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Does higher degree of monopoly imply worse results for output and employment?

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Abstract

In an economy producing *n* symmetric goods (where *n* is an integer number equal or greater than one), monopolistic competition produces smaller output and employment than perfect competition. The inferiority of the equilibrium is directly related to the number of goods produced and to the returns of labour on production (when there is just one good perfect competition and monopoly are equivalent). Therefore, inter-industry coalitions among monopolistic competitors approach the economy to the perfect competition equilibrium. In the limit, when all monopolistic competitors collude, the *ex ante* recognition of symmetries implies an identical equilibrium than perfect competition.

Key words: monopoly, inter-industry coalition, intra-industry coalition, prices, wage.
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Introduction

For more than twenty years there has been a growing interest about the effects of monopolistic competition and price setting on the main macroeconomic aggregates.[1] Such interest emerges basically from the observation that many producers set the prices of the goods they sell, while it is more difficult to find economic agents behaving according to the traditional assumptions of perfect competition.

The majority of works in this area conclude that imperfect competition is necessary to find results where money affects real variables. Adjustment costs of changing nominal prices (e.g. menu costs: Mankiw, 1985) or a near rational behaviour on the part of some agents (Akerlof and Yellen, 1985, Akerlof *et al*., 2000) imply that under monopoly power an increase of money with fixed prices increases output and employment. That result would not happen in a competitive environment, where prices are equal to marginal costs.[2]

While research in the lines already described has enlighten the effects of money expansions over the economy, there are less works dedicated to carefully analyzing the macroeconomic effects of different forms of industrial organisation. Monopolistic competition, understood as one good, one producer, generates an inferior solution to perfect competition (Romer, 1996: 260), but it is not clear how technology and the number of goods produced influence this result. It is not clear, either, whether coalitions among producers of different goods (for example holdings) generate or not an inferior solution with respect to the usual concept of monopolistic competition.

This work analyses the effect of different forms of industrial organization on output and employment at a macroeconomic level. To do that, it sets a model where there are n produced goods (where n can take any integer value equal or greater than one). All of these goods enter symmetrically in the utility function of consumers. Production function for all goods needs labour also in a symmetric way. When producers are price setters, they can influence the price level of the economy if the number of goods produced is not very large.

[1] The analysis of wage setting started many years ago and has been discussed in the last decades by Fischer (1977), Taylor (1979, 1980), Solow (1979), McDonald and Solow (1981). Price setting studies started in the works by Taylor (1979, 1980) and then by Akerlof and Yellen (1985) and Mankiw (1985). More recently Akerlof *et al*. (2000) have continued analyzing price setting under monopolistic competition. Other authors analyse sticky price adjustment in the presence of monopolistic competition (see Bergin and Feenstra, 1998).

[2] See Akerlof and Yellen (1985), Mankiw (1985), Blanchard and Kiyotaki (1987), Blanchard and Fischer (1989), Romer (1996), Akerlof *et al*. (2000).

Different works assume that while monopolistic competitors set their own prices, they are unable to affect the price level of the economy. However, some empirical examples show that the power of some agents at macroeconomic level is not negligible. George Soros had a considerable influence on the behaviour of exchange rates in Europe in 1992. When some time ago the price of the shares of Microsoft fell, there were important losses in the US stock market.

In developing countries the problem is even worse. Total property in small economies is sometimes concentrated in few families. They own a range of services, from telephonic companies to banks or the provision of electricity and the monopoly in the distribution of food. It is plausible to think that this people may actually influence the macroeconomic aggregates directly. And sometimes, in small towns the behaviour of a single monopolistic competitor quite possibly affects the relevant price index of the community.

The results of this paper show that equilibrium under monopolistic competition is inferior than perfect competition's, as expected. The degree of inferiority depends on the number of goods produced and on technology. The more goods produced, and the higher returns of labour on production, the more inferior the equilibrium under monopolistic competition is.

One of the main conclusions of the paper is that while intra-industry coalitions of producers are negative for output and employment, inter-industry coalitions when the economy is under monopolistic competition approach the economy to the solution under perfect competition. In the limit, when all monopolistic competitors collude, the resulting equilibrium is, under certain circumstances, the perfect competition equilibrium.

The paper is divided in two sections. The first one sets the model and analyses equilibrium under perfect competition and under monopolistic competition. The second section shows the factors generating inferiority in monopolistic competition equilibrium and the effects of intra and inter industry coalitions of producers.

1. Perfect and monopolistic competition, output and employment

This section shows a model that offers results under perfect or monopolistic competition. The economy lasts one period. There are n goods produced (n equal or greater than one), which enter the utility function in the same way and have identical production functions depending on a fixed amount of capital and variable labour. Production can take place in the presence of price takers or price setters. If the latter, then it is assumed that each good is produced just by one firm. When n is

relatively small, monopolistic competition implies that the price setting process of any producer affects the average price index of the economy.

Money enters through the cash in advance constraint. Production takes place at the beginning of the period. At that moment, workers and shareholders of the firms receive money as payment for their services.[3] They spend that money in consumption of all goods at the end of the period.[4] Theoretically, people could save part of the money received but since it is a one period model, they will spend all the received money.

The budget constraint is then set as:

$$M_h = \sum_{i=1}^{n} P_i Y_i \geq \sum_{i=1}^{n} P_i C_i \tag{1}$$

Where:

M_h = is the quantity of money received by people and equal to the total nominal output;

P_i = is the nominal price for good *i*;

Y_i = is total production of good *i*; and

C_i = is total consumption of the same good.

[3] Here there is the implicit assumption of perfect foresight. All agents know exactly what the general equilibrium of the economy will be at the end. That is why firms can deliver money according to the share of each agent, worker or shareholder, in production. Another implicit assumption is that the government delivers the money to the firm and this one, in again, provides the money to the workers and shareholders, who spend it in the market later in the day. The firm gets again the money and it is compelled to return it to the government. If it were not like that then there would be a problem because the firm would not accept worthless money at the end of the world and therefore nobody would accept money since the beginning. Hahn (1983) asserts that several authors, including himself, have made the assumption that the firm has to return the money to the authorities.

There is, however, another way in which the model presented in this paper would work in an infinite horizon. This is the case of stationary equilibrium in an overlapping generations economy. In that case there are an equal number of old people and young people, who live for two periods. In the first period young people produce as workers or shareholders and in the second period consume. Old people have the money and demand consumption. Given the quantity of money M_h there is a defined price level equal to the one shown in this paper under different possible forms of industrial organisation. A potential problem in this case is which prices set the price setters, present prices of future prices. In an stationary equilibrium that would not be very important because prices are always the same if money is always the same, but in order to make the model tractable and logical it would be convenient to assume that price setters set future prices. An unexpected increase in money would increase production under prices already set in the previous period.

[4] The fact that people consume everything at the end of the period implies that velocity is one (for other alternatives see Ackley, 1961).

Consumers are price takers and maximise the Cobb-Douglas utility function subject to (1):

$$\text{Max}_{ci} \quad U = \prod_{i=1}^{n} C_i^{\frac{1}{n}} \tag{2}$$

From this maximization:

$$C_i = \frac{1}{n}\frac{M_h}{P_i} \tag{3}$$

The expenditure in each good is the n^{th} part of total money in the economy. The same maximization yields to the indirect utility function:

$$IU = \frac{1}{n}\frac{M_h}{\prod_{i=1}^{n} P_i^{\frac{1}{n}}} \tag{4}$$

The term in the denominator may be interpreted as the geometric price index for the economy, which weights all goods in the same way because they are symmetric in the utility function.

Production function for any good in the economy depends on labour in an identical way:[5]

$$Y_i = L_i^{\alpha}, \; 0 \leq \alpha \leq 1 \tag{5}$$

Where:

L_i = is labour in sector i; and

α = being smaller than one implies decreasing returns of labour.

1.1 Equilibrium under perfect competition

Producers of each good maximise real profits. However, under perfect competition all prices are given for producers. The profit function to maximize is:

[5] That does not imply that any producer can produce any of the goods, since capital to produce each good might be very specific.

$$\text{Max}_{L_i} \frac{1}{\prod_{j=1}^{n} P_j^{\frac{1}{n}}} (P_i L_i^{\alpha} - W L_i) \tag{6}$$

Where:

W = is the nominal wage of the economy; and

real profits are nominal profits in parentheses divided by the price level.

Maximizing (6) is equivalent to maximize the indirect utility function of shareholders, since the profits of the firm are delivered in money. Maximization of (6) with respect to L_i generates the demand for labour and also the supply of output of sector *i*:

$$L_i = \left(\frac{\alpha}{w_i}\right)^{\frac{1}{1-\alpha}} \tag{7}$$

$$Y_i = \left(\frac{\alpha}{w_i}\right)^{\frac{\alpha}{1-\alpha}} = \left(\frac{\alpha}{w_i}\right)^{\theta} \tag{8}$$

With $w_i = \frac{W}{P_i}$, and $\theta = \frac{\alpha}{1-\alpha}$.

Equation (7) is the demand for labour of sector *i* and (8) the supply of output of the same sector. Equating the output supply of good *i* (8) with the demand for good *i* in (3) we obtain:

$$P_i = \left(\frac{1}{n}\right)^{\beta} \left(\frac{1}{\alpha}\right)^{1-\beta} W^{1-\beta} M_h^{\beta} = P_j, \ \beta = \frac{1}{1+\theta} \tag{9}$$

Nominal prices of sector *i* are homogenous of degree one in nominal wages and money. Since demand and supply for all goods are identical, all prices (relative and nominal) are the same. This work will assume that real wages, defined as $w = W/(\Pi_i^n P_i^{1/n})$, are given.

Real wage inflexibility may appear for different reasons: efficiency wages is one of them. Akerlof and Yellen (1985) and Akerlof *et al*. (2000) use this argument

in a framework similar to this paper's.[6] Another possibility is a reservation real wage. When the total supply of labour is very large, the equilibrium real wage may be below a minimum socially acceptable. Then the prevailing real wage is that minimum. In that case it is almost sure that there will be unemployment.

The assumption of a reservation wage is useful because it can make the real wage prevailing under perfect competition compatible with the same concept prevailing under imperfect competition. Manipulating equation (9) we arrive to:

$$P_{pc} = (\frac{1}{n})(\frac{w}{\alpha})^{\theta} M_h \,,\; w = \frac{W}{P} \tag{10}$$

Where:

P = is the price level of the economy; and

for a given real wage w, money is neutral to the system.

1.2 Equilibrium under monopolistic competition

Under monopolistic competition, the producers of each sector recognise his/her own demand and set the price of the good they sell so as to maximize real profits. If the number of goods is not very large, each monopolist can actually influence the price level. That is something that any monopolistic competitor knows. Nonetheless, they cannot influence the price of the other monopolists, so for each producer the price set by others is given.[7] The monopolistic competitor of sector i maximizes the function:

$$\text{Max}_{P_i} \frac{P_i}{P_i^{\frac{1}{n}} \prod_{i \neq j} P_j^{\frac{1}{n}}} (\frac{1}{n}\frac{M_h}{P_i}) - w(\frac{1}{n}\frac{M_h}{P_i})^{\frac{1}{\alpha}} \quad , \qquad w = \frac{W}{\prod_{i=1}^{n} P_i^{\frac{1}{n}}} \tag{11}$$

[6] Using the same specification as Akerlof and Yellen (1985) and Akerlof *et al*. (2000), the real wage would remain fixed and independent of the industrial organization. That is a result first found by Solow (1979).

[7] Akerlof and Yellen (1985), Akerlof *et al*. (2000) and Blanchard and Kiyotaki (1987) assume that any monopolistic competitor cannot influence the price level of the economy and therefore they need a demand function with elasticity greater than one (see also Blanchard and Fischer, 1989).

Maximization of (11) with respect to P_i yields to the result:

$$P_i = (\frac{w}{\alpha})^{\lambda} n^{p} M_h^{\varphi} \prod\nolimits_{j \neq i} P_j^{\Omega} \tag{12}$$

With $\lambda = \frac{\alpha n}{n-\alpha}$; $\rho = \frac{n(2\alpha-1)}{n-\alpha}$; $\varphi = \frac{(1-\alpha)n}{n-\alpha}$; and $\Omega = \frac{\alpha}{n-\alpha}$.

Though the demand for each good has unit elasticity, there is a defined equilibrium. This is because producers consume their own goods and when they change prices they influence the price level of the economy.

Prices of sector *i* are linearly homogenous in money and prices of the other products. Equation (12) is very similar to Blanchard and Fischer's (1989: 389). That kind of relation is the base for models of price stickiness *a la* Taylor, which have been widely used to check for output and price inertia over the business cycle (see Taylor, 1979, 1980; and more recently Bergin and Feenstra, 1998).

Since demands and production functions are equal, there is a symmetric equilibrium where the price level is defined as:

$$P = (\frac{w}{\alpha})^{\theta} (\frac{1}{n})^{\xi} M_h, \xi = \frac{1-2\alpha}{1-\alpha} \tag{13}$$

$$(\frac{1}{n})^{\xi} \geq (\frac{1}{n}) \tag{14}$$

As in the case of perfect competition, money is neutral to the system.[8]

Equations (10), (13) and (14) show that for the same real wage and stock of money, the price level under monopolistic competition is greater than the price level under perfect competition. Therefore, output and employment in the former will be lower than under perfect competition. That is not a new result and several authors have reached the same conclusion (see for example Romer, 1996: 260).

[8] Though money is neutral, some authors advocate menu costs or near rational behaviour to account for real effects of money under monopolistic competition (Mankiw, 1985; Akerlof and Yellen, 1985; Akerlof *et al*., 2000).

Differently from other works, our next section will show that the relative difference between the price level under monopolistic competition and the same concept under perfect competition is directly related to the number of goods produced in the economy and to the size of the returns of labour in production.

2. Nominal *versus* relative price setting and coalitions

Dividing the price level under monopolistic competition in (13) (P_{mc}) by the price level under perfect competition in (10) (P_{pc}) we find:

$$\frac{P_{mc}}{P_{pc}} = n^{1-\xi} = n^{\theta} \tag{15}$$

There are two factors affecting the difference between the price level under perfect competition and under monopolistic competition: the number of goods produced and technology.

With respect to the number of goods produced, equation (15) shows that when there is one good in the economy both price levels are the same, which means that for a given real wage perfect competition and monopoly are equivalent. The more goods the economy produces, the higher the price level under monopolistic competition.

There are several reasons explaining this last result. When the economy produces one good and the real wage is given for whatever reason, the monopolist can control the nominal price level of the economy but cannot set any relative price. Then his/her best strategy is to equate the marginal productivity of labour to the given real wage, which maximizes his/her profits. The monopolist is a nominal price setter but a relative price taker *ex ante* and *ex post*.

When the economy produces more goods there are two effects. On the one hand, the producer cares less about the consumption of he/she own product because it also cares about the consumption of other goods. Since the demand faced has unit elasticity, production is lower than in the case of just one good. The more goods there are, the less the producer cares about his/her own good and the less he/she can influence the price level. In the limit, when *n* is sufficiently large, the price level is given for the monopolistic competitor and the demand with unit elasticity implies zero production. The other effect is about relative prices. In monopolistic competition producers are always nominal price setters and are relative price setters *ex ante* but not *ex post*. It is precisely the fact that they can set relative

prices *ex ante* that produces an inferior equilibrium. The more goods there are, the more relative prices the monopolistic competitor can set *ex ante*, the more inferior the equilibrium is.

With respect to technology, the price level under monopolistic competition is relatively higher than the price under perfect competition the higher the returns on labour are. This result is related to the fact that higher returns imply more obstacles to creating competitive markets. For instance, the presence of increasing returns calls for a natural monopoly. Then higher returns of labour imply more differences between a competitive market and monopolistic competition.

These results imply two conclusions. Intra-industry coalitions are negative for the economy. In the limit, when all the producers of one good collude, and this happens for all goods, the equilibrium is inferior to the perfect competition case. However, when the economy is under monopolistic competition, inter-industry coalitions are positive and approach the economy to the competitive equilibrium. The inter-industry coalition recognizes the symmetry among goods and sets an equal price for all goods in the coalition, reducing the number of relative prices to set ex ante.

In practical terms these two results might be better understood with an example. In Mexico the holding called Grupo Carso is the owner of many different enterprises, some of them belonging to a same industry and others from different ones. According to the results of this work, the coalition of enterprises pertaining to some definite industry is not positive for the economy. For instance, the alliance between Telmex (a firm that provides traditional telephonic services) and Telcel (wich provides mobile phone services) quite possibly is not good in terms of better perspective of employment at a general level. Instead, the coalition between Telmex and the department store Sears, which is another firm of the same group but pertaining to a different industry, would be positive for society.

In the limit, a coalition of all monopolistic competitors will generate the competitive equilibrium. The super-monopolist of the economy becomes again a relative price taker. To show this last result, when there is a coalition of all monopolistic competitors the profit function to maximize becomes (see Apendix for a more formal proof of this assertion):

$$\text{Max}_P \; n\left[\frac{1}{n}\frac{M_h}{P} - w\left(\frac{1}{n}\frac{M_h}{P}\right)^{\frac{1}{\alpha}}\right] \tag{16}$$

Maximization of (16) with respect to the price level *P* will generate, as a result:

$$P = (\frac{1}{n})(\frac{w}{\alpha})^{\theta} M_h \tag{17}$$

For the same real wage and money stock this equation is identical to equation (10), which shows the price level under competitive equilibrium. A total monopoly will have the same output, employment and distribution of income as a perfect competitive market.[9]

One last reflection is about the influence of the number of goods in total output and employment. The concrete question is what happens when the real wage is constant and there are more goods produced in the economy?

Under perfect competition, the increase of symmetric goods equally valued in the utility function increases output and employment. This can be seen checking that, *ex post*, all prices are the same and therefore total production is the sum of total consumption in equation (3). Using this sum and the price level (10), total output in the economy is defined as:

$$Y = n(\frac{\alpha}{w})^{\theta} \tag{18}$$

Under monopolistic competition, the inclusion of more goods has one negative effect, because it pushes the economy far away from the competitive solution. However, it also has a positive effect because there is more variety in goods. Knowing that *ex post* all prices are the same, taking the sum of consumption in (3) and taking into account equation (13), total output under monopolistic competition is:

$$Y = n^{\xi}(\frac{\alpha}{w})^{\theta} \tag{19}$$

$$\frac{\partial Y}{\partial n} = \xi n^{\xi - 1}(\frac{\alpha}{w})^{\theta} \tag{20}$$

[9] To maintain this result it is necessary to assume that the real wage is given. Otherwise, the monopolist of the economy is a monopsonist of the labour market and can set a lower real wage.

ξ is a value smaller than one but can be positive or negative. It is positive when the parameter α is smaller than 0.5 and negative when such parameter is greater than 0.5. If it is positive, then more goods produced in the economy have a positive impact in total output and employment. However, if returns are higher, a greater number of goods produced reduces total output and employment. This result is directly related to the fact that a higher number of goods imply more relative price setting *ex ante* and an inferior solution with respect to perfect competition.

Conclusions

As expected, monopolistic competition produces an inferior solution with respect to perfect competition. However, the reasons why this happens are relatively surprising. Setting relative prices *ex ante* is the main factor generating a sub-optimal equilibrium. Therefore, the more goods the economy produces, the more relative prices *ex ante* any monopolistic competitor can set and the worse equilibrium results *ex post*. For the same reason, collusions among symmetric monopolistic competitors approach the economy to the perfect competition solution.

Given these results, what this paper concludes is that intra-industry coalitions of producers generate negative results for the economy but inter-industry coalitions, when the economy is under monopolistic competition, would improve the allocation of resources. Agencies dedicated to approve or disapprove mergers should take into account these results.

According to these results, holdings like Grupo Carso or Grupo BAL in Mexico, which comprise many different industries, are a better solution in terms of employment when in fact they comprise different industries.

Instead, fusions of enterprises that belong to the same industry, like Banco Santander and Banca Serfín in the financial sector of the Mexican economy, or Telmex and Telcel in the Grupo Carso itself, would generate a worse solution in terms of employment than letting these banks and telephonic companies work independently.

General equilibrium under imperfect competition and different goods usually works under very strong assumptions. Hart (1985) asserts that in order to cope with mathematical difficulties this kind of analysis has to make unrealistic, or at least simplistic assumptions, to say the least. In fact, there is not yet a general equilibrium theory of imperfect competition. A general theory along these lines would have to consider many different imperfections, which would pose a great difficulty for the models.

When applied to macroeconomics, general equilibrium under imperfect competition usually assumes symmetric goods in terms of production and consumption (see for example Blanchard and Fischer, 1989).[10] In many cases, the considered supply and demand for each good take a specific functional form.[11]

While the assumption of symmetry is very useful in mathematical terms, it is certainly unrealistic. In the real world the different existent enterprises are not symmetric. Even in the same sector symmetries are not always the rule. In Mexico, for instance, in the banking industry the private banks Banamex and Bancomer are greater by far than all the other banks. Firms like Lala or Alpura in the milk industry are perhaps more similar.

Would coalitions among monopolistic competitors generate the same results under asymmetries? Probably yes because if the coalition takes asymmetries for granted *ex ante*, then relative prices are given since the beginning and the economy approaches to the perfect competition solution anyway. Nonetheless, it is necessary to do more research on this topic.

The other very strong assumption of this paper is the one that sets the real wage independently of the market structure. This could happen when there is a relatively high reservation wage, or even in the case of efficiency wages.

However, when real wages can move freely, inter-industry coalitions among monopolistic competitors might have a strong influence on the labour market since producers acquire monopsonic power to hire workers. In that situation, we would expect aggregate output and employment to be the same as in perfect competition –or even greater– but with a deteriorated distribution of income.

Nonetheless, the assumption of a real reservation wage is plausible in poor countries, where there is a dual economy. The reservation wage is a minimum real wage that is greater than the opportunity cost of working in a marginal sector, which many times implies either unemployment or self consumption.

In general, it would be desirable to extend the results of this paper to a more general framework. However, as we have already said many models analyzing imperfect competition in general equilibrium have to be simplistic in order to be tractable (see Hart, 1985). This one is not exent from that problem.

[10] See also Rotemberg (1982), Akerlof and Yellen (1985), Mankiw (1985), Blanchard and Kiyotaki (1987), Ball and Romer (1990), Akerlof *et al*. (2000), among others.

[11] See for example Rotemberg (1987), Akerlof and Yellen (1985), Blanchard and Kiyotaki (1987), Akerlof *et al*. (2000).

The main result of this paper is inscribed in the general topic analyzed in the second best theorem (Lipsey and Lancaster, 1956). The economy faces a restriction: the reservation real wage. Other imperfections besides the one described, may approach the economy nearer to the first best solution. In this case inter-industry coalitions are a way to generate higher employment with the same real wage, something that would not happen if the economy started in a situation of perfect competition.

Though the results might be influenced by the kind of demand and supply assumed, the main message in terms of economic policy is that since we do not live in a perfect competitive environment, some practices that usually are considered as monopolistic may actually have beneficial effects in terms of employment without necessarily harming the real wage. Agencies aimed at improving competition should be equipped with the necessary resources to analyse these possibilities in a macroeconomic context.

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Appendix

Solution to the problem of the super-monopolist

A coalition among competitor monopolists looks to maximize the joint profits of all competitor monopolists. The problem is then to choose all prices in order to maximize the sum of all profits.

The profit function for the super-monopolist is the sum of the profit functions of all sectors, which can be written as

$$Max_{p1,p2,\ldots,pn} \quad \frac{1}{n}\sum_{j=1}^{n}\frac{P_j}{P_i^{\frac{1}{n}}\prod_{k\neq i}P_k^{\frac{1}{n}}}\frac{M_h}{p_j} - w\sum_{j=1}^{n}\left(\frac{1}{n}\frac{M_h}{P_j}\right)^{\frac{1}{\alpha}} \tag{A.1}$$

This function can be transformed in:

$$\frac{P_i^{-\frac{1}{n}}}{\prod_{j\neq i}P_j^{\frac{1}{n}}}M_h - w\left(\frac{1}{n}\frac{M_h}{P_i}\right)^{\frac{1}{\alpha}} - w\sum_{j\neq i}\left(\frac{1}{n}\frac{M_h}{P_j}\right)^{\frac{1}{\alpha}} \tag{A.2}$$

Where:

i is any of the goods produced.

Taking the derivative of (A.2) with respect to P_i and rearranging:

$$P_i = \left(\frac{w}{\alpha}\right)^{\frac{n\alpha}{n-\alpha}} \left(\frac{1}{n} M_h\right)^{\frac{n(1-\alpha)}{n-\alpha}} \prod_{j \neq i} P_j^{\frac{\alpha}{n-\alpha}} \tag{A.3}$$

The sum of the exponents of *M* and all prices different to *i* is 1. Equation (A.3) is symmetric for all possible prices between 1 and *n*. Therefore, for any pair of goods *i* and *k*, the relative price P_i over P_k is:

$$\frac{P_i}{P_k} = \left(\frac{P_k}{P_i}\right)^{\frac{\alpha}{n-\alpha}} \tag{A.4}$$

This equation holds always if and only if $P_i = P_k$. Taking then into account that all prices are the same, equation (A.3) becomes into:

$$P_i = P = \left(\frac{1}{n}\right)\left(\frac{w}{\alpha}\right)^{\theta} M_h \tag{A.5}$$

But this solution is exactly the perfect competition one.