffargue (1996). This finding is sensitive to the assumption that wages are not very responsive to unemployment—the simulations assume that a one point reduction in unemployment leads to an increase in wages of only 1 percent. With greater responsiveness of wages to unemployment (i.e., a less elastic surrogate labor supply), tax reform tends to contribute less to the budget. The possibility of a virtuous circle cannot, however, be dismissed: the elasticity estimate of 0.1 was obtained for a number of countries in empirical work by Blanchflower and Oswald and seems reasonable. One policy implication of the presence of self-financing is that it may be desirable to reduce the tax burden fairly quickly, subject to budgetary constraints.

The Simulation Model

1. Production and Labor Demand

Output, X, is a function of three factors of production, employment of skilled workers, L_s, employment of unskilled workers, L_u, and capital, K. A two-stage CES production function is adopted following EC (1994), which used the model to investigate the effect of a reduction in payroll tax financed by a tax on energy. The first stage CES function combines effective labor, L, with capital, K, to produce output, X. The second stage CES function combines skilled and unskilled labor, L_s and L_u, to produce effective labor, L.

$$X^{\rho 1}=\delta_l \cdot L^{\rho 1}+\delta_K \cdot K^{\rho 1} \qquad \text{first stage CES}$$

$$L^{\rho 2}=\delta_{ls} \cdot L_s^{\rho 2}+\delta_{lu} \cdot L_u^{\rho 2} \qquad \text{second stage CES}$$

Note that the formulation implies equal degrees of substitution between capital and different types of labor, which corresponds to the finding of Sneessens and Shadman-Mehta (1993) (the literature is not unanimous in this regard: Maurin and Parent (1993) find that substitution possibilities with capital are large for unskilled labor and small for skilled labor). Firms are assumed to maximize profits:

$$\Pi=X-\left(1+T_p\right)\cdot W_u \cdot L_u-\left(1+T_p\right)\cdot W_s \cdot L_s$$

Here Π represents profits. W_u and W_s are unskilled and skilled wages and T_p is the employer social security tax rate. The output price, wages, tax rates and the capital stock are taken as given. The output price is taken as the numeraire and set equal to one. The first-order conditions for profit maximization (the usual equality between factor costs and the value of marginal products) are:

$$\frac{\delta X}{\delta L_u}=\left(1+T_p\right)\cdot W_u \qquad \frac{\delta X}{\delta L_s}=\left(1+T_p\right)\cdot W_s$$

Substituting the expressions for marginal products from the CES production function and using the chain rule for differentiation one obtains the following labor demand functions:

$$\left(1+T_p\right)\cdot W_u=\delta_l \cdot \delta_{lu} \cdot X^{1-\rho 1} \cdot L^{\rho 1-\rho 2} \cdot L_u^{\rho 2-1}$$

$$\left(1+T_p\right)\cdot W_s=\delta_l \cdot \delta_{ls} \cdot X^{1-\rho 1} \cdot L^{\rho 1-\rho 2} \cdot L_s^{\rho 2-1}$$

2. Wage-formation

Wages of unskilled workers, W_u, are assumed to be fixed at the minimum wage. For skilled workers wage determination is modeled following the extensive literature on equilibrium wage curves developed in the 1980s according to which "labor market equilibrium [...] lies at the intersection of the derived labor demand curve with a surrogate labor supply curve that lies to the left of, and is flatter than, the true Marshallian labor supply curves" (Woodford (1992), p. 396, as quoted in Blanchflower and Oswald (1994)). Specifically, after-tax wages of skilled workers are assumed to be a positive function of the reservation wage--assumed to be equal to the (constant) after-tax unemployment benefit θ_s and a negative function of the unemployment rate of the skilled labor force, U_s:

$$W_s = \frac{S(\theta_s, U_s)}{(1 - T_n - T_{pe})}$$

where T_n and T_{pe} stand for income and employee social security tax rates respectively. The applicability of such a surrogate labor supply goes beyond economies characterized by a high degree of unionization and collective bargaining. A surrogate labor supply also obtains based on efficiency wages or implicit contract theory (see e.g. Phelps (1994b) and Blanchflower and Oswald (1994)). In the functioning of the model, this wage curve will take the role of the labor-supply curve in competitive models. Note that inelastic surrogate labor supply can be modeled by setting the unemployment elasticity of the wage at infinity.

The skilled and unskilled labor forces are assumed to be constant.

3. Government Budget

The budget surplus, BS, can be written (in simplified form) as follows:

$$BS = \left[T_n \cdot R \cdot K + (T_p + T_n + T_{pe}) \cdot BILL - \theta_u \cdot U_u - \theta_s \cdot U_s.\right]$$

where R represents the rate of return on capital, T_n represents the income tax rate, θ refers to the after-tax level of unemployment benefit, BILL refers to the wagebill, and U to the level of unemployment. Other components of the budget are not included as they are not affected by the variables in the model. The actual simulations will take into account differential tax rates for skilled and unskilled workers, as well as income from capital.

4. Investment

Investment I is assumed to be a positive function, g, of the ratio of the after-tax rate of return on capital to the foreign rate of return, R_f. Note that this is not a very restrictive formulation. Investment can be positive even if the foreign rate of return exceeds the domestic rate of return. The assumed functional form only implies that a larger the rate of return differential is associated with greater incentives for investment. Note also that investment and the capital stock are not formally linked. However, since the model only calculates results for the short and long run, not for intermediate points, consistency between investment and the capital stock is not affected.

$$I=g\cdot\left[\left(1-T_n\right)\cdot\frac{R}{R_f}\right]$$

5. Solution

The model is solved using the well-known logarithmic linearization (see Johansen (1960) for the first empirical implementation of general equilibrium models (using linearization) and van de Klundert (1984) for a more recent example). The equations are written in terms of deviations in percent change around an initial path. The deviations from this path are equal to zero, except following a disturbance, which here will take the form of changes in payroll and income taxes. All deviations can then be expressed in terms of the changes in payroll and income taxes.

In the notation which follows, all variables in lower case represent percent changes from the corresponding capitalized notation, with the exception of tax rates, t_n, t_p^e, and t_p, which represent point changes and the budget surplus, bs, which is expressed in percent of GDP.

The production function can be re-written in percentage change terms as follows, where λ's stand for production elasticities of various factors (the percent change in output corresponding to a one percentage change in the input). Given equality between factor costs and marginal products λ's also correspond to the share of factors in output.

$$x=\lambda_1\cdot l+\left(1-\lambda_1\right)\cdot k \qquad (1)$$

$$l=\frac{\lambda_s}{\lambda_1}\cdot l_s+\left(\frac{\lambda_1-\lambda_s}{\lambda_1}\right)\cdot l_u \qquad (2)$$

The percent change in factor demand can be expressed in terms of the elasticities of substitution between effective labor and capital, σ_1, and between skilled and unskilled labor, σ_2, noting that $\sigma_i=1/(1-\rho_i)$.

$$l_s=\frac{\sigma_2}{\sigma_1}\cdot x+\left(1-\frac{\sigma_2}{\sigma_1}\right)\cdot l-\sigma_2\cdot lc_s \qquad (3)$$

$$l_u = \frac{\sigma_2}{\sigma_1} \cdot x + \left(1 - \frac{\sigma_2}{\sigma_1}\right) \cdot l - \sigma_2 \cdot lc_u \qquad (4)$$

lc_s and lc_u stand for percent change in labor costs. These can in turn be expressed in function of their components:

$$lc_s = w_s + \frac{1}{1 + T_p} \cdot t_p \qquad (5)$$

$$lc_u = w_u + \frac{1}{1 + T_p} \cdot t_p \qquad (6)$$

The rate of return on capital corresponds to the part of output not paid out to other factors:

$$r = \frac{1}{1 - \lambda_1} \cdot x - \frac{\lambda_s}{1 - \lambda_1} \cdot (l_s + w_s) - \frac{(\lambda_1 - \lambda_s)}{1 - \lambda_1} \cdot (l_u + w_u) - k$$

Substituting the production function into this expression yields the factor price frontier:

$$r = \frac{\left[\lambda_s \cdot lc_s + (\lambda_1 - \lambda_s) \cdot lc_u\right]}{(-1 + \lambda_1)} \qquad (7)$$

In percentage change terms the investment equation can be written as follows, assuming a constant foreign rate of return:

$$i = \varepsilon \cdot \left(r - \frac{1}{1 - T_n} \cdot t_n\right) \qquad (8)$$

where ε is the elasticity of investment with respect to the rate of return.

The assumptions for wage determination of skilled workers and of a constant minimum wage applicable to unskilled workers translate into the following expressions:

$$w_s = -EUR_s \cdot \psi \cdot l_s + \left(\frac{1}{1 - T_n - T_{pe}}\right) \cdot (t_n + t_{pe}) \qquad (9)$$

$$w_u = 0 \qquad (10)$$

where ψ is the unemployment elasticity of the wage and EUR_s represents the ratio of employment to unemployment of skilled workers. Finally, the change in the government budget surplus (as a percent of GDP), bs, can be expressed in terms of changes in income tax and social security tax rates. Writing first in levels, and then taking first differences and expressing in percentage terms yields:

$$bs=\frac{\theta_u}{W_u}\cdot\left(\lambda_l-\lambda_s\right)\cdot l_u+\frac{\theta_s}{W_s}\cdot\lambda_s\cdot l_s+\left(1-\lambda_l\right)\cdot t_n+T_n\cdot\left(1-\lambda_l\right)\cdot(r+k)+\left(t_p+t_n+t_{pe}\right)\cdot\lambda_l$$

$$+\ \left(T_n+T_p+T_{pe}\right)\cdot\left[\left(\lambda_l-\lambda_s\right)\cdot\left(w_u+l_u\right)+\lambda_s\cdot\left(w_s+l_s\right)\right] \qquad (11)$$

Depending on the policy experiment, employer or employee social security tax rates are assumed unchanged:

$$t_p=0 \qquad \text{or} \qquad t_{pe}=0 \qquad (12)$$

This 12 equation model is then solved for the 14 variables, bs, t_n, t_p or t_{pe}, x, k, r, l, l_s, l_u, lc_s, lc_u, w_s, w_u, and i. The restriction i=0 in the long-run or k=0 in the short-run constitutes the 13th equation. The budget constraint, bs=0, or an assumption for some other tax rate (for non-balanced budget exercises) constitutes the 14th equation. Net-of-tax wages w_{snet} and w_{unet}, and labor incomes (which include income from unemployment benefits), in_s and in_u then follow readily. EUR represents the ratio of employment to unemployment.

$$w_{snet}=w_s-t_n\cdot\frac{1}{1-T_n-T_{pe}} \qquad w_{unet}=w_u-t_n\cdot\frac{1}{1-T_{pe}}$$

$$in_s=\frac{W_s\cdot\left(1-T_n-T_{pe}\right)\cdot EUR_s}{W_s\cdot\left(1-T_n-T_{pe}\right)\cdot EUR_s+\theta_s}\cdot\left(w_{snet}\right)+\frac{\left[W_s\cdot\left(1-T_n-T_{pe}\right)-\theta_s\right]\cdot EUR_s}{W_s\cdot\left(1-T_n-T_{pe}\right)\cdot EUR_s+\theta_s}\cdot l_s$$

$$in_u=\frac{W_u\cdot\left(1-T_{pe}\right)\cdot EUR_u}{W_u\cdot\left(1-T_{pe}\right)\cdot EUR_u+\theta_u}\cdot\left(w_{unet}\right)+\frac{\left[W_u\cdot\left(1-T_{pe}\right)-\theta_u\right]\cdot EUR_u}{W_u\cdot\left(1-T_{pe}\right)\cdot EUR_u+\theta_u}\cdot l_u$$

6. **Relevant Parameters**

Following EC (1994), it is assumed that total labor costs represent 67 percent of total costs, whereas the cost of unskilled labor (defined as the 3 bottom deciles) represents 16.8 percent of total labor costs. The elasticities of substitution are also from the same source, and are higher in the long-run than the short-run.

$\lambda_l=0.67$ Labor's share in total costs

$\lambda_s=(1-0.17)\cdot\lambda_l$	Share of skilled labor in total costs
$\sigma_1=0.49$ or 0.14	Elasticity of substitution between effective labor and capital
$\sigma_2=1.50$ or 0.43	Elasticity of substitution between skilled and unskilled labor

Tax rates and replacement rates are from Moghadam (1995). Replacement rates in the baseline scenario refer to those at initial stages of unemployment, as it is reasonable to assume that employment increases will draw on the short-term unemployed. Payroll tax rates are equal for skilled and unskilled workers. Only skilled workers and skilled unemployed pay income taxes. Income from capital is taxed at the average income tax rate.

$T_n=6.8$	Average income tax rate
$T_p=44.7$	Average employer social security tax rate
$T_{pe}=17.4$	Average employee social security tax rate
$\theta_s=0.6\cdot(1-T_n-T_{pe})\cdot W_s$	After-tax unemployment benefit level, skilled workers
$\theta_u=0.75\cdot(1-T_{pe})\cdot W_u$	After-tax unemployment benefit level, unskilled workers

Employment-unemployment ratios were calculated based on an assumption of an unemployment rate of 7 percent among the skilled and 16 percent among the unskilled, for a combined total of 10 percent. Corresponding to the estimate of Blanchflower and Oswald (1994), the elasticity of wages with respect to unemployment is assumed to be equal to - 0.1 (so that a 1 point increase in the unemployment rate leads to a 0.1 percent reduction in wages). For simplicity (as this has no consequence in the model), the elasticity of investment with respect to relative rates of return is assumed to be equal to 1.

$EUR_s=13.3$	Employment-unemployment ratio skilled workers
$EUR_u=5.3$	Employment-unemployment ratio unskilled workers
$\psi=-.1$	Elasticity of wages with respect to unemployment, skilled workers
$\varepsilon=1$	Elasticity of investment with respect to relative rates of return

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