

**Exchange rate, output and employment: revisiting the contractionary devaluation hypothesis<sup>1</sup>**  
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## **I. Introduction**

The purpose of this paper is to stimulate the discussion on the relationship between the exchange rate and employment and to advance some ideas in connection to some recent behavioral changes in the Argentinean economy. Regarding exchange rate policy, there are two opposite views in Argentina nowadays. On the one hand, heterodox economists support the competitive (namely, high) real exchange rate policy pursued by Nestor Kirchner's government in order to sustain output and employment expansion, which relies on sterilization measures and (some) restrictions to capital inflows. On the other hand, orthodox economists propose a clean float and inflation targeting, that is to say, a policy choice which under the current conditions of balance of payments surplus would lead to a significant real appreciation of the currency. Economic policy priorities of Tyrians and Trojans have not changed. However, the instrumental measures proposed have changed dramatically. In the past, heterodox Argentinean economists, were firmly opposed to the adjustment and stabilization programs based on currency devaluation supported by the IMF and orthodox economists because of their alleged contractionary consequences. The structuralist theory of contractionary devaluations provided solid foundations for that opposition.

This paper attempts to revisit the current relevance of the theory of contractionary devaluations which arose from structuralist macroeconomics in the seventies and that has been recently discarded by many of their former proponents. Though the article refers to the Argentinean case, we believe this revisionist exercise presents a more general interest for two reasons: (1) the contractionary devaluation hypothesis was very popular in the developing world, (2) from a methodological viewpoint this paper presents macroeconomic models that take into account the structural characteristics of a specific country.

The article includes four sections and an analytical appendix. The second section presents a review of the rise and fall of the theory of contractionary devaluation in the general context of debates between structuralism and orthodox economics. The third section summarizes the principal assumptions and results of three structuralist macroeconomic models that introduce relatively new features of the Argentinean economy; the more interesting result is that the effect of a devaluation on the level of activity and employment could be contractionary or expansionary depending on the initial conditions of the economy. The fourth section offers an interpretation of the recent Argentine experience based on the results in the third section. The fifth section contains some conclusions. The Appendix derives the three analytical models.

## **II. Devaluation and employment. The turns of structuralism from the seventies to the new millennium**

In the sixties and seventies, Latin American structuralism had consolidated a comprehensive vision of the economic problems of developing countries in clear opposition to

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<sup>1</sup> This paper was originally written in Spanish. A French language version is forthcoming in the next issue of "Revue Tiers Monde". This English version was possible thanks to the superb work of Martin Fiszbein. Of course, I am responsible for the remaining mistakes.

the orthodox view. Structuralist ideas referred not only to long term issues such as development and international insertion strategies, but also to short term macroeconomic problems such as inflation, balance of payments adjustment and the business cycle.

The contractionary experiences associated to orthodox adjustment and stabilization programs applied in Argentina and Chile between the late fifties and the early sixties, sometimes under IMF monitoring and sponsorship, stimulated the rise of an alternative macroeconomics whose main contributions were the development of the structural inflation theory and the contractionary devaluation theory.<sup>2</sup> The central aim of this article is to reassess the contractionary devaluation theory in light of the turns of structuralism and the recent Argentinean experience.

According to the Keynesian open economy model then prevailing, the achievement of internal balance (full employment and price stability) and external balance (a current account balance consistent with sustainable capital flows) required two kinds of policies: *expenditure-switching policies*, to reallocate expenditure between tradable and nontradable goods, and *expenditure-reducing policies*, to control aggregate expenditure or absorption. The exchange rate was the classic instrument of the first kind of policies. Monetary and fiscal policies were the typical instruments of the second kind of policies. An increase in the exchange rate (a currency devaluation) should improve the trade balance as long as the Marshall-Lerner conditions held.<sup>3</sup> In turn, if these conditions held, devaluation would have an expansionary effect on output and employment within the Keynesian open economy model, because of the positive impact on aggregate demand of higher exports and import substitution.

The right policy mix in each case depended on the imbalances prevailing in the economy. However, the orthodox recipe for balance of payments deficits always recommended a currency devaluation combined with tight monetary and fiscal policies. Such treatment was based not only on the hypothesis of expansionary devaluations, but also on the assumption of full employment as an initial condition.<sup>4</sup> Therefore, tight fiscal and monetary policies were required to offset the excess aggregate demand and inflationary pressures triggered by an expansionary devaluation under full employment. The IMF has been the champion of the orthodox recipe in every place and time, for instance during the developing countries foreign debt crisis in the early eighties or in all the “emerging market” crises during the nineties. Note that even if devaluations were expansionary, the treatment of a balance of payments crisis under conditions of idle capacity and high unemployment, should not include *expenditure-reducing policies*, that is to say, a fiscal and monetary contraction, since the latter would hinder the achievement of internal balance.

Before proceeding with the structuralist theory of contractionary devaluations it is convenient to make explicit some typical features of structuralism. According to Nora Lustig (1988) the structuralist approach considers “... the distribution of income and wealth, land tenure relations, the kind and degree of trade specialization, the degree concentration in markets, the control of the means of production by different class of actors (the private sector, the State, transnational capital), the working of financial intermediaries, and the penetration of technical progress, as well as the sociopolitical factors associated with the degree of organization of the working class and other influential sectors and classes, the geographical and sectoral distribution of population, and its skill levels”. In contrast with the orthodox mono-economics criticized by Alfred Hirschman, the emphasis in the concrete structure of production, demand and distribution of each country implies that there is not a general structuralist model. The theory of contractionary devaluations is not an exception and its validity is historically conditioned.

The theory of contractionary devaluations was born as an effort to understand the causes of the recessionary bias of orthodox adjustment programs implemented in Argentina in the late

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<sup>2</sup> On the theory of structural inflation see for example Sunkel (1958) and Olivera (1964, 1977a y 1977b).

<sup>3</sup> Marshall-Lerner conditions establish that the sum of price elasticities of export and import demand be greater than one (starting from a balanced trade).

<sup>4</sup> Of course, we could replace “full employment” with “natural rate of unemployment” or “potential output”.

forties and early sixties. Important references in this literature are Ferrer (1963), Díaz-Alejandro (1963, 1965) and Braun and Joy (1968). Porto (1975) offered a comprehensive analytical model which included not only structuralist features but also the real balances effect proposed by Sidrauski (1968); Canitrot (1975) applied the structuralist model to the analysis of the limits of certain redistributive policies. The theory is based on some typical features of the Argentinean economy in the sixties and fifties: (1) the export good is the wage-good par excellence, food; (2) food domestic supply is inelastic but foreign food demand is perfectly elastic; (3) the price elasticity of the domestic demand for food is less than one; (4) manufacturing production is oriented to the domestic market and its supply curve is very elastic<sup>5</sup>; (5) imported goods are not substitutes for, but rather complementary to domestic production, that is to say, manufacturing inputs not produced domestically; (6) workers have a marginal propensity to spend on domestic goods greater than urban and rural property owners.

The structuralist explanation of contractionary devaluations emphasizes its redistributive mechanism. An increase in the exchange rate makes food more expensive and reduces real wages (given nominal wages<sup>6</sup>). Because of a low price elasticity of domestic food demand, the fall in real wages has a larger impact on the domestic demand for other goods, for instance, manufactures. Given the inelasticity of the supply of export goods, its price increase does not induce higher output or employment in the food sector<sup>7</sup>. The workers' fall in manufactures demand is not offset by a higher demand from higher profits or rents in the export good sector. This can be due to the post-Keynesian assumption that workers have a marginal propensity to consume higher than capitalists (Kaldor, 1956), highlighted by Díaz-Alejandro (1963 y 1965), along with the fact that higher savings are not translated into a sufficiently higher demand for domestic capital goods. In turn, insufficient investment might be caused both by a negative accelerator effect in manufacturing (Canitrot, 1975) or the increase in the interest rate due to a price level rise with a constant money supply (Porto, 1975). Finally, even if the post-Keynesian assumption does not hold, aggregate demand would fall if higher profits or rents in the exportable sector were channeled to import goods demand.

In contrast to the Keynesian model prediction, a contractionary devaluation improved the trade balance through a mechanism that differs from the standard one. The trade balance improved more due to a fall in imports than an increase in exports. Food exports increased more due to a smaller domestic demand associated to the fall in real wages and employment, than an increase in supply. The underlying assumption of agricultural supply inelasticity also appears in the theory of structural inflation<sup>8</sup> and is consistent with a common perception in Latin America then. The collapse of international trade during the Great Depression had led to stagnation of agricultural production in food exporting countries; the slow recovery of agricultural production in spite of the reestablishment of a multilateral trade and payments system since the late fifties, spurred an important debate about its causes. Orthodox economists placed emphasis on the need to raise the relative price of food to offer incentives to agricultural producers, which in a country like Argentina implied a currency devaluation. On the other hand, structuralists pointed out the shortcomings of price incentives and currency devaluation due to the price inelasticity of

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<sup>5</sup> The usual assumption on manufacturing is that prices are set according to a markup on marginal cost, while output adjusts to demand.

<sup>6</sup> Strictly speaking, a food price increase reduces real wages because we have assumed that nominal wages in the economy and the markup margin in manufacturing are given.

<sup>7</sup> This assumption can be relaxed and substituted by that of a low price elasticity of food supply, which combined with the low relative labor intensity of this sector in Argentina would imply a second order effect on sectoral employment, much smaller than the negative impact on employment in manufacturing and services.

<sup>8</sup> According to Olivera (1977a), the relative price of agricultural goods had risen 45 percent in 1949-59, while agricultural output had only increased 12 percent during the same period.

agricultural supply, that was allegedly caused by sectoral technological stagnation<sup>9</sup>, reinforced, according to some authors, to a land tenure structure dominated by large estates.<sup>10</sup>

The limits of devaluation and the rigidities in production pointed out by structuralism were also part of a more general issue, namely, the foreign exchange constraint, which had stimulated the development of the *two-gap model*, an extension of the Harrod-Domar growth model to the open economy contributed by economists involved in the problems of developing countries (Chenery and Bruno, 1962; McKinnon, 1964; Chenery and Strout, 1966). The *two-gap model* was used in discussions on development planning, financing and aid. A recurrent topic was trade deficit financing of developing countries by multilateral banks to channel foreign exchange to investment in sectors that promoted import substitution and non-traditional exports, in order to relieve the foreign exchange constraint.

The theory of contractionary devaluations provided a powerful argument to criticize the orthodox recipe used in external adjustment programs sponsored by the IMF. By combining a currency devaluation, that was itself contractionary, with tight monetary and fiscal policies, orthodox adjustment programs aggravated –unnecessarily– the economic and social costs of the balance of payments crisis they were supposed alleviate and lead very often to an excessive adjustment of the trade balance through an additional fall in imports, which exacerbated output and balance of payments fluctuations. As proved by Canitrot and Rozenwurcel (1984), in order to reach both external and internal balance, a devaluation should be accompanied by expansionary fiscal and monetary policies, given its contractionary impact.

The contractionary view of devaluation later spread outside Latin America, combined structuralist and non structuralist elements, as in Krugman and Taylor (1978), and gathered certain strength in the eighties because of the violent adjustments associated to the developing countries foreign debt crisis (Hanson, 1983; Katseli, 1983). The idea of excessive adjustment associated to the orthodox recipe had wide international repercussion and became known as “*overkill*”.

Some orthodox economists replied the structuralist critique without denying the validity of the theory of contractionary devaluations, but conditioning it to the permanence of distortions supposedly generated by the import substitution industrialization strategy. For instance, Krueger (1983) explained the complementary character of imports in Latin America as a consequence of redundant protection for local manufactures; in her view, opening up the economy would give domestic industry enough competitiveness as to be able to substitute imports efficiently in response to a devaluation. Therefore, according to Krueger (1983), the production rigidities that explained a contractionary devaluation, would not be a result of the structural features of some economies, but of the distortions caused by their protectionist policies.

Until the eighties, the contractionary view of devaluations had been very influential among Argentinean macroeconomists regardless of their agreement with structuralism *in toto*. In fact, the macroeconomic experience in 1975-1992 had not been inconsistent with it. However, the severe consequences of the currency board regime, locally known as Convertibility (Convertibilidad), which set a one to one parity between the Argentinean peso and the US Dollar, from April 1991 to December 2001, had a deep impact on heterodox and structuralist economists views. In particular, the appearance of two-digit unemployment rates since 1993 in a context of strong real appreciation of the peso and the strong negative impact of currency depreciation in Brazil (Argentina’s main trade partner) on Argentinean manufacturing output in the late nineties, weakened the structuralist view of exchange rate effects. Strictly speaking, the policy experiment of the nineties combined real currency appreciation with neo-liberal structural reforms such as opening up of the economy and privatization of public utilities, so that failure of

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<sup>9</sup> It is no coincidence that the National Institute of Agricultural Technology, the research and extension agency for Argentina’s countryside, was created in the late 1950s.

<sup>10</sup> Land reform was quite popular then and it was even included on the agenda of the Alliance for Progress fostered by John F. Kennedy’s government.

the *ceteris paribus* clause makes it very difficult to isolate the effects of different policy measures. Nevertheless, the perception that real appreciation might have played some negative role on employment, for example, for not having offset the impact of lower tariffs, or because of the Brazilian currency depreciation, started to gather certain strength.

In fact, the change in viewpoint of some structuralist economists on the effects of exchange rate policy and its importance, was already noticeable in the consequent and continuous critique of “Convertibility”. Two outstanding cases are Roberto Frenkel and his associates (Fanelli and Frenkel, 1999; Frenkel and González Rozada, 1999; Damill, Frenkel and Maurizio, 2002) and some economists of Plan Fénix (Phoenix Plan) such as Aldo Ferrer (2001a and 2001b), Hugo Nochteff (2001) and Héctor Valle (2001), who pointed out the central importance of relative prices and the high costs of the misalignment implicit in the strong real appreciation which took place under “Convertibility”. Note that this stance implies a change in regard with the distrust in price mechanisms which prevailed among structuralists in the sixties. At the same time, orthodox economists also reversed their previous stance on the importance of *getting prices right* and based on the new monetarist orthodoxy associated with the “equilibrium approach to exchange rates” they postulated the irrelevance of the real exchange rate and the current account balance. Curiously, structuralist and orthodox economists traded places in terms of their attitudes towards the relevance of real exchange rates!

The equilibrium approach to exchange rates is based on two assumptions typical of new classical macroeconomics: (a) free markets are always in equilibrium (which requires full price flexibility), (b) absence of market failures.<sup>11</sup> Under these assumptions, the First Theorem of Welfare Economics always holds, so that market prices correspond to an efficient equilibrium. Under these conditions, free market relative prices could not be distorted; the real exchange rate would not be an exception; therefore, it would not make sense to speak of overvalued or undervalued currencies, or to worry about current account sustainability. According to this approach, the real variability (and nominal, in floating regimes) of exchange rates in free market conditions simply reflects disturbances in equilibrium relative prices caused by changes in exogenous variables such as productivity, technology and preferences. Stockman (1987) offers a classic account of this point of view. Frankel (1989) provides a clever and ironic critique of the equilibrium approach.

The equilibrium approach to exchange rates is typical of the orthodox vision in the era of financial globalization and floating exchange rates. However, the validity of its assumptions (rational expectations, perfect flexibility of prices, perfect arbitrage is highly disputable, especially given the long history of crises in financial markets.<sup>12</sup> For a review of the shortcomings of the assumptions of rationality and perfect arbitrage in financial markets, see Barberis and Thaler (2003). These failures (along with goods price rigidity) allow for the existence of persistent financial bubbles that enable “equilibrium” exchange rates in the sense that the supply of and demand for foreign exchange is balanced, but can be highly distorted and unsustainable in the long term, with high real costs in terms of efficiency due to the irreversibility of investments. That was the case of the US “Super-dollar” in the early eighties and the Argentinean peso in the nineties.

Going back to the relationship between the exchange rate and output, it is worth mentioning that although before the collapse of the currency board one could still hear some structuralist arguments against abandoning “Convertibility” based on the alleged contractionary effects of devaluation, the fast recovery of output and employment which started in the second quarter of 2002 (one quarter after the devaluation which ended “Convertibility”) had a devastating effect on them. A noticeable change is that some economists, clearly identified with structuralism, had recently advocated a “competitive and stable” (meaning high) exchange rate

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<sup>11</sup> This assumption is not always explicit though it is crucial for the theory.

<sup>12</sup> See for example Kindleberger (1978).

policy to foster employment, thus reversing the relationship between the exchange rate and employment which was typical of the old structuralist argument (Frenkel and Rapetti, 2004). Plan Fénix economists also accompanied this turn (Plan Fénix, 2002).

Given the historically conditioned character of structuralist models, this turn does not necessarily go against the methodological principles, so to speak, of the structuralist approach. Insofar as the structure of the Argentinean economy has changed, it should not be discarded that its behavioral relations have changed too. However, in contrast to the hypotheses developed in the sixties and seventies that were supported by formal models and detailed discussions about the features of the Argentinean economy, the recent turn has not offered comparable foundations so far.

### III. Synthesis of three macroeconomic models

In this section we present the assumptions and main qualitative results of three models that examine the relationship between the exchange rate (strictly speaking, the ratio between the exchange rate and nominal wages) and employment. The analytical development of the models and the derivation of its results appear in Appendix 1. The models attempt to capture certain structural changes in the economy to assess its theoretical impact on the relationship between the exchange rate and employment. In contrast to models from the sixties and seventies, all models under consideration assume that food production (the exportable good) uses labor and a fixed land endowment, and that it is price sensitive; the presence of land as a fixed factor imposes a maximum on sectoral output. The price sensitivity of exportable output is an undisputed stylized fact, be it because of the significant technological progress of the sector or because of the greater access to land property since the fifties (partially reversed in the nineties) or other factors. The price-elasticity of workers' food demand is less than one, that is to say, if the price of food goes up, *ceteris paribus*, workers' food demand falls, but less than proportionally, and the monetary expenditure on food rises, reducing demand for other goods.<sup>13</sup> Landowners demand is not explicitly modeled, which would be not necessary if we suppose that they consume luxury imported goods or we assume that their consumption of domestic goods is rather constant. In the three models we obtain an aggregate labor demand that we identify with an employment function under the simplifying assumption that labor supply is greater than labor demand at the prevailing market wage and is inelastic to wages.

The first model called a "semi-closed economy", combines an exportable sector with a non-tradable sector that can be seen as encompassing nontradable services and/or highly protected manufactures. To simplify, the production of nontradables only uses labor and has constant returns to scale. The introduction of a price sensitive exportable good supply eliminates the monotonically decreasing relation between the exchange rate and employment. The effect of devaluation (an increase in the exchange rate/wage ratio) on employment is positive at the minimum level of the exchange rate/wage ratio. For some values of the model parameters, devaluation will always be expansionary, up to the maximum possible value of the exchange rate (associated with a subsistence wage). However, for other parameter range values, the expansionary effect of devaluation will reverse for an exchange rate lower than the maximum level (technically, employment will have an interior maximum), so that devaluation will be expansionary for low levels of the exchange rate and contractionary for high levels of the exchange rate. In other words, the relationship has an inverted U shape (see Graphic 1).

The second model, called "an open economy without nontradables", combines the exportable sector with a manufacturing sector that produces imports substitutes, using labor under constant returns to scale. To obtain a continuous function production of manufactures with respect to the level of the exchange rate, we assume a continuum of manufacture varieties

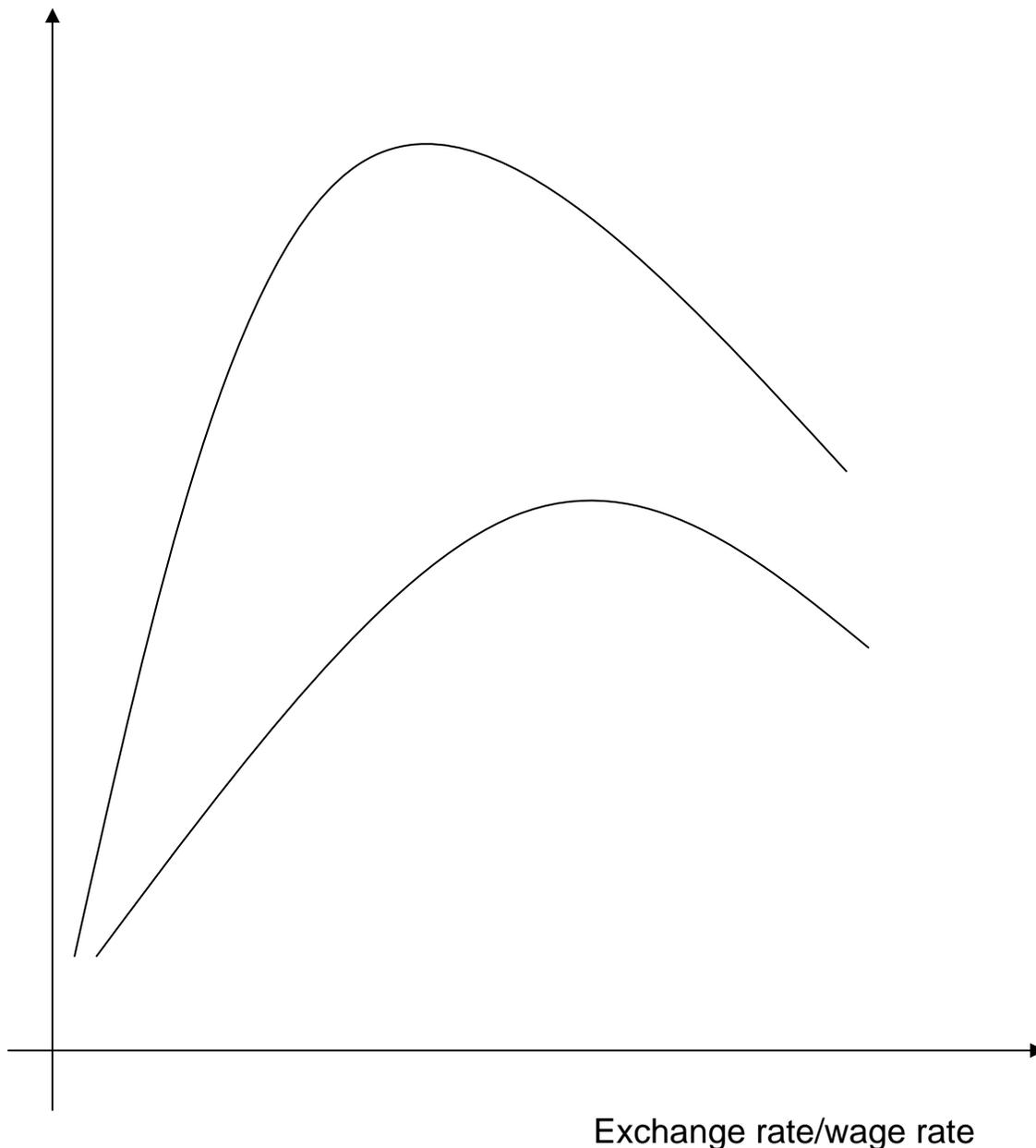
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<sup>13</sup> Expenditure on goods other than food is a fraction of income above subsistence expenditure on food.

ordered according to their production costs. To simplify, the international price of imported varieties is constant. Varieties with domestic cost lower than the imported good, will be domestically produced, given the exchange rate/wage ratio and the import tariff. An important assumption is that domestic varieties that are cheaper than imported ones (before tariffs), will not be exported because of the existence of entry barriers in manufactures international markets (information, distribution networks, protectionism, etc). Workers' expenditure on manufactures is a fraction of their income above the subsistence expenditure on food.

**FIGURE 1**

Employment



The presence of a domestic industry that competes with imports attempts to capture the conditions prevailing in manufacturing after trade liberalization in the nineties. The reasons for substitutability, however, are a matter of interpretation. We can follow Krueger and accept that the competitiveness of domestic manufacturing is a result of trade liberalization. But it can also be argued that substitutability of manufacturing is a consequence of the success of the import substitution industrialization strategy. Qualitative results of the model are similar to those of the semi-closed economy. Again, according to the value of parameters, employment can be monotonically increasing with in the exchange rate, or it can be a function of the exchange rate/wage ratio with an inverted U shape. The possibility that the employment function has an inverted U shape is independent of the tariff level, which refutes Krueger's conjecture according to which in an open economy devaluation could not be contractionary. On the other hand, a decrease in tariffs shifts moves the employment function downwards and to the right (Figure 1), so that: (1) employment will be lower in a more open economy, whichever the exchange rate, (2) the exchange rate that maximizes employment will be higher in a more open economy.

The shift of the employment function downwards and to the right caused by the tariff reduction implies that there is an interval of the exchange rate/wage ratio for which devaluation would go from being contractionary before the tariff reduction, to expansionary, after the tariff reduction, although with lower levels of employment.

The last model refers to an open economy with nontradable goods and amounts to the inclusion of nontradables (in this case interpreted as services) in the open economy model. Nontradables in this model behave just like nontradables in the first model. The qualitative results are identical to that of the open economy model.

#### **IV. An interpretation of the Argentinean experience**

The traditional structuralist interpretation placed emphasis on a monotonically decreasing relationship between the exchange rate and employment, that was consistent with the Argentinean experience until the nineties. The recent structuralist interpretation, that has captured the experience of the last decade, proposes a reversion of the relationship posed before, and stresses a monotonically increasing relationship between the exchange rate and employment. The change in stance is made without discussing the probable determinants of the reversion.

The models discussed have the power to encompass certain features of the evolution of the Argentinean economy in the last decades. We have showed that in an economy with exportable, importable and nontradable goods, the relationship between employment and the exchange rate could be non monotonous. More precisely, employment as a function of the exchange rate/wage ratio must always be increasing for low values of the ratio, but could be decreasing for high values of the ratio, that is, it could have an inverted U shape. We also showed that trade policy could change both the employment level as a function of the exchange rate/wage ratio, and the sign of the impact of a devaluation on the level of employment, which is graphically equivalent to a movement of the curve downwards and to the right (Figure 1).

Note that two central features of the "Convertibility" policy experiment were a strong real appreciation of the peso, which implied an important reduction of the exchange rate/wage ratio, and a fast and deep trade liberalization, that is, a drastic fall in tariffs levels and the removal of non-tariff barriers. The significant fall in the exchange rate/wage ratio could have led the economy from the decreasing interval to the increasing interval of the employment function. On the other hand, the shift of the employment curve caused by tariff reductions probably

strengthened the former effect because the slope of the employment function turned from negative to positive in some interval of the exchange rate/wage ratio.

The recent structuralist interpretation and the one advanced in this paper have some similar local predictions. However, they might have different policy implications. The recent structuralist view assumes that a higher exchange rate will always be beneficial for employment. Of course, there would still be a conflict between the real exchange rate and real wages<sup>14</sup>, but insofar as there is a high level of unemployment, Keynes' conjecture that the market wage is greater than the marginal disutility of labor (his definition of involuntary unemployment) will hold, and employment will rise with a devaluation. However, according to our interpretation, there could be a level of the real exchange rate that maximizes (*ceteris paribus*) the level of employment. If the current real exchange rate was greater than the employment maximizing level, there would be room to increase both real wages and employment, because the economy would lie in the decreasing interval of the employment curve.

From our point of view, the moderate real appreciation that followed the initial *overshooting* of the nominal and real exchange rate after the collapse of the currency board was not necessarily damaging to employment creation. On the other hand, if an attempt was made to raise the real exchange rate to reverse the moderate appreciation with the purpose of raising employment, the effects could be contrary to those expected.

Of course, to show the possibility of a fact does not amount to prove that it has happened. However, research is always oriented and limited by what is considered to be possible and probable. Certainly, we should not be deterred from considering that the right model of the Argentinean macroeconomy might have changed dramatically, and that as consequence, the relationship between the real exchange rate and employment might have become monotonically increasing.

This transformation would take place in case of a successful strategy of manufacture exports, already considered by Canitrot (1975) as one possible way out from the dilemmas of Argentinean macroeconomic policy. The models presented here exclude that possibility as we assume that domestic manufacturing substitutes for imports when its competitiveness improves, but it does not export more. Until proved to be wrong, this assumption seems to be a reasonable stylized representation of the short run behavior of the Argentinean economy.

## V. Conclusions

This paper has two goals. On the one hand, to advance some (at least partial) ideas to stimulate the discussion of macroeconomic models intended to capture each country's specific traits, in our case, Argentina, thus resuming the structuralist methodological tradition. Certainly, many simplifications have been made, since this paper does not intend to present *the* model of the Argentinean economy, but rather to focus on one aspect that seems crucial to draw attention to certain hypotheses of standard usage that do not appear to be sufficiently well grounded.

On the other hand, we are interested in pointing out that macroeconomic policymaking should not be based on an empiricism of trends and variables associations which could be shortlived, and emphasize the need to do more research on these issues in order to make policies that help best to overcome our severe social crisis. As an example, let us mention that such empiricism led to underestimate the job creation ability of output growth in the last decade, by extrapolating the nineties low employment-output elasticity. Post-convertibility strong recovery in output and employment buried this hypothesis. To be cautious, we believe that we should not limit ourselves to the extrapolation of recent trends in employment and exchange rates. Instead, we should attempt to understand them in a comprehensive analytical framework.

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<sup>14</sup> As long as the *markup* margin in nonagricultural sectors remains constant.

## Appendix

### Semi-closed economy

Let us assume that there are two goods in the economy, the exportable<sup>15</sup> or agricultural good, A, and the nontradable good, C. Under very high import tariffs the nontradable sector includes not only services but also manufactures, due to redundant protection. There is involuntary unemployment in the labor market: employment depends on the demand for both goods. This is a reasonable assumption for an economy with two-digit unemployment rates. The price of good A,  $p_a$  is given by:

$$p_a = p_a^* e (1-r) \quad (1)$$

where  $p_a^*$  stands for the US dollar international price of the exportable good,  $e$  is the nominal exchange rate (pesos per dollar), and  $r$  is the export tax rate. The production function of the exportable good is:

$$Q_a = AL_a - L_a^2/2, L_a \in [0; A] \quad (2)$$

where  $Q_a$  is the quantum of agricultural output and  $L_a$  the is number of workers employed in agriculture. Equation (2) has a maximum at  $Q_a=A^2/2$ . The agricultural sector's demand for labor is described by:

$$L_a = A - w/p_a \quad (3)$$

where  $w$  is the wage rate. Equation (3) sets a floor for  $p_a/w$ ,  $p_a/w = 1/A$ . Note that a currency devaluation increases the exportable sector's demand for labor by raising  $p_a/w$ . The agricultural supply function is  $Q_a = [A^2 - (w/p_a)^2]/2$ , increasing in  $p_a/w$ .<sup>16</sup>

We assume that domestic demands are of the Linear Expenditure System kind. Regarding the domestic demand for the agricultural good, we assume, as usual, that price and income elasticities are less than one. The quantity of the agricultural good demanded by an employed worker will be  $x_a$ :

$$x_a = [\alpha w + (1-\alpha)p_a \underline{x}_a]/p_a \quad (4)$$

where  $\underline{x}_a$  stands for subsistence consumption of the agricultural good. Of course,  $0 < \alpha < 1$  and  $\underline{x}_a > 0$ . The demand for nontradables is given by:

$$x_c = (1-\alpha)(w - p_a \underline{x}_a)/p_c \quad (5)$$

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<sup>15</sup> Since we are not explicitly considering an importable good, the exportable sector should be interpreted as a net tradable sector, in order to be accurate.

<sup>16</sup> This differs from Braun and Joy (1969), Canitrot (1975) and Porto (1975), as they assume a short-run perfectly inelastic supply curve, perhaps because they consider the period between harvests. We are interested in a longer time horizon.

where  $x_c$  and  $p_c$  stand for the quantity demanded and the price, of the nontradable good, respectively. To ensure that  $x_a \geq \underline{x}_a$  and  $x_c \geq 0$ , we assume that condition  $w > p_a \underline{x}_a$  holds, which imposes a ceiling on  $p_a/w$ ,  $p_a/w = 1/\underline{x}_a$ .

The production function of nontradables is:  $Q_c=L_c$ , where  $Q_c$  is the quantum of the nontradable output and  $L_c$  the number of workers employed in the nontradable sector. Therefore, under competitive conditions,  $p_c = w$ . In turn,  $Q_c = x_c L = (1-\alpha)(w - p_a \underline{x}_a)/p_c L = (1-\alpha)(1 - p_a \underline{x}_a/w)L = L_c$ .

Aggregate employment is, then:

$$L = L_a + L_c = A - w/p_a + (1-\alpha)(1 - p_a \underline{x}_a/w)L = (A - w/p_a)/[\alpha + (1-\alpha)(p_a \underline{x}_a/w)] \quad (6)$$

If we normalize  $p_a^* = 1$  and assume  $r = 0$ , then  $p_a = e$  and we get (6')

$$L = (A - w/e)/[\alpha + (1-\alpha)(\underline{x}_a e/w)] \quad (6')$$

We will work with the  $e/w$  ratio, already identified as the key variable by Canitrot. To simplify, we have ignored landowners demand for goods. Since we are mainly interested in changes in  $L$  due to changes in the  $e/w$  ratio, this procedure can be justified on a much lesser sensitivity of the landowners demand for goods.

The  $e/w$  ratio has a floor at  $1/A$ , where  $L$  equals zero and a ceiling at  $1/\underline{x}_a$ . At this ceiling,  $L$  equals  $A - \underline{x}_a$ . As  $e/w \in [1/A, 1/\underline{x}_a]$ ,  $A > \underline{x}_a$  must hold.

Deriving  $L$  with respect to  $(e/w)$  in (6') we get the employment effect of devaluation:

$$\partial L / \partial (e/w) = [\alpha(w/e)^2 + (1-\alpha)2\underline{x}_a(w/e) - A(1-\alpha)\underline{x}_a] / [\alpha + (1-\alpha)\underline{x}_a(e/w)]^2 \quad (7)$$

The sign of (7) will depend on the level of  $e/w$ ;  $\partial L / \partial (e/w)$  reaches a maximum when evaluated at the minimum of  $e/w$ ,  $1/A$ , where it is positive. From then on, the effect of raising  $e/w$  on employment falls monotonically. The minimum of (7) is found at  $e/w = 1/\underline{x}_a$ . Employment as given by (6) will have an interior maximum if  $\underline{x}_a < (1-\alpha)A/[\alpha + (1-\alpha)2]$ , (6). In this case, there will exist an interval of  $e/w$  for which (7) is negative. This corresponds to the structuralist hypothesis of a contractionary devaluation. As  $A > \underline{x}_a$ , the existence of an interior maximum is possible, although not necessary. If (6) has no interior maximum, devaluations will never be contractionary.

If there is an interior maximum, the relationship between the exchange rate and employment will depend on the level of the del exchange rate to wage rate ratio. For low levels of the ratio, a devaluation will necessarily raise employment, for high levels of the exchange rate to wage rate ratio, it will lower employment. If there is no interior maximum within the economically relevant interval, devaluations will always improve employment.

### Open economy without nontradables

We maintain the same behavioral assumptions for the exportable agricultural good and introduce the importable manufactured good,  $B$ ; we exclude nontradables from the analysis. We

assume a continuum of manufacture varieties indexed by  $i$ . The production function of each variety  $i$  is given by:

$$Q_b(i) = L_b(i)/(i+h), i \in [0, 1], h>0 \quad (8)$$

The competitive price of a domestically produced variety will be:

$$p_b(i) = w(i+h) \quad (9)$$

In an open economy, we will see domestic production of varieties with a domestic price no greater than the imported variety price. To simplify, we assume that all imported manufacture varieties have the same price given by:

$$p_b^* e (1+t) \quad (10)$$

where  $p_b^*$  is the US dollar price of the imported manufacture,  $t$  is the uniform (for simplicity) import tariff rate. The specialization pattern is given by manufacture variety  $\gamma$  such that:

$$p_b(\gamma) = w(\gamma+h) = p_b^* e (1+t) \quad (11)$$

$$\gamma = p_b^* (e/w) (1+t) - h \quad (12)$$

Then, all varieties  $i \in [0, \gamma]$  will be domestically produced while all varieties  $i$  within the  $(\gamma, 1]$  interval will be imported. Note that  $\gamma$  will be increasing in  $e/w$  and  $t$ . We rule out exports of domestic manufactures, because we assume that there are different barriers to entry in foreign markets in the short run (problems of information, protectionist barriers, etc.). Therefore, we are assuming that the short run impact of a devaluation on domestic manufacture output works mainly through import substitution rather than export expansion.

An employed worker demand for manufacture variety  $i$  is:

$$x_b(i) = \beta(w - p_a \underline{x}_a)/p_b(i) \text{ for all } i \in [0; 1] \quad (13)$$

If all varieties were domestically produced, derived demand for labor of the manufacture sector,  $L_b$ , would be:

$$L_b = \int_0^1 L_b(i) di = \int_0^1 [Q_b(i)(i+h)] di = \int_0^1 [x_b(i)L(i+h)] di = \beta(w - p_a \underline{x}_a)L/w \quad (14)$$

after replacing  $p_b(i)$  from (9) in the demand function. Generally, in an open economy,  $L_b$  will equal (14) times  $\gamma$ , that is to say:

$$L_b = \gamma \beta(w - p_a \underline{x}_a)L/w = \beta[1 - (p_a/w)\underline{x}_a]L \quad (14')$$

Let us normalize the international prices of exportable and importable goods to 1, and assume that export tax and import tariff rates equal zero. Aggregate employment in the open economy will then be given by:

$$L = L_a + L_b = A - w/p_a + \gamma \beta[1 - (p_a/w)\underline{x}_a]L = (A - w/e)/[1 - \gamma \beta(1 - e \underline{x}_a/w)] \quad (15)$$

In an open economy without nontradables, the effect of a devaluation on employment will be:

$$\partial L/\partial(e/w) = \{(w/e)^2 [1-\gamma\beta(1-\underline{x}_a e/w)] + \beta[1-(e/w)\underline{x}_a - \gamma\underline{x}_a](A-w/e)\}/[1-\gamma\beta(1-e\underline{x}_a/w)]^2 \quad (16)$$

The sign of (16) is positive at the minimum of  $e/w$ ,  $1/A$ . However, the sign of (16) evaluated at the maximum of  $e/w$ ,  $1/\underline{x}_a$ , is *a priori* ambiguous and it would be negative if:

$$\underline{x}_a < A\gamma_{\max}\beta/(1+\gamma_{\max}\beta) \quad (17)$$

where  $\gamma_{\max}$  is the maximum of  $\gamma$  as a function of  $e/w$ . This means that even in an open economy model without nontradables, a devaluation could be contractionary. The ambiguity of (16) is due to the opposite effects of a devaluation on the demand for domestic manufactures. On the one hand, a devaluation diminishes the demand for all manufactures because food becomes more expensive; on the other hand, it raises the demand for domestic manufactures which substitute for the imported manufactures that become more expensive after the devaluation.

Besides, since  $\gamma$  is a function of  $t$ , the tariff rate, both the level of employment and the change in employment when  $e/w$  varies, will depend on  $t$ . In fact, the employment equation, (15), shows that employment is an increasing function of  $\gamma$  and, thus,  $t$ . Given international prices and the  $e/w$  ratio, both manufacturing and aggregate employment will be lower, the greater  $t$  is, that is to say, the greater the exposure to imported manufactures.

Let us rewrite (16) to better appreciate the influence of  $t$  on the effect of devaluation on employment, assuming now that  $t$  is not necessarily zero:

$$\partial L/\partial(e/w) = \{(w/e)^2 [1-\beta[(1+t)(e/w) - h](1-\underline{x}_a e/w)] + \beta[(1+t)(1-2\underline{x}_a e/w) + h\underline{x}_a](A-w/e)\} / \{1-[(1+t)(e/w) - h]\beta(1-e\underline{x}_a/w)\}^2 \quad (16')$$

It is seen that  $t$  can change the sign of (16'), More precisely, tariff cuts can modify the relationship between the exchange rate and employment, so that the economy could move from a contractionary devaluation regime to a expansionary devaluation regime, though with loss of employment.

### Open economy with nontradable goods

We consider now the case of a three-sector open economy: agricultural exportable goods, importable manufactures, and nontradable goods. We combine now the three sectors to obtain an aggregate employment equation, and normalize international prices:

$$L = A-w/p_a + \gamma\beta(w-p_a\underline{x}_a)L/w + (1-\alpha-\beta)(w-p_a\underline{x}_a)L/w = (A-w/e) / \{1-[1-\alpha-\beta(1-\gamma)](1-\underline{x}_a e/w)\} = (A-w/e) / \{\alpha+\beta(1-\gamma)+[1-\alpha+\beta(1-\gamma)]\underline{x}_a e/w\} \quad (18)$$

Note that if all varieties of manufactures were domestically produced, that is, if  $\gamma=1$ , (19) would become (6'), the employment equation in the economy with exportable and nontradable goods. This favors the interpretation of the first model as that of an economy where high protection turns all manufactures into nontradable goods. It is also seen in (18) that employment is increasing in  $\gamma$  and, therefore, in  $t$ .

The impact of devaluation in an open economy with nontradables is expressed in (19):

$$\begin{aligned} \partial L / \partial (e/w) &= \{ (w/e)^2 [\alpha + \beta(1-\gamma) + [1-\alpha + \beta(1-\gamma)] \underline{x}_a e/w] - \{ (1-\alpha)\underline{x}_a - \beta[(1+t)(1-\underline{x}_a e/w) + \underline{x}_a(1-\gamma)] \} (A-w/e) / \\ & \quad / \{ \alpha + \beta(1-\gamma) + [1-\alpha + \beta(1-\gamma)] \underline{x}_a e/w \}^2 = \\ &= \{ [\alpha(w/e)^2 + (1-\alpha)2\underline{x}_a(w/e) - A(1-\alpha)\underline{x}_a] + \beta(1-\gamma)[(w/e)^2 - 2\underline{x}_a(w/e) + A\underline{x}_a] + \beta(1+t)(A-w/e)(1-\underline{x}_a e/w) \} / \\ & \quad / \{ \alpha + \beta(1-\gamma) + [1-\alpha + \beta(1-\gamma)] \underline{x}_a e/w \}^2 \end{aligned} \quad (19)$$

Note that the first bracket of the numerator in (19) is identical to that in (7). Again, the effect of a devaluation on employment is ambiguous *a priori*. If we evaluate (19) at the maximum of  $e/w, 1/\underline{x}_a$ , we find that a devaluation will be contractionary if:

$$\underline{x}_a < [(1-\alpha) + \beta(1-\gamma_{\max})]A / [\alpha + (1-\alpha)2 + \beta(1-\gamma_{\max})] \quad (20)$$

Sin embargo, como en la sección anterior, cambios en la política arancelaria pueden modificar el signo del impacto de la devaluación sobre el empleo. Reemplazando  $\gamma$  en (19) y agrupando los términos en  $t$  se obtiene:

where again  $\gamma_{\max}$  is the maximum of  $\gamma$  as a function of  $e/w$ . Obviously, if condition (20) held, employment would have an interior maximum. Curiously, this condition is less stringent than its analogous for the case of a semi-closed economy. This result refutes Anne Krueger's conjecture (1983) according to which the case of a contractionary devaluation would come from the protectionist bias of trade policy. Strictly speaking, if  $t$  was higher,  $\gamma_{\max}$  would be higher and condition (20) would be more restrictive; with  $\gamma_{\max}=1$  we go back to the semi-closed economy condition.

However, as seen on the previous section, changes in tariff policy can modify the sign of the impact of a devaluation on employment. Replacing  $\gamma$  in (19) and grouping in  $t$  we obtain:

$$-2(w/e) + 3\underline{x}_a - 2A\underline{x}_a(e/w) + A \quad (21)$$

a negative expression for the range of  $e/w$ . This implies that tariff cuts could lead the economy from a situation in which a devaluation is contractionary to another in which it is expansionary.

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