Simulating the Impact on Family Welfare of a Tax Regime Shift:

Individual Taxation to Income Splitting

by

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We accept this honours thesis as conforming
to the required standard

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Abstract

In this paper, I use Gugl's model of the household to analyze the effects of a tax regime shift on family welfare and behaviour. This regime shift is from the current system used in Canada of individual taxation to income splitting or to joint taxation. I show that there are positive effects on the household; however, there may be negative effects on individuals. I find an approach to achieve revenue neutrality with a shift to income splitting where there are two separate tax schedules for households and individuals, and discuss the impacts on output and household production.

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1. Introduction

In this paper, I look at the effect on household behaviour, and welfare, when there is a tax regime shift to income splitting or to joint taxation from the current system of individual taxation. Canada has a system of pension income splitting for retired spouses, however; non-retired spouses are taxed individually. There has been support by Canadian groups for income splitting to be expanded to non-retired couples. Is this a good thing, and what impacts may this expansion have?

It is important to look at the impact of tax policy in relation to families. Families comprise a large part of the population, and clearly are affected by changes in net income. Nelson (1996) claims that a shift to income splitting would necessarily hurt the low earning spouse, generally the wife. Is this actually the case, when applied to Gugl's (2009) model of the household?

I show that there are positive welfare effects on households when there is a shift to income splitting by simulating the regime change on Gugl's model. In some cases, the low earning spouse is hurt; however, this is only in few cases. Using this approach, I explore three areas. Firstly, I ensure that the predicted outcomes of the model are borne out, with respect to Gugl's own propositions, and Kesselman's (2008) expected outcomes. Secondly, I explore possible approaches to achieving a revenue neutral tax shift to pure income splitting. Lastly, I discuss the

possible impacts on national output and household production. I carry out the first and third areas with respect to a shift to pure income splitting, and to joint taxation.

Throughout this paper, I refer to the primary wage earner and secondary wage earner as husband and wife, respectively. Also, I use household and family interchangeably, and mean households comprising of two spouses capable of engaging in wage earning activities.

I begin by reviewing related literature. Following this, there are some key definitions and concepts. I will introduce the model and simulation approach, and follow this with results and brief conclusion.

2. Related Literature

The literature for models of the household is rich. I review the key aspects of this literature relating to this paper below when discussing the model.

The literature on the appropriate tax policy for households is vast. Munnell (1980) explains that there are three principles of taxation: equal taxation of couples with equal incomes, marriage neutrality, and progressivity. She indicates that these three principles cannot be applied at the same time, and argues that the unit of taxation should be the individual, and not the household, possibly with some allowances for scale economies.

Apps and Rees (1999) argue that the individual should be the unit of taxation applicable to couples. The authors use a model incorporating household production, private consumption and leisure, and assume that resources are allocated efficiently in the household. Apps and Rees (2007) approach the problem of the optimal unit of taxation using a different model. The

authors introduce household production into the Boskin and Sheshinski model. It is concluded that, under a linear tax system, it may be appropriate to tax men and women separately, with two distinct tax schedules. Both of these papers from Apps and Rees judge the appropriate unit of taxation an efficiency grounds.

From an empirical perspective, Crossley and Jeon (2006) analyze the impact of a tax policy change in Canada. In 1988, the spousal tax deduction (given to the primary wage earner) was replaced by a tax credit applied to the secondary wage earner. The authors find that there was increased labour force participation by women after the change. This change in policy decreased the effective tax rate on the wife's first dollar of earning, providing an incentive to engage in wage earning activities.

The survey paper by Kesselman discusses the appropriate unit of taxation for Canada, and provides insight into the approach taken by many Western countries. This will be reviewed in depth later in this paper.

It is difficult to find a natural experiment that can be used to analyze the impact of a tax regime change. This has given rise to the application of simulating impacts of changes. Feenberg and Rosen (1980) simulate the effects of family tax reforms on income distribution, government revenue and labour supply. Using a unitary model, the authors find (not surprisingly) that government revenues decrease when the unit of taxation moves from the individual to the household under pure income splitting. Additionally, the authors find that when this change occurs, there is increased specialization (husbands work more and wives work less).

Van Soest and Das (2001) simulate the labour supply effects of a change in tax policy in the Netherlands. The authors use a one period neo-classical model of labour supply, and that the household jointly maximizes one representative utility function. When there is a change from a tax free amount (an income range over which the marginal tax rate is zero) to lower marginal tax rates (with the abolishment of the tax free amount), the authors conclude that, on aggregate, hours worked by wives would increase, however; wives' labour force participation rates would decrease. This is attributed to shift from part time labour to full time labour or to withdrawing from the labour force.

The case of Germany is discussed by Steiner and Wrohlich (2004), where the effects of a change from pure income splitting (currently used in Germany) to limited real income splitting and to individual taxation are considered. Using a household utility function with leisure and income, the authors find that there would be a positive labour supply effects for wives when these changes occur. The changes would be more pronounced when there is a shift to taxing the individual.

3. Kesselman's Definitions

Kesselman explains four possible policies for taxing a household, and the expected outcomes with respect to labour supply decisions and income. He discusses the concepts of horizontal and vertical equity, OECD countries' tax practices, and the tax policies of non-wage income. I abstract from the non-wage analysis, and focus solely on labour income. A description of the possible income tax policies, and their expected outcomes, and equity considerations follow.

Horizontal equity applies to the treatment of equals, and vertical equity is concerned with the treatment of inequals. While these are simple concepts, it is not simple to practically implement tax policies that adhere to them (Bittker, 1980). Kesselman notes that a common problem regarding horizontal equity is the decision regarding how to measure individuals. He indicates that the ideal unit of measurement of equals should be utility, but notes that utility is hard to measure (if not impossible), and so income is used as a proxy for relative station of the individual. Three concepts proposed to look at the problems of measuring horizontal equity relate to: family size, preferences regarding labour supplies, and availability of tax-avoidance opportunities.

Regarding family size, adult equivalence (AE) measures are used. AE accounts for the scale economies found in the household. Preferences regarding labour supplies are not currently evaluated when reporting income (dollars earned is the measure, not hours worked). These considerations about horizontal equity are built into my analysis, as the model allows for AE changes, and spousal work preferences (through differing utility functions). I abstract from looking at tax avoidance opportunities.

Vertical equity is treated as secondary to horizontal equity. When a tax proposal would impact both horizontal equity and vertical equity, Kesselman advocates that, "the ideal response is to pursue horizontal equity and to adjust the ... tax rate schedule to restore the ideal degree of vertical equity (p.7)." It can be inferred from this that the problems with vertical inequity are simpler to deal with, and I assume this to be true.

The four possible approaches to taxing couples are: individual taxation, income splitting, joint taxation, and aggregation. There are three characteristics that I measure for each approach. They are marriage bonuses and penalties, and secondary wage earner disincentives to labour force participation. Marriage bonuses are defined as the household tax liability decreases under a given tax regime, compared to the base case of individual taxation. Marriage penalties, conversely, are the household tax liability increases under a given tax regime, compared to the same base case.

Individual taxation treats each spouse as if he or she were not married. Each individual is taxed at the marginal tax rate according to his or her own earnings. This simple approach is considered the benchmark case for all of my analysis, as it is straightforward, and the system currently used in Canada. There are no marriage penalties or bonuses, and no work disincentives (there is no change!).

Income splitting is a form of joint taxation, where the household is treated as if there were no scale economies (AE=2 for a household of 2 earners). In this case, the average household income is applied to the tax schedule, and the marginal tax rate is determined. There are marriage bonuses only. At no income level will the household tax burden increase. The marginal tax rate for the wife may increase, but the marginal tax rate for the primary earner will never increase. Because of this possible higher marginal tax rate for the wife, it is argued that there will be labour force disincentives: the marginal benefit of entering (or increasing participation in) the labour market is at most the same, as under individual taxation.

Joint taxation is an approach that allows for scale economies in the household (1<AE<2). The sum of household income is scaled by the inverse of the AE factor, and then the marginal tax rate is determined from the tax schedule. In this case, there are marriage penalties and marriage bonuses. Marriage bonuses are likely to occur when there is a significant gap between earnings of spouses. It is clear that marriage penalties are most likely to occur when each spouse earns within the same tax band. Marriage penalties offer an additional disincentive to engage in wage earning activities for wives.

A policy of full aggregation is based on the principle that there are infinite scale economies (AE=1). The sum of household income is applied to the tax schedule to determine the marginal tax rate, absent of scaling. This approach achieves marriage penalties or no change at all, and is the opposite of pure income splitting. There are even greater disincentives for the secondary wage earner to engage in wage earning activities. I do not look at full aggregation in this paper. The table below summarizes these approaches.

Summaries of household tax approaches and outcomes

Tax policy	Marriage penalty	Marriage bonus	Secondary wage earner disincentives
Individual	NO	NO	NO
Pure splitting	NO	YES	YES
Joint	YES	YES	YES
Aggregation	YES	NO	YES

Table 1. Adapted from Kesselman (2008).

4. The Model

4.1 Related Literature

The Gugl model used in this paper is a dynamic family bargaining model with a divorce threatpoint. The model is chosen for a number of factors. Contrasting this model's characteristics to other models of the household highlights these factors. The unitary model, as pioneered by Becker (1974), allows for analysis of household utility, as it assumes one representative utility function for the household. From this, a change in tax regime to income splitting would increase household utility. The limitation to this approach lies in the analysis of intra family effects such as the distribution of utility changes to each spouse.

In contrast to the unitary model, bargaining models were introduced to the analysis of the household by Manser and Brown (1980). Manser and Brown's static model allowed for the analysis of intra-household behaviour and specified separate utility functions for the agents in the household. This approach incorporated private consumption, leisure and a parameter that represented the compatibility of each individual (in order to show the effects of married and non-married people).

Another model of the household was introduced in Chiappori (1992). This static model allowed for individual utility functions (similarly to family bargaining models) which are dependent on private consumption and leisure. The fundamental outcome of this approach is to indicate that regardless of how decisions are made within the household, these decisions are Pareto efficient.

Dynamic bargaining models of the household are a more recent development. Gugl's model shares with other models it's two period structure. Similar to Konrad and Lommerud (2000) and Lundberg and Pollak (2003), first period decisions are made independently. There is no bargaining in the first period for spouses. Konrad and Lommerud have individuals making education choices (human capital accumulation determining wages) in the first period. Lundberg and Pollak have each agent choose independently in the first period and recognize that these decisions affect the next period's outcome, either divorce or cooperation. It is recognized that independent first period choices may lead to inefficient future period outcomes, as efficiency is contingent on there being binding agreements.

Similar to Bolin, Jacobson and Lindgren (2001), Gugl's model has each agent negotiating from a divorce (non-cooperative) threatpoint when making second period decisions. A change, therefore, in the divorce threatpoint leads to different second period bargaining outcomes. In contrast to Bolin et al., the model I use is governed by individuals making their own labour supply decisions.

4.2 Setup of Model

The model is a two period bargaining model with two agents: a primary wage earner (husband) and a secondary wage earner (wife). There is a finite amount of time available per period (T), and can divided into either wage earning activities (l) or into household production (t).

$$i = m, f \;\; ; \;\; j = m, f \;\; ; \;\; i \neq j$$

$$k = 1,2$$

$$T = l_{ik} + t_{ik}$$

Income is earned only through wage earning activities, and it is assumed that the initial wage rate for husbands is greater than the initial wage rate for wives. This may not be the case in the second period, as first period labour supply time, initial wages, and a wage growth factor (π) determine second period wages.

$$w_{m1} > w_{f1}$$

$$w_{i2} = w_{i1} \cdot (1 + \pi l_{i1})$$

Net income (x) is a function of wages, labour supply and the tax schedule. It is assumed that all net income is spent on private goods, with a price of unity. The marginal tax rate (τ) is determined by gross income. There is a significant difference in how net income is calculated, dependent on the tax regime being used. α represents a lump sum transfer from the government. Under a regime of individual taxation:

$$x_{ik} = (1 - \tau_{ik})(w_{ik} \cdot l_{ik}) + \alpha_{ik}$$

So a household's income (x_k) is represented as:

$$x_k^{IT} = x_{ik} + x_{jk} = (1 - \tau_{ik})(w_{ik} \cdot l_{ik}) + \left(1 - \tau_{jk}\right)\left(w_{jk} \cdot l_{jk}\right) + \alpha_{ik} + \alpha_{jk}$$

Under a regime of pure income splitting, household income is represented as:

$$x_k^{IS} = 2\left[\frac{(1 - \tau_k)\left(w_{ik} \cdot l_{ik} + w_{jk} \cdot l_{jk}\right)}{2} + \alpha_k\right]$$

With income splitting, the mean of a household's gross income has its own tax rate and lump sum transfer. Given that first period wages are lower for wives than husbands, a wife's tax liability should always be lower than the husbands if both work the same number of hours in the labour force.

$$(1-\tau_{f1})(w_{f1}\cdot l_{f1}) < (1-\tau_{m1})(w_{m1}\cdot l_{m1}) \qquad l_{m1} = l_{f1}$$

Household production (y) is a function of the amount of time spent not in wage earning activities. When the couple is together (not divorced), household production is treated as a public good that benefits both individuals. The function is twice differentiable passing through the origin, with a positive first derivative and negative second derivative.

$$y_{ik} = h(T - l_{ik})$$

$$y_k = y_{ik} + y_{jk} = h(T - l_{ik}) + h(T - l_{jk})$$

An individual's utility is a function of net income and household production.

$$u_{ik} = u(x_{ik}, y_k) = A(y_k)\cdot x_{ik} + B(y_k)$$

Inertemporal utility is determined by the sum of each period utilities, with the application of a discount rate (β) on the second period.

$$U_i = u(x_{i1}, y_1) + \beta u(x_{i2}, y_2)$$

The k period utility function is formed as it is to allow for transferable utility: the frictionless transfer of utility from one agent to the other. This results in a utility possibility frontier (UPF) with slope of -1. Since the inputs of the k-th period utility functions are themselves functions of

k-th period labour supplies, the value of the point on the utility possibility frontier is a function of labour supplies. This sum of utility values is represented below as the functionΩ, and this is independent of income distribution among the partners in the period.

$$UPF_k = \{(u_{fk}, u_{mk}) \in \mathbb{R}^2 | u_{fk} + u_{mk} = \Omega_k(l_{fk}, l_{mk})\}$$

It is assumed that agents are forward looking, so they understand the impact of decisions made in each period. There are two periods, but there are three decisions that the agents make. There is the choice of first and second period labour supplies, and the labour supply if the spouses were to divorce. From the perspective of an individual, fist period labour supplies are decided while understanding the impact on second period wages and utility. Before the second period decision is made, an agent evaluates their utility if divorced. From this divorce point, the agents negotiate to a second period decision.

In the first period, utility is split evenly among spouses.

$$u_{i1} = \frac{\Omega_1}{2}$$

Following this, the agents then determine their labour supplies under divorce, which in turn determines private consumption, household production and utility.

$$x_{i2}^d = (1 - \tau_{i2}^d) w_{i2} \cdot l_{i2}^d + \alpha_{i2}^d$$

$$y_{i2}^d = h(T - l_{i2}^d)$$

$$d_{i2} = A(y_{i2}^d) x_{i2}^d + B(y_{i2}^d)$$

There are welfare gains to be made if the spouses do not get divorced. This should be clear, as divorce utility is explained by one's own private consumption, and one's own household production, while not getting divorced uses total household production. These gains occur when the sum of each individuals household labour hours is greater than an individual's own divorce household labour hours.

The negotiation from the divorce utilities leads to the following expression for second period utility (see figure 1). It should be noted that utility is not evenly split among the spouses, however the gains from utility are shared equally.

$$u_{i2} = \frac{\Omega_2 + d_{i2} - d_{j2}}{2}$$

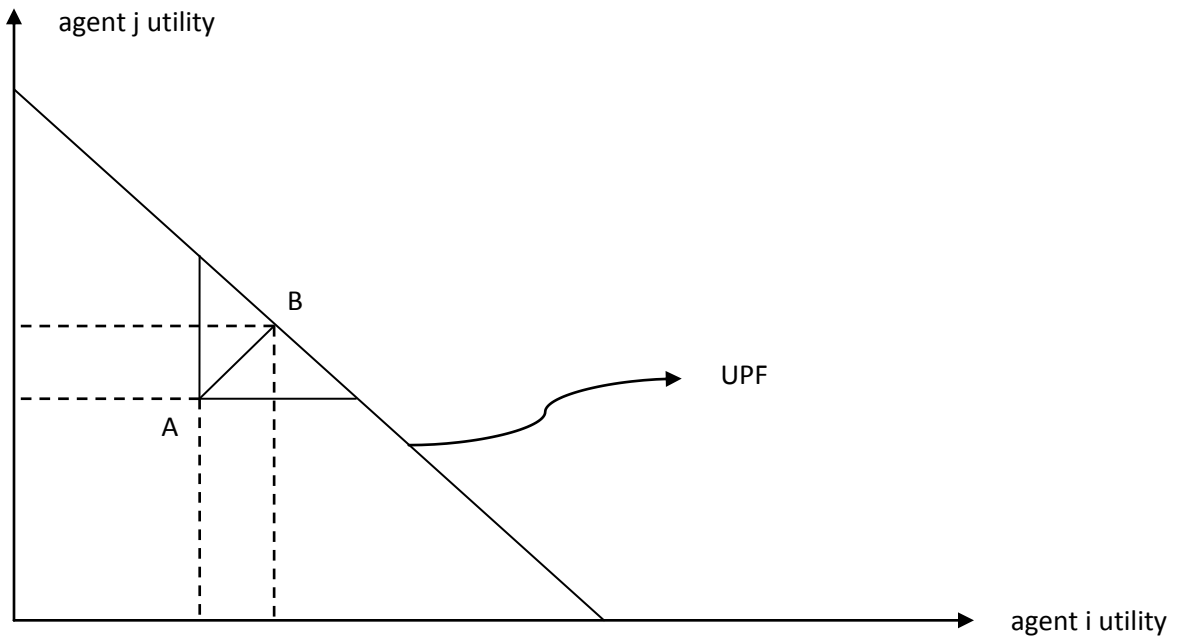

Figure 1: Second period bargaining solution from divorce utilities. Divorce utilities are at point A, and the equal split of utility gains lead to point B. (graph adapted from Gugl (2009)).

The agents solve the above problem by working backward from the second period to the first. By taking first period labour supplies as given, spouses seek to maximize second period utility. Second period labour supplies are not dependent on the divorce supplies chosen, so in effect, spouses are maximizing Ω_2. From this equilibrium set of second period labour supplies and associated utility, agents then determine actual first period labour supplies. First period labour supplies are found using (given second period utility)

$$\arg\max_{l_{i1}} \frac{\Omega_1}{2} + \beta \frac{u_{i2}}{2}$$

Solving the following first order condition allows discovery of actual first period labour supplies.

$$\frac{\partial(\Omega_1 + \beta\Omega_2)}{\partial l_{i1}} + \beta \frac{\partial d_{i2}}{\partial d_{i1}} = 0$$

4.3 Simulation Approach

The model is programmed into computer simulation software, and this necessitates definitions of functional form. The output provided is in utils and labour hours. Utility is an ordinal measure, so an increase in utility implies an unambiguous preference for that situation, while a decrease in an unambiguous dislike for that situation.

I define household production, a function of time not spent in wage earning activities, as taking a Cobb-Douglas form:

$$y_{ik} = \gamma(T - l_{ik})^h = \gamma(t_{ik})^h$$

The exponent on the household production function (h), in order to satisfy the requirements of a positive first and negative second derivatives, must be a value between 0 and 1. The scalar

on the household production function (γ) represents the productivity of household production. I restrict its value to be $1 \leq \gamma \leq 2$.

For k-th period utility, again Cobb-Douglas forms are used:

$$A(y_{ik}) = (y_{ik})^{\rho}$$

$$B(y_{ik}) = (y_{ik})^{\varepsilon}$$

The exponents on the utility function (ρ , ε) are set between 0.4 and 0.7.

The intertemporal utility function now becomes (when a couple is not divorced):

$$U_i = [y_1^{\rho} x_{i1} + y_1^{\varepsilon}] + \beta [y_2^{\rho} x_{i2} + y_2^{\varepsilon}]$$

For the simulation, I assume that the discount factor on second period utility is set as $0 < \beta < 1$. It is unreasonable to assume that individuals do not value second period utility, and unreasonable that individuals value second period utility equally with the current period.

In order to find wages in the second period, I need to define a wage growth factor. The wage growth factor (π) is set at 0.0001. The literature indicates that there is a significant wage growth effect with experience. Following the results found in Altonji & Shakotko (1987), where they find that approximately 53% of wage growth can be explained by experience, I calculated the wage growth factor using Canadian data on earnings growth and hours worked. Since I am using a broad array of representative households, I treat the wage growth factor as constant throughout the analysis. Varying it does not change the fundamental results.

Additionally, I set initial wages for the male and female, while ensuring that the strict inequality in first period wages (male wage is higher than female wage) holds. I use $4 \leq w_{f1} \leq 14$, and $15 \leq w_{m1} \leq 25$.

A difference between the simulation model and the theoretical model lies in the treatment of net income under a tax regime of income splitting. As expressed in the theoretical model, net income under income splitting should be

$$x_k^{IS} = 2\left[\frac{(1-\tau_k)\left(w_{ik} \cdot l_{ik} + w_{jk} \cdot l_{jk}\right)}{2} + \alpha_k\right]$$

In the simulation model, I use:

$$x_k^{IS} = \varphi\left(w_{ik} \cdot l_{ik} + w_{jk} \cdot l_{jk}\right)$$

where φ is the tax vector with the income cutoffs expanded by a factor of θ. For the case of pure income splitting, equivalent to the theoretical definition, $\theta = 2$. By allowing this scaling factor to change, I can look at partial income splitting. This is consistent with the federal tax policy in the United States, where income splitting is not pure, and $\theta < 2$ Please see the appendix for comparison of tax schedules for individual and split tax regimes using Canadian federal income tax data. For the simulations, I use $\theta = 2$ and $\theta = 1.5$ for income splitting analysis.

The total number of hours available, to be allocated between household production and wage earning activities is 4200 hours, per period, per spouse.

5. Results

An overview of the simulation results follows. As indicated earlier, I varied parameters to obtain a broad range of households. The total number of households with two spouses is 6534. The main approach to the analysis is to look at the difference between decisions made under a tax regime of income splitting versus individual taxation, and the difference between joint taxation and individual taxation. I will start with the income splitting case, and then joint taxation.

5.1 Income Splitting

Broadly, wives reduce hours spent in the labour force, and husbands increase labour force participation. This difference is largest when initial wages between husband and wife are furthest apart. In these households, there were broad increases in intertemporal utility for both husbands and wives. There are no cases where husbands are worse off in these households, and few where wives were worse off. The characteristics of the households where wives are worse included small wage differentials and high exponents on household production. The implication of a high exponent on household production is that it is cheaper to produce the household good. While wives are worse off in some cases, overall household utility increased (the welfare loss of the wife was more than offset by the welfare gain of the husband) in all cases.

There are, unsurprisingly, cases when wives do not change their participation in the labour force. The characteristics of these households are interesting, however. These cases appear when the first period wages are very close ($w_{f1} = 14$ and $w_{m1} = 15$), with the other parameters varrying, and when the wages are most different, with the exponent on the

household production function is its largest value ($h = 0.7$). In the cases where the wages are close, both spouses are engaged in mixed employment and household production. When the wages are at their maximum difference, wives engage only in household production under both tax regimes.

I find that labour supply elasticities for both husbands and wives are broadly inelastic. Using the arc elasticity approach, I calculated that the median labour supply elasticity for husbands is 0.119 in the first period and 0.21 in the second period. There are some cases where labour supply is elastic. These households have similar first period wage rates for spouses.

For wives, the median elasticity in the first period is 0.946, and 1.131 in the second period. This indicates that wives are more responsive to changes in their net wage than husbands, and are willing to substitute from wage earning activities to engaging in household production.

The change in divorce utility is also important. Since this is the starting point for negotiations in the second period, the tax regime's impact on the position of spouses is an indicator for their wellbeing. If, for example, wives have a lower divorce utility, they have more to gain from staying married in the second period. The data indicates broad decreases in wives' divorce utility. In cases where wives' divorce utility is greater under income splitting, there are widely divergent first period wages between spouses, large exponent on household production, and the large discount rates on second period utility. Additionally, while wives' divorce utility increases, husbands' divorce utilities decrease; however, intertemporal utility actually increases for both spouses.

5.2 Joint Taxation

When a regime change occurs to joint taxation, the results differ. Broadly, I find that wives reduce labour force participation, and husbands increase hours worked. Under joint taxation, there are cases when the household is better off, however the wife is worse off. In these cases, I find that there are widely divergent first period wages, with wives' wages at most one half of the husbands. There is no evidence that when household utility increases, husbands' utility decreases.

There are cases when wives keep their first period labour supply the same under both regimes. In these cases, wives are completely engaged in household production. The first period wage differential between husbands and wives is at its highest. There are no increases in labour force participation from the first period to the second. Household production is relatively inexpensive in these cases, with the exponent at its highest value ($h = 0.7$).

There are instances where the wife increases first period labour force participation in response to the change in tax regime. There are small wage differentials in these cases. In the second period, these wives maintain the same hours worked as under individual taxation. Additionally, when wives increase their first period labour force participation, I find that there are negative effects on household utility, as well as negative effects for each spouse.

Regarding labour supply elasticities under joint taxation, I find that husbands have relatively inelastic labour supply in both periods (0.115 in the first period, and 0.182 in the second period). There are no cases where husbands have elastic labour supplies under joint taxation.

Wives have inelastic median labour supplies (0.571 in the first period and 0.518 in the second period). There are many cases where wives' labour supply is elastic. In these cases, I notice find that household production is relatively inexpensive (high h).

Like pure income splitting, wives divorce utility is broadly lowered under joint taxation. There are, however, more instances of wives having higher divorce utility under joint taxation. This occurs when there is the maximum difference between first period wages and relatively inexpensive household production, and when wages are similar. When wages are at their maximum difference, wives don't work in either period, but their labour supply if divorced is the same under both regimes.

Unlike the change to pure income splitting, there are cases of increased divorce utility for wives when first period wages is close between spouses. In these cases, wives work more under joint taxation than individual, in the first period, and less in the second. This is not surprising, given the higher wages wives can realize if divorced. A higher number of hours worked in the first period necessarily leads to higher second period wages. However, intertemporal utility decreases for each spouse, and for the household as a whole.

It should be noted that the model I use endeavours to have interior solutions, and not pure specialization of each spouse. If the amount of time was more limited, we may find that there are more cases of specialization when there is a regime change, so labour supply elasticities may become more elastic.

5.3 Kesselman's Expected Outcomes and Gugl's Propositions

Given my simulation results, I find that they are consistent with the expected outcomes as described by Kesselman. On the household level, holding the tax schedule constant throughout the simulations, I find marriage bonuses (in terms of earnings) when the shift is to pure income splitting, and marriage penalties and bonuses when the shift is to joint taxation. Additionally, there are clear disincentives for the secondary wage earning to engage in labour market activities. There are added disincentives for wives to work due to the marriage penalties applied to spouses with similar earnings.

My results allow me to evaluate the propositions presented by Gugl in her paper. There are two propositions presented. The first deals with anticipated welfare effects of a change to individual taxation, and the second with labour supply effects. I look at these with respect to regime shifts to both pure income splitting and to joint taxation.

Proposition 1:

A change from IT of couples to IS has an ambiguous welfare effect on the spouse whose partner increases first-period labour supply as a reaction to the change in tax regime.

A change from IT of couples to IS has a positive welfare effect on the spouse whose partner decreases first period labour supply or keeps it the same as a reason to the change in tax regime. (p. 1063)

To confirm that these welfare effects occur, I first look at the households where an agent increases labour supply as a response to the change, and then look at the impact on welfare of

the other spouse. Additionally, I look for households where an agent does not increase first period labour supplies, and then look at the impact on welfare of the other spouse.

In the first case, I indeed find that there are ambiguous welfare effects on one spouse when the other increases first period labour supplies. In the second case, I find unambiguous increases in intertemporal utility of one spouse when the other decreases first period labour supplies, or keeps them constant.

Under joint taxation, I find that, when a spouse decreases first period labour supplies, the other spouse may gain or lose. The gains occur when there are widely divergent wages, and the losses occur when the wages are close together. This is due to the impact of marriage penalties associated with joint taxation.

Proposition 2:

> *The first-period labour supplies generally involve a higher first-period labour supply of the husband and a lower first-period labour supply of the wife under IS than under IT. However, the change in first-period labour supplies is ambiguous if IS does not lower the husband's marginal tax rate when evaluated at the labour supplies under IT, or in the case in which the wife's marginal tax rate is 15% and the husband's marginal tax rate is 29% under IT and the marginal tax rate under IS is 26%. (p. 1064)*

There are three parts to this proposition. As I showed earlier in the general results, I find that the labour supply effects are consistent. For the second part, I find cases where the marginal tax rate of the husband is higher under individual taxation, and apply the income splitting

marginal tax rate to the labour supplies found under individual taxation. The results are ambiguous, as expected. This ambiguity also holds for the third part of the proposition.

Under a regime change to joint taxation, the same patterns are realized as under pure income splitting. Labour supplies move appropriately and the welfare effects of parts two and three are ambiguous.

5.4 Revenue Neutrality

This tax regime shift does not imply revenue neutrality. In order to look at this case, I evaluated the differences between tax liabilities of households under pure income splitting and under individual taxation across different tax schedules. By maintaining the federal tax liabilities of 2007, I find a large loss in government revenue due to the regime change of 8.71%.

There are two approaches to achieving a revenue neutral tax change. This first would involve increasing the marginal tax rates of the single tax schedule, and changing the number of tax bands. The second involves creating two tax schedules: one for individuals and one for spouses. The algebraic solution to this issue is problematic, so I simulate the effects on government revenue by adjusting the tax rates, and by allowing for more than one tax schedule.

This approach to adding a set amount onto all marginal tax rates leads to a more regressive tax schedule, and may not be politically feasible. The approach of scaling all marginal tax rates by the same amount would maintain the current progressivity of the tax schedule. While scaling the higher marginal tax rates by a larger value would increase progressivity of the tax schedule.

When varying the marginal tax rates only, I find that the impact on government revenue is not large. A one percentage point increase in marginal tax rates (from 15% to 16% for example) leads to a reduction in government revenue of 8.39% (as opposed to the original drop of 8.71%). A two percentage point increase in marginal tax rates leads to a reduction of government revenue of 8.17%. Even a ten percentage point increase in the marginal tax rates does not lead to a significant reduction in the decrease of government revenue (7.11%).

With the number of tax bands doubled, and the marginal tax rates scaled by 1.1, I found a decrease in government revenue of 7.93%. The doubling of the tax bands had the midpoints between the existing tax band thresholds be a new threshold, and I added a new top band 50% higher than the existing top band. When I increased the scaling factor to 1.3, and keeping the doubling of tax bands, I found that there would be a decrease in government revenue of 8%. Lastly, when the tax schedule is scaled by 1.5, I find a reduction in government revenues of 9.45%.

While keeping the tax bands doubled, I introduced more progressivity into the tax schedule. I scaled the lowest two marginal tax rates by 15%, the next two tax bands by 20%, the next by 25% and the last by 30%. By introducing this additional progressivity, I found a decrease in government revenues of 9%. This shows that increasing the progressivity of the tax schedule may not be the ideal approach to achieving revenue neutrality.

I now change focus to looking at the second possible approach to achieving revenue neutrality: introducing two separate tax schedules. When I keep the original 2007 Federal Tax Schedule applied to couples, tax receipts from non-married individuals needs to almost be doubled.

I first used an increase to the tax schedule of three percentage points for each marginal tax rate. As indicated earlier, this is reducing the progressivity of the tax schedule. I find that there would be a reduction in government revenue of 6.5% in this case. Using the tax scheduled with ten percentage points added, I find the loss would become 1.5%. This is a significant reduction in the loss.

I used a progressivity-maintaining change to the marginal tax rates. When the marginal tax rates are scaled by 1.1, there is a loss of government revenue of 7.36%. When the marginal tax rates are scaled by 1.3, the loss in government revenue would be 4.7% reduction in government revenue. Lastly, I scaled the marginal tax rates by 1.5, and found that the loss in government revenue would be 2.1%.

Doubling the tax bands, and not scaling the marginal tax rates leads to a decrease in government revenue of 7.87%, which is less than the initial reduction. This indicates that, even without scaling, more tax bands may be appropriate. With scaling of 1.1, I find that the reduction would become 6.43%. When the scaling is 1.3, I find that the reduction in government revenue is 3.6%. When I scaled the marginal tax rates by 1.5, I found a reduction of 0.84%. See table 2 for comparison of one and two tax schedule approaches, and appendix for the individual non-spouse tax schedule.

Households substitute away from wage earning activities much more than individuals. This would help to explain why keeping one tax schedule, doubling the tax bands and scaling marginal tax rates actually would cause larger decreases in government tax receipts.

Given the two available options of achieving revenue neutrality, it seems that applying two separate tax schedules is the most appropriate method. I find that extended tax bands and scaled marginal tax rates applied to the individuals tax schedule achieves a change in government revenue that is small.

Scaling factor	Change in government tax receipts from population (%)	
	Single Schedule	Separate Schedules
No scaling	-7.68	-7.87
1.1	-7.93	-6.43
1.3	-8.00	-3.60
1.5	-9.45	-0.84

Table 2. Comparison of one tax schedule vs. two separate tax schedules

5.5 Output and Household Production

Some other interesting implications arise from this simulation exercise. I will specifically look at two of these implications: the effects on output, and the effects on household production. If there are changes in national output when spouses change behaviour given a shift in tax policy, this is important to recognize. Additionally, as has been argued by the Green Party of Canada, a shift in policy from individual taxation of couples to income splitting or joint taxation would aid the household in the rearing of children.

When looking at the impact on output, I focus on the gross earnings of the household and individuals. There is no savings in my model, and I assume that the government exhausts all receipts from income tax. I treat the economy as closed. On aggregate, a change in household earnings in response to the tax change, weighed against the change in the earnings of individuals would provide a measure of the change in output.

Estimates for 2007, based on Statistics Canada data, have approximately 75% of Canadian adults (over 19) as defined as married, including common-law. The remaining 25% are considered single. I use this ratio to calculate the impacts of the regime change. Individuals would face the same tax burden, regardless of the change on spousal tax policies.

In response to the change, aggregate gross earnings of households would decrease. Under a regime shift to pure income splitting, this response, however, this impact is a reduction of 0.87% in the first period and 0.95% in the second. If a change occurred to joint taxation, the impact would be a decrease in the first period of 0.84% and in the second period 1.00%.

Regarding the change in household production, I take the same approach as the previous case. Instead of looking at changes in gross income, however; I look at the percent difference in household production, on aggregate. It is important to note that I am looking at household production, and not just hours worked in household. I do this in order to capture the different household productivity characteristics of spouses in the economy.

In response to the change, household production would increase on aggregate. Under a change to pure income splitting, I encountered approximately 20% of households would experience decreases in household production, however the economy would experience a 5.02% increase in the first period, and a 4.16% increase in the second. Under joint taxation, approximately 10% of household would experience a decrease in household production. On the whole, there would be a 4.79% increase in household production in the first period, and in the second period there would be a 4.47% increase.

Given a change from individual taxation with a single schedule, to the (almost) revenue neutral change of doubling the tax bands and scaling the marginal tax rates by 1.5, I find that there would be a decrease of gross earnings in the economy of 1.04%. In the second period, I find that the decrease would become 1.17%. As for household production, in the first period there would be an increase of 5.55%, and in the second period, there would be an increase of 4.61%.

6. Conclusion

In this paper, I simulated tax regime shifts from individual taxation to income splitting and to joint taxation. I showed that there are general increases in household utility when the shift to income splitting occurs, and that there are differences between husbands' and wives' welfare effects when this shift occurs. These impacts are less pronounced when the shift is to joint taxation. Labour supplies are broadly inelastic, with wives' labour supplies being elastic in some household that have moderate wage differentials between spouses. Generally, divorce utilities are lower for wives after the change, but given the gains to negotiation, they still benefit.

In order to achieve revenue neutrality, I showed that using two income tax schedules is the most appropriate approach, given the greater substitution away from wage earning activities of spouses than that of non-married individuals. An expansion of the tax bands, and a broad, progressivity maintaining increase in the marginal tax rates of individuals can make the transition to income splitting least costly in terms of government revenue.

I found that the change in tax regime would decrease national output, under both income splitting and joint taxation, and under the conditions for revenue neutrality. Given the

emerging push for income splitting from some Canadian groups, I find that household production, which is not measured purely in hours spent at home, increases broadly.

6. References

Altonji, Joseph G., and Robert A. Shakotko (1987) "Do wages rise with job seniority?" *The Review of Economic Studies* 54, 437-459

Apps, Patricia F., and Ray Rees (1999) "Individual versus joint taxation in models with household production," *The Journal of Political Economy* 107, 393-403

Apps, Patricia F., and Ray Rees (2007) "The taxation of couples," IZA Discussion Paper No. 2910

Becker, Gary S. (1974) "A theory of social interactions," *The Journal of Political Economy* 82, 1096-1093

Bolin, Kristian, Lena Jacobson, and Bjorn Lindgren (2001) "The family as the health producer - when spouses are Nash-bargainers," *Journal of Heath Economics* 20, 349-62

Chiappori, Pierre-Andre (1992) "Collective labor supply and welfare," *The Journal of Political Economy* 100, 437-467

Crossley, Thomas F., and Sung-Hee Jeon (2006) "Joint taxation and the labour supply of married women: evidence from the Canadian tax reform of 1988," SEDAP Research Paper No. 149

Feenberg, Daniel, and Harvey Rosen (1980) "Alternative tax treatment of the family: simulation methodology and results," NBER Working Paper No. 497

Green Party of Canada (2009) "Relief for the middle class," Green Party of Canada, http://greenparty.ca/node/13354 (accessed April 3, 2010)

Gugl, Elisabeth (2009) "Income splitting, specialization, and intra-family distribution," *Canadian Journal of Economics* 42, 1050-1071

Kesselman, Jonathan (2008) "Income splitting and joint taxation of couples: what's fair?" *IRPP Choices* 14, February, Institute for Research on Public Policy, Montreal

Konrad, Kai A., and Kjell Erik Lommerud (2000) "the bargaining family revisited," *Canadian Journal of Economics* 33, 471-87

Lundberg, Shelly J., and Robert A. Pollak (2003) "Efficiency in marriage," *Review of Economics of the Household* 1, 153-168

Manser, Marilyn, and Murray Brown (1980) "Marriage and household decisionmaking: a bargaining analysis," *International Economic Review* 21, 31-44

Munnell, Alicia H. (1980) "The couple versus the individual under the Federal Personal Income Tax," In *The Economics of Taxation*, edited by Henry J. Aaron and Michael J. Boskin. Washington, DC: Brookings Institution

Nelson, Julie A. (1996) *Feminism, Objectivity and Economics* (London and New York: Routledge)

Statistics Canada (2010) "Population by marital status and sex," *Statistics Canada*: Ottawa, Canada, http://www40.statcan.ca/l01/cst01/famil01-eng.htm (accessed March 15, 2010)

Statistics Canada (2010) "Average earnings by sex and work pattern," *Statistics Canada*: Ottawa, Canada, http://www40.statcan.ca/l01/cst01/labor01a-eng.htm (accessed March 21, 2010)

Steiner, Viktor, and Katherina Wrohlich (2004), "Household taxation, income splitting and labour supply incentives - a microsimulation study for Germany," *CESifo Economic Studies* 50, 541-568

Van Soest, Arthur, and Marcel Das (2001) "Family labour supply and proposed tax reforms in the Netherlands," *De Economist* 149, 191-218

Appendix

2007 Federal Income Tax Schedule: Individual taxation pure income splitting, and joint taxation

Tax Bands: Individual Taxation Unit of tax: individual income		Marginal Tax Rate (%)
Greater than	up to	
0	9600	0
9600	37178	15
37178	74357	22
74357	120887	26
120887	-	29

Tax Bands: Pure Income Splitting (θ=2) Unit of tax: household income		Marginal Tax Rate (%)
Greater than	up to	
0	19200	0
19200	74356	15
74356	148712	22
148712	241774	26
241774	-	29

Tax Bands: Joint Taxation (θ=1.5) Unit of tax: household income		Marginal Tax Rate (%)
Greater than	up to	
0	14400	0
14400	55767	15
55767	111535.50	22
111535.50	181330.50	26
181330.50	-	29

Tax Schedule for Individual Non-Spouses

Tax Bands: Individual Taxation Unit of tax: individual income		Marginal Tax Rate (%)
Greater than	up to	
0	9600	0
9600	23389	15
23389	37178	18.5
37178	55767	22
55767	74357	24
74357	97622	26
97622	120887	27.5
120887	181331	29
181331		31