

# WELCOM

User Manual<sup>1</sup>

Version 2.0

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## *Abstract*

This User Manual presents the **WELCOM** Stata tool. The Global Solutions Group on Markets and Institutions for Poverty Reduction and Shared Prosperity at the Poverty and Equity Global Practice has developed **WELCOM**, a novel microsimulation tool that estimates distributional effects of changes in market structure (e.g. a move from monopoly to more competitive markets) which could be induced through regulatory reform or easing of trade barriers. The **WELCOM** tool is a software interface that requires data from household surveys, particularly households' consumption of different goods and services, as well as information about market structure in the relevant sectors, to assess how changes in prices affect the welfare of households along the income/consumption distribution. In addition, the tool relies on a poverty line and a relevant welfare aggregate (income or consumption) to assess first-order effects on poverty indicators such as headcount and poverty gap, in addition to changes in inequality.

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## List of Acronyms and Abbreviations

CEA—Counsel of Economic Advisers

CD—Cobb-Douglas function

CES—Constant elasticity of substitution utility function

CMA—Competition and Markets Authority

FGT—Foster-Greer-Thorbecke class of poverty measures

GP—Global Practice

GSG—Global Solutions Group

PCO—Partial Collusive Oligopoly

PERC—Perfect Competition

WB—The World Bank

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# 1. Introduction

This User Manual presents the WELCOM module, a tool build on Stata to analyze the potential distributional impacts produced by changes in competition conditions either in specific or multiple markets. In general, analyzing the welfare effects of policy reforms aimed at correcting market imperfections is not a simple task, especially when the potential distributional impacts of such policies need to be assessed prior to their implementation. Market imperfections not only reduce economic efficiency and social welfare in both developed and developing countries, but recent economic literature suggest that market imperfections are more pernicious for households at the bottom of the income distribution (Urzua, 2013; Busso and Galiani, 2015; and Atkin et al., 2016).<sup>6</sup>

Market imperfections affecting competition can take multiple forms such as collusive arrangements among firms with market power,<sup>7</sup> vertical or horizontal agreements limiting competition at different stages of the production or distribution chain,<sup>8</sup> legal barriers to entry or exit markets,<sup>9</sup> prohibitive tariffs on imports and exports, statutory monopolies and price controls, among others. This User Manual focuses in market imperfections affecting the conditions for competition in specific markets or industries<sup>10</sup> such as anticompetitive behaviors by firms and government restrictions, and in the effects of development policies aimed at fostering competition.

Interventions to correct market imperfections and, more specifically, policy reforms to foster competition can have mixed effects in household's welfare given the different roles played by households in the economy as consumers, employees and producers. First, competition policy reforms can affect the overall conditions of competition between firms in the market, affecting

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<sup>6</sup> In spite that we use the term “income distribution,” we could also organize and rank households based on their level of consumption or wealth, producing analysis based on consumption distribution or wealth distributions, respectively.

<sup>7</sup> Harrington (2017) argues that collusive agreements occur when firms in a market coordinate their behavior to produce a supracompetitive outcome.

<sup>8</sup> For a survey on the determinants and effects of vertical integration se Perry (1989).

<sup>9</sup> Barriers to entry generally refer to any form of advantages that have accrued to incumbents over time such as demand-side network effects (i.e. the quality of a product or service increases with the number of users), increased economies of scale that make harder for entrants to compete, or those created by successful political lobbying, among others (Furman, 2016).

<sup>10</sup> One non-exhaustive classification of potential anticompetitive conducts includes: (i) horizontal agreements or collusion practices such as price or geographical cartels; (ii) vertical restraints or vertical mergers like exclusive supply contracts; and (iii) other abusive practices such as predatory pricing, bundling and tying, refusal to supply, raising rival's costs and price discrimination (Motta, 2010). Also, notice that none of these practices are necessarily anti-competitive *per se*, since they could also be a consequence of a legitimate strategic response to specific market conditions; therefore, they should be independently analyzed by competition authorities.

household's wellbeing in their role as consumers through changes in prices, quality and diversity of alternatives available for purchase (Atkin et al., 2016; Begazo and Nyman, 2016). In addition, competition reforms can affect household's wellbeing in their role as employees as well as producers of good and services. For instance, competition reforms may affect the nominal wages perceived by workers, the number and composition of firms demanding labor—due to the potential entry or exit of firms—affecting employees bargaining power, the presence of oligopsonies in factor markets such as labor, or the consolidation of firms (CEAb, 2016). Moreover, competition policy reforms also affect household welfare through their effects on capital gains due to changes in firms' profits due to more intense competition or affecting small firms exposure to anticompetitive behavior from larger rivals (Outreville, 2015).<sup>11</sup> Furthermore, market power is also a source of production misallocation, resulting in welfare losses for the overall economy, since output ends up being produced in higher-cost (less productive) units of production, and less output in more efficient production units of the economy (Bridgman et al., 2015; Asker et al., 2017).

The impacts of competition policy interventions are often conditional on the initial characteristics of the market or industry under analysis as well as on the effective regulatory and competition framework following the intervention. Thus, the analysis of the conditions of competition in markets typically involves more than meets the eye. For instance, an increase in revenue concentration is neither necessary nor sufficient to indicate increases in market power; higher prices can either be a signal of quality or of a lack of competition; similar price movements can be evidence of either efficiency or of a cartel; and neither concentration nor large market share equal market power nor dominance (Gonzalez, et al 2015; Furman, 2016). Thus, each policy should be evaluated on its own merits, and understanding what influences the observed market outcomes and how business behave and interact in the market should be a priority.<sup>12</sup>

In addition, notice that the policy reforms under study involve a broad set of government interventions and private agent behaviors that can affect the functioning of markets. Moreover, this User Manual does not deal with the question of what type of behavior constitutes an abuse of market power or what are the best policies to remedy it (see Motta, 2004; or Buccirossi, 2008 for

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<sup>11</sup> The body of early literature in industrial organization known as the Structure-Conduct-Performance (SCP) hypothesis argues that there is a relationship between market concentration and firm profitability (Bain, 1951). For instance, according to the SCP theory dominant firms in concentrated markets are more capable of setting prices through collusion and, therefore, earn extraordinary profits. Later approaches such as the Relative-Market-Power (RMP) and the Efficient Structure (ES) also argued that market structure affects the market competition among firms (Outreville, 2015).

<sup>12</sup> This approach is analogous to the “rule of reason” in antitrust, that appeals to a rigorous analysis of how markets work, taking into account the specificities of particular industries; in contrast to the “per se rules”, where certain behaviors are mechanically allowed or prohibited (Tirole, 2015).

discussions on these topics), but instead focuses on the distributional impacts of the policy interventions or changes in competitive conditions affecting competition in specific markets, taking the policies or behaviors under analysis as given.

Three common examples how the behavior of private firms affect competition are: (i) through the creation and exploitation of market power by individual firms, (ii) the joint exploitation of market power by a group of firms, and (iii) the partial or total exclusion of competitors from markets to create or protect the market power of a dominant or dominants firms (Buccirossi, 2008). Since competition policy reforms can have mixed impacts in households, given the institutional characteristics of the markets, the identification of the overall effects of these policies must hinge on the individual analysis of each reform or competition policy.

The User Manual for the WELCOM<sup>13</sup> package is part of a larger effort by the World Bank to generate knowledge to improve the understanding of the links among competition, growth and shared prosperity as well as to promote policies that foster competition, especially in developing countries. This Manual currently focuses on the **mcwel** tool for Stata—the first step of a more comprehensive project to provide a menu of flexible and user-friendly tools to analyze the effects of market imperfections in well-being—and is divided into five main sections. The first section is a general introduction that helps to motivate the importance of this User Manual, of the WELCOM package. In the second section, this Manual discusses the importance of competition policy reforms, discusses a general theoretical framework and relevant empirical studies on the relationship between competition and poverty and inequality. In section three, the User Manual shows the theoretical framework underlying the alternative methods of analysis available in the tool. This version of the tool focuses on the study of the potential distributional impacts of market concentration in consumer welfare through the prices channel. The forth section presents the WELCOM package for Stata and how it can be used as well as examples to interpret the outputs of the package. In the medium term the team plans to integrate additional modules to analyze the impact of the trade liberation and especially the entry of the foreign distribution chains on well-being.

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<sup>13</sup> Welfare and Competition (WELCOM).

## 2. WELCOM Models

Section 2 of this user Manual discusses the theoretical framework, assumptions and data requirements of the **tool**. First, Section 3 discusses the theoretical underlying WELCOM. Then, this Section discusses the three alternative market structures—a monopolistic structure, an oligopolistic market with firms involved in a Cournot-type competition<sup>14</sup> and an oligopolistic market with collusion among the dominant firms (firms with largest market share)—available in the tool, their key assumptions and their associated equilibria. Finally, the third part of Section 3 discusses three alternative monetary measures of well-being that can be estimated using the tool and briefly presents an empirical example.

### 2.1 The theoretical framework of WELCOM

The current version of the WELCOM toolkit includes the **mcwel** command that was designed to help assess the impact of competition policy reforms on consumer prices. Thus, WELCOM presents an absolute and relative incidence analysis of the effects of competition reforms (i.e., changes in market power) on consumer welfare operating through the prices mechanism. A second stage of the tool is expected to introduce the potential impacts of market power on welfare through the labor market channel.

In competitive markets firms behave as price takers which are unable to affect equilibrium prices through their individual actions<sup>15</sup> (other assumptions of the competitive markets include the private nature of goods and services, free entry and exit in the long-run, the absence of externalities between economic agents and the existence of perfect information, as discussed in Tirole, 1988). However, the price-taking assumption does not adequately describe firm’s behavior when there are only few firms on the supply side—of which monopolies are the most extreme case—or in

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<sup>14</sup> For details on the model of oligopoly competing via quantities see Mas-Colell et al. (1995) and Varian (2006).

<sup>15</sup> More precisely, in competitive markets “*all consumers and producers are assumed to act as price takers, in effect behaving as if the demand or supply functions that they face are infinitely elastic at going market prices.*” (Mas Colell et al. 1995:383).

industries where few firms with large market shares manage to collude to achieve market power and obtain “market power rents.”<sup>16</sup>

One frequent question in this literature is what are the main factors contributing to market concentration. One can think of natural economic factors or barriers, like economic efficiency (own technology, own specific inputs, etc.), as elements that favor or limits the competition in a market. For instance, when economies of scale or network effects are strong enough, markets could naturally tend to be dominated by a monopolistic firm (Viscusi et al. 2005). Another factor contributing to market concentration and, furthermore, to generate market power, are governmental regulations that privilege few producers, distributors or importers (facilitations, large access to the public finance, unjustifiable regulation barriers for other competitors, etc.).

What are the implications of market concentration? There are several negative effects associated with the excessive concentration of markets and with the unregulated exercise of market power. Microeconomics shows that the profits of a monopolistic group are lower than the loss in the consumer surplus, generating a net well-being loss for the society (in addition from a transfer of surplus from the consumers to the producers). The transmission mechanisms between market concentration and household well-being can be summarized into two relationships. The first one is between market concentration and the potential raise in prices of goods and services. The second one is between the change in prices and the household well-being.

## 2.2 Market concentration structure and prices

This section of the User Manual describes three alternative models available in WELCOM to estimate the effects of competition policy reforms on welfare and their associated equilibria. Each incorporates different assumptions about the underlying structure of the relevant market and the behaviors of the firms interacting in it. The section begins by presenting a simple model of market power where a monopolist provides a good or service in the market, i.e.: a monopoly whose actions will affect the equilibrium prices in the market. Then, the analysis relaxes the assumption of a single provider to allow for a—typically—small number of firms with market power to compete imperfectly in the market (oligopoly). Then, the third discussed model allows for the

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<sup>16</sup> The term “market-power-rents” refers to profits that a firm earns in virtue of its market power and that would not be possible in the absence of it (Khan and Vaheesan, 2017). These rents extracted by firms exploiting their market power are also called “extranormal rents” (Rodriguez-Castelan, 2015).



presence of multiple firms, but with a small number of large firms with market power which collude to obtain market power rents, while the rest of small firms act as price takers.

*a. Monopolistic structure*

The extreme case of market concentration involves a single producer in the market (monopoly) or a group of firms colluding to operate as monopoly (the levels of prices and quantities associated with such market will include the subscript *MONO*). If the market demand faced by the monopolist is a continuous decreasing function of price, then the monopolist realizes that a small increase in its price above the competitive level may lead only to a small increase in prices (Mas-Colell et al. 1995). Thus, raising prices above the competitive level is an optimal profit maximization strategy for the firm.

The monopolist decision problem consists in choosing the level of output that it desires to sell,  $q_{MONO} \geq 0$ , given the *inverse demand function*<sup>17</sup> “ $p(q)$ ”—the price that must be charged to sell  $q$  units of output—and a known cost function,  $c(q)$ :

$$\text{Max}_{q \geq 0} p(q) \cdot q - c(q) \tag{2.1}$$

Assuming differentiability conditions (both the inverse demand  $p(q)$  and the cost function  $c(q)$  are continuous and twice differentiable for any non-negative level of output), the monopolist optimal output ( $q_{MONO}$ ) must satisfy the following first order condition:

$$p'(q_{MONO}) \cdot q_{MONO} + p(q_{MONO}) = c'(q_{MONO}) \tag{2.2}$$

The left-hand side of the previous equation is equivalent to the marginal revenue from a differential increase in  $q$  at the point  $q_{MONO}$ , while the right-hand side corresponds to the *marginal cost*,  $c'(q_{MONO})$ , at a similar level of output. The previous results can be reorganized such that:

$$\begin{aligned} p'(q_{MONO}) \cdot q_{MONO} + p(q_{MONO}) &= c'(q) \\ p(q_{MONO}) \cdot \left[ p'(q_{MONO}) \cdot \frac{q_{MONO}}{p(q_{MONO})} + 1 \right] &= c'(q) \\ p(q_{MONO}) \cdot \left[ \frac{1}{\eta} + 1 \right] &= c'(q) \end{aligned} \tag{2.3}$$

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<sup>17</sup> Following Mas-Colell et al. (1995), the monopolist faces a demand function given by  $x(p)$  that is continuous and strictly decreasing at all  $p$  such that  $x(p) > 0$ . Then, the *inverse demand function* would be given by  $p(\cdot) = x^{-1}(\cdot)$ .

Where  $\eta$  denotes the own-price elasticity of demand faced by the monopolist, given by  $\eta = \frac{\partial q / \partial p}{q/p}$ . From the previous equation, note that in a competitive market the elasticity of demand faced by an individual firm,  $\eta$ , should approach to infinity (i.e., if the firm decides to raise prices above the market price it would lose all its market share). This implies that in a competitive market prices should be equal to the marginal cost of producing an additional unit ( $p = c'(q)$ ).<sup>18</sup> The previous equation could be further used to show that:

$$p(q_{MONO}) = \frac{\eta}{1 + \eta} \cdot c'(q) \quad (2.4)$$

Assume that we have the simple model of constant returns to scale such that the marginal cost,  $c'(q)$ , is a constant term ( $MC$ ), i.e. is not a function of  $q$ . Then, in monopolistic markets the equilibrium price is given by the following expression:

$$p_{MONO} = \frac{\eta}{1 + \eta} \cdot MC \quad (2.5)$$

Remember that, in the case of the perfect competition ( $P_{PERC}$ ) we have that prices must equal marginal costs:

$$p_{COMP} = MC \quad (2.6)$$

Therefore, it follows that the change in the price (in percentage) resulting from moving from a competitive equilibrium to a monopolistic structure is equal to:

$$dp = \frac{p_{MONO} - p_{COMP}}{p_{COMP}} \quad (2.7)$$

$$dp_{MONO} = \frac{p_{MONO}}{p_{COMP}} - 1 = p_{MONO} \cdot \frac{1}{p_{COMP}} - 1 = \left( \frac{\eta}{1 + \eta} MC \right) \cdot \frac{1}{MC} - 1$$

Where  $\eta$  denotes the own-price elasticity of demand at the monopoly equilibrium. In this User Manual, the **MC is normalized to be equal to one** (by extension, the price in equilibrium should also be equal to one) and it is further assumed that the demand function is linear.

$$dp_{MONO} = \frac{\eta}{1 + \eta} - 1 = -\frac{1}{1 + \eta} \quad (2.8)$$

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<sup>18</sup> In addition, note that equation (2.3) could be used to show that the **monopoly mark-up** (how much can a monopolist charge above the marginal cost) is given by the following relationship, also known as the *inverse elasticity pricing rule*:  $\frac{p(q_{MONO}) - c'(q)}{p(q_{MONO})} = -\frac{1}{\eta}$ .

The monopolist selects a quantity for which the consumer is willing to pay a higher price for any additional quantity. Around this monopoly equilibrium, the elasticity of demand should be smaller than one. It is also useful to express the final price of the monopoly market as a function of the initial elasticity (i.e. with price and quantity of the competitive market). We denote that elasticity by  $\eta^*$ . Then, it is possible to rewrite equation (2.8) as:

$$\eta = \frac{\partial Q}{\partial p} \frac{p_{MONO}}{Q_{MONO}} = \frac{\partial Q}{\partial p} \cdot \frac{p_{COMP} \cdot (1 + dp)}{Q_{COMP} \cdot (1 + \eta^* \cdot dp)}$$

Note that the previous expression suggests that the price elasticity of demand evaluated at the monopoly equilibrium is equivalent to the response of the demand function to changes in prices multiplied by the ratio of the competitive price and output, adjusted by factors corresponding to the effects of moving from perfect competition to a monopoly structure. Also, note  $(Q_{COMP}, p_{COMP})$  are the values in a competitive market equilibrium and  $(Q_{MONO}, p_{MONO})$  are the values under a monopoly equilibrium. Assuming that  $MC = 1$ , then:

$$\begin{aligned} \eta &= \frac{\partial Q}{\partial p} \cdot \frac{p_{COMP}}{Q_{COMP}} \cdot \frac{(1 + dp)}{(1 + \eta^* dp)} \\ \eta &= \eta^* \cdot \frac{(1 + dp)}{(1 + \eta^* dp)} = \eta^* \cdot \frac{(p_{MONO} - 1)}{1 + \eta^* \cdot (p_{MONO} - 1)} \\ \eta &= \frac{\eta^* \cdot p_{MONO}}{1 + \eta^* \cdot (p_{MONO} - 1)} \\ \frac{1 + \eta^* \cdot (p_{MONO} - 1)}{\eta^* \cdot p_{MONO}} &= \frac{1}{\eta} \end{aligned}$$

$$\frac{1 + \eta^* \cdot (p_{MONO} - 1)}{\eta^* \cdot p_{MONO}} + 1 = \frac{1}{\eta} + 1$$

$$\frac{1 + 2 \cdot \eta^* \cdot p_{MONO} - \eta^*}{\eta^* \cdot p_{MONO}} = \frac{1 + \eta}{\eta}$$

$$\frac{1 + 2 \cdot \eta^* \cdot p_{MONO} - \eta^*}{\eta^* \cdot p_{MONO}} = \frac{MC}{p_{MONO}}$$

$$1 + 2 \cdot \eta^* \cdot p_{MONO} - \eta^* = \eta^* \cdot MC$$

$$p_{MONO} = \frac{(1 + MC) \cdot \eta^* - 1}{2 \cdot \eta^*}$$

As we did previously, under the assumption that  $MC = 1$ , then we can simplify the previous expression as:

$$p_{MONO} = \frac{2 \cdot \eta^* - 1}{2 \cdot \eta^*} \quad (2.9)$$

and

$$dp_{MONO} = -\frac{1}{2\eta^*}$$

For instance, where the initial elasticity = -0.5,  $p_{MONO} = \frac{-2.0}{-1.0} = 2$ . The final elasticity is:  $\frac{-0.5 \cdot 2}{(1-0.5)} = -2$ . Note that, by assuming a linear demand function, we have that:

$$\eta = \frac{\partial Q}{\partial P} \frac{p_1}{Q_1} = \frac{\partial Q}{\partial P} \frac{p_0(1 + dp)}{Q_0(1 + \eta^* dp)} = \eta^* \frac{(1 + dp)}{(1 + \eta^* dp)}$$

Or also:

$$\eta^* = \frac{\eta}{1 + dp(1 - \eta)}$$

In general, based on the equation (2.5), the observed elasticity must be higher than one in absolute value to maximize the profit of the monopolist (the empirical estimated elasticity is larger than -1).

### *b. Oligopolistic Cournot-Nash equilibrium structure*

A second market structure available in the WELCOM tool deals with situations where there are few, but more than one, producers in the market, a structure known as *oligopoly*. In an oligopolistic market competition among firms is inherently affected by a setting of strategic interactions (Mas-Colell et al. 1995). The two typical approaches to analyze competition in oligopolies are the Cournot (1838) and Bertrand (1883) models. In the Cournot model the firms choose simultaneously the amount of output they want to supply and sell in the market at the market clearing price. In the Bertrand model the firms still choose simultaneously, but in contrast with the previous case where the strategic variable is the level of output, the firms now decide over the prices they want to charge and then must produce the output necessary to meet the demand after the price choices become known (Fudenberg and Tirole, 1991).

This section of the User Manual focuses on the equilibrium produced in an oligopoly when the firms compete following a Cournot model. This model implies a one-stage game in which firms choose their quantities or capacities simultaneously.<sup>19</sup> Given these quantity choices, price will adjust to the level that clears market,  $p(Q)$ , where  $Q = q_1 + \dots + q_n$ , and  $p(\cdot)$  is the inverse demand function. It is possible to assume a generalized profit function,  $\Pi^i(q_1, \dots, q_i, \dots, q_n)$ , such that the optimization problem faced by the firm can be written as:

$$\max_{q_i \geq 0} \Pi^i(Q) = q_i \cdot p(Q) - C_i(q_i) \quad (2.9)$$

Or, also can be expressed as:

$$\max_{q_i \geq 0} \Pi^i(q_1, \dots, q_i, \dots, q_n) = q_i \cdot p(q_1, \dots, q_i, \dots, q_n) - C_i(q_i) \quad (2.10)$$

Both expressions are equivalent, but the second one makes more explicit the fact that the price is a function of the aggregate output of all the firms in the market, while the cost is only a function of each firm own's production level. Each firm maximizes its profit given the quantity supplied by all the other firms in the market.

To solve equation (2.9) each firm  $i$  behaves as a monopolist who faces an inverse demand function given by  $\tilde{p}(Q) = p(\bar{q}_1, \dots, q_i, \dots, \bar{q}_n)$ . This implies that the optimally chosen quantity for firm  $i$ ,  $q_i$ , is decided taking as given the level of output of the rival firms ( $\bar{q}_1, \dots, q_{-i}, \dots, \bar{q}_n$ ). To be more precise, if the profit function  $\Pi^i(Q)$  is strictly concave in  $q_i$  and twice differentiable, the first-order condition for the previous Cournot model follows:

$$\frac{\partial \Pi^i(Q)}{\partial q_i} = p(q_1, \dots, q_i, \dots, q_n) + q_i \cdot p'(q_1, \dots, q_i, \dots, q_n) - C'_i(q_i) = 0 \quad (2.11)$$

We can also reorganize the results in equation (2.11) to facilitate their interpretation. In the equation (2.12) below the first two terms refer to the additional profit associated with an extra unit of output, which is equal to the difference between price and marginal cost. The third term captures the effect of this extra unit on the profitability of inframarginal ones, since this additional unit of output will decrease the price affecting the  $q_i$  units already produced:

$$p(q_1, \dots, q_i, \dots, q_n) - C'_i(q_i) + q_i \cdot p'(q_1, \dots, q_i, \dots, q_n) = 0 \quad (2.12)$$

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<sup>19</sup> An example of competition following a Cournot model are the “farmers *deciding how much of a perishable crop to pick each morning and send to a market. Once they have done so, the price at the market ends up being the level at which the crops that have been send are sold.*” (Mas-Colell et al. 1995:389).

To showcase this previous result, we rely on the assumptions proposed by Rodriguez-Castelan (2015), who discusses a model that shows how exogenous variations in market power could affect poverty. In Rodriguez-Castelan (2015), the competition among the oligopolistic markets follow a Cournot model and produces a Nash equilibrium. Note that the idea of Nash equilibrium<sup>20</sup> is implicit in the solution of the Cournot equilibrium. The equilibrium is determined by the condition that each firm choose the action that is a best response to the anticipated plays of the rest of firms in the market (Fudenberg and Tirole, 1991). To be able to solve the problem in (2.10), Rodriguez-Castelan (2015) assumes that there are  $N \geq 2$  firms in the market, the firm's cost function  $C_i(q_i)$  is a constant  $c$  (so the marginal cost of production,  $MC$ , would also be equal to  $c$ ), and that the inverse demand function is given by  $p(Q) = \frac{\beta\omega}{Q}$  such that:

$$\max_{q_i \geq 0} \Pi^i(Q) = q_i \cdot \frac{\beta\omega}{Q} - c \cdot q_i = q_i \cdot \frac{\beta\omega}{\sum_{i=1}^N q_i} - c \cdot q_i \quad (2.13)$$

Thus, the first order conditions are:

$$\frac{\partial \Pi^i(Q)}{\partial q_i} = \frac{\beta\omega}{\sum_{i=1}^N q_i} - q_i \cdot \frac{\beta\omega}{(\sum_{i=1}^N q_i)^2} - c = 0 \quad (2.13)$$

In addition, if all firms are identical, then we have that  $q_1 = \dots = q_i = \dots = q_n = \bar{q}$ , and we can replace  $Q = N\bar{q}$  in equation (2.13), where  $N$  denotes the number of firms in the market, such that:

$$\begin{aligned} \frac{\beta\omega}{N\bar{q}} - \bar{q} \cdot \frac{\beta\omega}{(N\bar{q})^2} - c &= 0 \\ \frac{\beta\omega}{N\bar{q}} \cdot \left(1 - \frac{1}{N}\right) - c &= 0 \\ \bar{q} &= \frac{\beta\omega}{c} \cdot \left(\frac{N-1}{N^2}\right) \end{aligned} \quad (2.14)$$

This individual level of individual firm production implies that the aggregate output in the market should be equal to:

$$Q = \frac{\beta\omega}{c} \cdot \left(\frac{N-1}{N}\right) \quad (2.15)$$

The equilibrium price then comes given by:

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<sup>20</sup> A Nash equilibrium is a “profile of strategies such that each player’s strategy is an optimal response to the other player’s strategies.” (Fudenberg and Tirole, 1991:12)

$$P = \frac{N}{N-1} \cdot c$$

Replacing the constant marginal cost,  $c$ , by  $MC$  and denoting the Nash equilibrium outcomes of the oligopoly model by the subscript  $OLI - NASH$ , the previous expression can be rewritten as:

$$p_{OLI-NASH} = \frac{N}{N-1} \cdot MC \quad (2.16)$$

It follows that the change in price resulting from the oligopolistic structure, assuming a competition price equal to the marginal cost, is given by:

$$\begin{aligned} dp &= \frac{p_{OLI-NASH} - p_{COMP}}{p_{COMP}} \\ dp_{OLI-NASH} &= \frac{\frac{N}{N-1} \cdot MC - MC}{MC} \\ dp_{OLI-NASH} &= \frac{1}{N-1} \end{aligned} \quad (2.17)$$

However, in practice we may not have the full information on the demand and the inverse demand function. Assume that all what we dispose is the price elasticity of demand,  $\eta = \frac{\partial q / \partial p}{q/p}$ . Given the quantity of the rest of firms, producer “n” maximizes the profits function:

$$\pi_n = p(Q) \cdot q_n - Cq_n \quad (2.18)$$

For simplicity, assume that  $AC = MC = C$

$$\begin{aligned} \frac{\partial \pi_n}{\partial q_n} &= \frac{\partial p(Q)}{\partial q_n} \cdot q_n + p - c = 0 \\ &= \frac{q_n p}{Q} \cdot \left( \frac{\partial p(Q)}{\partial Q} \cdot \frac{\partial Q}{\partial q_n} \cdot \frac{Q}{p} \right) + p - c = 0 \\ &= \frac{q_n}{Q} \cdot \frac{p}{\eta} + p - c = 0 \end{aligned} \quad (2.19)$$

Under the assumption that all firms are identical, each firm will produce the same amount of output in equilibrium, such that:  $q_n = \frac{Q}{N}$ , so it is possible to reorganize equation (2.19) to obtain:

$$-\frac{q_n}{Q} \cdot \frac{p}{\eta} = p - c \quad (2.20)$$

$$-\frac{1}{N} \cdot p = \eta \cdot (p - c)$$

$$-\frac{1}{N} \cdot p = \eta \cdot p - \eta \cdot c$$

$$p + N \cdot \eta \cdot p = N \cdot \eta \cdot c$$

Using equation (2.20) and denoting the results from this model with the subscript *OLI – NASH* is possible to find that at equilibrium:

$$p_{OLI-NASH} = \frac{\eta N}{1 + \eta N} \cdot MC \quad (2.21)$$

Relying in (2.21) and assuming that in competitive markets prices are equal to the marginal cost is possible to find that:

$$dp = \frac{p_{OLI-NASH} - p_{COMP}}{p_{COMP}}$$

$$dp_{OLI-NASH} = \frac{\frac{\eta N}{1 + \eta N} \cdot MC - MC}{MC}$$

$$dp_{OLI-NASH} = -\frac{1}{1 + \eta \cdot N} \quad (2.22)$$

### *c. Partial collusive oligopolistic structure*

So far, this User Manual has discussed two classical market structures in the industrial organization literature dealing with market concentration and market power. The first is the case of monopoly where a single firm controls the whole market and charges monopoly prices extracting market-power rents from the price-taking consumers. The second market structure considers the case where few identical firms with market power compete—either by choosing quantities, in a Cournot model, or through prices, as in a Bertrand model—in an oligopoly, whose strategic interaction produces an outcome that can be characterized as a Nash equilibrium (see Tirole, 1988; Fudenberg and Tirole, 1991). Even though these two cases are widely taught in standard microeconomic courses, it is seldom that we observe a unique firm that control the whole market (monopoly), or a set of few identical firms competing through quantities, as assumed in the Cournot-Nash equilibrium.

This section of the User Manual introduces another model of market concentration that can be more realistic and that will require a limited level of information to assess the impact of market



concentration on prices. A common structure of concentrated markets—that this User Manual refers to as Partial Collusive Oligopoly Structure (PCO)—involves few firms with a significant share of the market and multiple smaller firms with no market power and small market share (i.e., this large number of small firms that can contribute in the provision of the good, but without any market power). This structure is not too different from the concept of a dominant firm and competitive fringe discussed in Perloff (2013). In this latter model, a monopoly with competitive fringe could occur when a former monopoly maintains a cost advantage over later entrants (e.g., after the end of import restrictions, foreign firms enter the market, but they might face higher costs than the former monopoly), which in turn can only supply a small part of the market acting as price takers. Thus, these price-taking firms are called the *competitive fringe*. In this model, the former monopoly acts as a price-setting firm that competes with price-taking firms, maximizing its profits based on a residual demand curve, i.e. the demand that is not met by the competitive fringe at any given price.<sup>21</sup> The PCO model proposed in this User Manual requires four basic assumptions:

- **Assumption 1:** A small number of large firms have a significant share of the market. The rest of the market is supplied by many smaller firms that lack market power. The user manual will refer to this case as: *the partial collusive oligopoly structure*.
- **Assumption 2:** In the shorter or medium term the small firms cannot easily update their produced/supplied quantities. Their quantities are assumed to be fix or highly rigid for the adjustments. There are a lot of reasons that can explain this rigidity:
  - The limited supply of some specific production inputs: specialized labor, specific intermediate inputs, etc.
  - A prohibitive cost of entry for new firms, and this, by converting their observed activities.
  - Consequently, it is assumed that the supplied quantity by the small firms is constant. Note that without the entry constraint, the outcome of this model would be similar to the Bertrand model (Tirole, 1988; Fudenberg and Tirole, 1991) where firms compete their prices down such that in equilibrium:  $p = MC$ . This can be explained by the gradual entry of firms that are attracted by the profit, and this will increase the quantity, and then, reduces the price until the level:  $p = AC = MC$ . However, this *Bertrand paradox* is not consistent with what we observe empirically.
- **Assumption 3:** The firms with market power (the oligopoly part of the market) coordinate to maximize their profits. Their predefined market share—if they act as in a competitive market—

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<sup>21</sup> See Perloff (2013): [http://wps.aw.com/aw\\_perloff\\_microcalc\\_3/235/60177/15405461.cw/index.html](http://wps.aw.com/aw_perloff_microcalc_3/235/60177/15405461.cw/index.html)

is ( $\phi_o$ ). An additional assumption is that firms know the market reaction or the price elasticity of demand ( $\eta$ ).

- **Assumption 4:** The group composed by the smaller firms with no market power behave as followers. Firms of this groups will benefit from the increase in price implied by the reduction in the supplied quantity of the oligopoly group.

In addition, assume that the cartel (the oligopoly group) will act as a leader, and decides to reduce its supplied quantity share by  $d\phi_o$ . As indicated, the cartel cannot influence the quantity produced by the small firms ( $Q_S$ ) that behaves as price takers when  $p \geq MC$ . Starting from the known price elasticity  $\eta$ , what would be the level of  $d\phi_o$  that maximizes the profit of the oligopoly group? For simplicity, suppose that the marginal cost is constant and equal to the price of the full competitive market. The profit of the oligopoly group is:

$$\pi_o = p(Q = Q_o + Q_S) \cdot Q_o - C(Q_o) \quad (2.23)$$

Assume that the cartel (the oligopolistic group) acts as a leader, and decides to reduce its supplied quantity share by  $\phi_o$ . As indicated, the cartel cannot influence the produced quantity of the small firms ( $Q_S$ ) when  $p \geq MC$ . Starting from the known price elasticity  $\eta$ , what can be the level of  $d\phi_o$  that maximizes the profit of the partial-oligopolistic group? For simplicity, assume that the marginal cost,  $MC$ , is constant such that the maximization problem that firms with market power face is equivalent to:

$$\pi_o = p(Q_o + Q_S) \cdot Q_o - cQ_o \quad (2.24)$$

Under the previous conditions, and assuming that  $\pi_o$  is a concave and twice differentiable continuous function, the first order condition are given by:

$$\frac{\partial \pi_o}{\partial Q_o} = \frac{\partial P}{\partial Q} \cdot \frac{\partial Q}{\partial Q_o} \cdot Q_o + p - MC = 0 \quad (2.25)$$

$$\frac{\partial P}{\partial Q} \cdot \frac{\partial Q}{\partial Q_o} \cdot Q_o + p = MC$$

$$\frac{\partial P}{\partial Q} \cdot \frac{\partial Q}{\partial Q_o} \cdot \frac{Q_o}{Q} \cdot Q = MC - p$$

$$\frac{\partial P}{\partial Q} \cdot \frac{Q}{p} \cdot \frac{\partial Q}{\partial Q_o} \cdot \phi_o = \frac{MC}{p} - 1$$

$$\begin{aligned}\frac{1}{\eta} \cdot 1 \cdot \phi_o &= \frac{MC}{p} - 1 \\ \frac{1}{\eta} \cdot \phi_o + 1 &= \frac{MC}{p} \\ p_{PCO} &= \left( \frac{1}{1 + \phi_o/\eta} \right) \cdot MC\end{aligned}\tag{2.26}$$

This formula reproduces some familiar results. For instance, it follows from formula (2.26) that if  $\phi_o \rightarrow 0$ , then  $p = MC$ , the classical result in competitive markets. Also, this formula could be used to infer some information on the proportion of increase in the price implied by the market concentration.

Going from the competitive market outcome, ( $p_{CM} = MC$ ), to the partial collusive oligopoly, ( $p_{PCO} = \frac{MC}{1 - \phi_o \eta}$ ), implies a proportional price increase of:

$$\begin{aligned}dp &= \frac{p_{PCO} - p_{CM}}{p_{CM}} \\ dp &= \frac{\frac{1}{1 - \phi_o \eta} \cdot MC - MC}{MC} = \frac{MC \cdot \left( \frac{1}{1 + \phi_o/\eta} - 1 \right)}{MC} \\ dp &= \frac{1}{1 + \phi_o/\eta} - 1 = \frac{1 - 1 - \phi_o/\eta}{1 + \phi_o/\eta} \\ dp &= \frac{p_{PCO} - p_{CM}}{p_{CM}} = -\frac{\phi_o/\eta}{1 + \phi_o/\eta} = -\frac{\phi_o}{\eta + \phi_o}\end{aligned}\tag{2.28}$$

Empirically, it is assumed that the observed market share of the oligopoly group with PCO ( $\phi_o^{PCO}$ ) is lower than in the competitive market ( $\phi_o^{COMP}$ ). Precisely, the observed market share is:

$$\phi_o^{PCO} = \frac{\phi_o^{COMP} + \eta^* \cdot dp}{1 + \eta^* \cdot dp}$$

Thus, we have:

$$\phi_o^{COMP} = \phi_o^{PCO} \cdot (1 + \eta^* \cdot dp) - \eta^* \cdot dp$$

In general, while in the monopoly case a positive change in price implies that:  $\eta < -1$ , in the PCO model the constraint becomes  $\eta < -\phi_o$ . The PCO model can justify existence of the market power even if the elasticity is lower than one, and this what makes such a model attractive.

Based on 2.5 and 2.28, we find the following result:

$$\begin{aligned}\eta &= \frac{\partial Q}{\partial P} \frac{p_1}{Q_1} = \frac{\partial Q}{\partial p} \cdot \frac{p_{COMP}}{Q_{COMP}} \cdot \frac{(1 + dp)}{(1 + \eta^* dp)} \\ \eta &= \frac{\partial Q}{\partial p} \cdot \frac{p_{COMP}}{Q_{COMP}} \cdot \frac{(1 + dp)}{(1 + \eta^* dp)} = \eta^* \cdot \frac{(1 + \frac{-\phi_o}{\eta + \phi_o})}{(1 + \eta^* \cdot \frac{-\phi_o}{\eta + \phi_o})} \\ \eta &= \eta^* \cdot \frac{\frac{\eta + \phi_o - \phi_o}{\eta + \phi_o}}{\frac{\eta + \phi_o - \eta^* \cdot \phi_o}{\eta + \phi_o}} = \frac{\eta^* \cdot \eta}{\eta + \phi_o - \eta^* \cdot \phi_o}\end{aligned}\quad (2.29)$$

$$\begin{aligned}1 &= \frac{\eta^*}{\eta + \phi_o - \eta^* \cdot \phi_o} \\ \eta^* + \eta^* \cdot \phi_o &= \eta + \phi_o \\ \eta^* &= \frac{\eta + \phi_o}{1 + \phi_o}\end{aligned}\quad (2.30)$$

Next, the User Manual reports two illustrative examples for the two suggested methods of the PCO model. Let  $\eta = -0.8$ ,  $\tilde{\phi}_o = 0.20$ , the observed exchanged total quantity is 1000. For the monopoly example, we assume that the elasticity is -1.2. The following table gives the results of the two examples.

Competitive market	PCO market
$\eta^* = -1.5/(1 + 0.25 * 2.5) = -0.9231$ $\eta^* = \eta/(1 + dp(1 - \eta))$	$\eta = -1.5$
$p_{comp} = 1.00$	$p_{OLI} = \left(\frac{1}{1 + (\phi_o/\eta)}\right) = 1.25$
$MC = 1.00$	$MC = 1.00$

$\phi_R = 0.7$ $Q_R = 700$ $Q_{o\_OLI} = (1 - 0.9231 * 0.25) * Q_{o\_COMP}$ $Q_{o\_COMP} = 390$	$\bar{\phi}_0 = 0.3$ $Q_{o\_OLI} = 300$
Profit = $(1-1)*390=0$	Profit = $(1.25-1)* 300 \approx 75$

Competitive market	MONOPOLY market
$\eta^* = -1.2/(1 + 5 * 2.2) = -.1$ $\eta^* = \eta/(1 + dp(1 - \eta))$	$\eta = -1.2$
$p_{comp} = 1.00$	$p_{MONO} = \left(\frac{1}{1 + 1/\eta}\right) = 6$
$MC = 1.00$	$MC = 1.00$
$Q_{o\_MONO} = 1000$ $Q_{o\_MON} = (1 - .1 * 5) * Q_{o\_COMP}$ $Q_{o\_COMP} = 2000$	
Profit = $(1-1)*2000=0$	Profit = $(6-1)* 1000 \approx 5000$

The suggested PCO model offers three main advantages:

- i. The User not need to know the exact number of firms, but can model the market using information on the share of the largest firms.
- ii. This market structure requires moderate information to assess the impact of market concentration on prices. Mainly, it requires the elasticity of demand and the market share of the oligopoly group.
- iii. The suggested model mimics the real life and where we observe that small and large firms realize some profits.

#### *d. Partial market adjustment*

The three previous subsections discuss cases of complete movements from a market concentration situation to a perfective competitive market, or vice versa. However, it may be helpful to cover the case of a partial or stepwise movement. For instance, suppose a situation when starting from a given number of oligopoly firms, the user is interested in assessing the impact of a discrete increase in the number of firms. In addition, notice that the monopoly model is similar to

the PCO model when the oligopoly market size is equal to 100%. In general, for the monopoly and PCO models, it is possible to assume that a partial movement implies a decrease in the market size from  $\phi_o^1$  to  $\phi_o^m$ .

Starting from the equation (2.30), is possible to show that:

$$\eta^m = \eta^* \cdot (\phi_o^m + 1) - \phi_o^m$$

Then:

$$dp_{PCO}^m = \frac{-\phi_o^m}{\eta^m + \phi_o^m}$$

Finally, for the case of oligopoly with the Nash equilibrium:

$$\eta^m = \frac{1 + \eta^* (1 + N^m)}{N^m}$$

Such that:

$$dp_{NASH}^m = \frac{1}{1 - \eta^m \cdot N^m}$$

### 2.3 Price changes and the household well-being

This User Manual focuses in estimating the welfare impacts derived from changes in prices following the tradition of indirect welfare measurement. The essential empirical problem that this section of the User Manual discusses is how to measure welfare changes when the price of at least one of the goods considered changes and if utility, demand or both are unknown (Abdelkrim and Verme, 2016). There are three alternative money-metric well-being measurements in the **mcwel** Stata module:<sup>22</sup> the Laspeyres measure, the equivalent variation measurement and the compensated variation measurement. This section briefly discusses the characteristics of each of the measurements.

The indirect utility depends on the level of income and that of prices of goods and services. According to King (1983), the *equivalent income* is a level of income for which one can keep the level of utility unchanged after the change in prices. Formally, if the indirect-utility function is denoted by  $V$ , we can write:

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<sup>22</sup> Hicks (1942) discusses five common measures of welfare changes: (i) Consumer's surplus variation, (ii) compensating variation, (iii) equivalent variation, (iv) Laspeyres variation, and (v) Paasche variation. For a recent discussion of alternative welfare measures see Abdelkrim and Verme (2016).

$$V(\mathbf{p}^r; m_e^t) \equiv V(\mathbf{p}^t; m^0)$$

where  $\mathbf{p}^r$  and  $\mathbf{p}^t$  denote the vectors of prices in  $r$  and  $t$  periods respectively and  $m_e^t$  denotes the equivalent income.

$$m_e^t = f(\mathbf{p}^r; \mathbf{p}^t; m^0)$$

The reference period can be the initial ( $r = 0$ ) or the final ( $r = 1$ ). The equivalent variation is equal to:

$$EV = f(\mathbf{p}^0; \mathbf{p}^1; m^0) - f(\mathbf{p}^0; \mathbf{p}^0; m^0),$$

and the compensated variation is equal to:

$$CV = f(\mathbf{p}^1; \mathbf{p}^1; m^0) - f(\mathbf{p}^1; \mathbf{p}^0; m^0).$$

#### *a. The Laspeyres measurement*

The Laspeyres measurement of the change in well-being resulting from the change in prices is simply equal to the change in the total expenditures where the initial quantities are maintained. This measurement is also equal to the first order Taylor approximation of the price impact on well-being (see Abdelkrim and Verme (2016) for more details). Formally, if we denote the expenditures of the household ( $h$ ) on the product of interest ( $k$ ) by  $e_{h,k}$ , we have that:

$$dw_h^{Laspeyres} = -e_{h,k} \cdot dp_k \tag{2.32}$$

#### *b. The equivalent variation measurement<sup>23</sup>*

The user can select among two consumer preferences functional forms. The first is that of Cobb-Douglas function (*CD*). The second is the *constant elasticity of substitution* (*CES*) functional form. Let  $\alpha_{k,h}$  denotes the expenditure share of household  $h$  on the product of interest  $k$ . Using

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<sup>23</sup> <http://www2.econ.iastate.edu/classes/econ501/Hallam/documents/FunctionalForms.pdf>  
See <http://www2.econ.iastate.edu/faculty/hallam/>

the King (1983) approach, and assuming initial prices are normalized to one in the initial period, the change in well-being of household  $h$ , measured by the equivalent variation, is equal to:

$$dw_h^{EV:CD} = w_h \cdot \left[ \frac{1}{(1 + dp_k)^{\alpha_{k,h}}} - 1 \right] \quad (2.33)$$

$$dw_h^{EV:CES} = w_h \cdot \left( \frac{\pi_{0,h}}{\pi_{1,h}} - 1 \right) \quad (2.34)$$

where  $\pi_{0,h} = (\alpha_{k,h}^\sigma + (1 - \alpha_{k,h})^\sigma)^{\frac{1}{1-\sigma}}$  and  $\pi_{1,h} = (\alpha_{k,h}^\sigma (1 + dp_k)^{1-\sigma} + (1 - \alpha_{k,h})^\sigma)^{\frac{1}{1-\sigma}}$ .

### *c. The compensated variation measurement*

The change in well-being of household  $h$ , measured by the compensated variation, is equal to:

$$dw_h^{CV:CD} = w_h \cdot (1 - (1 + dp_k)^{\alpha_{k,h}}) \quad (2.35)$$

$$dw_h^{CV:CES} = w_h \cdot \left( 1 - \frac{\pi_{1,h}}{\pi_{0,h}} \right) \quad (2.36)$$

## 2.4



### 3. The WELCOM Stata Package

The fourth section of this User Manual discusses the installation, preparation of data and alternative methods of analysis available in **mcwel** tool to estimate the impacts of competition policy reforms in welfare.

#### 3.1 Installation

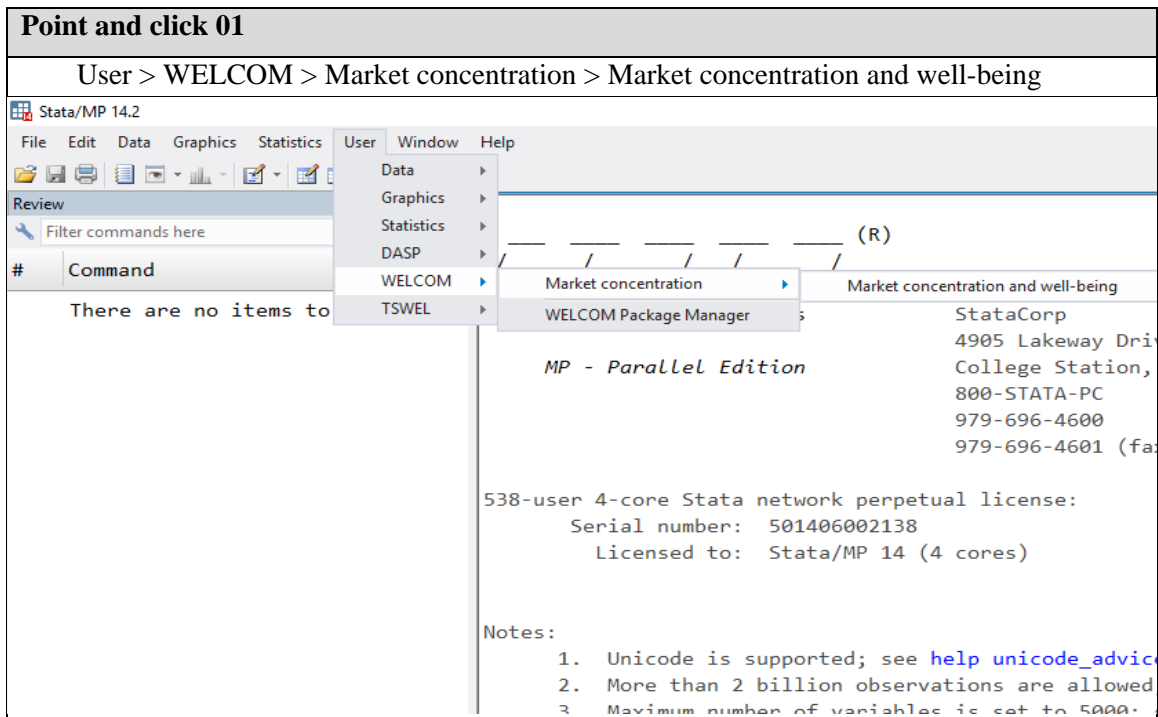
To install WELCOM execute the following commands in the Stata command line. Note that it is possible to either copy and paste these lines directly in the command window or in the dofile editor preferred by the User:

Commands 01
set more off net from http://dasp.ecn.ulaval.ca/welcom/Installer net install welcom, force cap addmimenu profile.do _ welcom_menu _ welcom_menu

**Note:** The Stata command lines in the chart **Commands 01** tries to add the file profile.do automatically or add the command **\_welcom\_menu** in this profile file, if the latter already exists. However, if the previous commands do not function, the User needs to manually copy and paste the profile.do file in the following locations (based on the operating system of the computer):

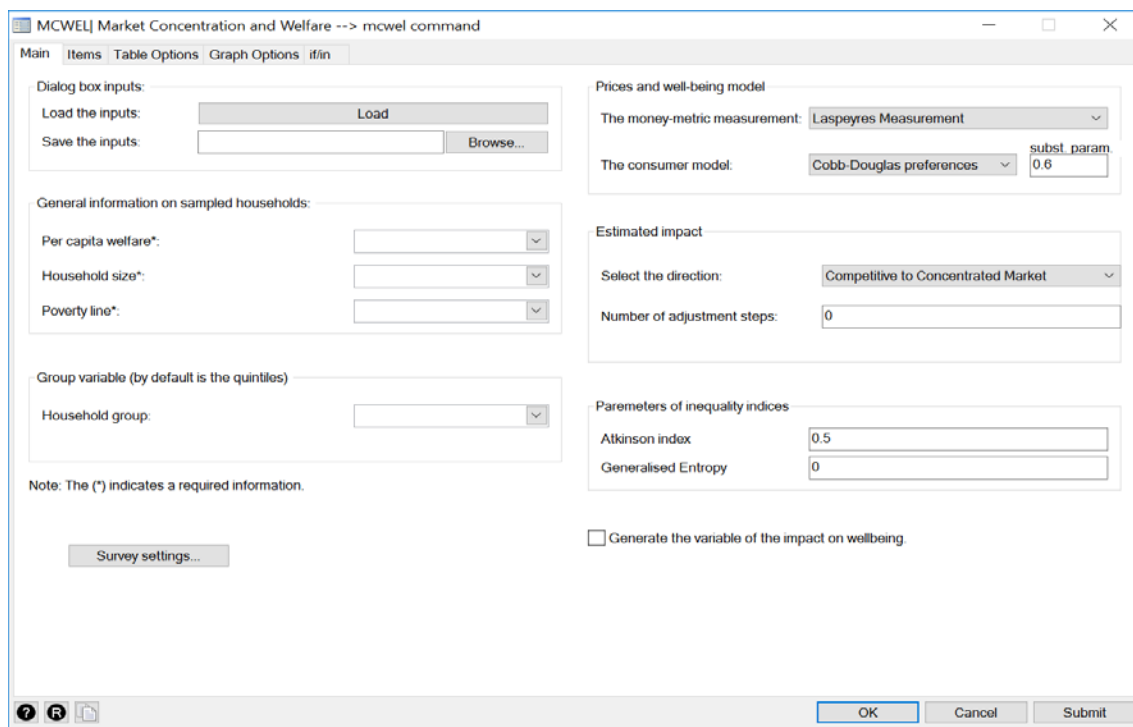
- a. *Windows OS system:* copy the file in **c:/ado/personal/**
- b. *Macintosh system:* copy the file in one of the Stata system directories. To find these directories, type the command **sysdir**.

Once the previous steps were executed, the User should close all Stata sessions and restart the program. After opening a new window, the User should be able to go to the menu bar in Stata, click on the User option, choose the WELCOM package, select the Market concentration option and launch the **mcwel** tool by clicking on Market concentration and well-being:

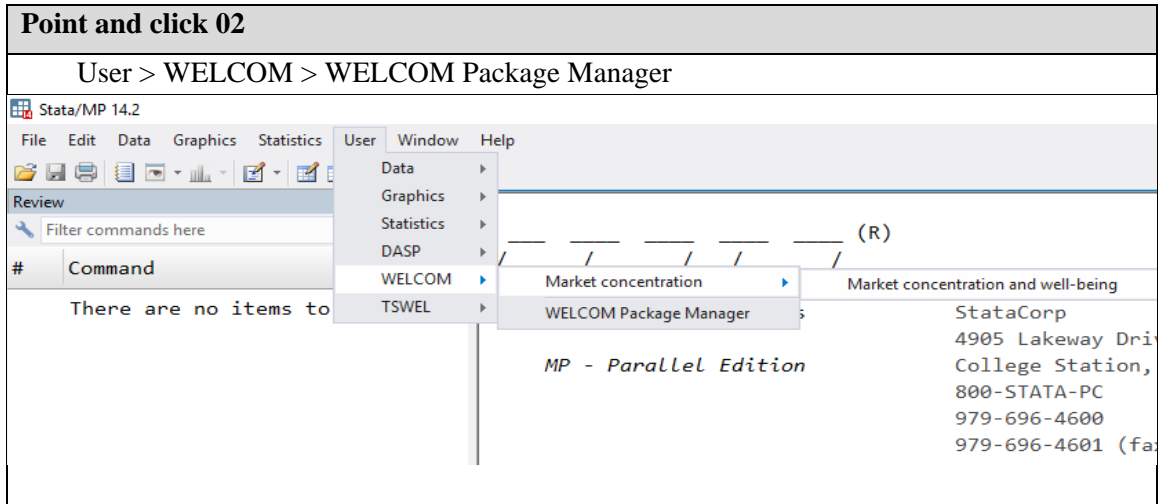


After selecting the “Market and well-being” option, a window with the main user interface of the **mcwel** module will open and the User can start interacting with the program:

Figure 4.1: Main tab in **mcwel** module interface

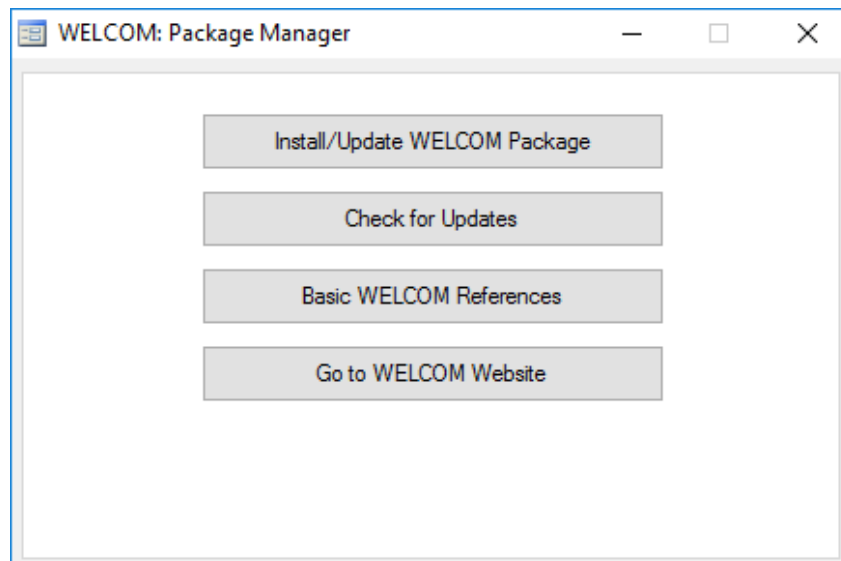


Note that the WELCOM package also provides the option of “WELCOM package manager” to manage updates in the tool, read the reference material or visit the WELCOM website<sup>24</sup> as shown in Figure 3.2 below:



The following window corresponds to the user interface of the WELCOM: Package Manager, showing alternatives to manage the version of the WELCOM Package and of the **mcwel** Stata tool:

Figure 3.2: WELCOM: Package Manage Window



<sup>24</sup> <http://WELCOM>

After the User executes the commands in the table **Commands 01** and launches the **mcwel** tool following the instructions in **Point and click 01**, the tool is ready for use. The next section will discuss in more detail the user interphase of the **mcwel** module for Stata.

### 3.2 The WELCOM package for Stata

The WELCOM package for Stata and was designed to assess the impact of changes in consumer prices resulting from policy interventions to strengthen competition in specific markets relying on the alternative theoretical models discussed in Section 3.2 of this User Manual. The current version of the tool is flexible enough to accommodate three alternative market structures and firms' competitive behavior:

- *Monopoly*: probably the simplest situation, when a single firm or a group of collusive firms acting as a single supplier have market power on the supply side.
- *Oligopoly*: in this scenario, a small number of firms with market power control the supply side and compete generating a Cournot-Nash equilibrium.
- *Partial collusive oligopoly*: a small number of firms with market power control a given share of the market supply side and several smaller firms with no market power behave as price takers.

The empirical analysis produced by the tool is based on micro-economic models where the household is the unit of reference. One of the advantages of the tool is that it has mild minimum data requirements that allow the User to run *ex-ante* analysis of policies aimed at strengthening competition. The data requirements of the tool include:

- A representative sample of the population (i.e., a consumption survey).
- Information on total household expenditures (i.e., a variable representing a consumption aggregate).
- Data on household expenditures on the product of interest where we observe the market concentration or expect a competition policy reform.
- Information on one of the following parameters of the model (market structure), based on the characteristics of the industry under study:
  - Monopoly: demand price elasticity.
  - Oligopoly: number of firms in the market and demand price elasticity.
  - Partial collusive oligopoly: market share of the firms colluding and the demand price elasticity they face.

Note that the data requirements of WELCOM can typically be met with data from two alternative sources. On one hand, a household survey with a consumption module should provide enough information on total consumption and expenditure in the type of good of interest. On the other hand, basic information on the characteristics of the market and market structure can be obtained from industry reports (such as the number of firms and market shares), studies from government agencies (market shares, elastic of demand, collusive agreements) and firms or industry surveys (number of firms, market shares), among others.

The rest of this section of the User Manual presents the different elements and features of the tool in five parts:

- a. Preparing the dataset
- b. Launch the dialog box
- c. Load the key variables
- d. The “Main” tab
- e. The “Items” tab
- f. Select options to produce tables
- g. Select options to produce graphs
- h. The “if/in” tab

#### *a. Preparing the dataset*

Prior to launching the dialog box it is necessary to load in the memory of Stata a database including variables with the relevant information on consumption in the format required by the tool as well as additional characteristics on the market structure for the alternative options that the user would like to estimate.<sup>25</sup> The tool requires information on the following dimensions of household characteristics and poverty measurement in the market:

- **Expenditure per capita in the product of interest:** to analyze the effects of competition policy interventions, the dataset available should include information on expenditure per capita in the good or service where a firm or group of firms have market power or where a competition policy reform is expected to have impact.

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<sup>25</sup> Please notice that if the database of interest already includes all the necessary variables to use the **mcwel** command it can be directly load to memory from the mc dialog box.

- **Per capita expenditures:** since the estimation of the effects of the competition policies rely on a relative incidence analysis, information regarding the overall level of expenditure per capita is also required.
- **Household size:** the tool also requires to identify a variable capturing the size of the household.
- **Poverty line:** a variable representing the relevant poverty line (alternatively, other line such as extreme poverty, vulnerability or middle class could be used) is necessary to assess the effects of the intervention on poverty.<sup>26</sup>

In Figure 3.3. the User Manual shows a simple example of the kind of data on consumption that the tool requires:

Figure 3.3: Data Requirements

The screenshot shows a software interface titled 'Data Editor (Browse) - [mc\_example.dta]'. It features a menu bar (File, Edit, View, Data, Tools) and a toolbar. The main area displays a data table with columns: communication, pcep, hsize, pline, strata, psu, and sweight. The table contains 23 rows of data. To the right, there are two panels: 'Variables' and 'Properties'. The 'Variables' panel lists variables with checkboxes and labels: communication (Comm. Expenditure), pcep (Per capita income), hsize (Household size), pline (Poverty line), strata (Stratum), psu (Primary sampling units), and sweight (Sampling weights). The 'Properties' panel shows details for the selected 'communication' variable, including its name, label, type (double), format (%10.0g), and value label.

	communication	pcep	hsize	pline	strata	psu	sweight
1	2.2222222	696.1188	4	264	1	3	29.37666
2	7.5757576	829.0881	4	264	1	3	29.37666
3	13.333333	951.552	5	264	1	3	29.37666
4	7.2222222	501.7114	7	264	1	3	29.37666
5	22.594203	678.34	6	264	1	3	29.37666
6	0	665.0084	4	264	1	3	29.37666
7	0	1015.569	2	264	1	3	29.37666
8	12.479167	729.906	5	264	1	3	29.37666
9	3.7037037	1495.956	5	264	1	3	29.37666
10	11.527778	1340.938	7	264	1	3	29.37666
11	108.41026	906.4763	4	264	1	3	29.37666
12	0	1147.267	2	264	1	3	29.37666
13	.74074074	266.384	5	264	1	3	29.37666
14	1.6666667	452.6646	2	264	1	3	29.37666
15	34.484848	813.7813	6	264	1	3	29.37666
16	0	390.6719	4	264	1	3	29.37666
17	27.037037	1029.278	3	264	1	3	29.37666
18	5.5555556	738.8141	8	264	1	3	29.37666
19	3.7681159	703.0042	6	264	1	3	29.37666
20	9.125	515.1771	10	264	1	6	23.75874
21	5.9770115	734.7753	8	264	1	6	23.75874
22	0	2240.688	1	264	1	6	23.75874
23	23.507937	361.9401	6	264	1	6	23.75874

In addition, the **mcwel** command allows to include the sample weights of the survey and, ideally, additional variables indicating the Primary Sampling Unit (PSU) and Strata. Moreover, the tool also allows the user to include a variable with information on the finite sample population

<sup>26</sup> The current version of the tool expects that the three monetary variables (expenditure in the relevant good, total expenditure and poverty line) are expressed in comparative terms, for instance in current local currency units or in real terms using the same base year.

correction. However, if no information on the sample design of the survey is entered (the sampling design is not initialized), the simple random sampling is used by default.

Moreover, by default the tool will analyze the impacts of the policies by expenditure quintiles, however we may want to include a variable capturing a different disaggregation such as income deciles (to perform a relative incidence analysis by income decile), the urban/rural divide, bottom 40 and top 60, or an indicator of ethnicity, among others.

*b. Launch the dialog box*

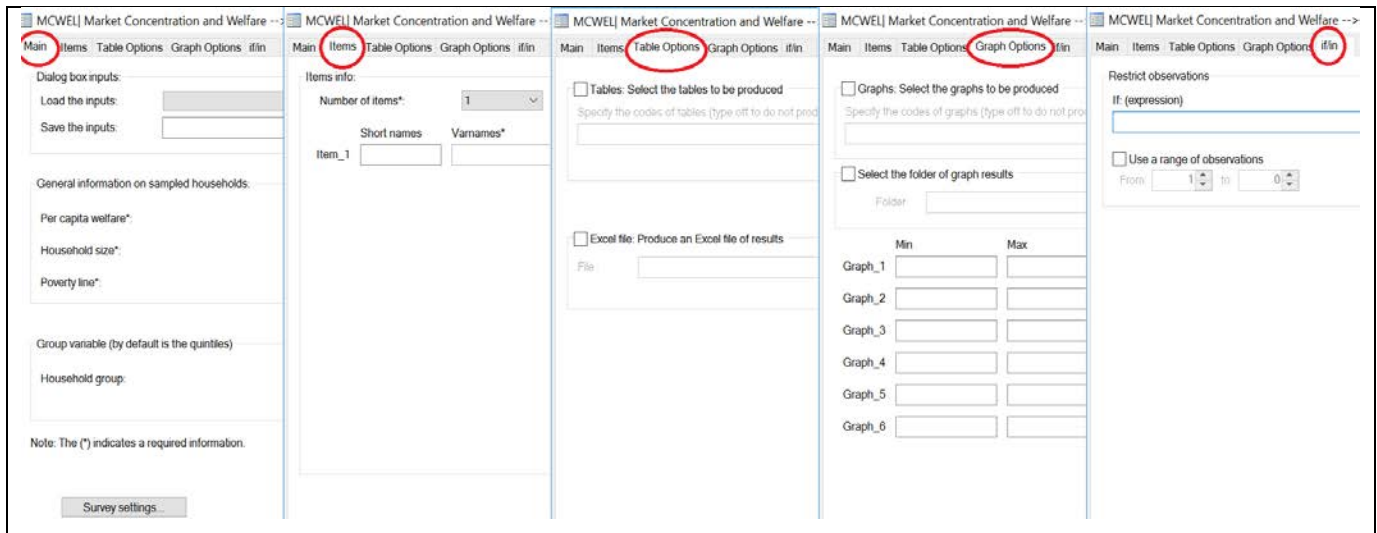
Once the relevant database is loaded in the memory of the Stata program, the dialog box of the tool enables the User to interact with the tool and identify the variables with the required information on household consumption, as well as to select the appropriate models—and their parameters—for the alternative market structures and estimations. Thus, after the User loaded to memory the database with the relevant variables for the analysis, she can launch the dialog box following the steps discussed in the following **Point and click 03** table:

<b>Point and click 03</b>	
User > WELCOM > Market concentration > Market concentration and well-being	

Once the tool in Stata is launched the user interface will show a window with the “Main” tab, where the variables and parameters of the models to be analyzed can be selected. In addition, there is a second tab labeled “Items” where the User can indicate the markets or products under analysis. A third tab is optional and called “Table Options” to select the tables to be produced as

well as the location to save an Excel file with such tables. The “Graph Options” tab allows the User to choose alternative options to produce graphs. Finally, the “if/in” allows the User to select a subsample of the observations for the analysis. The “Figure 3.4: Tabs in the **mcwel** window” shows the location and main view of each of the tabs available in WELCOM.

Figure 3.4: Tabs in the main window



In the rest of this section, the User Manual will discuss the different elements that compound each of the tabs available in the dialogue box of the tool.

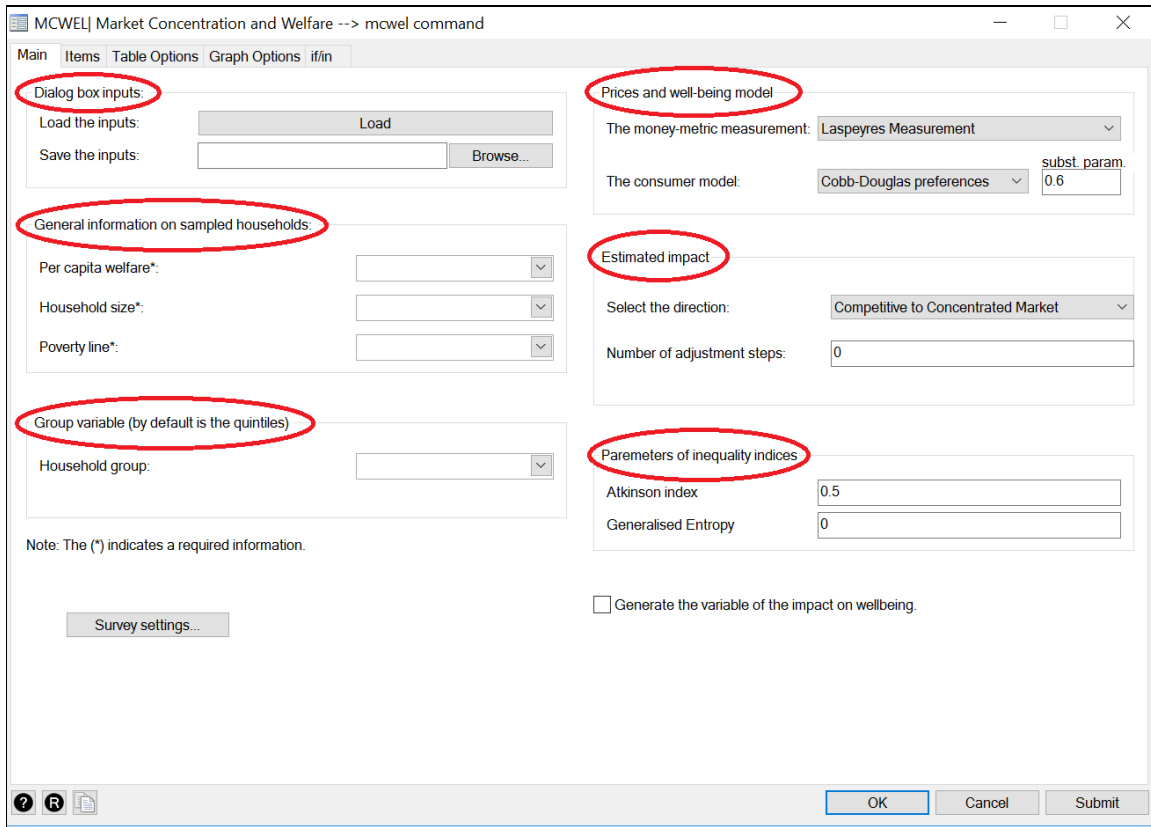
### c. The “Main” tab

The “Main” tab of the tool is organized in seven sections, as indicated by the red circles in Figure 3.5, each associated to a different element of the data available, characteristics of the sample design, market structure and survey design, among others.

In addition, the “Main” tab also includes a box at the bottom right that the User can check if she wants to “Generate the variable for the impact on well-being”, in case the User wants to generate a new variable in Stata to store the results of the analysis of the impacts of competition policy reforms.



Figure 3.5: Elements of the Main Tab Window



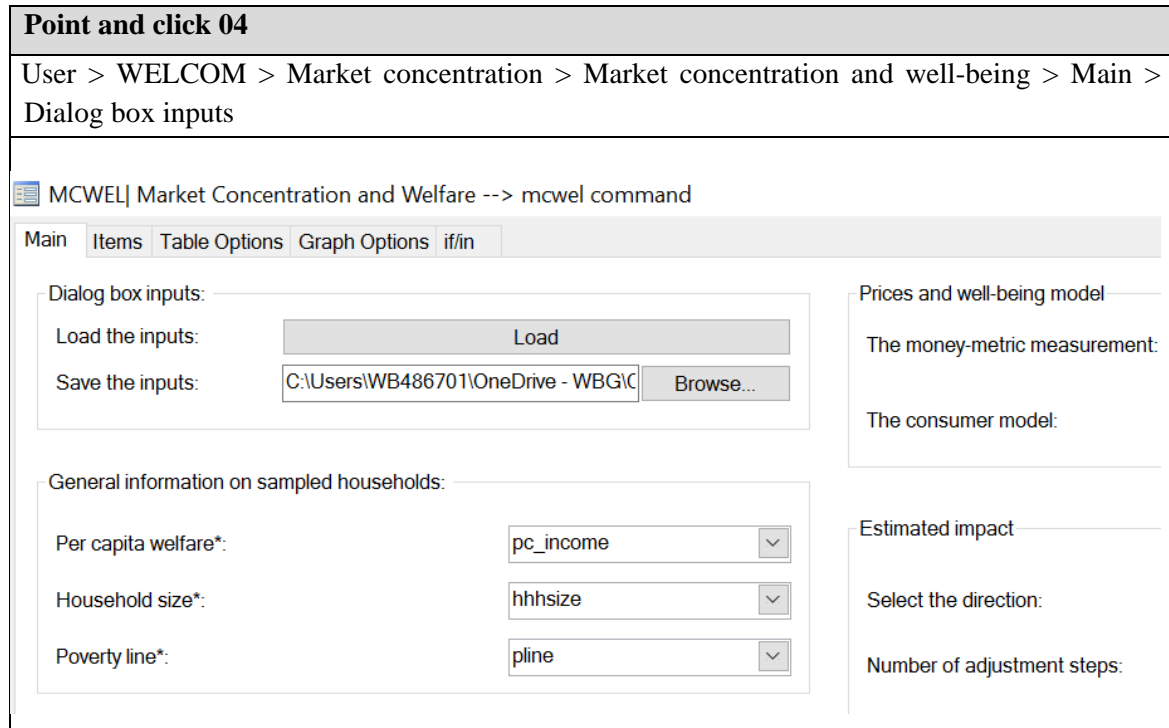
In the rest of this section each of the options in the seven section of the Main tab showed in Figure 3.5 will be discussed in detail:

- Dialog box inputs
- General information on the sampled households
- Group variable
- Prices and well-being model
- Estimated impact
- Parameters of inequality indices

- *The Dialog box inputs*

This is to load and save the dialog box information. The box enables the user to load information already saved into the WELCOM window, or to save the information inserted in the dialog box in a file to be stored for future simulations. This information is stored in text files with

the extension \*.mcw. You can test this feature by uploading the file “mcwel\_example.mcw” provided with the toolkit. Note that you can load the file from one directory (“Load the Inputs”) and save it in a different directory with a different name (“Save the Inputs”).



- *General information on the sampled households*

The box “General information on sampled households” is located at the top left of the window. This box includes 4 options to select the relevant variable from the database in memory using a dropdown menu such as the one showed in **Point and click 04** chart. At a minimum, the tool requires the user to introduce information about the following three variables of interest:

- i. Per capita expenditures: continuous numerical variable with monetary values.
- ii. The household size: integer variable.
- iii. The poverty line: continuous numerical variable with monetary values.

**Point and click 05**

User > WELCOM > Market concentration > Market concentration and well-being > Main > Per capita welfare / Household size / Poverty line

MCWEL| Market Concentration and Welfare --> mcwel command

Main | Items | Table Options | Graph Options | if/in

Dialog box inputs:

Load the inputs:

Save the inputs:

Prices and well-being model

The money-metric measurement:

The consumer model:

General information on sampled households:

Per capita welfare\*:

Household size\*:

Poverty line\*:

Group variable (by default is the quintiles)

Household group:

Estimated impact

Select the direction:

Number of adjustment steps:

Parameters of inequality indices

Atkinson index

Generalised Entropy

Note: The (\*) indicates a required information.

Notice that these variables should be included in the database in memory and need to be prepared in advance in the required format as discussed in the section “Preparing the dataset.” In addition, the three monetary variables (Per capita expenditures on the product of interest, Per capita expenditures and Poverty line) should be expressed in comparable terms such as current currency units or in real terms using the same base year.

- *Group variable (by default is quintiles)*

The main information required by the tool to estimate the effect of policies that promote competition in markets were discussed in the “General information on sampled households” and “Market structure” sections. So far, the User was expected to introduce information based on the data on consumption and characteristics of the industry available in household surveys, market

studies, firm surveys or other sources. Now, the User is expected to introduce information on the way she wants the data to be analyzed and the estimates and results to be presented.

The box “Group variable” enables the User to select a population group variable in a dropdown menu from the database in memory or by directly introducing the number of groups to classify the households given their expenditure levels, as shown in the **Point and click 06** chart.

**Point and click 06**

User > WELCOM > Market concentration > Market concentration and well-being > Main > Household group

MCWEL| Market Concentration and Welfare --> mcwel command

Main
Items
Table Options
Graph Options
if/in

Dialog box inputs:

Load the inputs:

Save the inputs:

General information on sampled households:

Per capita welfare\*:

Household size\*:

Poverty line\*:

Group variable (by default is the quintiles)

Household group:

Note: The (\*) indicates a required information.

Prices and well-being model

The money-metric measurement:

The consumer model:

Estimated impact

Select the direction:

Number of adjustment steps:

Parameters of inequality indices

Atkinson index

Generalised Entropy

Generate the variable of the imp

Notice that, in contrast with the previous boxes where the User had to either select an alternative or introduce a value, now she can either choose to select a variable or directly introduce an integer value representing the number of groups required. If the User decides to group the estimates using a variable, the results could show the differences by socio-demographic group such as gender or urban-rural area of residence. In contrast, if the user indicates an integer such as 10 in the “Household group” option, the population is organized by decile groups based on their level of expenditure. If the “Household group” option is left empty, then the results are shown organized by expenditure quintiles by default.

- *Price and well-being model*

Once the data on consumption, the parameters on the characteristics of the market and the organization of the results is selected, the User needs to decide the type of measurement to use to estimate the impacts of the policy fostering competition. More precisely, this implies choosing the main approach to be adopted to assess the impact of price change on well-being. The user can select among the three following alternative measurements (see the Section 3.3 for more details on the characteristics of these measures).

- The Laspeyres measurement (linear approximation).
- The equivalent variation measurement.
- The compensated variation measurement.

**Point and click 07**

User > WELCOM > Market concentration > Market concentration and well-being > Main > Select the structure > Prices and well-being model

MCWEL Market Concentration and Welfare --> mcwel command

Main Items Table Options Graph Options if/in

Dialog box inputs:

Load the inputs:

Save the inputs: C:\Users\WB486701\OneDrive - WBG\...

General information on sampled households:

Per capita welfare\*:

Household size\*:

Poverty line\*:

Group variable (by default is the quintiles)

Household group:

Note: The (\*) indicates a required information.

Prices and well-being model

The money-metric measurement:

The consumer model:

Estimated impact

Select the direction:

Number of adjustment steps:

Parameters of inequality indices

Atkinson index:

Generalised Entropy:

Generate the variable of the impact on wellbeing.

- *Estimated impact*

So far, this User Manual has implicitly assumed that the base scenario under analysis is one where a concentrated market exists, such that the authorities responsible of policy design have identified the presence of market power and are planning to implement a policy to promote competition in the market. Therefore, the analysis of the effects of the policy implicitly assume moving from an industry where a group of firms exploit their market power, to a competitive market

where firms are not able to extract market power rents and charge prices according to their marginal costs.

**Point and click 08**

User > WELCOM > Market concentration > Market concentration and well-being > Main > Estimated impact

MCWEL| Market Concentration and Welfare --> mcwel command

Main | Items | Table Options | Graph Options | if/in

Dialog box inputs:

Load the inputs:

Save the inputs:

General information on sampled households:

Per capita welfare\*:

Household size\*:

Poverty line\*:

Group variable (by default is the quintiles)

Household group:

Note: The (\*) indicates a required information.

Prices and well-being model

The money-metric measurement:

The consumer model:

Estimated impact

Select the direction:

Number of adjustment steps:

Parameters of inequality indices

Atkinson index:

Generalised Entropy:

Generate the variable of the impact on wellbeing.

However, the tool is flexible enough to accommodate the analysis of policies aimed at fostering competition in the market (e.g., by selecting the “Concentrate to Competitive Market” option in the “Select the direction” box) as well as the opposite scenario, where a policy is expected to somehow reduce competition in the market (e.g., limit imports, setting price ceilings, creating artificial monopolies, etc) and the User needs to assess the impact on welfare of moving from a competitive market to a more concentrated one.

To switch between the base scenarios that the User wants to run for the analysis, she can go to the “Estimated Impact” box and follow the indications in the **Point and click 08** chart below. Notice that as the User change the base scenario, the interpretation of the results should also be adjusted to reflect the relevant conditions.

In addition to estimating the impact of moving from the initial to the final state (for instance from the concentrated market to the competitive market), the module can estimate the intermediate states of the partial movements toward the final state. This is can be achieved by indicating the number of steps of adjustments. For instance, assume that we have a case of a PCO model for which

the market size of the oligopoly firms is equal to 60%. If the selected number of adjustment is zero, then the tool estimates directly the impact of a full impact. If the number of steps is one, then the impact is estimated from a change of the market change from 60% to 30% and then from 60% to 0%. As a general rule, if we denote the initial market share by  $\phi^I$  and the number of steps by  $s$ , then, the intermediate steps are:  $\phi^I \rightarrow \frac{\phi^I}{(1+i)}$  and  $i \in \{1; s\}$ . The monopoly is a special case when  $\phi^I = 100\%$ .

Now, assume the case of the oligopoly market structure which a Nash equilibrium that depends on the number of firms. For instance, if the initial number of firms is  $N^I = 4$ , and the number of steps is three, the intermediate steps are: for  $N = 6, 8$  and  $12$ . As a general rule, when the number of steps is  $s$ , then, the intermediate steps are:

**Step 1:**  $N^I \rightarrow N^I * 1.5$  // **Step 2 to s:**  $N^I \rightarrow N^I * i$  and  $i \in \{2; s\}$ .

As an additional example, in table ##, we present some displayed results for the case of two product items (Combustible and Communication). In this case, the indicated number of steps is 3. For the combustible item, the initial market size is 42.31%. The step1 is by moving toward the competitive market by a decline is the size from the 42.31 to 42.31/2, the step 2 is a decline in size until 42.31/3 and the step 3 is a decline until 42.31/4=10.57%. For the Communication item, the initial number of the oligopoly firms is 8, in the step 1 it increases by 50% to 12, and then it doubles in step 2 and triple in step 3.

### The number of adjustment steps and results

Table 1.1: Models and parameters						
	Combustible			Communication		
	Market size (in%)	Elasticity	Price	# of firms	Elasticity	Price
Concentrated_Market	42.3100	-0.9040	1.8798	8.0000	-0.6430	1.1628
Step__1	21.1550	-0.6210	1.5167	12.0000	-0.5821	1.1252
Step__2	14.1033	-0.5266	1.3658	16.0000	-0.5517	1.1018
Step__3	10.5775	-0.4794	1.2831	24.0000	-0.5213	1.0740
Competitive_Market	0.0000	-0.3379	1.0000	.	-0.4604	1.0000

The user can select another number of steps of adjustments, and this to have more refined results if needed.

- [Parameters of inequality indices](#)

In the “Parameters of inequality indices” the tool offers the option to select some of the parameters necessary to estimate the two alternative inequality indices:

- a. The Atkinson index
- b. The Generalized Entropy

**Point and click 09**

User > WELCOM > Market concentration > Market concentration and well-being>Survey settings

wel command

Prices and well-being model

The money-metric measurement: Laspeyres Measurement

The consumer model: Cobb-Douglas preferences

subst. param. 0.6

Estimated impact

Select the direction: Competitive to Concentrated Market

Number of adjustment steps: 0

Parameters of inequality indices

Atkinson index 0.5

Generalised Entropy 0

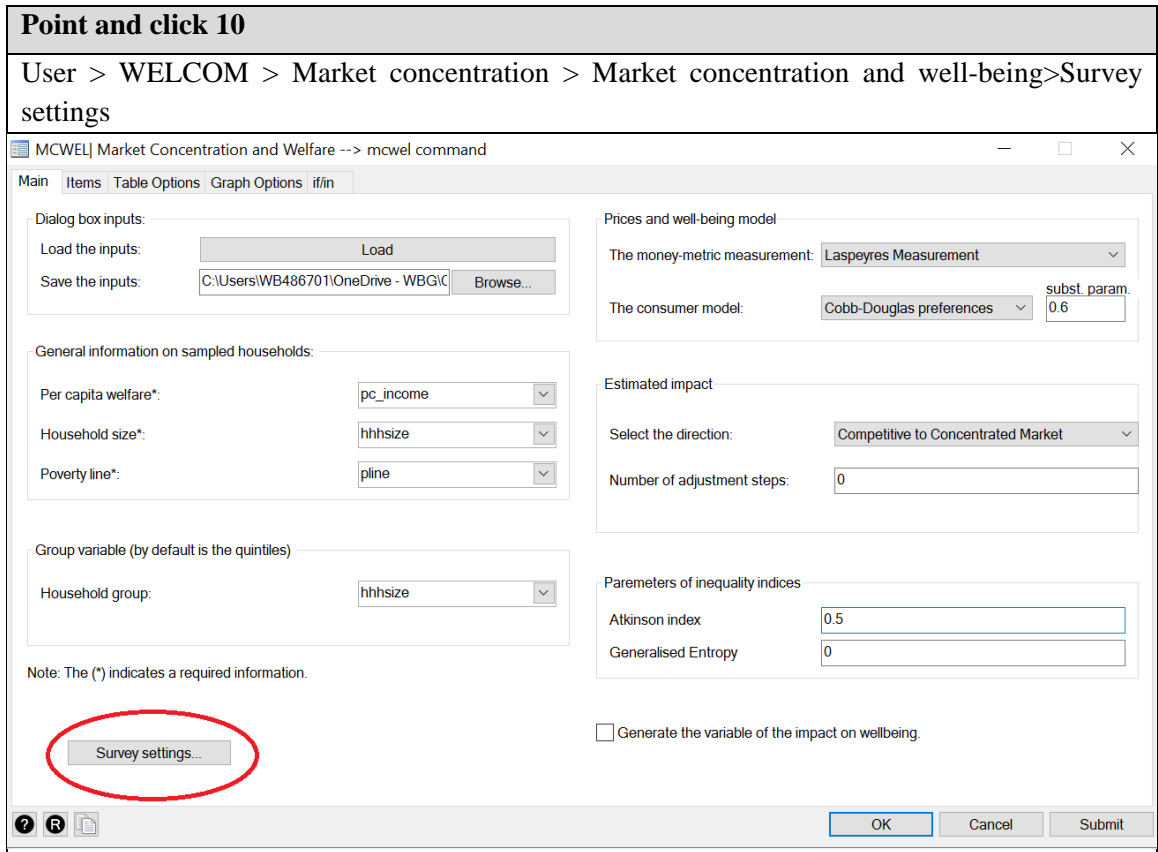
Generate the variable of the impact on wellbeing.

OK Cancel Submit

- *Survey settings*

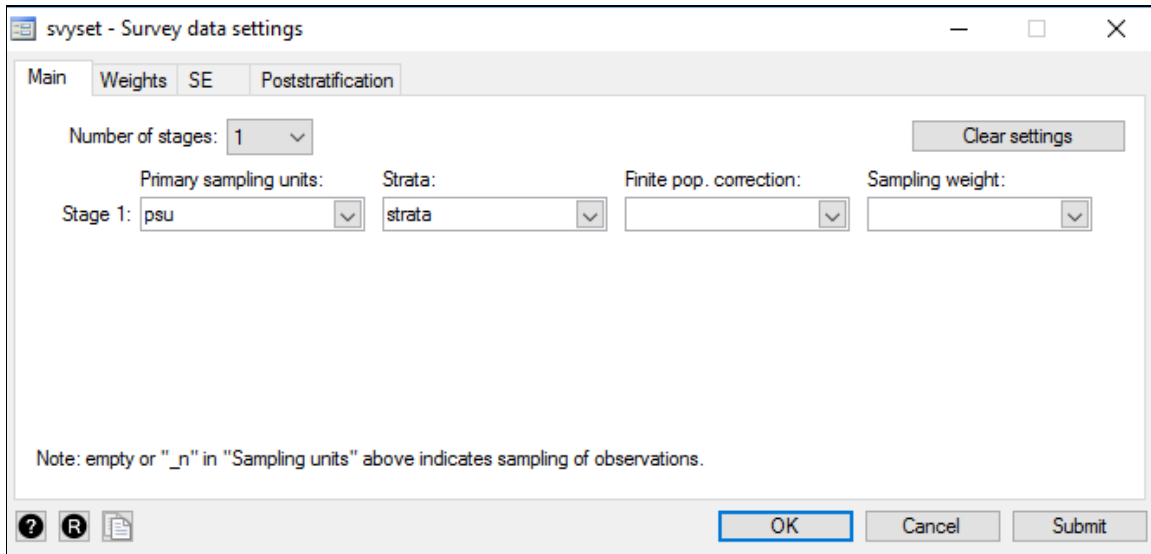
Notice that to use the options for survey settings, the User needs to prepare the variables associated with the different dimensions of the survey design before launching tool. These settings include information on the sampling weights, sampling design, adjustment for finite population, among others. This can be done with the command “svyset” in Stata or using the button “Survey Settings...” located in the bottom right-hand corner of the “Main” tab, as shown in the **Point and click 08** chart.





For more information on the alternative survey settings available in the tool, see the Stata Reference Manual on [Survey Data](#).

Figure 3.6: Survey Settings Options in the tool



*d. The “Items” tab*

Among the main improvements in the version 2.0 is the possibility of estimating the impacts of different market concentrations. The tab “Items” enables to indicate the number or products of interest with concentration markets, as well we, the market structure of each product/item. While the options in the “Main” tab generally rely on information from a household or consumer survey, the information for the “Items” tab comes from studies on the organization of the industry or market under study as well as from firm surveys or analysis on competition conditions from the competition market authorities (CMA).

The user can choose from 1 to 10 items. For each item, the user can indicate:

- The short name of the item or the product.
- The variable name of the expenditures per capita.
- The market structure: The tool needs information on the structure of the supply side of the industry, i.e. how many firms or suppliers are and how do they interact in the market. In addition, each model of market structure requires a different set of parameters that the User requires to feed into the mcwel tool. For instance, while the Monopoly structure only requires information on the elasticity of the demand, the Oligopoly: Nash Equilibrium needs in addition to the demand elasticity, information on the initial number of firms in the market. Following the instructions in the chart Point and click 05, the user can select among three alternative structures and the required industry parameters:

- a. *Monopoly*: The User only needs to provide the value of the price elasticity of the demand. Notice that this elasticity is typically a negative parameter in the range  $(-1,0)$  since by theory the monopolist optimizes by producing in the elastic segment of the demand curve.
  - b. *Oligopoly-Nash equilibrium*: Under this type of market structure, the User must provide information on the elasticity of demand faced by the firms, as well as on the number of firms in the oligopolistic market.
  - c. *Partial collusive oligopoly*: In this scenario, the User must provide the value of the price elasticity of demand as well as the observed market share of the oligopolistic group.
- The non-compensated elasticity.
  - The number of firms (model: Oligopoly: Nash equilibrium).
  - The market size of the oligopoly group (model: PCO).

**Point and click 11**

User > WELCOM > Market concentration > Market concentration and well-being > Items > Number of firms

MCWEL| Market Concentration and Welfare --> mcwel command

Main Items Table Options Graph Options if/in

Items info:

Number of items\*: 3

	Short names	Varnames*	Structure	Elasticity	Number of firms	Market size
Item_1	Combustible	pexp_comb	Oligopoly (PCO)	-0.904		0.4231
Item_2	Communicat	pexp_comu	Oligopoly (Nash)	-0.643	8	
Item_3	Cereals	pexp_cereal	Oligopoly (PCO)	-.92700186		0.3471

OK Cancel Submit

It must be noted that one of the caveats of the analysis currently available in the tool is that the welfare outcomes of the alternative market structures are compared against a perfect competition counterfactual. This implies that the tool assumes, for instance, that after implementing a policy reform aimed at eliminating a monopoly in a market, this market will become perfectly competitive, assumption that might be problematic in some circumstances.

*e. The “Table Options” tab*

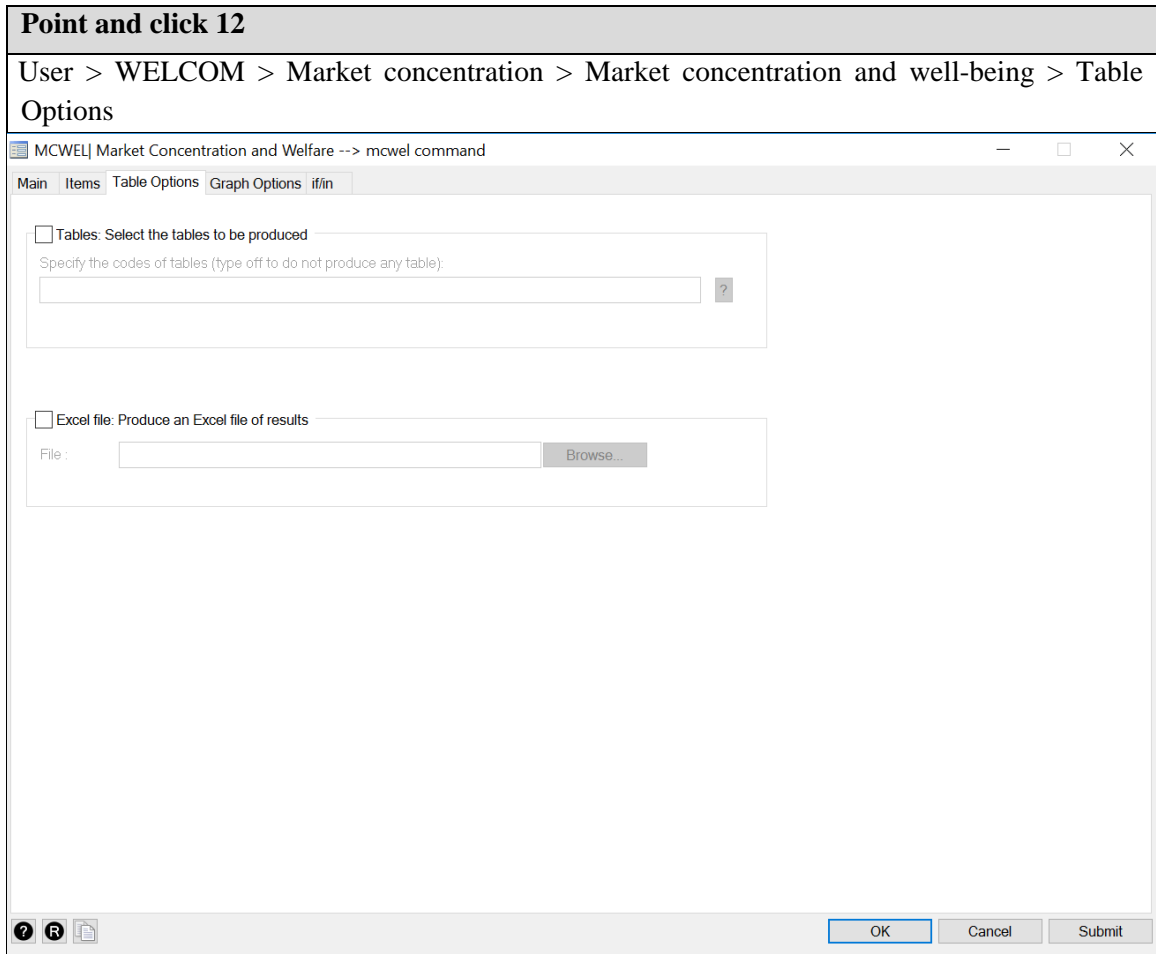
This tab allows the user to select the tables’ options. The default option when you do not select the tables and override options is the production of all tables.

- *Tables: Select the tables to be produced*

In case the user wishes to have only a selected number of tables the code of these tables can be indicated in the box. The list of codes with the titles of the tables can be seen by clicking on the question mark button “?”. For example, you can type “11 23” to produce tables 1.2 and 2.3 only (no commas, one space between numbers).

- *Excel file: Produce an Excel file of results*

This box allows the user to define the Excel file where all tables should be stored. The user can select an existing file to override or create a new file. The user can either specify the name of the file or not. In the case of an existing file, the user should make sure that this file is closed when the program is launched, otherwise an error message will appear.



*f. The “Graph Options” tab*

The tab on the Graph Options allows the User to decide if she wants the tool to produce graphs with the estimated impacts of the analysis of the policy interventions aimed at foster competition, and what are the parameters and characteristics of the graphs. To access the “Graph Options” tab, the User should follow the indications in the **Point and click 10** box. The main three options available allow to select the graphs to be produced, choose the folder to save such graphs and select among alternative graph options.

- *Graphs: Select the graphs to be produced*

This option allows the User to save only selected graphs by indicating the code of each graph. The list of codes with the titles of the graphs can be seen by clicking on the question mark button “?”. For example, if the user wishes to produce only Graphs 1, 2 and 4, the user will simply type “1 2 4” (no commas, one space between numbers).

- *Select the folder of graph results*

This option allows the user to select the directory where the saved graphs should be stored. Note that all graph files are saved in three formats: .gph, .pdf and .wmf. will save a folder with the name “Graphs” in the directory selected.

- *Graph options*

For each graph, the user can select options regarding the y-axis scale (min and max) and other two-way graphs options as indicated in the Stata graph help files. For example, users may want to limit the range of the graphs to a specific interval like between 10 and 80. This can be done by indicating min and max values. Or users may want to omit titles of the graphs to add these titles separately in the report. This can be done by adding the Stata graph option “title (“”)”. Note that each of the displayed graphs is automatically saved in three format in a the previously indicated folder (“Graph”). The three format the saved graphs are: (i) \*.gph; (ii) \*.wmf; and (iii) \*.pdf.

**Point and click 13**

User > WELCOM > Market concentration > Market concentration and >Graph options

MCWEL| Market Concentration and Welfare --> mcwel command

Main Items Table Options **Graph Options** if/in

Graphs: Select the graphs to be produced  
Specify the codes of graphs (type off to do not produce any graph):

?

Select the folder of graph results  
Folder:

	Min	Max	Other twoway graph options
Graph_1	<input type="text"/>	<input type="text"/>	<input type="text"/>
Graph_2	<input type="text"/>	<input type="text"/>	<input type="text"/>
Graph_3	<input type="text"/>	<input type="text"/>	<input type="text"/>
Graph_4	<input type="text"/>	<input type="text"/>	<input type="text"/>
Graph_5	<input type="text"/>	<input type="text"/>	<input type="text"/>
Graph_6	<input type="text"/>	<input type="text"/>	<input type="text"/>

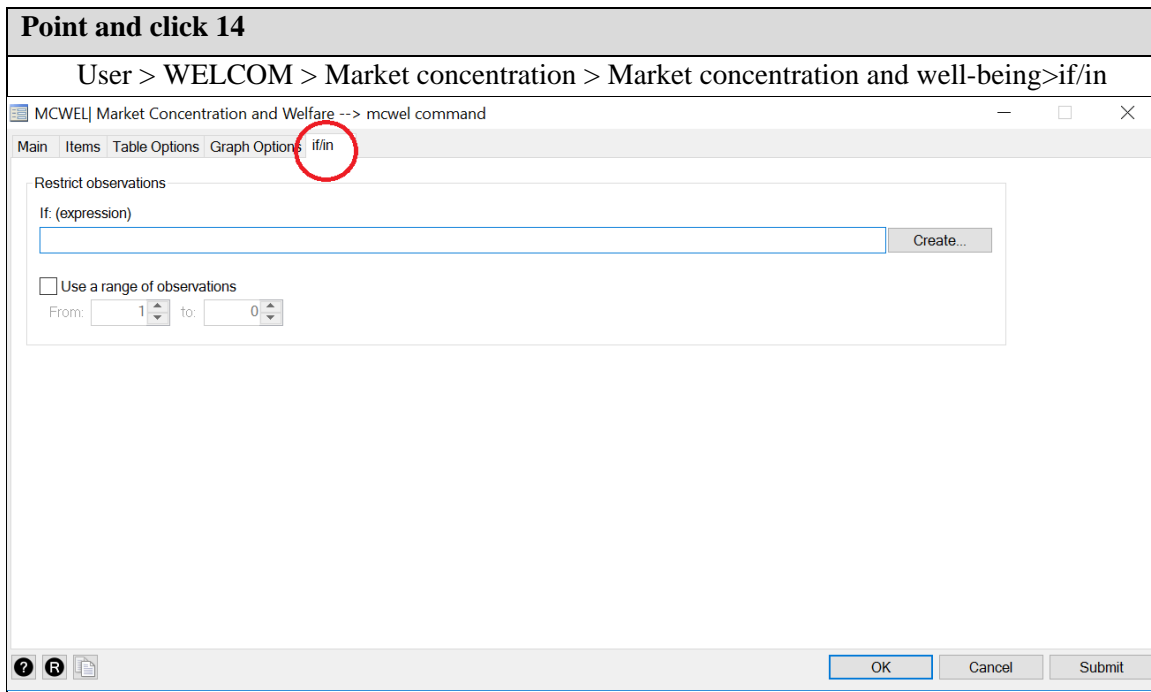
OK Cancel Submit

### *g. The “if/in” tab*

The “in/in” tab includes a single command box to select a relevant subsample from the database on memory to perform the analysis.

- *Restrict observations*

Note that, as shown by the **Point and click 09** box below, the mcwel tool offers two main ways to restrict the observations to a smaller subsample. The first alternative is to select observations conditional on a specific if expression or criteria. The second alternative implies restricting the analysis to a predetermined range of observations.



### 3.3 The mcwel outputs

After launching the computation, a series of results (tables and figures) are displayed. The main results tables provided are:

#### a. *The estimated market parameters*

In table 1, the price change, the adjusted elasticity and the rest of used or estimated parameters of the market structure are reported.

*b. The descriptive statistics on household expenditures*

In table 2, the average per capita to expenditures and that on the product of interest are reported for each population group. Also, it is displayed the expenditure shares.

*c. The impact of the market concentration on household well-being*

In table 3, the price change implied by the moving from a market without concentration to that with concentration is reported. In addition, table 3 reports the average impact of the price change on household well-being, and this by population groups.

*d. The impact of the market concentration on poverty*

In table 4, the three popular poverty indices are reported for the cases of with and without market concentration. Also, the impact of the market concentration on poverty is reported.

*e. The impact of the market concentration on inequality:*

In table 5, four inequality indices are reported for the cases of with and without market concentration. Also, the impact of the market concentration on the inequality is reported. The inequality indices are:

- The Gini index;
- The Atkinson index;
- The generalized entropy index;
- The Quantiles ratio index ( $Q(p=0.1)/Q(p=0.9)$ ).

**Note:** The full information on the sampling design of the survey is used to assess the standard error of the different statistics.

The Figure results are:

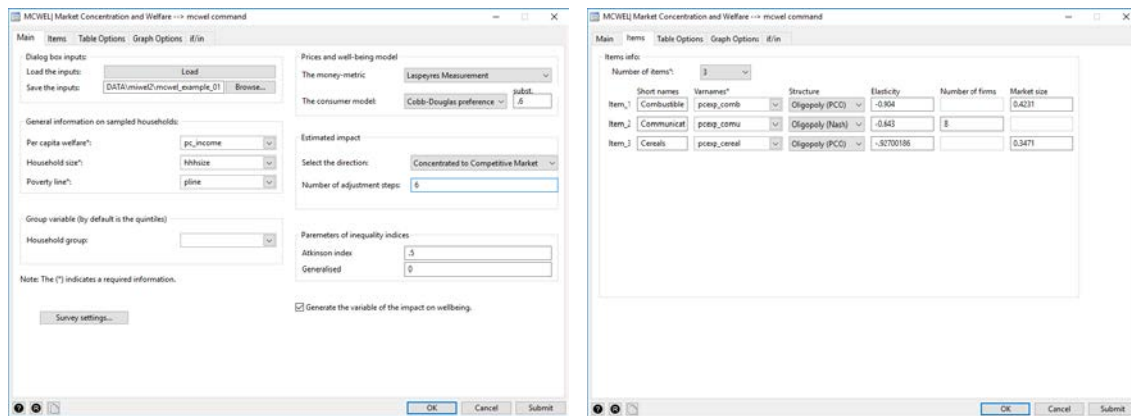
- The expenditures share on the product of interest, per the well-being percentile;
- The per capita impact on well-being according to the well-being percentile;
- The Lorenz curve of well-being and the concentration curve of the product of interest.



## 3.4 Examples of WELCOM

### Example 01:

- Step 1: Be sure that you have installed the WELCOM
- Step 2: load the zipped folder:  
[http://dasp.ecn.ulaval.ca/WELCOM/examples/mcwel\\_examples.rar](http://dasp.ecn.ulaval.ca/WELCOM/examples/mcwel_examples.rar)
- Step 3: Unzip the loaded folder in a given folder location: for instance c:/PDATA/WELCOM2/
- Step 4: Open the dialog box (type: db mcwel);
- Step 5: Load the file mcwel\_example\_01.mcw. This step will initialize the information in the dialog box



- Step 6: Click on the button submit.

In this first example, we would like to produce the tables 1.1 and 1.2, as well as the figure 01. We have three items of interest, and their three corresponding market structures are already indicated in the TAB items of the dialog box. As we can remark in the box *estimated impact*, we would like to estimate the impact of moving from the concentrated market to the competitive market. Further, we would like to estimate the impacts of a six partial moving toward the competitive markets.

Table 1.1: Models and parameters

Item: Combustible	Market type : Partial Collusive Oligopoly		
Step	Market size (in%)	Elasticity	Price
Concentrated Market	42.310	-0.9040	1.879809
Step : 1	21.155	-0.6210	1.516716
Step : 2	14.103	-0.5266	1.365767
Step : 3	10.578	-0.4794	1.283072
Step : 4	8.462	-0.4511	1.230875
Step : 5	7.052	-0.4323	1.194930
Step : 6	6.044	-0.4188	1.168670
Competitive Market	0.000	-0.3379	1.000000
Item: Communication	Market type : Oligopoly: Nash Equilibrium		
Step	# of firms	Elasticity	Price
Concentrated Market	8.000	-0.6430	1.162760
Step : 1	12.000	-0.5821	1.125223
Step : 2	16.000	-0.5517	1.101755
Step : 3	24.000	-0.5213	1.074013
Step : 4	32.000	-0.5061	1.058158
Step : 5	40.000	-0.4970	1.047897
Step : 6	48.000	-0.4909	1.040714
Competitive Market	.	-0.4604	1.000000
Item: Cereals	Market type : Partial Collusive Oligopoly		
Step	Market size (in%)	Elasticity	Price
Concentrated Market	34.710	-0.9270	1.598550
Step : 1	17.355	-0.6787	1.343533
Step : 2	11.570	-0.5960	1.240897
Step : 3	8.677	-0.5546	1.185481
Step : 4	6.942	-0.5298	1.150793
Step : 5	5.785	-0.5132	1.127035
Step : 6	4.959	-0.5014	1.109745
Competitive Market	0.000	-0.4305	1.000000

For instance, for the combustible item, we have initially a PCO market structure, and where the market share of the oligopoly firms is 42.31 %. In the first step of the adjustment toward the competitive market, the market share is reduced, by the half, and then by two thirds and so on. Table 01 also shows the corresponding elasticities and prices.

Table 02 gives some descriptive statistics on the population and the expenditures

Table 1.2: Population and expenditures (in currency)

Groups	Population	Number of households	Household size	Total expenditures	Total expenditures per capita	Total expenditures per household
Quintile 1	24009490	4854708	4.95	18849142784	785.07	3882.65
Quintile 2	23958312	5402162	4.43	35458871296	1480.02	6563.83
Quintile 3	23982586	5894251	4.07	52534333440	2190.52	8912.81
Quintile 4	23986720	6734927	3.56	80423206912	3352.82	11941.21
Quintile 5	23969206	8784954	2.73	232294957056	9691.39	26442.37
Total	119906312	31671002	3.79	419560521728	3499.07	13247.47

Figure 01 gives more refined results similar to those of table 1.1:

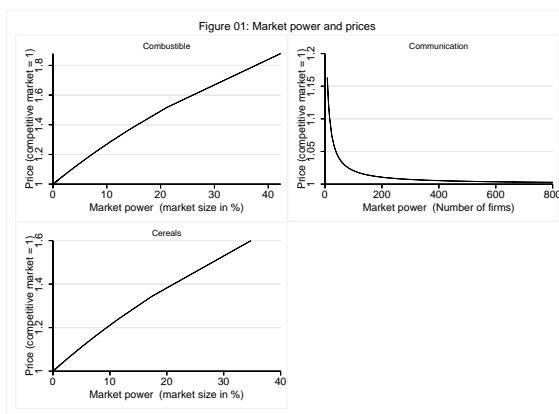


Figure 1: The mcwel table outputs

**Example 02:**

- Step 5: Load the file mcwel\_example\_02.mcw.
- Step 6: Click on the button submit.

This example is similar to the first, but in this case the number of steps of adjustment are two and we produce all of the tables and figures.

Table 1.1: Models and parameters

Item: Combustible		Market type : Partial Collusive Oligopoly		
Step	Market size (in%)	Elasticity	Price	
Concentrated Market	42.310	-0.9040	1.879809	
Step : 1	21.155	-0.6210	1.516716	
Step : 2	14.103	-0.5266	1.365767	
Competitive Market	0.000	-0.3379	1.000000	
Item: Communication		Market type : Oligopoly: Nash Equilibrium		
Step	# of firms	Elasticity	Price	
Concentrated Market	8.000	-0.6430	1.162760	
Step : 1	12.000	-0.5821	1.125223	
Step : 2	16.000	-0.5517	1.101755	
Competitive Market	.	-0.4604	1.000000	
Item: Cereals		Market type : Partial Collusive Oligopoly		
Step	Market size (in%)	Elasticity	Price	
Concentrated Market	34.710	-0.9270	1.598550	
Step : 1	17.355	-0.6787	1.343533	
Step : 2	11.570	-0.5960	1.240897	
Competitive Market	0.000	-0.4305	1.000000	

The mcwel module estimates the different statistics for each step of adjustment. For instance, for the impact on the poverty headcount, the first table shows the level of poverty with the concentrated market (53.352%), and then with only the partial adjustment of the combustible market (52.28). The last line shows the impact of the partial adjustment in the three markets (51.43). The table 5.1 is reproduced for each adjustment step.

Table 5.1: The market power and the poverty headcount || Concentrated to competitive: Step 1

Step	Poverty level	The change in poverty	Standard error	P-Value
Concentrated Market	53.352	.	.	.
Combustible	52.280	-1.072	0.101	0.000
Communication	53.263	-0.089	0.027	0.001
Cereals	52.566	-0.786	0.083	0.000
Competitive Market	51.435	-1.917	0.131	0.000

Table 5.1: The market power and the poverty headcount || Concentrated to competitive: Step 2

Step	Poverty level	The change in poverty	Standard error	P-Value
Concentrated Market	53.352	.	.	.
Combustible	51.923	-1.429	0.114	0.000
Communication	53.219	-0.133	0.040	0.001
Cereals	52.273	-1.079	0.097	0.000
Competitive Market	50.725	-2.627	0.156	0.000

Table 5.1: The market power and the poverty headcount || Concentrated to competitive: Full adjustment

Step	Poverty level	The change in poverty	Standard error	P-Value
Concentrated Market	53.352	.	.	.
Combustible	51.041	-2.311	0.147	0.000
Communication	52.895	-0.457	0.073	0.000
Cereals	51.557	-1.795	0.124	0.000
Competitive Market	49.057	-4.295	0.198	0.000

For the poverty and inequality, the Figures 05 and 06 will show the partial impacts in a refined way.

Figure 06: Market power and inequality

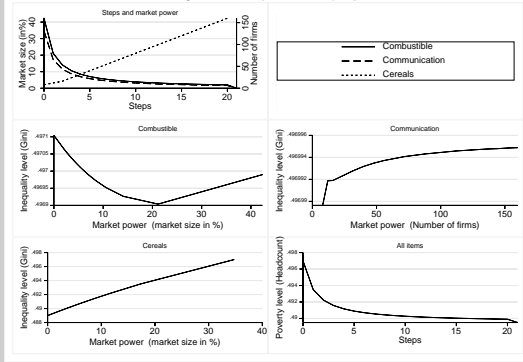
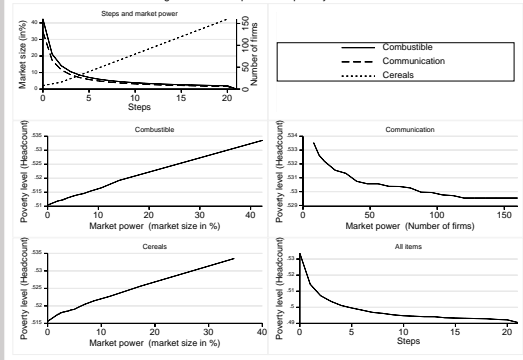


Figure 05: Market power and poverty headcount



Also, all of the tables are stored in an \*.xml file that can be edited by Excel.

The screenshot shows an Excel spreadsheet titled "myexample.xml - Excel". The active sheet is "Table 1.1: Models and parameters". The table contains data for three market types: Concentrated\_Market, Step\_1, Step\_2, and Competitive\_Market. Each market type has three columns: Market size (in€), Elasticity, and Price. The data is organized into three main sections: Combustible, Communication, and Cereals.

	Combustible			Communication			Cereals		
	Market size (in€)	Elasticity	Price	# of firms	Elasticity	Price	Market size (in€)	Elasticity	Price
Concentrated_Market	42.3100	-0.9040	1.8798	8.0000	-0.6430	1.1628	34.7100	-0.9270	1.5985
Step_1	21.1550	-0.6210	1.5167	12.0000	-0.5821	1.1252	17.3550	-0.6787	1.3435
Step_2	14.1033	-0.5266	1.3658	16.0000	-0.5517	1.1018	11.5700	-0.5960	1.2409
Competitive_Market	0.0000	-0.3379	1.0000	.	-0.4604	1.0000	0.0000	-0.4305	1.0000

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