Leeds University
Business School

UNIVERSITY OF LEEDS

Online Examination Coversheet

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Module Leader:	Dr. Alan Piper								
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Please Note:

Your declared word count must be accurate, and should not mislead. Making a fraudulent statement concerning the work submitted for assessment could be considered academic malpractice and investigated as such. If the amount of work submitted is higher than that specified by the word limit or that declared on your word count, this may be reflected in the mark awarded and noted through individual feedback given to you.

It is not acceptable to present matters of substance, which should be included in the main body of the text, in the appendices (“appendix abuse”). It is not acceptable to attempt to hide words in graphs and diagrams; only text which is strictly necessary should be included in graphs and diagrams.

Advanced Microeconomics Assessment

Question 1A

Question 1.i

The equation for the PPF is:

$$5x + 20y = 1000 \tag{1}$$

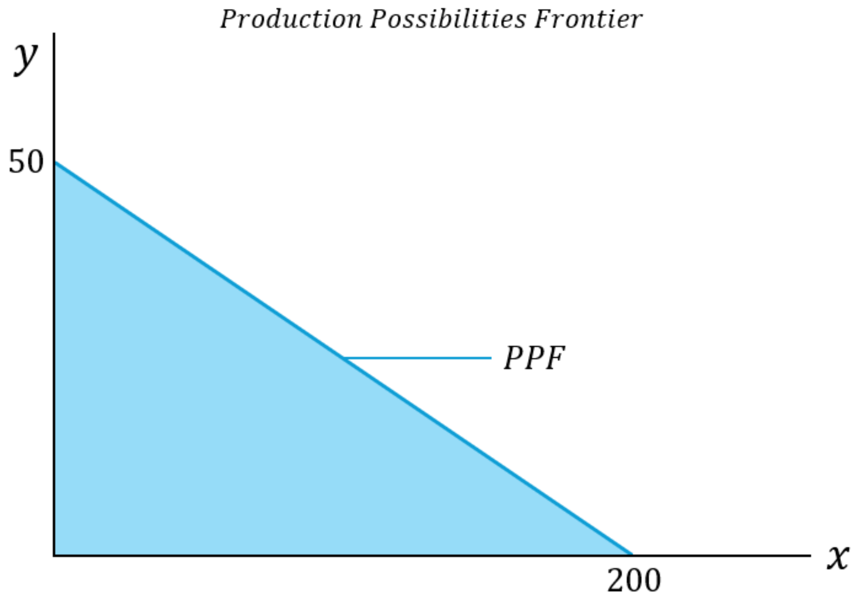

Figure 1

Figure 1 plots the PPF given (1). The PPF a negative constant slope $= -\frac{1}{4}$ because of a few reasons.

First, x and y exhibit constant returns to scale with labour inputs, see (2) and (3).

$$\frac{\partial x}{\partial L} = \frac{1}{5} \tag{2}$$

$$\frac{\partial y}{\partial L} = \frac{1}{20} \tag{3}$$

This fact, combined with the fact that we only have a single factor input (labour) produces a straight-line graph. If the production equations for x and y had increasing returns to scale (as in (4)), then the PPF would be convex.

$$\frac{1}{5}L^2 = x \tag{4}$$

- Where L represents labour units.

Furthermore, the PPF changes when marginal costs are changed – figure 2 shows the PPF where $MC_x = 10$.

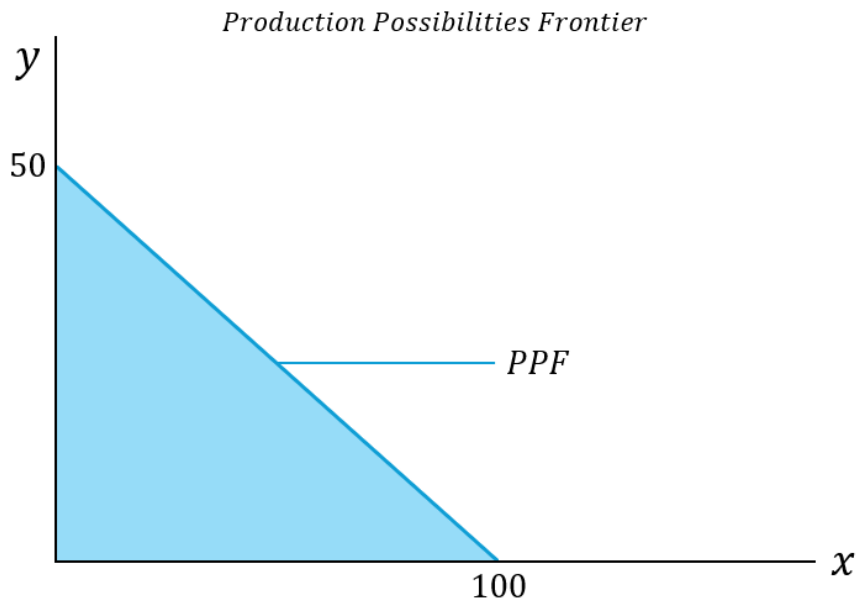

Figure 2

Finally, different production techniques can generate a convex PPF. For example, if labour could be spent according to two different production techniques:

$$5x + 20y = 500 \tag{5}$$

$$15x + 10y = 500 \tag{6}$$

We would achieve the PPF in figure 3 (Varian, 2014, p. 641).

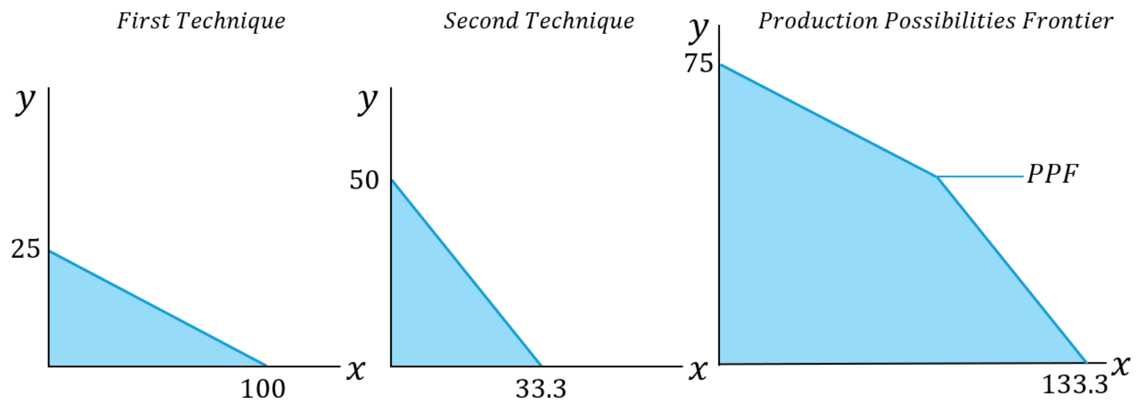

Figure 3

Question 1.ii

The top-level Pareto optimality condition is:

$$MRS_{y,x}^{All\ Consumers} = MRT_{x,y} = \frac{MC_x}{MC_y} = \frac{p_x}{p_y} \tag{1}$$

We know $MC_x = 5$ and $MC_y = 20$.

Solving for $MRT_{x,y}$:

$$MRT_{x,y} = \frac{MC_x}{MC_y} = \frac{1}{4} \tag{2}$$

Setting $MRS = MRT$ to fulfil (1), we find:

$$MRS = \frac{\partial u}{\partial x} \div \frac{\partial u}{\partial y} = MRT = \frac{1}{4} \tag{3}$$

Given $U(x, y) = x^{0.6}y^{0.4}$,

$$\frac{\partial u}{\partial x} = 0.6\left(\frac{y}{x}\right)^{0.4} \tag{4}$$

$$\frac{\partial u}{\partial y} = 0.4\left(\frac{x}{y}\right)^{0.6} \tag{5}$$

Dividing (4) by (5), we get:

$$\frac{\partial u}{\partial x} \div \frac{\partial u}{\partial y} = \frac{0.6}{0.4} \cdot \frac{y}{x} \tag{6}$$

Substituting (6) → (3), we get:

$$\frac{0.6}{0.4} \cdot \frac{y}{x} = \frac{1}{4}$$

$$\frac{3y}{2x} = \frac{1}{4}$$

$$12y = 2x$$

$$y = \frac{1}{6}x \tag{7}$$

Finally, substituting (7) → (8),

$$5x + 20y = 1000 \tag{8}$$

Gives (9):

$$5x + 20\left(\frac{1}{6}x\right) = 1000$$

$$5x + 3.33x = 1000$$

$$8.33x = 1000$$

$$x \approx 120 \tag{9}$$

And substituting (9) → (7),

$$y = \frac{1}{6}(120)$$

$$y = 20$$

The Pareto optimal level of output is therefore $(x, y) = (120{,}20)$.

The set of prices must satisfy (1), giving (10):

$$\frac{1}{4} = \frac{p_x}{p_y} \tag{10}$$

Therefore, the relative price becomes is $p_y = 4p_x$.

Question 1.iii

Where good x is produced by a monopolist, the new monopolistic price $p_x' = 3 \cdot p_x$, where p_x is the old competitive price. The top-level condition (1) does not hold, because $\frac{MC_x}{MC_y} = \frac{p_x}{p_y} \neq \frac{p_x'}{p_y}$.

$$MRS_{y,x}^{All\ Consumers} = MRT_{x,y} = \frac{MC_x}{MC_y} = \frac{p_x'}{p_y} \tag{1}$$

Because (1) is not satisfied, one implication for Pareto optimality and welfare is that we cannot be at a Pareto optimum level of output; so, welfare must be lower than in the Pareto optimum case where $(x, y) = (120{,}20)$.

The PPF is described by (2).

$$5x + 20y = 1000 \tag{2}$$

Since $MRT_{x,y} = \frac{MC_x}{MC_y}$, we have $MRT = \frac{1}{4}$.

Consumers maximise their utility subject to a budget constraint. Consumers' new budget constraint is (3).

$$p_x'x + p_y y = (3 \cdot p_x)x + p_y y = m \tag{3}$$

Each consumer's utility function is:

$$U(x, y) = x^{0.6}y^{0.4} \tag{4}$$

Utility is a monotonic function, so we maximise the natural logarithm of (4), as it outputs the same consumption and price vectors while reducing calculation steps.

$$\ln\big(U(x, y)\big) = 0.6\ln(x) + 0.4\ln(y) \tag{5}$$

Maximising (5) with respect to (3) results in the following Lagrangian and first order conditions:

$$L = 0.6\ln(x) + 0.4\ln(y) - \lambda[(3 \cdot p_x)x + p_y y - m]$$

$$\frac{\partial L}{\partial x} = \frac{0.6}{x} - 3\lambda p_x = 0 \tag{6}$$

$$\frac{\partial L}{\partial y} = \frac{0.4}{y} - \lambda p_y = 0 \tag{7}$$

$$\frac{\partial L}{\partial \lambda} = (3 \cdot p_x)x + p_y y = m \tag{8}$$

Dividing (6) by (7) gives (9).

$$\frac{3}{2} \cdot \frac{y}{x} = \frac{3p_x}{p_y} \tag{9}$$

In other words, MRS (left) is equal to the price ratio (right).

Substituting $\frac{MC_x}{MC_y} = \frac{p_x}{p_y}$, we get:

$$\frac{3}{2} \cdot \frac{y}{x} = \frac{3(5)}{20}$$

$$\frac{3}{2} \cdot \frac{y}{x} = \frac{3}{4}$$

$$\frac{y}{x} = \frac{6}{12}$$

$$\frac{y}{x} = \frac{1}{2}$$

$$y = \frac{1}{2}x \tag{10}$$

Substituting (10) → (2):

$$5x + 20\left(\frac{1}{2}x\right) = 1000$$

$$15x = 1000$$

$$x = 66.67 \tag{11}$$

Substituting (11) → (10):

$$y = 33.33$$

This new monopolistic level of output is shown in figure 1.

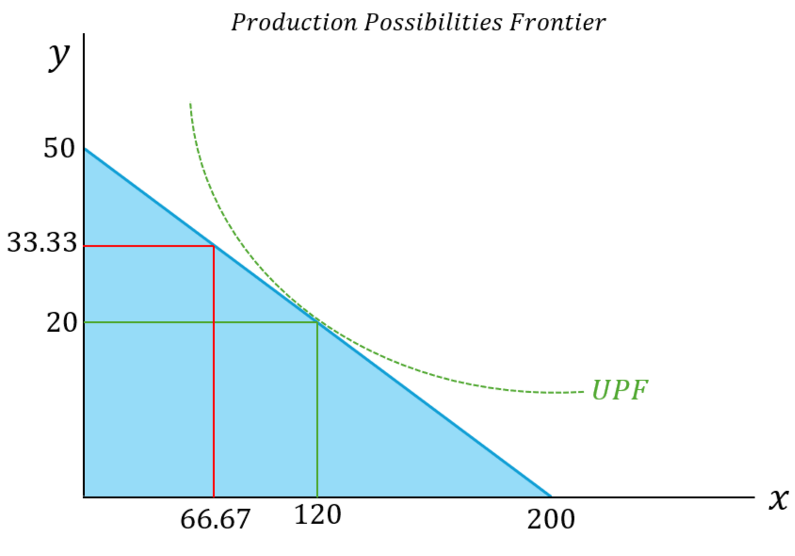

Figure 1

The fact that $\frac{1}{4}$ of the labour is needed to produce x relative to y is no longer reflected in their relative pricing. As such, consumers do not substitute between the two goods at the marginal rate of transformation. Less labour is allocated to produce x and more is allocated y, which is not as utilitarian as x. The subsequent output, $(x, y) = (66.67,33.33)$ no longer lies on the UPF, as seen in figure 1.

Question 1.iv

The Fundamental Welfare Theorems (FWTs) have a few important assumptions. When these assumptions are satisfied, consumption and production decisions will be Pareto optimal, such that no individual can be made better off without making another individual worse off, and the FWTs will hold.

First, we assume an economy contains only utility-maximising individuals and profit-maximising firms – both groups are price-takers; second, individuals have perfect knowledge and are aware of their own (and others') utility functions; third, there are no externalities, i.e., third parties are not affected by consumption or production decisions; fourth, there are no distortionary taxes or subsidies; fifth, returns to scale are non-increasing – coupled with convex indifference and isoquant curves this allows unique equilibria to be determined across all sectors.

The first FWT states that every competitive equilibria is also a Pareto optimal outcome. The second FWT states that any Pareto optimal distribution can always be reached from a competitive equilibrium following a lump-sum transfer of resources from initial endowments.

The limitations for the first FWT are practical in nature, since the prerequisite assumptions are rarely, if ever, satisfied. For example, externalities tend to exist, either due to envy or equity concerns – typically associated with consumption – or due to pollution and waste disposal – typically associated with production – all of which impact third parties. Similar pragmatic criticisms can be levied at the assumption of perfect information and an absence of taxes and subsidies. Lipsey (2007, p. 354) considers the fact that spatial location will often create localised oligopolies and thus perfect competition nor price-taking is present.

I argue the second FWT supports the first FWT, because the second FWT relies on the first FWT. If the second FWT undermines the first, it would undermine itself, which is a contradiction. Varian (2014, p. 625) points out that, even while lump-sum transfers are non-distortionary forms of taxation, agents' behaviour still changes post-transfer. The critical point is that no matter how agents' behaviour changes, according to the first FWT, any competitive equilibrium reached thereafter will be Pareto optimal. To clarify, this is the case no matter *how* endowments are redistributed, so long as *only* endowments are redistributed.

Finally, there is the question of the practical use of the FWTs in guiding policy. On the one hand, even granting the practical limitations of the theorems, some argue that we should strive to approach the prerequisite assumptions as closely as possible. Varian (2014, p. 625) posits that even if we cannot practically introduce lump-sum transfers, we can still use the second FWT as a justification to focus on transfers, rather than price adjustment, to meet distributional goals, and furthermore that even if lump-sum transfers are practically impossible, the second FWT justifies making them as non-distortionary as possible. However, I believe that Lipsey & Lancaster (1956) and Lipsey (2007) provide the best argument for why the use of the FWTs as policy guides fails. Lipsey & Lancaster (1956) show that, given any of the initial assumptions are unattainable, an optimum situation can be achieved only by departing from all other assumptions. An optimum achieved under constraint is termed a 'second best' optimum. As we exist in a second-best world, there is reason to doubt Varian's (2014, p. 625) argument and any policy prescriptions based on the FWTs as guidelines. Instead, a contextual, specific examination of the policy prescriptions is preferred.

Question 4

Non-market valuation is important in policy analysis. If non-market values cannot be assessed, then the benefit of non-market goods and services will likely be severely over- or underestimated. When the input data into cost-benefit analyses (CBAs) is inaccurate, policy evaluations will likely lead to projects being approved or rejected such that the level of non-market goods becomes very different from their socially optimal level. Insofar as the goal of policy is to align the stock of *things* with their socially optimal levels, this would be a policy failure relative to the world where input data is more accurate.

Some examples of non-market goods and services include parks, upcoming market products, and pro-bono legal advice. Ozdemiroglu & Hails (2016) point out that the opportunity to exercise and engage in leisure activities in local parks should be included in their valuation; as it stands, the nominal value of parks in local authority accounts tends to be £1. In a naïve CBA, £1 is the value of any given park; in a more representative CBA, non-market benefits are captured in monetary terms so the value of parks varies based on, e.g., popularity and health benefits.

Non-market valuation methods fall into either revealed preference (RP) or stated preference (SP) methodologies. RPs give information on *use* value, i.e., the direct and indirect personal benefit gained from using a certain good/service, while SPs can inform researchers on both *use* and *non-use* value, the latter being benefits from the **option to use**, the fact that **others can use** (both **now** and in the **future**), and finally for the sake of the thing's existence **in and of itself (**Ozdemiroglu & Hails, 2016, p. 3).

There are many RP methods – this study examines the pros and cons of the econometric-based RP (ERP) methods, notably hedonic pricing models. As Bishop et al. (2020) point out, the hedonic property-value model has "become one of the premier approaches to valuing environmental amenities", so for the sake of time it makes sense to focus here. ERP models measure market price differentials due to non-market factors to estimate the willingness-to-pay (WTP) for, or willingness-to-accept (WTA), those non-market factors. The central tension within ERP methods lies between their ability to utilise market data and thus generate relatively robust non-market valuations (DEFRA, 2007, pp. 36-37) versus the practical applicability of the model's assumptions. For example, individuals making purchasing decisions are assumed as knowledgeable about the non-market factor which is influencing their decision – however, Bishop et al. (2020, p. 267) point out that consumers often are relatively informationally deficient and different disclosure rules adjust housing prices on, e.g., properties near a noisy airport. A further practical problem is the potential for omitted-variable bias (OVB) due to the strong potential for spatial correlation between features, e.g., parks and rivers, which both affect the housing prices. Potential for OVB must be balanced with not overfitting the model (Bishop et al., 2020, pp. 270-3); as such, ERPs will retain some level of bias in their non-market valuations.

SPs instead utilise hypothetical markets in either choice-based conjoint (CBC) surveys or contingent valuation methods (CVM) (McFadden, 2017, p. 153). McFadden (2017, p. 158) argues that CBC surveys, which are often used to forecast demand for new products, successfully simulate real in-market choices and are therefore widely accepted in market research to predict the demand for consumer products. See figure 1 for common CBC survey design.

Attribute	Alternative 1	Alternative 2	Alternative 3
Price/roll	$2.29	$1.54	$1.25
Sheets/roll	110	58	117
Absorptive capacity (oz. of water per sheet)	2X	3X	1X
Strength when wet (compared to standard towels)	2.5X	1X	1.5X
Brand	Bounty	Viva	Brawny
Check here ______ if you would not pick any of these. Otherwise, check your choice on the right	——	——	——

Figure 1 – "A typical CBC menu: paper towels" McFadden (2017, p. 158, Table 1)

On the other hand, CVMs tend to be more common in environmental economics for assessing the non-use value of environmental amenities/disturbances; Bishop et al. (2017) used a CVM in which taxpayers were asked their WTP to prevent either injury set A: oil spills, dead birds, and lost recreational trips; or injury set B, which was: injury set A plus injuries to bottlenose dolphins, deep-water corals, snails, young fish, and young sea turtles. The WTP price was varied randomly from $15-435.

Of the two methods, CVMs are certainly the most controversial because CVMs focus on non-use value, typically of goods which will never enter the market, reducing chances to evaluate the reliability of methods (McFadden, 2017, p. 160). Furthermore, it is probable that most respondents are not in a position to form robust, consistent preferences about unfamiliar environmental situations in an experimental setting (McFadden, 2017, p. 154). Baron (2017) highlighted additional CVM short-comings in his reply to Bishop et al. (2017): Bishop et al. (2017) claim that the increasing WTP from injury group A to B proves their CVM elicited consistent preferences, but Baron (2017) points out that the difference between the WTPs is likely too small. If we take injury group C as the additional injured parties from groups A to B, the additional WTP between A and B is likely too small to estimate the WTP for group C; therefore, the survey suggests respondents did not take $WTP(A + C) = WTP(A) +$

$WTP(C)$, which casts doubt on CVMs' ability to reliably elicit consistent preferences in line with standard economic theory, as CBC surveys often do (Bishop, 2017; McFadden, 2017).

In conclusion, while non-market valuation is significant in policy analysis, there exist many methodological obstacles, biasing researchers' ability to accurately gauge this value. Precise valuation is important so that policy evaluations can meaningfully capture the benefits of non-market goods, in addition to the costs. Welfare economics has developed two main methods to appraise non-market value: revealed and stated preference (RP, SP). RP's "premier approach" (Bishop et al. 2020) is the hedonic property-value model. While this method *can* generate robust valuations, it suffers from econometric constraints in certain contexts – some can be solved and others only minimised. SP's main methodologies are choice-based conjoint (CBC) surveys and contingent valuation methods (CVMs). CBCs enjoy broad empirical support, often being used to predict demand for new products (McFadden, 2017); CMVs are more controversial, since they evaluate more esoteric environmental situations – as such, CVMs have a harder time eliciting in-market attitudes; inaccuracy is unfortunately likely built into the experimental design and objectives.

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