Payroll versus Value Added Social Security Contributions: The Effect on Firms' Localisation Decisions

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1 Introduction

Shifting the the burden of social security contributions from labour compensation to value added corresponds to a reduction in the implicit tax rate on labour and an increase in the implicit tax rate on capital. In an open economy framework, this may not only lead to substitution between domestic factors of production but also to substitution of domestic factors of production for foreign factors. The present paper analyses the second type of substitution effects. More specifically, it analyses the impact of changes in the social security contributions regime on the localisation strategies of firms. In practice, it is possible to shift only part of the social security contributions from labour compensation to value added. To illustrate the mechanisms at work as clearly as possible and to provide an upper bound for the effects on the localisation strategies of firms, the present paper analyses the case where the entire social security contributions are shifted from labour compensation to value added.

The main results are as follows. The introduction of value added contributions (VAC) reduces the incentive to outsource the labour intensive stage of production to a low-wage foreign country but increases the incentive to outsource the capital intensive stage of production to a high wage country. Quantitatively the decrease in the incentive to outsource the labour intensive stage of production to a low-wage country is likely to be small: The wage differential between the low-wage country and the home country dwarves the social security contributions savings motive for outsourcing the labour intensive stage of production. However, the social security contributions savings motive may be quantitatively relevant for outsourcing the capital intensive stage of production given that under integrated capital markets the cost of capital does not differ significantly across industrialised countries.

The remainder of the paper first provides data from the French national accounts from 2004 to derive the revenue neutral VAC rate in Section 2. Section 3 sketches a simple partial equilibrium model of the outsourcing decision under imperfect competition: The outsourcing decision is modelled as potentially reducing unit costs which under imperfect competition results both in a reduction in prices and an increase in profit margins. Note that market entry induced by changes in profit margins

is not explicitly modelled so that the effects of changes in unit costs on profit margins derived below can be considered as an upper bound. Section 4 derives some partial equilibrium results and Section 5 provides orders of magnitude. Two digressions on the effects of the introduction of the VAC on the decision of outsourcing skilled / unskilled labour intensive stages of production to a foreign country in Section 6 are followed by the conclusions.

2 National Accounts

Shifting the tax base of employers' social security contributions from total compensation to gross value added modifies the implicit tax rates on labour and capital compensation. Table 1 illustrates this with French national accounts data for 2004, where data for non-financial and financial companies have been aggregated.

Table 1: French national accounts 2004 (in bn of euros)

	WC	**VAC**
Total labour compensation	579.7	521.1
... Gross wages received by employees	430.4	430.4
... Employers' payroll contributions	149.3	90.8
+ Total capital compensation	277.7	336.3
... Gross operating surplus	277.7	277.7
... Employers' capital contributions	0	58.6
= Gross value added at factor prices	857.4	857.4
Implicit tax rate on gross valued added (in %)	17.4	17.4
Implicit tax rate on total labour compensation (in %)	25.8	17.4
Implicit tax rate on total capital compensation (in %)	0	17.4
Implicit tax rate on gross value added net of social security contributions (in %)	21.1	21.1
Implicit tax rate on gross wages received by employees (in %)	34.7	21.1
Implicit tax rate on gross operating surplus (in %)	0	21.1

Note: Aggregate of financial and non-financial companies

Source: Insee, Tableau Economique d'Ensemble : Comptes Courants de l'Année 2004 base 2000

The left hand column shows the national accounts data and associated implicit tax rates on labour and capital compensation under the current regime (say the wage contributions or WC regime), where employers' social security contributions are levied on total compensation. The right hand column recalculates the national accounts data and implicit tax rates for the VAC regime assuming that (i) the tax base for all employers' social security contributions is shifted from total compensation to gross value added, (ii) the shift to the VAC regime is revenue neutral with respect to the WC regime and

(iii) gross wages received by employees are not affected by the shift from the WC regime to the VAC regime. In a nutshell, Table 1 illustrates that the shift from the WC to the VAC regime (i) reduces the implicit tax rate on labour (from 34.7 percent to 21.1 percent on gross wages received by employees) and (ii) increases the implicit tax rate on capital (from 0 percent to 21.1 percent on gross operating surplus). This insight serves as a basis for the following partial equilibrium model.

3 Model Setup

3.1 Production

Consider an industry in which each of a continuum of firms produces a variety i of a differentiated final good X. The unit cost function for a unit of variety i is assumed to be $c_i = (c_{I1})^{\lambda_i} (c_{I2})^{1-\lambda_i}$, where λ_i ϵ $(0, 1)$ and c_{I1} and c_{I2} denote the costs of the labour intensive and the capital intensive intermediate goods, respectively. Note that this unit cost function implies that the elasticity of unit cost with respect to the labour (capital) intensive intermediate good is constant and given by λ_i $(1 - \lambda_i)$. For instance, a 10 percent decrease in the cost of the labour intensive intermediate good results in a 6.7 percent decrease in unit costs for a firm with $\lambda_i = 0.67$. This property of the unit cost function is particularly sensible in the short term where substitution between the labour intensive and the capital intensive intermediate good is constrained by the production technology. In the long term, firms may adjust to changes in unit costs by adjusting their production technology. Since it is further assumed that intermediate good I_1 is produced with labour (L) alone and intermediate good I_2 is produced with capital (K) alone, λ_i is effectively a measure of labour intensity in the production of variety i and $1 - \lambda_i$ a measure of capital intensity.[1]

3.2 Demand

Demand for variety i of final good X is given by $x_i = Ap_i^{-\sigma}$, where x_i is the quantity, p_i is the price, A is a measure for the demand level, and σ is the demand elasticity.[2] It is assumed that the demand elasticity is constant and $\sigma > 1$. Even though the demand level is endogenous to industry X, firm i perceives it as exogenous since it is of negligible size relative to the industry.

[1] It is well known that under perfect competition the unit cost function $c_i = (c_{I1})^{\lambda_i} (c_{I2})^{1-\lambda_i}$ can be derived from a Cobb-Douglas production function and λ_i and $1 - \lambda_i$ can be interpreted as the revenue shares of labour and capital, respectively. Even though the interpretation of λ_i and $1 - \lambda_i$ is not valid under imperfect competition, λ_i will be approximated by the share of labour compensation in total value added in the empirical part of the present paper.

[2] It is well known that this form of demand function can be derived from a constant elasticity of substitution (CES) utility function. In this case $A \equiv E/\int_{i \in I} p_i^{1-\sigma} di$, where E is total spending on industry X and I is the set of available varieties.

3.3 Countries

There are two countries: Home (H) and Foreign (F). The modelling of F's economy is simplified by the following assumptions: Factor prices are assumed to be fixed exogenously and it is assumed that there is zero demand for good X. Both the final good X and the intermediate goods I_1 and I_2 can be shipped from one country to another. It is assumed that iceberg transport costs are given by δ_1 for the intermediate good I_1, by δ_2 for the intermediate good I_2, and by δ_X for the final good X.

3.4 Tax Policy

Policy makers have the choice between two different tax policy regimes to finance social security: Wage contributions (WC) and value added contributions (VAC). Under the WC regime the cost for the labour intensive intermediate good I_1 is given by $c_{I1} = \left(1 + t^{WC}\right) w$, where t^{WC} denotes the implicit tax rate on gross wages received by employees and w denotes gross wages. The cost for the capital intensive intermediate good I_1 is given by $c_{I2} = R$, where R denotes the cost of capital. Under the VAC regime the cost for the labour intensive intermediate good I_1 is given by $c_{I1} = \left(1 + t^{VAC}\right) w$ and the cost for the capital intensive intermediate good I_2 by $c_{I2} = \left(1 + t^{VAC}\right) R$, where t^{VAC} denotes the implicit tax rate on gross value added net of social security contributions. If the intermediate stages of production are performed within the boundaries of the firm, the tax paid by firm i under the WC and VAC regimes is given by $T_i^{WC} = t^{WC}\left(wI_{i1}\right)$ and $T_i^{VAC} = t^{VAC}\left(wI_{i1} + RI_{i2}\right)$, respectively. It is assumed that the transition from the WC regime to the VAC regime is revenue neutral. This implies

$$\begin{aligned} \sum_i T_i^{WC} &= \sum_i T_i^{VAC} \\ \iff \quad t^{VAC} &= \frac{\sum_i \left(wI_{i1}\right)}{\sum_i \left(wI_{i1} + RI_{i2}\right)} t^{WC} \equiv \kappa t^{WC}, \end{aligned}$$

where κ is the share of wages in gross value added net of social security contributions. Since $\kappa < 1$, $t^{VAC} < t^{WC}$. In other words, since the tax base of the VAC regime is larger than the tax base of the WC regime, it follows that the tax rate of the VAC regime is smaller than the tax rate of the WC regime.[3]

3.5 Firm Behaviour

3.5.1 Strategies

In principle, firms can choose from a set of eight locational strategies (permutations of LLL, where $L \epsilon \{H, F\}$. For the present analysis, it is focused on the following:

[3] From the French national accounts data for 2004 in Table 1 $\kappa = 0.61$.

HHH: I_1 in H, I_2 in H, X in H

FHH: I_1 in F, I_2 in H, X in H

HFH: I_1 in H, I_2 in F, X in H

FFF: I_1 in F, I_2 in F, X in F.

Note that in Section 4 it will be distinguished between a case where country F is a is a high wage country and a case where country F is a low wage country. Notation distinguishes between these cases by setting F=N for the high wage case and F=S for the low wage case.

3.5.2 Fixed Costs

Fixed costs associated to locational strategy L are denoted by f_L, where $L \in \{HHH, FHH, HFH, FFF\}$.

HHH: $f_{HHH} = 0$ (assume the firm has already paid the fixed cost of entering the northern market)

FHH: $f_{FHH} = f$

HFH: $f_{HFH} = f$

FFF: $f_{FFF} = g \geq f$

It is assumed that the level of fixed costs associated to strategy FFF is at least the level of fixed costs associated to strategies FHH and HFH, i.e., $g \geq f$. This can be justified by noting that strategies FHH and HFH are often implemented as arm's length transactions whereas strategy FFF often involves an actual investment. It should also be noted that the strategy FFH that is not further considered in the present analysis is empirically relevant: Some firms outsource both the labour and the capital intensive stages of production to foreign countries and maintain only headquarter activities or retail in the home country. This strategy corresponds to a simple combination of strategies FHH and HFH and does not yield any further insights into the effects of a change in the social security contributions regime on firms' localisation decisions: If FHH and HFH are both profitable localisation strategies for a HHH firm, it can be concluded that jointly adopting them, i.e., adopting FFH, is profitable as well.[4] This strategy is therefore not further considered.

3.5.3 Unit Costs

Each strategy has a unit cost associated to it. Unit costs under the WC and VAC tax regime are displayed in Table 2:

[4] A firm is characterised by λ_i. In the below analysis, there exists no λ_i for which both FHH and HFH are profitable. In other words, FFH is never a profitable strategy.

Table 2: Unit costs

	WC ($t^{WC} > 0$, $t^{VAC} = 0$)	VAC ($t^{WC} = 0$, $t^{VAC} > 0$)
HHH	$c_{HHH}^{WC} = \left(\tau^{WC} w_H\right)^{\lambda_i} R^{1-\lambda_i}$	$c_{HHH}^{VAC} = \tau^{VAC} w_H^{\lambda_i} R^{1-\lambda_i}$
FHH	$c_{FHH}^{WC} = \delta_1^{\lambda_i} R^{1-\lambda_i}$	$c_{FHH}^{VAC} = \delta_1^{\lambda_i} \left(\tau^{VAC} R\right)^{1-\lambda_i}$
HFH	$c_{HFH}^{WC} = \left(\tau^{WC} w_H\right)^{\lambda_i} (\delta_2 R)^{1-\lambda_i}$	$c_{HFH}^{VAC} = \left(\tau^{VAC} w_H\right)^{\lambda_i} (\delta_2 R)^{1-\lambda_i}$
FFF	$c_{FFF}^{WC} = \delta_X R^{1-\lambda_i}$	$c_{FFF}^{VAC} = \delta_X R^{1-\lambda_i}$

where w_H denotes home wages, $R = 1 + r$ denotes one plus the world interest rate (perfectly integrated capital markets), and $\tau^{WC} \equiv 1 + t^{WC}$ and $\tau^{VAC} \equiv 1 + t^{VAC}$. Note that foreign labour compensation (wages plus payroll taxes) are normalised to one.

3.5.4 Profit Maximisation

Operating profits net of fixed costs are given by $\pi_i^O = (p_i - c_i)x_i$ which in combination with the profit maximising price setting behaviour of firm i ($p_i = \frac{c_i}{\alpha}$, where $\alpha \equiv \frac{\sigma-1}{\sigma}$) yields the following expression for the maximised operating profits $\pi_i^O = B c_i^{1-\sigma}$, where $B \equiv \frac{\alpha^{\sigma-1}}{\sigma} A$. Note, firstly, that the introduction of the VAC affects operating profits only indirectly through changes in unit costs. The VAC does not directly surtax operating profits which are treated as a residual.[5] Note, secondly, that firms react to changes in unit costs by adjusting prices so that part of the change in unit costs from (i) changes in locational strategies or (ii) changes in the tax policy regime is absorbed by price changes instead of changes in profit margins.

4 Partial Equilibrium Results

The present partial equilibrium analysis considers the incentives of a firm that is currently carrying out its entire production activity in H (strategy HHH) to outsource its labour intensive stage of production to F (strategy FHH), to outsource its capital intensive production stage to F (strategy NFN), or to shift its entire production activity to F (strategy FFF). More specifically, the present partial equilibrium analysis evaluates a firm's incentive to adopt a locational strategy involving offshore production as a function of λ_i, i.e., its capital/labour intensity in production. Note that in the framework described above the elasticity of operating profits (net of fixed costs) with respect to unit costs is constant and given by $1 - \sigma$. The percentage change in operating profits (net of fixed costs) resulting from a change in unit costs can thus be written as

$$\frac{\Delta \pi_L^O}{\pi_{HHH}} = (1 - \sigma) \frac{\Delta c_L}{c_{HHH}}, \text{ where } L \in \{FHH, HFH, FFF\}.$$

[5] In the national accounts, gross value added is the sum of total compensation and gross operating surplus. In turn gross operating surplus consists of the pure cost of capital, depreciation and operating profits. However, the introduction of the VAC does not directly surtax operating profits since it increases pre-tax gross operating surplus by reducing total compensation.

The above framework is too specific in the sense that the absolute change in profits resulting from a change in unit costs depends on the absolute level of operating profits under locational strategy HHH, i.e., on π^O_{HHH} ($= \pi_{HHH}$ since the fixed costs associated to strategy HHH are zero). To simplify the analysis, the absolute level of profits of a firm that is currently carrying out its entire production activity in H is therefore normalised to 1 under both tax policy regimes.[6] Note that it is hereby abstracted from the issue that the introduction of the VAC may change operating profits under strategy HHH. This can be justified by the scope of the present paper: For the outsourcing decision the relevant variable is not *absolute* profits under strategy HHH but profits under strategy HHH *relative* to profits under strategies involving offshore production.Then, the percentage change in operating profits (net of fixed costs) is equal to the absolute change or

$$\Delta\pi^O_L = (1-\sigma)\,\frac{\Delta c_L}{c_{HHH}}, \text{ where } L \in \{FHH, HFH, FFF\}\,.$$

In its decision calculus, a firm weighs the change in unit costs and the associated increase in operating profits associated to the change in locational strategy against the fixed costs of changing locational strategy. Analysing a firm's choice between four locational strategies is an intractable task given the very general structure of transport and fixed costs laid out above. It is therefore necessary to restrict the parameter space. Firstly, it is assumed that $\delta_J < \tau^{VAC} w_H$, $J = 1, 2, X$. In other words, it is assumed that transport costs are in a moderate range so that locational strategies involving offshore production are potentially attractive for firms. Secondly, it is assumed that the transport cost for the capital intensive intermediate good is zero, i.e., that $\delta_2 = 1$. This can be justified by noting that capital intensive intermediate goods are often services that can be transported at zero cost. Since this is obviously not the case for all capital intensive intermediate goods, the following results on the outsourcing of the capital intensive stage of production should be interpreted as an upper bound. Straightforward algebra yields the following expressions for changes in operating profits (net of fixed costs) associated to changes in locational strategies under the WC and the VAC regime.

Table 3: Changes in operating profits (net of fixed costs)

	WC ($t^{WC} > 0$, $t^{VAC} = 0$)	VAC ($t^{WC} = 0$, $t^{VAC} > 0$)
$\Delta\pi^O_{FHH}$	$(1-\sigma)\left[\left(\frac{\delta_1}{\tau^{WC} w_H}\right)^{\lambda_i} - 1\right]$	$(1-\sigma)\left[\left(\frac{\delta_1}{\tau^{VAC} w_H}\right)^{\lambda_i} - 1\right]$
$\Delta\pi^O_{HFH}$	0	$(1-\sigma)\left[\left(\frac{1}{\tau^{VAC}}\right)^{1-\lambda_i} - 1\right]$
$\Delta\pi^O_{FFF}$	$(1-\sigma)\left[\frac{\delta_X}{(\tau^{WC} w_H)^{\lambda_i}} - 1\right]$	$(1-\sigma)\left[\left(\frac{\delta_X}{\tau^{VAC} w_H^{\lambda_i}}\right)^{1-\lambda_i} - 1\right]$

[6] A is a free parameter that can be indexed by the tax policy regimes WC and VAC and by the labour intensity parameter λ_i to normalise π_{HHH} to 1.

4.1 Case 1: Outsourcing to a Low-wage Country

Suppose the foreign country F is a low-wage southern country (S), i.e., $w_H > 1$.

4.1.1 Locational Strategies under the WC Regime

It can be seen from Table 2 that under the WC regime adoption of locational strategy HSH does not affect a firm's unit costs with respect to locational strategy HHH. This follows directly from the above assumptions: Under the assumption of perfectly integrated capital markets (equal R in H and F) and zero transport costs for the capital intensive intermediate good ($\delta_2 = 0$), outsourcing of the capital intensive stage of production to S does neither entail a unit cost advantage nor a unit cost disadvantage with respect to production in H. Since fixed costs of adopting locational strategy HSH are positive, it can therefore never be a profit maximising locational strategy for any firm under the WC regime. In other words, locational strategy NSN is strictly dominated by strategy HHH under the WC regime. The only locational strategies involving offshore production and potentially maximising profits are therefore given by SHH and SSS.

It can be shown that the attractiveness of locational strategies SHH and SSS increases with a firms' labour intensity of production. A profit maximising firm weighs the decrease in unit costs and the associated increase in profits resulting from offshore production against the increase in fixed costs. Only the firms with the largest decrease in unit costs effectively engage in offshore production. This is summarised in Result 1.

Result 1: *Under the WC regime, the (percentage) increase in operating profits from adopting SHH or SSS increases with λ_i, i.e., with the labour intensity of production. In the presence of fixed costs of offshore production, only the most labour intensive firms potentially adopt SHH or SSS.*

Proof: *See appendix.*

The choice between SHH and SSS depends on the transport cost for the labour intensive intermediate good relative to the transport cost for the final good, i.e., on the ratio δ_1/δ_X, and on the fixed costs associated to SHH relative to the fixed costs associated to SSS, i.e., on the ratio f/g. This is summarised in Result 2.

Result 2: *For $\delta_1/\delta_X \leq 1$, locational strategy SHH dominates locational strategy SSS. For $\delta_1/\delta_X > 1$, locational strategy SSS yields higher operating profits to the most labour intensive firms than locational strategy SNN. For high values of the ratio f/g, the most labour intensive firms therefore maximise their profits by adopting locational strategy SSS.*

Proof: *See appendix.*

4.1.2 Locational Strategies under the VAC Regime

It can be seen immediately from Table 3 that under the VAC regime adoption of locational strategy HSH increases a firm's operating profits with respect to locational strategy HHH. In other words, locational strategy HSH is a potentially profit maximising locational strategy under the VAC regime. It can further be shown that the increase in operating profits from adopting strategy HSH decreases with λ_i, i.e., it increases with the capital intensity of production. Since locational strategy HSH is associated with the fixed cost of offshore production f, only the most capital intensive firms potentially adopt this strategy. This summarised in Result 3.

Result 3: *Under the VAC regime the (percentage) increase in operating profits from adopting HSH increases with the capital intensity of production. In the presence of fixed costs of offshore production only the most capital intensive firms potentially adopt HSH.*

Proof: *See appendix.*

Note that Result 1 also holds under the VAC regime: The increase in operating profits from adopting locational strategies SHH or SSS increases with λ_i, i.e., with the labour intensity of production.[7]

4.1.3 The Effects of the Transition from the WC to the VAC Regime on Locational Strategies

It can be seen immediately from Table 3 that the introduction of the VAC reduces the attractiveness of SHH for all firms: Since $\tau^{VAC} < \tau^{WC}$ $\Delta\pi^{O}_{SHH}$ is necessarily larger under the WC than under VAC. Straightforward algebra further shows that the introduction of the VAC increases the attractiveness of SSS for the most capital intensive firms but reduces it for the most labour intensive firms.[8] Inspection of $\Delta\pi^{O}_{HFH}$ yields the insight that the introduction of the VAC increases the attractiveness of SHS for all firms. In combination with the observation that under the WC the adoption of strategy SHS does not change operating profits, Result 3 further implies that the increase in attractiveness is highest for the most capital intensive firms.

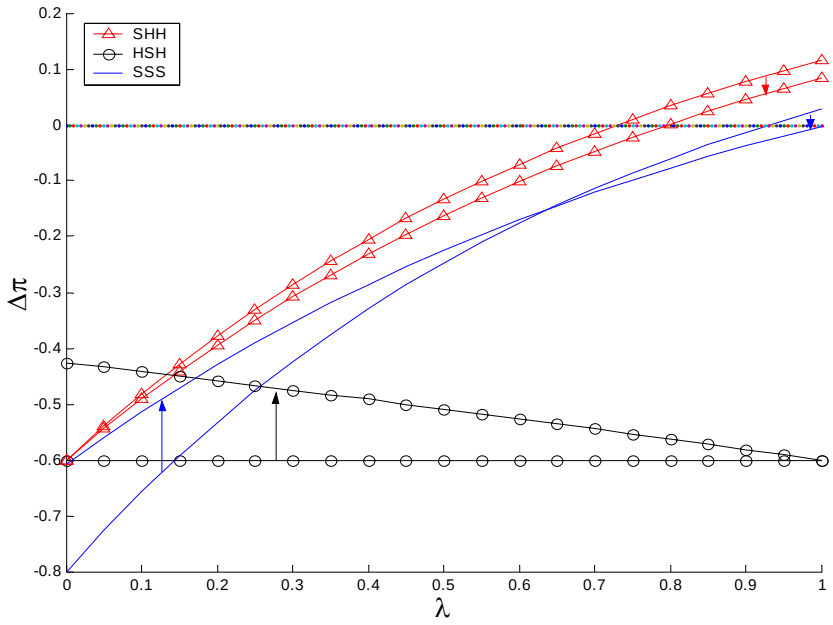
To sum up, locational strategies that involve the offshore production of the labour intensive stage of production become less attractive for labour intensive firms as a result of the introduction of the VAC. A smaller number of very labour intensive firms chooses to outsource the labour intensive stage of production to the south (SHH) or to shift the entire production process to the south (SSS). The intuition is that for these firms social security contributions under strategy HHH are lower under the VAC regime than under the WC regime. They only save the part of social security contributions levied on labour but not the part levied on capital. In contrast, locational strategies involving offshore

[7] See appendix.

[8] To see this, set $\left(\Delta\pi^{O}_{SSS}\right)^{WC} > \left(\Delta\pi^{O}_{SSS}\right)^{VAC}$ and plug in the expressions for $\Delta\pi^{OWC}_{SSS}$ and $\Delta\pi^{OWC}_{SSS}$. It follows immediately that $\left(\Delta\pi^{O}_{SSS}\right)^{WC} > \left(\Delta\pi^{O}_{SSS}\right)^{VAC} \Leftrightarrow \left(\tau^{WC}\right)^{\lambda} > \tau^{VAC}$ which is satisified for sufficiently high λ.

production of the capital intensive stage of production become more attractive for capital intensive firms as a result of the transition from the WC to the VAC. The most capital intensive firms may choose to outsource the capital intensive stage of production to the south while keeping the labour intensive stage of production and assembly in the north. The intuition is that outsourcing the capital intensive stage of production to the south allows them to avoid the VAC in the north. Additionally shifting the labour intensive stage of production and assembly to the south does not significantly reduce unit costs for the most capital intensive firms but increases their fixed costs. Note that for fixed costs f that ensure that only a small fraction of labour intensive firms outsource the labour intensive stage of production, the most capital intensive firms never adopt locational strategy HSN. The intuition is that the wage savings for the labour intensive firms from outsourcing the labour intensive stage of production to the south are large relative to the social security contributions savings for the capital intensive firms from outsourcing the capital intensive stage of production. Figure 1 illustrates this case.[9]

Figure 1: Outsourcing to a low-wage country



The introduction of the VAC leads to a clockwise rotation of the SHH curve so that the new SHH lies below the SHH curve under the WC. In other words, the profit change from adopting strategy SHH is lower under the VAC than under the WC for any λ_i. The SSS curve also rotates clockwise as

[9] $\delta_1 = 1.15$, $\delta_X = 1.1$, $f = 0.6$, $g = 0.7$, $\sigma = 2$, $t^{VAC} = 1.211$, $t^{WC} = 1.347$, $w_H = 3$.

a consequence of the introduction of the VAC but it lies above the SSS curve under the WC for the most capital intensive firms: Locational strategy SSS becomes more profitable for the most capital intensive firms while it becomes less profitable for the most labour intensive firms. But since locational strategy SSS is dominated by HSS for the parameter values chosen for Figure 1, no firm adopts this strategy under any regime. Finally, the introduction of the VAC leads to a clockwise rotation of the HSH curve so that it lies above the HSH curve under the WC for all λ_i. Even though under the VAC HSH dominates SHH and SSS for the most capital intensive firms, no firm adopts this strategy since the transition from HHH to HSH yields a negative profit change.

4.2 Case 2: Outsourcing to a High-wage Country

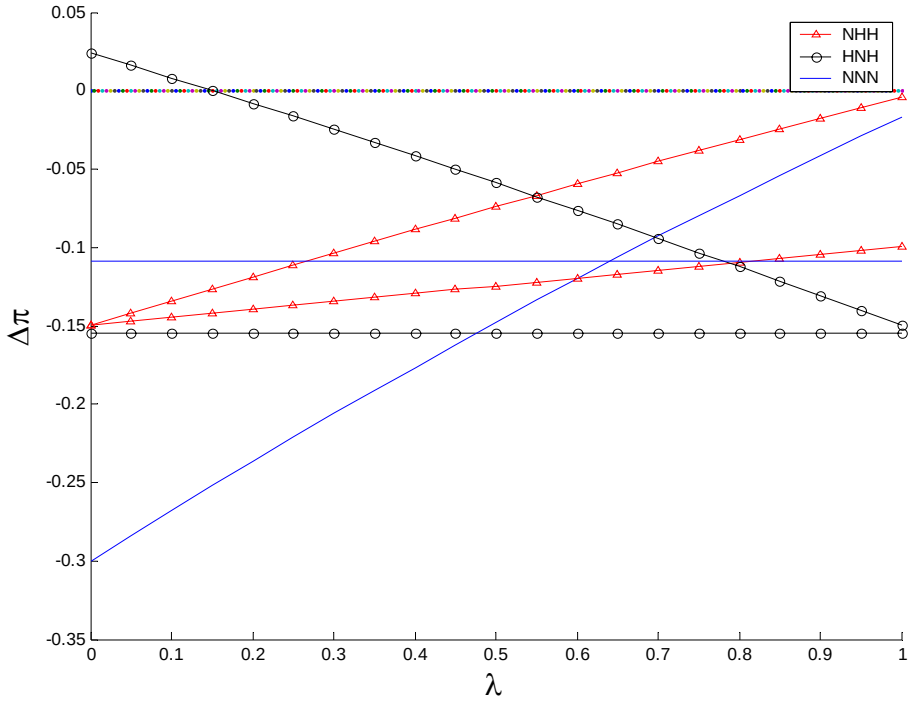
Suppose the foreign country F is a high-wage northern country (N), i.e., $w_H = 1$.

4.2.1 Locational Strategies under the WC Regime

Results 1 to 3 hold also for the case of outsourcing to a high-wage country. Since the only motive for outsourcing in this case are differences in social security contribution rates, there exists a range for f in which no firms outsources any stage of production under the WC regime but social security contributions savings make it profitable for the most capital intensive firms to outsource the capital intensive stage of production to the eastern country under the VAC. This case is depicted in Figure 2.[10]

[10] $\delta_1 = 1.15$, $\delta_X = 1.1$, $f = 0.1$, $g = 0.2$, $\sigma = 2$, $t^{VAC} = 1.211$, $t^{WC} = 1.347$, $w_H = 1$.

Figure 2: Outsourcing to a high-wage country



As in the case of outsourcing to a low-wage country depicted in Figure 1, the curves rotate clockwise. But while in Figure 1 the high level of fixed costs of offshore production f prevent HSH from becoming a profitable locational strategy, the lower fixed costs of offshore production in the case of a high-wage country make it profitable for the most capital intensive firms to outsource the capital intensive stage of production to the high wage country.

5 Orders of Magnitude

In a nutshell, the above partial equilibrium analysis shows that the introduction of the VAC may prevent firms in an interval of intermediate to high labour intensity either to outsource the labour intensive stage of production or to shift the entire production to the southern country. The most capital intensive firms may be induced to shift the capital intensive stage of production to the eastern country. The number of firms that change their locational strategy as a result of the introduction of the VAC depends, among others, on the capital distribution of western firms and the fixed costs associated to the different locational strategies. Even if the capital distribution were known, the unobservability of the fixed costs precludes the use of the present partial equilibrium analysis for quantitative predictions

on the number of firms changing their locational strategy.[11] However, the stylised partial equilibrium framework can be used to obtain an order of magnitude for the relative attractiveness of the different locational strategies under the WC and the VAC regimes. As shown in the partial equilibrium analysis, the attractiveness of locational strategies SHH and SSS relative to HHH under the WC and the VAC regimes is relevant for firms in an intermediate interval of intermediate to high labour intensity. The attractiveness of locational strategy HSH relative to HHH under the WC and the VAC regimes is relevant for the most capital intensive firms.

The fixed costs associated to the offshore locational strategies do not differ under the WC and the VAC regime. A measure for the relative attractiveness of the offshore locational strategies under the WC and the WAC regime can therefore be obtained by a comparison of operating profits net of fixed costs. More specifically, the measure

$$\phi_L = \Delta\pi_L^{VAC} - \Delta\pi_L^{WC}, \text{ where } L \in \{FHH, HFH, FFF\}$$

denotes the additional increase in operating profits net of fixed costs of adopting offshore locational strategy L under the VAC regime with respect to adopting L under the WC regime (in percentage points). Substitution of $\Delta\pi_L^{VAC}$ and $\Delta\pi_L^{WC}$ from Table 3 results in complicated nonlinear expressions. The present section therefore only reports orders of magnitude for the relative attractiveness of the offshore locational strategies under the WC and the VAC regime for specific parameter values.

Consider firstly the relative attractiveness of locational strategy SHH under the WC and the VAC regime. As shown in the previous section, the introduction of the VAC may induce firms in an interval of intermediate to high labour intensity to maintain the entire production in the home country instead of outsourcing the labour intensive stage of production to the southern country under the WC. Table 4 reports the value of ϕ_{SHH} for different constellations of the labour intensity parameter λ_i and the wage differential parameter w_H. Note that according to DGTPE (2006)[12] the most capital intensive sector in France is construction with a share of labour compensation in total value added of 78 percent, i.e., $\lambda_i = 0.78$. Further note that Polish wages are about one fifth of French wages, i.e., $w_H = 5$. The other parameter values are chosen as follows. τ^{WC} is one plus the current implicit tax rate on gross wage received by employees derived from the French national accounts for 2004 in Table 1, i.e., $\tau^{WC} = 1.347$. Similarly, τ^{VAC} is the revenue neutral value added tax derived from the French national accounts for 2004 in Table 1, i.e., $\tau^{VAC} = 1.211$. Following Malinvaud (1998)[13] the short-term demand elasticity is assumed to be given by $\sigma = 2$. The iceberg transport cost for the labour intensive intermediate good is assumed to be given by $\delta_1 = 1.1$. Note that δ_1 simply scales the labour cost advantage of the southern

[11] Moreover, the model is too stylised to allow quantitative predictions. In reality, the trade-off between lower unit costs and higher fixed costs is not the only variable entering the locational decision calculus (e.g., institutional factors, country risk, market access).

[12] See DGTPE (2006), 'Le poids du facteur travail dans la VA : une analyse descriptive selon le secteur d'activité et la taille de l'entreprise,' Direction Générale du Trésor et de la Politique Economique, Paris.

[13] See Malinvaud, E. (1998), 'Les cotisations sociales à la charge des employeurs: analyse économique,' Rapport au Conseil d'Analyse Economique, Paris.

country: For high iceberg transportation costs for the labour intensive intermediate good, the labour cost advantage of the southern country becomes smaller.

Table 4: Change in the relative attractiveness of SHH induced by VAC (in %)

w_H / λ_i	2	3	4	5	10
0.66	-4.17	-3.18	-2.63	-2.26	-1.43
0.7	-4.26	-3.21	-2.62	-2.24	-1.38
0.8	-4.5	-3.25	-2.58	-2.16	-1.24
0.9	-4.67	-3.24	-2.5	-2.05	-1.1
1	-4.79	-3.2	-2.4	-1.92	-0.96

Note, firstly, that the absolute value of ϕ_{SHH} decreases with w_H. The intuition is that for labour intensive firms the wage differential between the north and the south dwarves the social security contributions rate as a motive for outsourcing the labour intensive stage of production to the south. Note, secondly, that for high values of the wage differential parameter w_H the decrease in the relative attractiveness of strategy SNN induced by the introduction of the VAC is less pronounced for the firms with the highest labour intensity than for the firms in an intermediate to high interval of labour intensity. The intuition is similar to the one for the negative relation between ϕ_{SHH} and w_H. The higher the wage differential between the north and the south, the higher the weight of the wage savings motive relative to the social security contributions savings motive in the HHH versus SHH decision. For sufficiently high values of the wage differential, the wage savings motive dominates the social security contributions savings motive while the social security contributions savings motive dominates the wage savings motive for sufficiently low values of the wage differential. In the region where the wage savings motive dominates the social security contributions savings motive ($w_H \geq 4$ in Table 4) the decrease in the relative attractiveness of strategy SNN induced by the introduction of the VAC is less pronounced for the most capital intensive firms: Even though in absolute terms they benefit from the largest social security savings, these savings are small relative to their wage savings. In the region where the social security contributions savings motive dominates the wage savings motive ($w_H = 2$ in Table 4) the decrease in the relative attractiveness of strategy SNN induced by the introduction of the VAC is more pronounced for the most capital intensive firms: They benefit from both the largest social security contributions savings and from the largest wage savings but, in contrast to the the case of a high value of the wage differential, the social security contributions savings are also large relative to the wage savings.

Consider secondly the relative attractiveness of locational strategy SSS under the WC and the VAC regime. Note, firstly, that the absolute value of ϕ_{SHH} decreases with w_H. The intuition is as for locational strategy SHH: For labour intensive firms the wage differential between the north and the south dwarves the social security contributions rate as a motive for outsourcing the labour intensive

stage of production. Note, secondly, that the decrease in ϕ_{SHH} is more pronounced for the most labour intensive firms than for the firms in an intermediate to high interval of labour intensity. The intuition is that under the WC regime the labour intensive firms adopt locational strategy SSS both to take advantage of lower wages and to avoid the payment of social security contributions levied on wages. The introduction of the VAC does not modify the first determinant of the SSS versus NNN decision but modifies the second: For firms in an intermediate to high interval of labour intensity that maintain HHH the reduction in social security contributions levied on wages is partly compensated by an increase in social security contributions levied on capital. In contrast, the most labour intensive firms that maintain HHH benefit fully from the reduction of the social security contributions rate levied on labour. Hence, the introduction of the VAC reduces the incentive to shift all production to the south for the firms in an intermediate to high interval of labour intensity by less than for the most labour intensive firms.[14]

[14]Note that $\delta_X = 1.15$ and the remaining parameter values are as in Table **XXX**.

Table 5: Change in the relative attractiveness of SSS induced by VAC (in %)

w_H / λ_i	2	3	4	5	10
0.66	-0.41	-0.31	-0.26	-0.22	-0.14
0.7	-0.95	-0.71	-0.58	-0.5	-0.31
0.8	-2.39	-1.73	-1.37	-1.15	-0.66
0.9	-3.59	-2.49	-1.92	-1.57	-0.84
1	-4.59	-3.06	-2.29	-1.83	-0.92

Consider thirdly the relative attractiveness of locational strategy HNH under the WC and the VAC regime. As shown in the previous section, the introduction of the VAC may induce the most capital intensive firms to outsource the capital intensive stage of production to the eastern country instead of maintaining the entire production in the home country. Table 6 reports the value of ϕ_{HNH} for different constellations of the labour intensity parameter λ_i and the value added contributions rate τ^{VAC}. Note that according to DGTPE (2006) the most capital intensive sector is finance with share of labour in total value added of 46 percent, i.e., $\lambda_i = 0.46$.[15]

Table 6: Change in the relative attractiveness of HNH induced by VAC (in %)

τ^{VAC} / λ_i	1.1	1.15	1.2	1.211	1.25
0.2	7.34	10.58	13.57	14.2	16.35
0.3	6.45	9.32	11.98	12.54	14.46
0.4	5.56	8.04	10.36	10.85	12.53
0.5	4.65	6.75	8.71	9.13	10.56
0.6	3.74	5.44	7.03	7.37	8.54

Note, firstly, that the absolute value of ϕ_{HNH} decreases with λ_i and increases with τ^{VAC}. Note secondly, that in general the increase in ϕ_{HNH} is larger than the decrease in ϕ_{SHH}. For instance, at $\tau^{VAC} = 1.211$ and $\lambda_i = 0.4$, the introduction of the VAC increases the incentive to outsource the capital intensive stage of production by 10.85 percentage points while at $w_H = 5$ and $\lambda_i = 0.8$, the introduction of the VAC reduces the incentive to outsource the labour intensive stage of production by 2.16 percentage points. The intuition is that beside the fixed costs associated to HNH and SHH the VAC rate is the only determinant of the attractiveness of HNH while for SHH it is outweighed by the wage differential between the north and the south.

[15] Note that ϕ_{HEH} is independent of τ^{WC} and that the other parameter values are fixed at $w_H = 1$, $\sigma = 2$.

6 Two Digressions

6.1 Unskilled and Skilled Labour

Note that under the present French social security contributions regime employers benefit from reduced social security contributions for employees below a wage threshold. These employees can be thought of as unskilled labour. In the event that the VAC does not maintain this wage threshold, its introduction effectively corresponds to an increase in the social security contributions tax rate for unskilled labour and a decrease for skilled labour. According the French national accounts data for 2004 from Table 1, the social security tax rate on skilled labour would decrease from 34.7 to 21.1 percent and the the social security tax rate on unskilled labour would increase from 0 to 21.1 percent assuming for simplicity that employers are exempted from social security contributions for unskilled labour. This case can be analysed by interpreting the intermediate good I_1 in the above model as skilled labour and intermediate good I_2 as unskilled labour. The analysis is similar to the one in Section 4 in the sense that the introduction of the VAC reduces the incentive to outsource I_1 and increases the incentive to outsource I_2 to the foreign country. In contrast to the analysis in Section 4, however, prices of both factors differ between the home country and the foreign country: It is assumed that the level wages of both skilled and unskilled labour in the home country is at least equal to or higher than in the foreign country but that the wage differential is smaller for skilled labour than for unskilled labour. Under these assumptions, the wage savings motive may dominate the social security contributions motive for outsourcing the unskilled intensive stage of production to the foreign country but not for outsourcing the skilled intensive stage of production. In other words, the increase in the incentive to outsource the unskilled intensive stage of production to the foreign country induced by the introduction of the VAC may be smaller than the decrease in the incentive to outsource the skilled intensive stage of production.

In the model of Section 3 this intuition is only valid when the factor by which the wage differential for unskilled labour exceeds the wage differential for skilled labour.is large. Table 7 illustrates this for specific parameter values.[16]

[16] $\sigma = 2$, $\delta_1 = 1$, $\delta_2 = 1.15$, $\tau^{WC} = 1.347$, $\tau^{WC} = 1.211$ and the wage differential for skilled labour is normalised to one.

Table 7: Decrease in incentive for skilled intensive relative to increase in unskilled intensive outsourcing

Ratio unskilled/skilled wage differential (Un-)skilled intensity	2	3	4	5	10
0.6	0.77	0.98	1.17	1.33	2.02
0.66	0.8	1.04	1.27	1.47	2.34
0.7	0.81	1.08	1.32	1.54	2.51
0.8	0.86	1.19	1.5	1.79	3.11
0.9	0.91	1.31	1.69	2.07	3.86

For the parameter values displayed in Table 7, the above intuition is only valid if the wage differential for unskilled labour exceeds the wage differential for skilled labour by at least a factor of 3. In other words, only for large values of the ratio of the unskilled wage differential to the skilled wage differential, the introduction of the VAC reduces the incentive to outsource the skilled intensive stage of production by more than it increases the incentive to outsource the unskilled stage of production.

6.2 Capital and Skilled Labour

Together, the analysis in Sections 5 and 6.1. indicates that the introduction of the VAC may increase firms' incentives to outsource the capital intensive stage of production while it may reduce their incentives to outsource the skilled intensive stage of production. The analysis is, in principle, similar to the one in Section 4 if intermediate good I_1 is interpreted as skilled labour and intermediate good I_2 as capital. However, it should be noted that skilled labour and capital are often tied together by a high degree of complementarity: For instance, researchers (skilled labour) depend on laboratories (capital) to carry out their work. While the lesser degree of complementarity between unskilled labour and capital allows the fragmentation of the production process into an unskilled labour intensive stage and a capital intensive stage, this is not necessarily the case for skilled labour and capital. Instead, the increase in the incentive to outsource the capital intensive stage of production induced by the VAC may entail the outsourcing of the skilled labour intensive stage of production even though the social security contributions rate on skilled labour is effectively reduced: For instance, a firm that faces a reduced rate of social security contributions for its researchers but an increased tax rate on its laboratory may choose to locate both its reasearchers and the laboratory abroad due to the complementarity between skilled labour and capital. Since the above model assumes the fragmentability of the production process, it is not the appropriate model to analyse the case of complementarity between skilled labour and capital since a high degree of complementarity implies that there is a high cost of fragmenting the production process internationally. Nonetheless, it is possible to conclude that a high degree of complementarity between skilled labour and capital dampens both the decrease in incentive to outsource the skilled labour intensive stage of production and the increase to outsource the capital

intensive stage of production even without a formal analysis in the framework of the above model.

7 Conclusions

The above analysis indicates that in an open economy framework in which firms can choose between localising all production in the home country, outsourcing either the labour intensive or the capital intensive stage of production or shifting all production to a foreign country, the introduction of the VAC is likely to (i) prevent some firms in an intermediate to high interval of labour intensity from outsourcing the labour intensive stage of production to the south but this effect is likely to be small for realistic parameter constellations, (ii) induce some very capital intensive firms to outsource the capital intensive stage of production to the north and this effect may be sizeable for realistic parameter constellations. Together these effects are likely to erode the tax base for the VAC which may constrain the government to either increase the VAC rate and thus to induce more very capital intensive firms to outsource the capital intensive stage of production to the north or to reverse the reform and re-introduce the WC regime.

A Proof of Result 1

Note (1) that partial differentiation of $\Delta\pi^O_{SHH}$ and $\Delta\pi^O_{SSS}$ yields $\partial\left(\Delta\pi^O_{SHH}\right)/\partial\lambda_i = \underbrace{(1-\sigma)}_{<0} \underbrace{\left(\frac{\delta_1}{\tau^{WC}w_H}\right)^{\lambda_i}}_{>0} \underbrace{\ln\left(\frac{\delta_1}{\tau^{WC}w_H}\right)}_{<0} > 0$ and $\partial\left(\Delta\pi^O_{SSS}\right)/\partial\lambda_i = \underbrace{(1-\sigma)}_{<0} \underbrace{\frac{\delta_X}{\left(\tau^{WC}w_H\right)^{\lambda_i}}}_{>0} \underbrace{\ln\left(\frac{1}{\tau^{WC}w_H}\right)}_{<0} > 0$. Note (2) that at $\lambda_i = 0$ $\Delta\pi^O_{SHH} = 0$ and $\Delta\pi^O_{SSS} < 0$. For SHH or SSS to be a profit maximising locational strategy, $\Delta\pi^O_{SHH} - f > 0$ or $\Delta\pi^O_{SSS} - g > 0$ must be satisfied, respectively. From (1) and (2) it follows that only the most labour intensive firms potentially maximise their profits by choosing SHH or SSS.

B Proof of Result 2

Straightforward algebra yields $\Delta\pi^O_{SHH} > \Delta\pi^O_{SSS} \Leftrightarrow \delta_1^{\lambda_i}/\delta_X < 1$. It follows immediately that for $\delta_1/\delta_X \leq 1$, $\Delta\pi^O_{SHH} > \Delta\pi^O_{SSS}$. From $f < g$, it follows that locational strategy SNN dominates locational strategy SSS for $\delta_1/\delta_X \leq 1$. For $\delta_1/\delta_X > 1$, $\Delta\pi^O_{SHH} < \Delta\pi^O_{SSS}$ for the most labour intensive

firms. It follows that for f/g sufficiently close to 1, the most labour intensive firms maximise their profits by adopting SSS.

C Proof of Result 3

Note (1) that partial differentiation of $\Delta\pi^O_{HSH}$ results in $\partial\left(\Delta\pi^O_{HSH}\right)/\partial\lambda_i = \underbrace{(\sigma-1)}_{>0}\ \underbrace{\left(\frac{1}{\tau^{VAC}}\right)^{1-\lambda_i}}_{>0}$ $\underbrace{\ln\left(\frac{1}{\tau^{VAC}}\right)}_{<0} < 0$. Note (2) that at $\lambda_i = 1$ $\Delta\pi^O_{HSH} = 0$. For HSH to be a profit maximising strategy $\Delta\pi^O_{HSH} - f > 0$. From (1) and (2) it follows that only the most capital intensive firms potentially maximise their profits by choosing HSH.

D Proof that Result 1 holds under VAC

Partial differentiation of $\Delta\pi^O_{SHH}$ yields $\partial\left(\Delta\pi^O_{SHH}\right)/\partial\lambda_i = \underbrace{(1-\sigma)}_{<0}\ \underbrace{\left(\frac{\delta_1}{\tau^{VAC}w_H}\right)^{\lambda_i}}_{>0}$ $\underbrace{\ln\left(\frac{\delta_1}{\tau^{VAC}w_H}\right)}_{<0} > 0$. Partial differentiation of $\Delta\pi^O_{SSS}$ yields $\partial\left(\Delta\pi^O_{SSS}\right)/\partial\lambda_i = \underbrace{(1-\sigma)}_{<0}$ $\underbrace{\left(\frac{1}{\tau^{VAC}w_H^{\lambda_i}}\right)^{1-\lambda_i}}_{>0}$ $\underbrace{\ln\left(\frac{\delta_X}{\tau^{VAC}w_H}\right)}_{<0} > 0.$