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Rossana Patron

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Rossana Patron

Departamento de Economia - FCS – UDELAR

Abstract

Changes in technology and markets result in the transformation of economic structure: When labor is quasi-fixed due to short-term specificity, changing conditions may imply either temporary unemployment or the need of retraining to enable mobility across the sectors. There is an economy-wide loss due to the unemployment or sluggish adjustment caused by the friction. This article discusses the role of training for development, providing a novel approach to assess its value. As training raises mobility, it may speed the development process by the abatement of key parameters, also with favorable distributional consequences. It is argued that these effects reveal the true value of easing mobility. The analysis highlights the relevance of improving training effectiveness and attractiveness.

Key words: training, labor mobility, restructuring, development

JEL: J24, O15,:F16, F17

Resumen

Los cambios en tecnología o en las tendencias del Mercado implican la transformación de la estructura económica. Cuando el trabajo es quasi-fijo por especificidades de corto plazo, cambios en el contexto económico pueden llevar a desempleo transitorio o implicar la necesidad de re-capacitar a los trabajadores para facilitar la movilidad entre sectores. Los efectos resultantes de las dificultades en el ajuste ocasionados por la movilidad imperfecta son de amplia repercusión. En el artículo se discute el rol de la capacitación en el desarrollo, proponiendo un nuevo enfoque para valuar este rol. Como la capacitación aumenta la movilidad tiene un papel fundamental para aumentar el ritmo de los procesos de desarrollo, básicamente reduciendo los parámetros clave que provocan fricciones al ajuste, también con efectos distributivos favorables. Se argumenta que estos efectos revelan el verdadero valor de facilitar la movilidad laboral y por lo tanto de la capacitación. El análisis resalta la relevancia de aumentar la atractividad y efectividad de los programas de capacitación.

Palabras clave: capacitación, movilidad laboral, reestructura y desarrollo

JEL: J24, O15,:F16, F17

1.- Introduction

Economic restructuring caused by changes in technology or markets' shifting demand patterns, external shocks, or technological innovation requires the ability of economic factors to adjust to a changing environment. However, some factors of production can only reallocate slowly or bearing some cost; e.g. recycling equipment or workers' skills, in some cases, may lead to a partial or total factor destruction when the factor is unable to find an alternative allocation, known as hysteresis effect.

As ILO (2011) states: *"The cornerstones of a policy framework for developing a suitably skilled workforce are: broad availability of good-quality education as a foundation for future training; a close matching of skills supply to the needs of enterprises and labour markets; enabling workers and enterprises to adjust to changes in technology and markets; and anticipating and preparing for the skills needs of the future."* When this "close matching to the needs of enterprises and labour markets" is not present, factors cannot move without a cost. Interactions between economic changes, skills formation policy, and unemployment are also discussed in recent literature, e.g. in the studies by Kreickemeier (2009), Manning (2010), and Johanson (2004) among others.

Recycling factors consume resources, which make the adjustment feasible at a cost; otherwise, there would be an overall cost because unemployed factors would result in reduced output. While firms are foremost interested in providing training to incumbent and entrant employees to enable expanding activities and maintain a technologically updated workforce, this could not be the most reliable tool to speed up the adjustment process in an economic downturn. Public training has been widely seen as a central element in dealing with dislocated workers in economic downturns (for instance, ILO, 2009; Jacobson et al. 2005). In any case, either for economic downturn or for economic development, economic restructuring makes the provision of training, either private or public, essential.

The evidence on effectiveness of retraining programs is inconclusive, as can be seen, e.g. in the studies by Cansino and Sanchez (2011), Arellano (2010), Rosholm and Skipper (2009), and in the works surveyed by Heckman et al. (1999) and Green et al (2000). However, a broader and more realistic way to assess the value this training activity is by referring to the contra-factual situation, as presented in the study by Lee and Wolpin (2006). The present study follows closely this line of research, discussing the dynamics of the labor market, which can provide useful information for the design and management of skills formation strategies, and help in improving the efficiency of the “adjustment technology.”

The aim of this study is to provide a methodological approach to discuss and assess this cost, paying particular attention to the short- and medium-term effects. There are at least two aspects worth considering: growth and distribution. The provision of training can reduce the cost of the adjustment by the abatement of key parameters in the process, because otherwise unemployment and labor destruction or a sluggish adjustment would arise. Also, there are distributional aspects of the activity because it may reduce the transitional losses for those hurt in the process, with longer lasting positive effects than safety nets (for a discussion, see Davidson and Matusz. 2000). While the model would support many of the results in the literature, it particularly focuses on providing a methodological approach to assess the economic value of easing mobility, by measuring the avoided unemployment or social losses.

The paper is organized as follows: Section 2 describes the adjustment in the labor market with quasi-fixed factors. Section 3 provides a general equilibrium model and discusses the main implications of the model. Lastly, Section 4 presents the conclusion. An Appendix with supplementary analytical details has also been provided.

2.- Adjustment in the labor market

Labor mobility costs have been extensively studied in the literature (e.g. Hammermesh and Pfann, 1996; Hammermesh, 1995). In this section, adjustment cost modeling fit many of the usual reasons to assume the existence of imperfect labor mobility, with the rather less frequent assumption that labor friction implies economy-wide losses, rather than firm’s losses. A quadratic form for the adjustment cost is assumed, which introduces the dynamics in the process. Though the functional form may be explained by the congestion cost in the market, the assumption of a quadratic functional form is not essential for the results, but significantly simplifies the presentation.

This section develops a multiperiod dynamic model with quasi-fixed labor, as defined by Oi (1962). Labor is imperfectly mobile across sectors; in the movement of factors, individuals need to undergo training to acquire mobility or endure unemployment; hence, the labor endowment is allocated as:

$$L_t^{A} + L_t^{B} + L_t^{M} = \overline{L} \qquad \forall t \tag{1}$$

$$L_t^{M} = \frac{a}{2}(L_t^{i} - L_{t-1}^{i})^2 \qquad \forall\, t \quad a > 0 \tag{2}$$

where L_t^M represents a training sector that makes individuals capable of working in alternative allocations – this is an only-time-input activity. Otherwise it may represent temporary unemployment. The quadratic functional form for L_t^M is assumed to be explained by the congestion in the market, which increases with the amount of workers moving.

The parameter a is the key in the model. If there is no friction to the movement ($a = 0$), then workers are perfectly mobile and (1) gives a linear input transformation function, where labor across sectors are perfect substitutes with an infinite elasticity of substitution. However, when the labor units differing in allocation are imperfect substitutes, there is imperfect mobility; training may ease the moving from contracting to expanding sectors by conferring suitable skills to the individuals.

The intertemporal problem to determine the optimal allocation presuming that labor is moving from sector B to A will consider the mobility friction and then incorporate the restriction in (4),

$$L_t^{M} = \frac{a}{2}(L_t^{A} - L_{t-1}^{A})^2 \qquad \forall\, t \quad a > 0 \tag{3}$$

$$L_t^{B} = \overline{L} - L_t^{A} - \frac{a}{2}(L_t^{A} - L_{t-1}^{A})^2 \tag{4}$$

The intertemporal workers' income maximization program, in discrete time, is as follows:

$$\underset{\{L_t^A\}t=0,\dots,\infty}{Max} \quad \sum_0^{\infty}\left[w_t^A L_t^A + w_t^B\left(\overline{L} - L_t^A - \frac{a}{2}(L_t^A - L_{t-1}^A)^2\right)\right]\frac{1}{(1+r)^t} \tag{5}$$

$$s.t.\ 0 \le L_t^A \le \overline{L}$$

$$initial\,allocation\,given$$

The first-order conditions take the following form:

$$w_t^A - w_t^B\left(1 + a(L_t^A - L_{t-1}^A)\right) + w_{t+1}^B \frac{a}{1+r}(L_{t+1}^A - L_t^A) = 0 \quad \forall t \tag{6}$$

Under perfect competition in good markets, the maximizing behavior of firms in the productive sectors implies that workers will be hired up so as the wages equalize the value of the marginal productivity in each sector as:

$$w_t^i = P_t^i\, MP_{Lt}^{\ i} \qquad i = A,B \qquad \forall t \tag{7}$$

where P_t^i is the good price and $MP_{Lt}^{\ i}$ is the marginal productivity of labor.

For a T big enough, and a terminal condition assuming steady-state values for the period $T+1$, the expressions (4), (6), and (7) conform a system of four equations and four unknowns (w_t^A, w_t^B, L_t^A, L_t^B) times $T+1$, from 0 to T ($T+1$ periods), given the values for the initial allocation, prices, and interest rate. Using (6), it is possible to solve the problem recursively as follows:

$$t = 0 \qquad w_0^A - w_0^B\left(1 + a(L_0^A - L_{-1}^A)\right) + w_1^B \frac{a}{1+r}(L_1^A - L_0^A) = 0 \tag{8}$$

$$t = 1 \qquad w_1^A - w_1^B\left(1 + a(L_1^A - L_0^A)\right) + w_2^B \frac{a}{1+r}(L_2^A - L_1^A) = 0 \tag{9}$$

By inserting w_2^B from (8) in (9) and analogously $\forall\, t$ also considering that $L_{T+1}^A - L_T^A = 0$, the following equilibrium condition along the optimal path is obtained:

$$w_t^B\, a(L_t^A - L_{t-1}^A) = \sum_t^T (w_t^A - w_t^B)\frac{1}{(1+r)^t} \tag{10}$$

The individuals' behavior would put the economy on the same path as if decisions were taken in a central way by the suppliers of labor (see Appendix).

The consolidate of labor recycled is $LT = \sum_{0}^{T} \frac{a}{2}(L_t{}^i - L_{t-1}{}^i)^2$, regulated by the parameter a, and, thus its economic value is given by the output produced by these labor units.

3 – General equilibrium adjustment

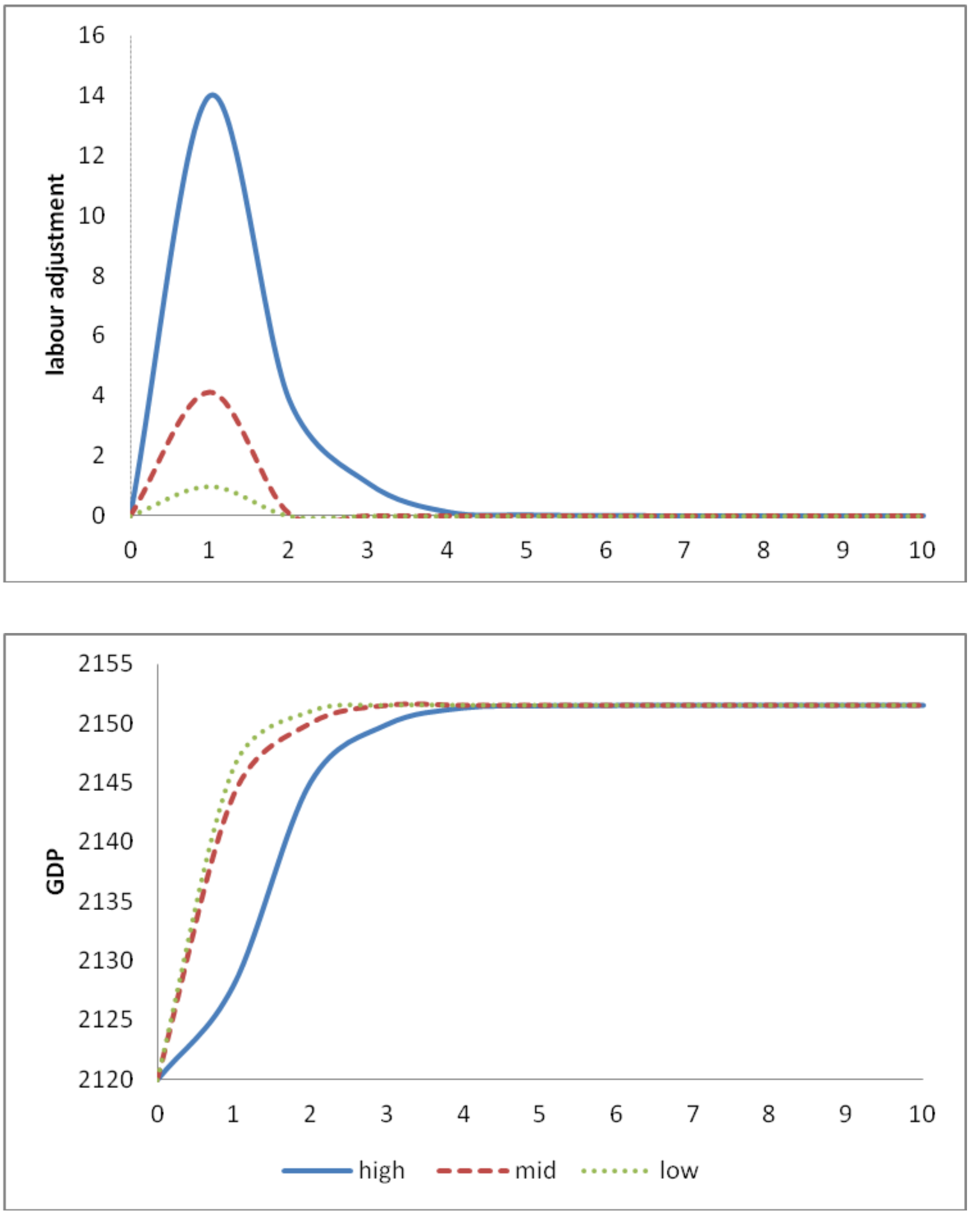
The model in partial equilibrium for the labor market with imperfect mobility in the previous section can be extended to a general equilibrium setup to serve the purpose of an economy-wide assessment of the value of training. The discussion follows a simple model with short-term rigidity in a multi-period context with labor demand dynamic, characterized by: two sectors producing final goods, two factors (capital and labor); constant returns to scale production functions; fixed factor supplies; two representative consumers (no savings); a price-taker economy; and no assumption of distortions or trade barriers.

In this context, some scenarios are of special interest, in particular those related to changes in economic environment or in policy. For instance: What is the difference when there is an external shock and labor is quasi-fixed rather than perfectly mobile? The presence of adjustment costs in the model gives rise to gradualism whose speed is inversely related to the level of the cost (parameter a). Thus, the reallocation induced by the shock causes a "temporary destruction" of a part of the labor force, because some labor units are not used for productive purposes during the transition. This causes a temporal contraction of the production possibilities frontier, with implications on distribution and welfare depending on the level of the adjustment costs involved.

Figure 1 illustrates this point. The figure shows that for a small a (low adjustment costs), the transitory unemployment is present only for a short while, whereas for high adjustment costs, unemployment takes longer to recede.

The upper panel of the figure shows the paths of the "labour in transit" variable for alternative levels of mobility costs. The amount of labor unused for productive ends during the transition process reaches its highest level at the beginning, decreasing steadily until the end of the transition.

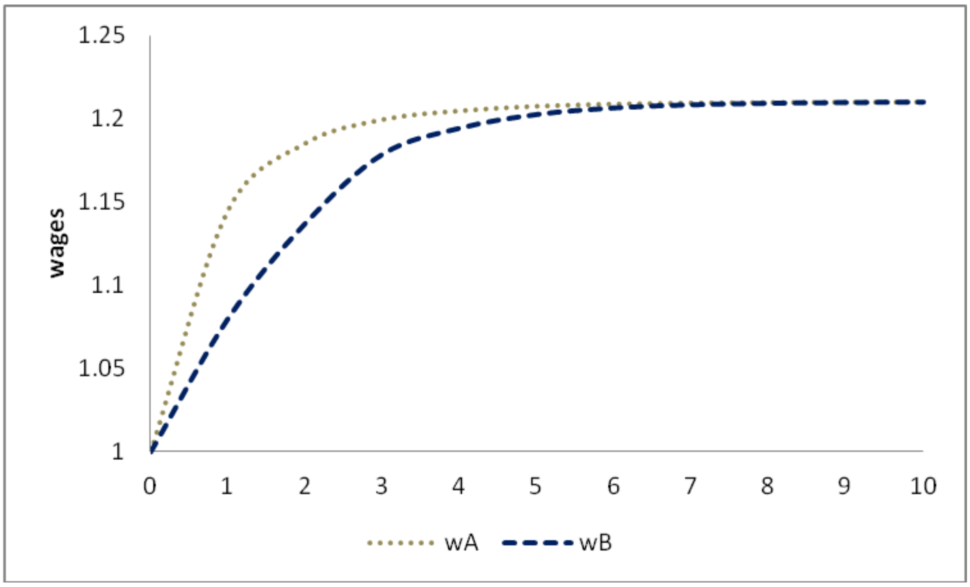
Figure 1 Labor in transit for alternative mobility levels.



Labor lost in training is equivalent to transitory unemployment; hence, a more efficient "adjustment technology" reduces output losses. The possibility frontier for each period depends on the adjustment cost level, because the loss for labor in transit, temporary unemployment, or auto-retraining undermines the actual possibilities in productive sectors; this situation is illustrated at the bottom of Figure 1. Therefore, the present value of the differences between the output level with and without adjustment costs provides a measure of the economic value of easing mobility.

The presence of imperfect mobility also generates a wage gap across the sectors during the adjustment process, with distributional effects between workers across the sectors. Figure 2 illustrates this situation. The costlier the adjustment is, the longer is the period needed for the wage convergence to take place. Therefore, workers' fate during transition also relies heavily on the level of adjustment costs. Consequently, the efficiency on the adjustment technology also has distributional effects. These two effects reveal the true value of easing mobility.

Figure 2 Wage gap during transition, high mobility costs.



4.- Conclusions

Changes in technology and markets result in the transformation of economic structure: When labor is quasi-fixed due to short-term specificity, changing conditions may imply either temporary unemployment or the need of retraining to enable mobility across the sectors. The worker will be willing to move only when the cost of training or unemployment spell is less than the (discounted) future stream of differences in return between the alternative allocations.

When labor is quasi-fixed there is a gradualism to adjust to a changing economic environment, short periods may be sufficient for a complete reallocation when the adjustment costs are low, but long periods may not be enough when the adjustment costs are high. There is an economy-wide loss due to the unemployment or sluggish adjustment caused by the friction during the transition.

Training may raise mobility speeding the development process, as it can reduce the cost of the adjustment by the abatement of key parameters in the process; the efficiency of the adjustment process has direct implications on the output growth and also has distributional implications. It is forcefully argued that these effects reveal the true value of easing mobility, contrary to conventional related literature. Thus, training seems to be a powerful "machine," increasing workers' mobility in economic slums as well as booms, and could make a key contribution for development. Indeed, in today's context of global turmoil, improving the effectiveness in the provision of training seems to be essential.

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APPENDIX

1 Individual's decisions on labor allocation

To analyze the intertemporal substitutability of labor units, it is useful to simplify the notation, taking $i_t = \dot{L}_t{}^A$, as follows:

$$L_t{}^M = \frac{a}{2} i_t{}^2 \quad \text{(A.1)}$$

$$L_t{}^B = \overline{L} - L_t{}^A - \frac{a}{2} i_t{}^2 \quad \text{(A.2)}$$

Expression (A.1), relating $L_t{}^B$ and i_t , shows the intertemporal input transformation frontier of labor units moving from sector B to A; the marginal input rate of intertemporal transformation is given by (A.3, which shows the slope of the curve for infinitesimal changes; thus, the lower the mobility costs (a) is, the flatter is the curve.

$$-\frac{\partial L^B}{\partial i} = a\ i \quad \text{(A.3)}$$

This rate shows how many units of labor must leave one sector at time *t* to obtain a marginal unit of increment in the level of employment of the other sector at time *t*+1, accounting for the friction to the movement. The rate increases with the increasing employment in the expanding sector due to the quadratic form assumed; this feature is not essential for the results.

Workers will be aware of the presence of friction to the movement and will take into account the marginal input rate of intertemporal transformation when deciding the move. Thus, workers' decisions at time t_0 (infinitely lived workers) will be based on the following rule:

$$w_{t_0}{}^B\ a\ i \le \sum_{t=t_0}^{\infty} (w_t{}^A - w_t{}^B) \frac{1}{(1+r)^t} \quad \text{(A.4)}$$

where $w_t{}^i$ is the wage rate and r is the exogenous interest rate. When equality in (A.4) holds, the worker will be indifferent to the movement. Intuitively, the worker will be willing to move as long as the return to the amount of labor units that must leave a sector now is less than the (discounted) future stream of the difference in the return between the alternative allocation of the marginal labor unit.. Expression (A.4) is equivalent to (10) in the text.

2 Dynamic path in continuous time: Allocation decisions centrally taken by labor suppliers

The intertemporal problem, in continuous time, when allocation decisions are centrally taken by labor suppliers is:

$$\underset{i}{Max} \int_0^\infty \left(w_t \, L_t{}^A + w_t \, L_t{}^B \right) e^{-rt} dt$$
$$s.t. \;\; \overline{L} = L_t{}^A + L_t{}^B + \frac{a}{2} i_t{}^2$$
$$i_t = \dot{L}_t{}^A$$

Using (A.2) it can be rewritten as:

$$\underset{i}{Max} \int_0^\infty \left(w_t \, L_t{}^A + w_t \, (\overline{L} - L_t{}^A - \frac{a}{2} i_t{}^2) \right) e^{-rt} dt \qquad \text{(A.5)}$$
$$s.t. \qquad i_t = \dot{L}_t{}^A$$

where r is the instantaneous discount rate (interest rate) taken as exogenous. The Hamiltonian for the program (A.5), where i_t is the control variable, $L_t{}^A$ is the state variable, and μ_t is the associated co-state variable, is as follows:

$$H = \left[w_t \, L_t{}^A + w_t{}^B (\overline{L} - L_t{}^A - \frac{a}{2} i_t{}^2) \right] e^{-rt} + \mu_t \;\; i_t$$

where the optimization conditions are:

$$-w_t{}^B \, a \, i_t \, e^{-rt} + \mu_t = 0 \qquad \text{(A.6)}$$

$$(w_t{}^A - w_t{}^B) e^{-rt} = - \dot{\mu}_t \qquad \text{(A.7)}$$

$$i_t = \dot{L}_t{}^A \qquad \text{(A.8)}$$

By integrating (A.7) with respect to time and using (A.6), it results:

$$w_t{}^B a \dot{i}_t \ e^{-rt} = \int_t^{\infty} \left(w_\tau{}^A - w_\tau^B \right) e^{-r(t-\tau)} \, d\tau$$

The expression shows that on the optimal path, the marginal cost of the movement is equal to the (discounted) stream of future benefits of the reallocation; this result is equivalent to (A.4) and (10) in the text.