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**Trade, Wages, and the Persistence
of Underdevelopment**

by

Graziella Bertocchi

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**Università degli Studi di Modena
Dipartimento di Economia Politica
Viale Berengario, 51
41100 Modena (Italia)
e-mail: bertocchi@unimo.it**

Trade, Wages, and the Persistence of Underdevelopment *

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University of Modena and CEPR

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Abstract

We consider a small, unionized economy which interacts with an economically larger one, and we study the growth implications of different institutional structures of the labor markets. We study three possible scenarios. Under decentralized bargaining in the large economy, the two countries converge to the same level of wages and income, even though these levels will be lower than under perfect competition. Under centralized bargaining in the large economy, the small one will end up with a higher capital to labor ratio and GDP in the steady state. However, this outcome will not necessarily be associated with higher wages and per capita GNP. Another possible scenario, with a competitive labor market in the large economy, predicts long run equalization of per capita capital and production, but lower wages and per capita GNP in the small economy.

Keywords: Underdevelopment, Wage Bargaining, Trade, International Capital Flows

JEL Classification Numbers: J50, O40, F21

1 Introduction

The current expansion in international trade and capital flows has linked the labor markets of the developed countries to those of the developing countries as never before. In particular, inflows of foreign direct investment into developing countries have already surged to considerable amounts and, according to some forecasts ¹, what we are witnessing is just the initial phase of a process that will reach as big a scale as during the late 19th century ².

The current debate on the effects of international trade on wages has exclusively focussed on the labor markets in the developed countries. Krugman (1995) surveys the literature and concludes that the evidence supporting the view that globalization has decreased western wages is, at best, weak, even taking into account shifts in the bargaining power from labor to capital ³.

In this paper, we focus instead on the effects of globalization on labor markets and wages in the developing countries. In these countries, labor is an abundant resource: This fact alone justifies a special interest in the structure of local labor markets. Moreover, in a situation where the developing countries' capital thirst cannot be satiated by the scarcer and scarcer saving of the developed countries, domestic labor income plays a crucial role in the process of development. Thus, labor market institutions, and in particular labor union strength and organization, appear to have very important implications for growth in emerging countries with a tradition of unionization, such as Eastern Europe, Israel, India, South Africa, and many Latin American countries.

In sum, the new international order has created complex linkages between international capital flows, labor markets, and growth. The scope of this paper is to examine the growth implications of the institutional structure of the labor market for a small open economy which interacts with an economically larger one. When the labor market is unionized, the distribution of output between labor and capital is modelled as the result of a bargaining game, under the assumption

¹See, for example, "The Economist" (1994).

²See Fishlow (1985) for an analysis of international capital markets during the 19th century.

³However, Krugman (1995) accepts Wood (1994)'s claim that international trade has caused a deterioration of the situation of unskilled workers, and therefore an increase of income inequality, in the developed countries.

that capital is internationally mobile and labor is not. This latter assumption is a reasonable one, both empirically and intuitively, since indeed labor tends to be more geographically committed than capital.

The framework we develop produces new, and sometimes seemingly paradoxical results. We distinguish between three possible scenarios, depending on the characteristics of the labor market in the large economy.

When the small, unionized country interacts with a larger country which is subject to decentralized bargaining, the results that are typical of the perfect-competition, two-country model are reproduced: International capital flows equalize wages and capital to labor ratios, and induce convergence to a common long run level of income. In the steady state, capital flows cease. The only difference with the competitive benchmark is that bargaining reduces wages and long run income worldwide.

However, when the small, unionized economy faces a large country with centralized bargaining, then the long-run levels of the capital to labor ratio and production in the small country become greater than in the large economy. This scenario therefore predicts the mass migration of investment, with consequent de-industrialization, who someone fears for the developed world. Still, it is not necessarily the case that wages in the small economy will be greater than wages in the large one: Depending on the technological parameters and on the bargaining strength of labor, the small economy may end up with a lower wage. The current account balance will also depend on the same parameters, but will in general not be zero even in the long run.

We also consider a third scenario, where the small economy is again unionized but the large economy has a competitive labor market. Surprisingly, the predictions of this version of the model are that, despite capital-to-labor-ratio equalization, wages remain permanently lower in the small economy, and that the latter will converge to a lower level of per capita GNP and to a permanent current account deficit. Thus the conclusion in this case is that capital inflows unambiguously damage the long term prospects of a developing economy and force it into a "poverty trap".

The common explanation of these seemingly diverging performances is that what determines the relative bargaining strength of capital in each country is the availability of an “outside option”⁴, i.e., a credible threat to leave, which has the power to reduce wages and in turn savings and accumulation. The availability of such an option, as we will see, turns out to depend crucially on the comparative structures of the markets for labor.

The framework we developed lends itself to an application to a very broad range of phenomena, which go beyond the analysis of the effects of unions’ behavior, which we have so far stressed. It can in fact be interpreted as a theory of conflict between capital-abundant countries and labor-abundant ones⁵. In particular, our model can usefully be applied to the analysis of 20th century European colonialism, which can be modelled as a struggle between indigenous labor and foreign capital in a context where the large economy is perfectly competitive. Our model predicts capital inflows into the colony, which is indeed what characterized colonial expansion, and that wages and income in the colony are lower than in the metropolis, which is also consistent with the historical evidence⁶.

The content of this paper draws on three different fields of economics: labor, growth, and international. It is therefore linked with a large literature. As we already mentioned, our paper focuses on labor markets and wages in developing countries, and therefore can be seen as complementary to the much larger literature that examines the effects of trade on wages in advanced countries (see, for example, Wood (1994) and Krugman (1995)). On the relationship between international trade and growth, Grossman and Helpman (1991), Young (1991), and Mountford (1993a) have shown that international trade can be harmful for growth because it can shift production away from sectors with positive learning-by-doing effects. However, the issue of how a capital inflow may diminish an economy’s long term growth was not addressed in those

⁴See Binmore, Rubinstein and Wolinsky (1986) and Sutton (1986) for a discussion of outside options in a game-theoretic framework.

⁵In the growing economic literature on conflict theory it is usually assumed that a technology of conflict, or appropriation, is added to the standard technology of production. See, for example, Hirshleifer (1991), Skaperdas (1992), and Grossman and Kim (1994). The connection with our approach is that the conflict technology can be interpreted as a bargaining-costs technology.

⁶See Bertocchi (1994) and Bertocchi and Canova (1995).

studies. Moreover, they assume that labor markets are perfectly competitive worldwide. Under competition, the possibility of steady state international capital flows has been demonstrated by Buiters (1991) for a two-country model with differences in the rate of time preferences. Mountford (1993a) also obtains steady state capital flows in an endogenous growth model. The relevance of imperfect competition for trade and growth has been demonstrated, for example, by Helpman and Krugman (1989). However, they focus on the structure of product markets, not in that of labor markets. Another group of papers, among which Devereux and Lockwood (1991), Bean and Pissarides (1993), and Bertola (1994), has studied the growth impact of unions' behavior within a closed economy. Huizinga (1993) and Rama (1994) focus instead on unions' behavior in internationally integrated markets, abstracting from the question of growth. Finally, there is a related strand of the literature that has examined static, open economies where the labor markets are non competitive (see, for example, Dixit (1978)). In sum, each of the above-mentioned contributions addresses a specific facet of the broader and more complex question which is the focus of this paper.

The paper is organized as follows. In section 2 we lay out the closed-economy version of the model under three different labor market structures: Perfect competition, centralized bargaining, and decentralized bargaining. In section 3 we consider a small open economy and study the implications of its integration with a larger country for domestic accumulation, growth, and capital movements. In section 4 we apply our model to an analysis of 20th century colonialism. Finally, in section 5 we derive some implications for policy.

2 The Closed Economy

In order to describe the basic structure of the model and in particular the nature of the bargaining problem, we will start with a closed economy. It should be noticed that the closed economy case is also interesting *per se*, because it contributes to the long-standing debate about the relative advantages of centralized *versus* decentralized bargaining within a dynamic, general equilibrium model.

We employ a simple version of the Diamond (1965) overlapping generations model with capital accumulation. We assume a one good economy where agents live for two periods and have perfect foresight. They are endowed with one unit of labor ⁷ only in the first period of their life, so that consumption in the second period must be financed from savings, s_t . For simplicity, there is no population growth and full capital depreciation at the end of each period.

An individual born in period t has preferences over consumption when young, c_t^t , and consumption when old, c_{t+1}^t . In order to obtain a closed-form solution in the bargaining problem that we will later introduce, we assume Cobb-Douglas preferences, that is, $u(c_t^t, c_{t+1}^t) = (c_t^t)^\alpha (c_{t+1}^t)^{1-\alpha}$.

Within each period output is produced via a standard neoclassical constant-returns-to-scale production function. That is, output produced at time t , Y_t , is given by

$$Y_t = F(K_t, L_t) = f(k_t)L_t$$

where K_t and L_t are the quantities of capital and labor employed, respectively, and $k_t = K_t/L_t$ is the ratio of capital to labor. The production function is assumed to be increasing, concave and to satisfy the Inada conditions.

2.1 Competitive Labor Market

Profit maximization under perfect competition in the markets for all factor of production yields the following expressions for the interest rate, r_t , and the wage rate, w_t :

$$r_t = f'(k_t)$$

$$w_t = f(k_t) - f'(k_t)k_t$$

i.e., factor payments equal their respective marginal products. Individuals maximize their utility function subject to the constraint that $c_t^t + \frac{c_{t+1}^t}{r_{t+1}} = w_t$. The capital market clearing condition $s_t = k_{t+1}$ will then generate the following difference equation, which determines the dynamic

⁷We assume labor quality to be homogeneous. Therefore we abstract from differences in skill level.

evolution of the economy starting from any initial condition k_0 :

$$k_{t+1} = s[f(k_t) - f'(k_t)k_t]$$

where s is the constant propensity to save, which represents the solution of the consumer's problem. The properties of the above equation are well-known: in particular, this economy can display multiple steady state equilibria ⁸ and cannot have long-run unbounded growth without redistributive taxation from capital to labor ⁹.

2.2 Centralized Bargaining in the Labor Market

Under this structure, it will be assumed that prices are competitively determined in all markets except that for labor, which is governed by centralized, or collective, bargaining between a national union and a single negotiator for capital, over the division of national output. We will model the bargaining process using the Nash bargaining solution ¹⁰. To do this, we must specify the payoffs of the two parties in the event that an agreement is reached, as well as in the event of no agreement.

The share of wages at each time t will in fact be determined by maximizing the following expression with respect to w_t :

$$(U_t^p - U_t^{np})^\beta (\Pi_t^p - \Pi_t^{np})^{1-\beta}$$

subject to the constraints $U_t^p \geq U_t^{np}$ and $\Pi_t^p \geq \Pi_t^{np}$, where U_t^p is the utility of the union when there is an agreement and goods are produced, and U_t^{np} is the utility of the union when there is no agreement. Similarly Π_t^p and Π_t^{np} are the income of the capital owners when there is an agreement and when there is not an agreement, respectively. The parameter β captures the union's strength in the bargaining process. Since agents live only for two periods, each subsequent generation will face an identically repeated bargaining problem.

⁸See Galor and Ryder (1989).

⁹See Boldrin (1992) and Jones and Manuelli (1992).

¹⁰See Devereux and Lookwood (1991) and Bean and Pissarides (1993) for other applications of the Nash bargaining solution to an overlapping generations model with production.

It should be noticed that, under bargaining, pure profits will be positive, so that ownership of the firm becomes important. To keep things simple, we will assume that the old-entrepreneurs will receive, and consume, the entire surplus from the production process, i.e., profit plus the return to investment, which is given by the expression $Y_t - w_t L_t$. The individual budget constraint, therefore, will be given by $c_t^t + \frac{c_{t+1}^t}{\pi_{t+1}} = w_t$, where π_{t+1} is the profit per unit of capital and w_t is the negotiated wage. The maximization problem under our assumptions about preferences gives rise to an indirect utility function that is proportional to $w_t(\pi_{t+1})^{1-\alpha}$.

From the above discussion, at each time t , we can set $U_t^p = w_t(\pi_{t+1})^{1-\alpha} L_t$, where L_t is the number of members of the union at time t , and $\Pi_t^p = Y_t - w_t L_t$. Since production and wages are zero when there is no agreement, we can also set $U_t^{np} = \Pi_t^{np} = 0$.

It should be stressed that, even if capital can move freely after an agreement is reached, this ability is worthless in a closed economy under centralized bargaining, as capital has nowhere to go: In other words, capital does not have an “outside option” in this case.

The timing of the process is the following: First k_t is unilaterally chosen, then bargaining takes place, and finally production is carried out and factors are remunerated. As standard, we will solve the problem backward by setting wages first.

At each t , the Nash product is given by

$$[w_t(\pi_{t+1})^{1-\alpha} L_t]^\beta (Y_t - w_t L_t)^{1-\beta}$$

The solution to the bargaining problem is given by the following wage rate, w_t , and profit per unit of capital, π_t :

$$w_t = \beta f(k_t) \tag{1}$$

$$\pi_t = (1 - \beta) \frac{f(k_t)}{k_t} \tag{2}$$

Under our assumptions on preferences, the evolution of the economy will be governed by the following equation:

$$k_{t+1} = s\beta f(k_t) \tag{3}$$

In contrast to the standard, competitive overlapping generations model previously reviewed, this model will display at most one non-trivial steady state equilibrium. This is seen by noting that the slope of the return function is always positive but is monotonically decreasing in k . Underdevelopment traps are therefore ruled out. Moreover, when the condition given by $\lim_{k \rightarrow \infty} f'(k_t) > s\beta$ is satisfied, this model is capable of unbounded growth in the long run. It can also be noticed that, when this economy reaches its (unique) steady state, the corresponding level of the capital to labor ratio may be lower or higher than the competitive level. For example, for a Cobb-Douglas technology, $y = k^\gamma$, the bargaining level is higher when $\beta > 1 - \gamma$. Moreover, since in this model accumulation is solely determined by workers' compensation, the higher β , the higher the stationary level of capital.

2.3 Decentralized Bargaining in the Labor Market

We are now going to analyze the case in which bargaining is conducted in a decentralized fashion, i.e., at the firm level, between the firm's union and the single entrepreneur. We assume that once labor is allocated to a firm, then it becomes tied to it (either because of firm-specific skill characteristics, or because of relocation costs)¹¹, while capital is still mobile after any agreement with labor.

We will first determine the equilibrium interest rate r_t . All firms have access to the same constant-returns-to-scale production function. Given their labor allocation, their negotiated wage rate, and the market interest rate, the single entrepreneur will choose k_t to maximize the profit from production which is given by:

$$f(k_t) - w_t - r_t k$$

¹¹If the bargaining power of labor, β , is not large, then the income of a particular entrepreneur can be shown to be increasing in the size of his firm, thus entrepreneurs will ensure that all labor is employed. The smallness of β is related to the production function. If the production function is $y = k^\gamma$, then we would require $\beta < 1 - \gamma$. If you do not want to restrict the size of β then you must assume, following Devereux and Lockwood (1991), that labor is exogenously "matched up" with a particular firm.

A perfectly competitive capital market implies that the equilibrium rate of interest must be

$$r_t = f'(\bar{k}_t)$$

where \bar{k}_t is the average capital to labor ratio in the economy. Thus given any wage agreement and the equilibrium rate of interest, we know that every entrepreneur will choose to employ a level of k in his firm so that the capital to labor ratio of the firm equals \bar{k}_t .

Next, we can determine the equilibrium wage by maximizing the Nash product. The expressions for U_t^p , U_t^{np} , and Π_t^p will be exactly as in the case with centralized bargaining. However, under decentralized bargaining, when there is no agreement with the union an entrepreneur will be able to invest his savings on the capital market at the market interest rate. In other words, an “outside option” is now open to capital, and $\Pi_t^{np} = r_t K_t$.

At each t , maximizing the resulting expression with respect to w_t gives the following levels of the wage rate, w_t , and profit per unit of capital invested in the firm, π_t :

$$w_t = \beta[f(k_t) - f'(k_t)k_t] \quad (4)$$

$$\pi_t = (1 - \beta)\frac{f(k_t)}{k_t} + \beta f'(k_t) \quad (5)$$

This economy has an equation of motion given by

$$k_{t+1} = s\beta[f(k_t) - f'(k_t)k_t] \quad (6)$$

which is identical to a standard overlapping generations model with savings rate $s\beta$, i.e., with slower accumulation than under perfect competition. Thus this economy can have multiple steady state equilibria and cannot experience unbounded growth. Moreover, if compared to the centralized bargaining economy, the one under examination has a lower wage and a lower steady state income. The intuition for this outcome is that the “outside option” which is opened to entrepreneurs by the existence of a capital market weakens unions’ power and slows down accumulation. In sum, steady state income under decentralized bargaining is lower than under centralized bargaining and perfect competition ¹².

¹²See also Calmfors and Driffill (1988) and Rama (1994) on the relative merits of centralized *versus* decentralized

3 The Open Economy

We are now going to investigate what happens to a small economy when it interacts with an economically larger country, which can also be interpreted as the rest of the world. We will work with the assumption of perfect capital mobility and zero labor mobility. Moreover, while the capital market will always be assumed to be competitive, we will contrast several different cases with respect to the structure of the labor markets.

As a benchmark, we will briefly review the case in which the labor market is perfectly competitive in both countries. Next, we will illustrate three possible departures from this benchmark: We will start by examining the case of a labor market in the large economy which is subject to decentralized bargaining. Next, bargaining in the large economy is instead centralized. Finally, we consider the case of a perfectly competitive labor market in the large economy. For each labor market structure in the large economy, we will examine both types of bargaining in the small economy. However, we will show that the specific bargaining structure in the small economy does not matter to our results, since the two types of bargaining turn out to be equivalent.

Our results can be summarized as follows: In the competitive benchmark, as is well-known, there will be convergence of wages, capital, and income across countries, and the steady state will be characterized by absence of international capital flows. In the decentralized case, the same convergence results again hold, even though wages and long-run income will be lower. In the centralized case, instead, the institutional features of the labor market will (i) prevent convergence, and (ii) generate steady state capital flows. However, under general parameter values, the sign of the wage differentials and the direction of the flows will be ambiguous. Finally, when the large economy has a competitive labor market, our results indicate again lack of convergence, and are more clear-cut, in the sense that they clearly predict that the wage will be lower in the small, unionized economy, and that this economy will always experience a current account deficit in the steady state. In the following discussion, all variables associated with the large country are distinguished by a hat above the relevant variable, while for the small country we adopt the bargaining.

notation developed for the closed economy.

3.1 Competition in Both Countries

When two economies, that are linked together in an international commodity market and an international capital markets, are identical in all respects, but size, under perfect capital mobility interest rates will be equalized. From interest equalization, capital to labor ratios and wage rates are also equalized. International capital flows, therefore, will lead the two countries to the same long run level of income, and will cease in the steady state. In other words, the model reduces to the closed economy ¹³.

3.2 Decentralized Bargaining in the Large Country

In this section we assume that in the large economy wages are determined by firm-level wage negotiations. Initially, we will also assume that bargaining is decentralized in the small economy as well.

3.2.1 Factor Price Determination

To determine factor prices in the large economy we will first describe the equilibrium in the capital market. As above we assume that capital is perfectly mobile and so can move after any wage agreement is made. Therefore, given any wage agreement which fixes \hat{w}_t and given the world market rate of interest, $\hat{r}_t = r_t$, the firm owner will choose \hat{k}_t to maximize his profits which are given by

$$f(\hat{k}_t) - \hat{w}_t - \hat{r}_t \hat{k}_t.$$

Equilibrium in a perfectly competitive capital market implies that each firm in the economy sets $f'(\hat{k}_t) = \hat{r}_t$, where \hat{k}_t is the capital to labor ratio of the large economy as a whole. Given this rationally expected level of \hat{k}_t for each firm in the large economy, the Nash product at each firm will be

¹³See Buiter (1981).

$$[\hat{w}_t(\pi_{t+1}^{1-\alpha})]^\beta [f(\hat{k}_t) - \hat{w}_t - \hat{r}_t \hat{k}_t]^{1-\beta} \quad (7)$$

and the bargaining solution will give the following wage rate

$$\hat{w}_t = \beta [f(\hat{k}_t) - \hat{r}_t \hat{k}_t] \quad (8)$$

To determine factor prices in the small economy, any firm will be faced with precisely the same decision as the owner of a firm in the large economy. Market conditions will determine the optimal level of the capital stock, which will be the same as in the large economy, i.e., $k_t = \hat{k}_t$. The Nash product will also be identical and so $w_t = \hat{w}_t$.

It should now become clear that the type of bargaining structure that applies in the small economy is irrelevant under constant returns to scale, i.e., when the scale of production does not matter: With openness, an “outside option” is in fact always offered capital, even in the case of a single negotiator for each side.

3.2.2 Long-Run Income and Capital Flows

Each country will evolve like a standard overlapping generations model with constant savings rate $s\beta$. Since wages and capital are equal, after one period capital mobility causes there to be an equalization of income. In the long run, international capital flows will of course be zero. Thus, in this case, departing from perfect competition does not change the predictions of the benchmark in a drastic way, in the sense that convergence still applies. However, the introduction of bargaining does reduce wages and accumulation in both countries, to a degree which is inversely related to β . From the point of view of the small economy, openness introduces an “outside option” for capital, which matters when under autarky bargaining was centralized.

3.3 Centralized Bargaining in the Large Economy

In this section we assume instead that wages in the large economy are determined by a centralized negotiation. Bargaining will also apply to the small economy. In addition, we assume that the small economy is small enough not to affect the workings of the large economy. Alternatively,

if we assumed that a single, multinational capital owner has to commit capital to the small economy before negotiating with labor in the large economy, we would obtain similar results.

3.3.1 Factor Price Determination

Since the large economy essentially behaves like a closed economy, no “outside option” is given to capital. The Nash product (in intensive form) is then the following:

$$[\hat{w}_t(\hat{\pi}_{t+1})^{1-\alpha}]^\beta [f(\hat{k}_t) - \hat{w}_t]^{1-\beta} \quad (9)$$

The absence of the “outside option” implies that labor in the large economy has more bargaining power and so will receive a greater share of output than in the previous section.

The maximization of (9) with respect to \hat{w}_t in fact gives the following wage rate:

$$\hat{w}_t = \beta f(\hat{k}_t) \quad (10)$$

and gives unit profits, $\hat{\pi}_t$, as

$$\hat{\pi}_t = (1 - \beta) \frac{f(\hat{k}_t)}{\hat{k}_t}$$

It is important to note that the increase in profit from a marginal increase in capital, $\hat{\rho}_t$, is given by $(1 - \beta)f'(\hat{k}_t)$. To determine the factor prices in the small economy we will proceed by setting first the level of capital invested there. The capital owner will maximize

$$f(k_t) - w_t - \hat{\rho}_t k_t$$

where now from above $\hat{\rho}_t = (1 - \beta)f'(\hat{k}_t)$ represents the marginal increase in profits from capital invested in the large economy. The solution for this problem will be to invest a level of capital in the small country such that $f'(k_t) = (1 - \beta)f'(\hat{k}_t)$, which implies that $k_t > \hat{k}_t$. Thus per capita output in the small economy will be greater than that in the large economy. Still, this does not mean that wages in the small economy will be greater than wages in the large economy. As in the previous section, wages are determined by maximizing the Nash product, which in this model is, in intensive form,

$$[w_t(\pi_{t+1}^{1-\alpha})]^\beta [f(k_t) - w_t - \hat{\rho}_t k_t]^{1-\beta} \quad (11)$$

Once again, it is clear that it does not matter if bargaining in the small economy is centralized or not. What matters is the fact that openness, for any local bargaining structure, offers an “outside option” to capital, and therefore implies the same expression for the Nash product. The resulting wage rate is given by

$$w_t = \beta[f(k_t) - \hat{\rho}_t k_t] \quad (12)$$

Thus, wages in the small economy may be greater or less than in the large economy, and in particular $w_t < \hat{w}_t$ whenever $f(k_t) - f(\hat{k}_t) < \hat{\rho}_t k_t$. The intuition for this result is the following: As we have shown, labor in the small economy has a weaker bargaining position than labor in the large economy. *Ceteris paribus*, this would lead to a lower wage rate in the small economy. However, this weak bargaining position of labor induces a greater inflow of capital into the small economy, which drives up its wage. Thus, depending on the curvature of the production function and the bargaining strength of labor, the wage rate in the small economy may be greater or less than that in the large economy. This can also be seen by working through an example where the production function is Cobb-Douglas. The equilibrium capital stock condition gives us that $\gamma k^{\gamma-1} = (1-\beta)\gamma \hat{k}^{\gamma-1}$ thus $k = (1-\beta)^{1/(\gamma-1)} \hat{k}$. The wage in the large economy is $\beta \hat{k}^\gamma$ and that in the small economy is $\beta(1-\gamma)k^\gamma$. Substituting in for \hat{k} implies that

$$\hat{w} > w \text{ if } (1-\beta)^{\gamma/(\gamma-1)}(1-\gamma) < 1$$

which will be true for a significant area of the parameter space.

3.3.2 Long-Run Income and Capital Flows

This version of the model implies that the long-run per capita GDP of the small economy will be greater than that of the large economy. In addition, depending on the sign and the size of the discrepancy between the wage rates, the model is consistent with the presence of long-run

capital flows. It is therefore possible that per capita GNP in the small economy will be smaller than that of the large one.

3.4 Competition in the Large Economy

In this section we assume that although wages in the small economy are determined by bargaining, those of the large economy are determined competitively.

3.4.1 Factor Price Determination

Factor prices in the large economy are determined by perfect competition, thus

$$\hat{w}_t = f(\hat{k}_t) - \hat{k}_t f'(\hat{k}_t) \quad (13)$$

and

$$\hat{r}_t = f'(\hat{k}_t) \quad (14)$$

To work out the factor prices in the small economy, we first determine what level of capital stock will be placed there. We are therefore thinking of a scenario where capital is controlled by a single multinational company. Since capital is perfectly mobile, it can move after any wage agreement is made. Given any wage agreement which fixes w_t and given the rate of interest in the large economy \hat{r}_t , the capital owner will choose k_t to maximize his profits which are given by

$$f(k_t) - w_t - \hat{r}_t k_t$$

The solution for this problem will be to invest a level of capital in the home country such that $f'(k_t) = \hat{r}_t$, which implies that the level of the capital to labor ratio will be equalized in the two countries, i.e., $k_t = \hat{k}_t$.

Given this rationally expected level of k_t , the Nash product can now be written as

$$[w_t(\pi_{t+1}^{1-\alpha})]^\beta [f(k_t) - w_t - \hat{r}_t k_t]^{1-\beta} \quad (15)$$

Maximizing this with respect to w_t gives the following wage rate for the small economy:

$$w_t = \beta[f(k_t) - \hat{r}_t k_t] = \beta \hat{w}_t \quad (16)$$

i.e., the wage rate in the small country will be only a fraction of the wage rate in the large economy, despite the fact that the capital to labor ratios are equalized.

Once again, because of the constant return to scale assumption, we can indifferently think of the bargaining process in the small economy as taking place either within each individual firm or in a centralized fashion between labor and capital as a whole.

3.4.2 Long-Run Income and Capital Flows

Despite the fact that the steady state level of per capita GDP is going to be equalized, the world economy will tend to a steady state where the small open economy will have lower wages than the large economy.

Next, we can examine the implications of the above results for the country's capital account. Since $k_t = \hat{k}_t$, but $w_t < \hat{w}_t$, domestic savings in the home economy fall short of what is required to sustain equilibrium capital accumulation. The gap will be made up by a capital inflow from the large economy, which can be quantified exactly, as it is simply given by $-g = s(\hat{w}_t - w_t)$. This implies that, despite per capita GDP equalization, per capita GNP will be permanently lower in the small economy. In other words, in this case a capital inflow may be associated with lower long-run income for a capital-poor country.

4 An Application to the Analysis of 20th Century Colonialism

The framework we developed lends itself to an application to a very broad range of phenomena. It can in fact be interpreted as a theory of conflict between capital-abundant countries and labor-abundant ones. In particular, our model can usefully be applied to the analysis of 20th century European colonialism. We will focus in particular to the implications of economic colonialism for foreign capital flows in the small economy. As discussed for example in Svedberg (1981),

the latter were subject to monopolistic control by the metropolitan country. In our context, the relationship between the colony and the metropolitan country can be modelled as a struggle between indigenous labor and foreign capital. While the metropolis has a standard, competitive labor market, the colony is characterized by bargaining, as in the case discussed in section 3.4. More specifically, on one side of the bargaining process we can place a monopolistic capital owner which is licensed by the colonial government. As for the other side, we can interpret more broadly labor unions as the indigenous population, or the local ruler of the colony.

Our predictions fit quite well some of the stylized facts of the history of 20th century colonialism, i.e., the colonial phase that started in 1880 with the scramble of Africa and ended, for most countries, by the 1960s¹⁴. One can in fact argue that, in the struggle between capital and labor in the colonies, capital was endowed with an “outside option”. That is, capital could threaten to leave the colony and move to the metropolis. This option reduced the bargaining power of indigenous labor, and hence slowed down domestic capital accumulation. Consistently with the evidence, our model then predicts capital inflows into the colony, which is indeed what characterized colonial expansion. Moreover, it implies that wage income in the colony is lower than in the metropolis. It is worth stressing that this would not be the outcome to be expected if the labor markets in the colony were perfectly competitive: Under that assumption, an inflow of capital would push the wage up! It can also be noticed that wages and income are lower in the colony than in an autarkic economy where centralized bargaining occurs between a local capital owner and the labor force. Moreover, had the two countries stayed in autarky, their steady state levels of income would have been the same, thus capital mobility can be said to have increased international inequality. Bertocchi and Canova (1995) do find evidence that colonization negatively affected growth for the case of Africa.

In a closely related literature, Lucas (1990) models colonialism by assuming the existence of a

¹⁴It is well-known that the experience of the self-governing British dominions has to be distinguished from that of the countries that were colonies in a strict sense. In the dominions, growth was undoubtedly enhanced by the interaction with the mother country. This observation, however, is not inconsistent with our approach, as what characterized the economic relation between Britain and its dominions was precisely a migration of labor, and not just capital, to countries that were underpopulated. Thus the local labor force was not in direct conflict with capital.

single foreign capital owner who invests in a colony which has no capital to start with. The labor market in the small economy is perfectly competitive. The reason why in the colony wages remain relatively low is that the monopolist chooses to restrict capital inflows in order to maximize his rents. Grossman and Iyigun (1993) study the profitability of colonialism taking into account the threat of appropriation by the indigenous population. Their approach is therefore closer to that of conflict theory. In a dynamic framework, Bertocchi (1994) takes foreign capital inflows as exogenous and focuses on the evolution of the colony's own capital stock, showing that steady state national product can still go down even if wages, which are competitively determined, do increase. These analyses can be viewed as complementary to the present one.

5 Conclusion

This paper has studied the growth implications of different institutional structures of the labor markets in an integrated world, with a focus on the consequences of openness on wages in the developing countries. There are several policy implications of our results. Some concern the developed countries as well: in particular, it appears that the ones with less flexible markets for labors have indeed reasons to fear capital outflows of a large entity and the consequent de-industrialization. On the other hand, small countries with strong labor unions should realize that opening to an integrated world economy may weaken the bargaining power of labor, and therefore depress domestic savings and steady state income. Moreover, since a tax on foreign earnings will devalue the "outside option" and protect the labor's share of output, our results could be used to justify a growth-enhancing policy of taxing foreign earnings or, more generally, capital controls.

References

- [1] Bean C. and Pissarides C., 1993, "Unemployment, Consumption and Growth", *European Economic Review* 37:837-859.
- [2] Bertocchi G., 1994, "Colonialism in the Theory of Growth", Brown University Working Paper N. 94-14.
- [3] Bertocchi, G. and Canova, F., 1995, "Did Colonization Matter for Growth? An Empirical Investigation into the Historical Causes of Africa's Underdevelopment", mimeo, University of Modena.
- [4] Bertola G., 1994, "Flexibility, Investment, and Growth", *Journal of Monetary Economics* 34:215-238.
- [5] Binmore K., Rubinstein, A. and Wolinsky, A., 1986, "The Nash Bargaining Solution in Economic Modeling", *Rand Journal of Economics* 17:178-188.
- [6] Boldrin M., 1992, "Dynamic Externalities, Multiple Equilibria, and Growth", *Journal of Economic Theory* 58:198-218.
- [7] Buiter W.H., 1981, "Time Preference and International Lending and Borrowing in an Overlapping Generations Model", *Journal of Political Economy* 89:769-797.
- [8] Calmfors L. and Driffill J., 1988, "Bargaining Structure, Corporatism and Macroeconomic Performance", *Economic Policy* 6:16-61.
- [9] Devereux M. and Lockwood B., 1991, "Trade Unions, Non-Binding Wage Agreements, and Capital Accumulation", *European Economic Review* 35:1411-1426.
- [10] Diamond P., 1965, "National Debt in a Neoclassical Growth Model", *American Economic Review* 55:1026-1050.
- [11] Dixit A., 1978, "The Balance of Trade in a Model of temporary Equilibrium with Rationing", *Review of Economic Studies* 45:393-404.
- [12] Fishlow A., 1985, "Lessons from the Past: Capital Markets during the 19th Century and in the Interwar Period", *International Organization* 39:37-93.
- [13] Galor O. and Ryder H., 1989, "Existence, Uniqueness, and Stability of Equilibrium in an Overlapping Generations Model with Productive Capital", *Journal of Economic Theory* 49:360-375.
- [14] Grossman G.M. and Helpman E., 1991, *Innovation and Growth in the Global Economy*, MIT Press, Cambridge.
- [15] Grossman H. and Iyigun, M., 1993, "The Profitability of Colonialism", Brown University Working Paper N. 93-30.
- [16] Grossman H. and Kim M., 1994, "A Theory of the Security of Claims to Property", Brown University Working Paper N. 94-12.
- [17] Helpman E. and Krugman P., 1989, *Trade Policy and Market Structure*, MIT Press, Cambridge.
- [18] Hirshleifer J., 1991, "The Technology of Conflict as an Economic Activity", *American Economic Review Papers and Proceedings* 81:130-134.

- [19] Huizinga H., 1993, "International Market Integration and Union Wage Bargaining", *Scandinavian Journal of Economics* 95: 249-255.
- [20] Jones L.E. and Manuelli R.E., 1982, "Finite Lifetimes and Growth", *Journal of Economic Theory* 58:171-197.
- [21] Krugman, P., 1995, "Trade and Wages", Econometric Society World Meetings, mimeo.
- [22] Lucas R.E. Jr., 1990, "Why Doesn't Capital Flow from Rich to Poor Countries?", *American Economic Review Papers and Proceedings* 80:92-96.
- [23] Mountford A., 1993a, "Trade Dynamics and Endogenous Growth - An Overlapping Generations Model", ch.1, unpublished Ph.D. Dissertation, Brown University.
- [24] Mountford A., 1993b, "Growth, History and International Capital Flows", mimeo, CentER, Tilburg University.
- [25] Rama M., 1994, "Bargaining Structure and Economic Performance in the Open Economy", *European Economic Review* 38:403-415.
- [26] Skaperdas S., 1992, "Cooperation, Conflict, and Power in the Absence of Property Rights", *American Economic Review* 82:720- 739.
- [27] Svedberg P., 1981, "Colonial Enforcement of Foreign Direct Investment", *The Manchester School* 49:21-38.
- [28] Sutton, J., 1986, "Non-Cooperative Bargaining Theory: An Introduction" *Review of Economic Studies* 53:709-724.
- [29] "The Economist", 1994, "A Survey of the Global Economy", October 1st.
- [30] Young A., 1991, "Learning by Doing and the Dynamic Effects of International Trade", *Quarterly Journal of Economics* 56: 369-405.
- [31] Wood A., 1994, *North-South Trade, Employment and Inequality*, Clarendon Press, Oxford.

1. Maria Cristina Marcuzzo [1985] "Yoan Violet Robinson (1903-1983)", pp. 134
2. Sergio Lugaresi [1986] "Le imposte nelle teorie del sovrappiù", pp. 26
3. Massimo D'Angelillo e Leonardo Paggi [1986] "PCI e socialdemocrazie europee. Quale riformismo?", pp. 158
4. Gian Paolo Caselli e Gabriele Pastrello [1986] "Un suggerimento hobsoniano su terziario ed occupazione: il caso degli Stati Uniti 1960/1983", pp. 52
5. Paolo Bosi e Paolo Silvestri [1986] "La distribuzione per aree disciplinari dei fondi destinati ai Dipartimenti, Istituti e Centri dell'Università di Modena: una proposta di riforma", pp. 25
6. Marco Lippi [1986] "Aggregations and Dynamic in One-Equation Econometric Models", pp. 64
7. Paolo Silvestri [1986] "Le tasse scolastiche e universitarie nella Legge Finanziaria 1986", pp. 41
8. Mario Forni [1986] "Storie familiari e storie di proprietà. Itinerari sociali nell'agricoltura italiana del dopoguerra", pp. 165
9. Sergio Paba [1986] "Gruppi strategici e concentrazione nell'industria europea degli elettrodomestici bianchi", pp. 56
10. Nerio Naldi [1986] "L'efficienza marginale del capitale nel breve periodo", pp. 54
11. Fernando Vianello [1986] "Labour Theory of Value", pp. 31
12. Piero Ganugi [1986] "Risparmio forzato e politica monetaria negli economisti italiani tra le due guerre", pp. 40
13. Maria Cristina Marcuzzo e Annalisa Rosselli [1986] "The Theory of the Gold Standard and Ricardo's Standard Comodity", pp. 30
14. Giovanni Solinas [1986] "Mercati del lavoro locali e carriere di lavoro giovanili", pp. 66
15. Giovanni Bonifati [1986] "Saggio dell'interesse e domanda effettiva. Osservazioni sul cap. 17 della General Theory", pp. 42
16. Marina Murat [1986] "Betwin old and new classical macroeconomics: notes on Lejonhufvud's notion of full information equilibrium", pp. 20
17. Sebastiano Brusco e Giovanni Solinas [1986] "Mobilità occupazionale e disoccupazione in Emilia Romagna", pp. 48
18. Mario Forni [1986] "Aggregazione ed esogeneità", pp. 13
19. Sergio Lugaresi [1987] "Redistribuzione del reddito, consumi e occupazione", pp. 17
20. Fiorenzo Sperotto [1987] "L'immagine neopopulista di mercato debole nel primo dibattito sovietico sulla pianificazione", pp. 34
21. M. Cecilia Guerra [1987] "Benefici tributari nel regime misto per i dividendi proposto dalla commissione Sarcinelli: una nota critica", pp. 9
22. Leonardo Paggi [1987] "Contemporary Europe and Modern America: Theories of Modernity in Comparative Perspective", pp. 38
23. Fernando Vianello [1987] "A Critique of Professor Goodwin's 'Critique of Sraffa'", pp. 12
24. Fernando Vianello [1987] "Effective Demand and the Rate of Profits. Some Thoughts on Marx, Kalecki and Sraffa", pp. 41
25. Anna Maria Sala [1987] "Banche e territorio. Approccio ad un tema geografico-economico", pp. 40
26. Enzo Mingione e Giovanni Mottura [1987] "Fattori di trasformazione e nuovi profili sociali nell'agricoltura italiana: qualche elemento di discussione", pp. 36
27. Giovanna Procacci [1988] "The State and Social Control in Italy During the First World War", pp. 18
28. Massimo Matteuzzi e Annamaria Simonazzi [1988] "Il debito pubblico", pp. 62
29. Maria Cristina Marcuzzo (a cura di) [1988] "Richard F. Kahn. A discipline of Keynes", pp. 118
30. Paolo Bosi [1988] "MICROMOD. Un modello dell'economia italiana per la didattica della politica fiscale", pp. 34
31. Paolo Bosi [1988] "Indicatori della politica fiscale. Una rassegna e un confronto con l'aiuto di MICROMOD", pp. 25
32. Giovanna Procacci [1988] "Protesta popolare e agitazioni operaie in Italia 1915-1918", pp. 45
33. Margherita Russo [1988] "Distretto Industriale e servizi. Uno studio dei trasporti nella produzione e nella vendita delle piastrelle", pp. 157
34. Margherita Russo [1988] "The effect of technical change on skill requirements: an empirical analysis", pp. 28
35. Carlo Grillenzoni [1988] "Identification, estimations of multivariate transfer functions", pp. 33
36. Nerio Naldi [1988] "Keynes' concept of capital", pp. 40
37. Andrea Ginzburg [1988] "locomotiva Italia?", pp. 30
38. Giovanni Mottura [1988] "La 'persistenza' secolare. Appunti su agricoltura contadina ed agricoltura familiare nelle società industriali", pp. 40
39. Giovanni Mottura [1988] "L'anticamera dell'esodo. I contadini italiani della 'restaurazione contrattuale' fascista alla riforma fondiaria", pp. 40
40. Leonardo Paggi [1988] "Americanismo e riformismo. La socialdemocrazia europea nell'economia mondiale aperta", pp. 120
41. Annamaria Simonazzi [1988] "Fenomeni di isteresi nella spiegazione degli alti tassi di interesse reale", pp. 44
42. Antonietta Bassetti [1989] "Analisi dell'andamento e della casualità della borsa valori", pp. 12
43. Giovanna Procacci [1989] "State coercion and worker solidarity in Italy (1915-1918): the moral and political content of social unrest", pp. 41
44. Carlo Alberto Magni [1989] "Reputazione e credibilità di una minaccia in un gioco bargaining", pp. 56
45. Giovanni Mottura [1989] "Agricoltura familiare e sistema agroalimentare in Italia", pp. 84
46. Mario Forni [1989] "Trend, Cycle and 'Fortuitous cancellation': a Note on a Paper by Nelson and Plosser", pp. 4
47. Paolo Bosi, Roberto Golinelli, Anna Stagni [1989] "Le origini del debito pubblico e il costo della stabilizzazione", pp. 26
48. Roberto Golinelli [1989] "Note sulla struttura e sull'impiego dei modelli macroeconomici", pp. 21
49. Marco Lippi [1989] "A Shorte Note on Cointegration and Aggregation", pp. 11
50. Gian Paolo Caselli e Gabriele Pastrello [1989] "The Linkage between Tertiary and Industrial Sector in the Italian Economy: 1951-1988. From an External Dependence to an International One", pp. 40
51. Gabriele Pastrello [1989] "Francois quesnay: dal Tableau Zig-zag al Tableau Formule: una ricostruzione", pp. 48
52. Paolo Silvestri [1989] "Il bilancio dello stato", pp. 34
53. Tim Mason [1990] "Tre seminari di storia sociale contemporanea", pp. 26
54. Michele Lalla [1990] "The Aggregate Escape Rate Analysed through the Queuing Model", pp. 23
55. Paolo Silvestri [1990] "Sull'autonomia finanziaria dell'università", pp. 11
56. Paola Bertolini, Enrico Giovannetti [1990] "Uno studio di 'filiera' nell'agroindustria. Il caso del Parmigiano Reggiano", pp. 164
57. Paolo Bosi, Roberto Golinelli, Anna Stagni [1990] "Effetti macroeconomici, settoriali e distributivi dell'armonizzazione dell'IVA", pp. 24
58. Michele Lalla [1990] "Modelling Employment Spells from Emilia Labour Force Data", pp. 18

59. Andrea Ginzburg [1990] "Politica Nazionale e commercio internazionale", pp. 22
60. Andrea Giommi [1990] "La probabilità individuale di risposta nel trattamento dei dati mancanti", pp. 13
61. Gian Paolo Caselli e Gabriele Pastrello [1990] "The service sector in planned economies. Past experiences and future prospectives", pp. 32
62. Giovanni Solinas [1990] "Competenze, grandi industrie e distretti industriali. Il caso Magneti Marelli", pp. 23
63. Andrea Ginzburg [1990] "Debito pubblico, teorie monetarie e tradizione civica nell'Inghilterra del Settecento", pp. 30
64. Mario Forni [1990] "Incertezza, informazione e mercati assicurativi: una rassegna", pp. 37
65. Mario Forni [1990] "Misspecification in Dynamic Models", pp. 19
66. Gian Paolo Caselli e Gabriele Pastrello [1990] "Service Sector Growth in CPE's: An Unsolved Dilemma", pp. 28
67. Paola Bertolini [1990] "La situazione agro-alimentare nei paesi ad economia avanzata", pp. 20
68. Paola Bertolini [1990] "Sistema agro-alimentare in Emilia Romagna ed occupazione", pp. 65
69. Enrico Giovannetti [1990] "Efficienza ed innovazione: il modello "fondi e flussi" applicato ad una filiera agro-industriale", pp. 38
70. Margherita Russo [1990] "Cambiamento tecnico e distretto industriale: una verifica empirica", pp. 115
71. Margherita Russo [1990] "Distretti industriali in teoria e in pratica: una raccolta di saggi", pp. 119
72. Paolo Silvestri [1990] "La Legge Finanziaria. Voce dell'enciclopedia Europea Garzanti", pp. 8
73. Rita Paltrinieri [1990] "La popolazione italiana: problemi di oggi e di domani", pp. 57
74. Enrico Giovannetti [1990] "Illusioni ottiche negli andamenti delle Grandezze distributive: la scala mobile e l'appiattimento delle retribuzioni in una ricerca", pp. 120
75. Enrico Giovannetti [1990] "Crisi e mercato del lavoro in un distretto industriale: il bacino delle ceramiche. Sez. I", pp. 150
76. Enrico Giovannetti [1990] "Crisi e mercato del lavoro in un distretto industriale: il bacino delle ceramiche. Sez. II", pp. 145
78. Antonietta Bassetti e Costanza Torricelli [1990] "Una riqualificazione dell'approccio bargaining alla selezioni di portafoglio", pp. 4
77. Antonietta Bassetti e Costanza Torricelli [1990] "Il portafoglio ottimo come soluzione di un gioco bargaining", pp. 15
79. Mario Forni [1990] "Una nota sull'errore di aggregazione", pp. 6
80. Francesca Bergamini [1991] "Alcune considerazioni sulle soluzioni di un gioco bargaining", pp. 21
81. Michele Grillo e Michele Polo [1991] "Political Exchange and the allocation of surplus: a Model of Two-party competition", pp. 34
82. Gian Paolo Caselli e Gabriele Pastrello [1991] "The 1990 Polish Recession: a Case of Truncated Multiplier Process", pp. 26
83. Gian Paolo Caselli e Gabriele Pastrello [1991] "Polish firms: Private Vices Public Virtues", pp. 20
84. Sebastiano Brusco e Sergio Paba [1991] "Connessioni, competenze e capacità concorrenziali nell'industria della Sardegna", pp. 25
85. Claudio Grimaldi, Rony Hamoui, Nicola Rossi [1991] "Non Marketable assets and households' Portfolio Choice: a Case of Study of Italy", pp. 38
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88. Antonella Caiumi e Roberto Golinelli [1992] "Stima e applicazioni di un sistema di domanda Almost Ideal per l'economia italiana", pp. 34
89. Maria Cristina Marcuzzo [1992] "La relazione salari-occupazione tra rigidità reali e rigidità nominali", pp. 30
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92. Paolo Silvestri e Giovanni Solinas [1993] "Abbandoni, esiti e carriera scolastica. Uno studio sugli studenti iscritti alla Facoltà di Economia e Commercio dell'Università di Modena nell'anno accademico 1990/1991", pp. 30
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95. Alberto Rinaldi [1993] "Lo sviluppo dell'industria metalmeccanica in provincia di Modena: 1945-1990", pp. 70
96. Paolo Emilio Mistrulli [1993] "Debito pubblico, intermediari finanziari e tassi d'interesse: il caso italiano", pp. 30
97. Barbara Pistoresi [1993] "Modelling disaggregate and aggregate labour demand equations. Cointegration analysis of a labour demand function for the Main Sectors of the Italian Economy: 1950-1990", pp. 45
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110. Massimo Baldini [1995] "INDIMOD. Un modello di microsimulazione per lo studio delle imposte indirette", pp. 37
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142. M. Dell'Amico, F. Maffioli, A. Sciomechen [1996] "A Lagrangean Heuristic for the Pirze Collecting Travelling Salesman Problem", pp. 14
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