Reallocation of Resources within the National Productive System in Bolivia
A View from the Perspective of Tradable and Non-Tradable Goods

Sergio G. Villarroel-Böhrt*
Fecha de recepción: 27 de julio de 2004; fecha de aceptación: 21 de junio de 2006.

Abstract: This paper explores Bolivia's current unemployment situation taking into account the reallocation of resources within the aggregate supply. The origin of this internal imbalance is due to negative impacts of external real exchange rate (RER) shocks, as well as to changes in the destination of foreign direct investment (FDI) among different sectors of the economy.

The model used to explain the imbalance is based on the Dependent Economy theoretical framework, in which production in a small open economy is disaggregated into tradable and non-tradable goods. Under this production scheme, any RER movement in terms of appreciation or depreciation produces a displacement of resources, either along the production possibilities frontier or through the unemployment zone.

After demonstrating that the RER suffered an important appreciation in 1997, a model of the aggregate-supply function is constructed considering two variable outputs (tradable and non-tradable goods) and two variable inputs (capital and labor), suggesting in the end the existence of a slow restructuring process at the expense of unemployment of the labor force.

Keywords: Inter-sector labor mobility, Internal balance, Tradable-Non-tradable (TNT) model.

Resumen: Este documento explora la actual situación de desempleo en Bolivia teniendo en cuenta una reasignación de recursos al interior de la

* Sergio G. Villarroel-Böhrt teaches at the Universidad Andina Simón Bolívar in La Paz, Bolivia. Comments are welcome at villabohrt@gmail.com. This paper is a short and updated version of a model used in my master's degree thesis at the Bolivian Catholic University (Maestrías para el Desarrollo) in December 2002. The thesis received University's Master Program *Best Graduate Work* award granted by the Harvard Alumni Association in Bolivia. I would like to thank Professor Gover Barja-Daza for reviewing the manuscript and an anonymous referee of the journal for his/her helpful comments. Any remaining errors are my own.

oferta agregada. El origen de este desequilibrio interno es atribuido tanto a impactos negativos de shocks externos del Tipo de Cambio Real (TCR), como a cambios en la proporción de Inversión Extranjera Directa (IED) destinada a los diferentes sectores de la economía.

El modelo empleado para explicar el desequilibrio está basado en el enfoque teórico de "Economía Dependiente", donde la producción en una pequeña economía abierta es desagregada en bienes transables y no transables. Bajo este esquema de producción, cualquier movimiento del TCR en términos de apreciación o depreciación, produce un desplazamiento de recursos, ya sea sobre la Frontera de Posibilidades de Producción (FPP), o a través de la zona de desempleo.

Luego de evidenciar que el TCR sufrió una importante apreciación en 1997, se construye un modelo de función de producción agregada con dos productos variables (bienes transables y no transables) y dos insumos variables (capital y trabajo), proponiendo al final la existencia de un lento proceso de reestructuración a costa del desempleo del recurso trabajo.

Palabras clave: movilidad laboral intersectorial, equilibrio interno, modelo TNT.

JEL Classification: E24, F41.

Introduction

Unemployment has become a severe macroeconomic problem in Bolivia, with main urban-area rates more than doubling in the last 8 years. While other macroeconomic indicators have begun to stabilize, unemployment remains, forcing researchers to find new and innovative explanations that could eventually lead to a better understanding of the problem.

Factors contributing to the internal imbalance derived from external and domestic sources, obliging the Bolivian governments to adopt several measures to contain the negative effects of these shocks. However, all adopted policies were mainly oriented toward reducing impacts on the aggregate demand, employing several analytical tools that do not consider important aspects of resources reallocation within the national productive system.

This article deals with the imbalance problem from the aggregate-supply perspective, assimilating macroeconomic techniques of small open economies. The document is divided into four sections. The first comprises this introduction, in which the economy is briefly evaluated, highlighting the relationships between unemployment and inflation.

In section I, a conceptual framework that contemplates the production structure concerning tradable and non-tradable goods is developed, while section II presents the estimation of certain national productive-system parameters and shows the transit of the economy through the unemployment zone. The paper's last section closes the work with concluding remarks.

Brief Description of the Economy

The period analyzed covers the years 1996-2002. The first year, 1996, was selected due to the profound structural change represented by the capitalization (the Bolivian version of privatization) that began in 1995. After this reform the role of the state was redefined, focusing on regulatory activities and moving away from production processes.

Transfer of the principal state-owned enterprises, to the foreign private sector in particular, attracted important investment that allowed the economy to grow at rates of 5% per year. Unfortunately, different internal and external shocks rendered it impossible to take advantage of this sudden economic emergence. Nonetheless, it is necessary to carry out an integral analysis of the multiple causes that influenced Bolivia's economic performance in order to implement (in the short term) policy responses that may reduce the negative impacts of future shocks. Table 1 shows certain key macroeconomic indicators during the 1996-2002 period.

Table 1. Key macroeconomic indicators (1996-2002)

Indicator	*1996*	*1997*	*1998*	*1999*	*2000*	*2001*	*2002*
GDP growth rate (%)	4.4	5.0	5.0	0.4	2.5	1.7	2.4
Per-capita GDP growth rate (%)	1.9	2.5	2.5	–1.9	0.1	–0.6	0.1
Inflation rate (%)	8.0	6.7	4.4	3.1	3.4	0.9	2.5
Urban open unemployment rate (%)	3.8	4.4	4.8	7.2	7.5	8.5	8.7
Nominal exchange-rate variation (%)	5.0	3.3	5.0	5.9	6.1	6.6	8.7
Fiscal deficit (% GDP)	–1.9	–3.3	–4.7	–3.5	–3.7	–6.8	–8.8
Balance of payments (% GDP)	4.0	1.3	1.2	0.3	–0.5	–0.5	–3.7
Net Foreign Direct Investment (% GDP)	5.8	10.8	12.1	12.2	8.8	8.7	8.5

Source: National Institute of Statistics (INE, 2005) and Central Bank.

The behavior of the economy demonstrates some clear patterns, such as the permanent reduction in the inflation rate (following the guidelines suggested by multilateral donors to maintain macroeconomic stability). On the other hand, the urban open unemployment rate[1] exhibits a rising tendency that doubled its value during the study period.

Regarding other variables, the economy's behavior can clearly be divided into two stages with the following characteristics:

- *1996-1998*. During this period, the economy showed a persistent growth in the GDP (approximately 5% on average), due in particular to the good performance of the hydrocarbons sector (prospecting, exploitation, and construction of the gas pipeline to Brazil) and in general because of the sudden economic strength experienced as a result of the capitalization process. This strength was also reflected in per-capita GDP, which grew at 2.3% on average.

  Nominal exchange-rate variation fell in 1997 but later increased to 5.2%, very near to the initial value registered at the initiation of this 3-year period. The fiscal deficit increased and doubled its value mainly due to pension-reform costs, which rose considerably as a GDP percentage.

  The balance-of-payments surplus declined to less than one half of its initial value as a consequence of a rise in the current account deficit. This increment was more significant than the increase in the capital account, which took place after the stream of foreign direct investment (FDI) entered the country.

  In the external context, factors that hindered a better performance of the economy were the Southeast Asian crises in 1997 and the Brazilian crisis in 1998. Both events negatively impacted international prices for Bolivian exports.

  Finally, the protest by the Bolivian Workers' Movement (COB), the confrontation between the Bolivian government and the citizens in 1996, the presidential election and International Development

[1] The reason that the urban open unemployment rate is utilized (instead of the national rate that also takes rural unemployment into account) is because of the survey methodology applied by the Bolivian National Institute of Statistics (INE), in which the main objective is to calculate unemployment rate as a flow variable in short and recent time periods. In this respect, some questions posed by pollsters — for example: *Did you work at least one hour during the last week*? — can introduce an important skew in the rural area because many persons think that certain daily activities that they perform can be considered economic activities, when in fact they are not. This misunderstanding is not possible in the urban area, and data gathered in these zones reflect the real unemployment rate of the economy more accurately.

Bank (Bidesa) bankrupcy in 1997, as well as the natural phenomenon denominated *El Niño* all produced negative effects during this period.

- 1999-2002. This period witnessed a clear decline in the GDP growth rate and a notorious deterioration of the per-capita GDP growth rate, which reached negative values in 1999 and 2001. Nominal exchange-rate variation became more aggressive to avoid a greater loss of Bolivian-exports competitiveness in international markets.

  With regard to fiscal deficit, an important increase is evident during the last 2 years, explained mainly by a fall in government income, a rise in public investments, and an increase in expenditure accounts due to the pension system.

  The balance of payments shows a growing deficit over the last 3 years (especially in 2002, when it produced a loss of reserves) as a consequence of FDI reduction. This reduction negatively impacted the capital account and was unable to compensate for the current account deficit despite the fall registered in the latter during previous years.

  External aspects that contributed to the economy's decline during this period included the drop of international prices in mining and agricultural products (both Bolivian exports), the decreasing power of the United States economy, the recession in Japan, the crises in Argentina, the Brazilian currency devaluation in 1999, and the European Union's slow-paced economy.

  Finally, adverse climate conditions, recurrent social conflicts such as blockades and strikes, the conclusion of the gas-pipeline to Brazil in 1999, the Bolivian national customs reform and the struggle against contraband, the slow performance of labor-intensive sectors (such as construction, trade, and manufacturing), and the widespread financial problems faced by the entire productive system all contributed negatively to the economy.

The Bolivian economy experienced a slow recovery after 2002. GDP grew from 2.8% in 2003 to a preliminary 4.0% in 2005. This recovery has its origin in a remarkable expansion of exports (from 1.3 billion U.S. dollars [$US] in 2002 to more than 2.5 billion $US in 2005), mainly from the primary sector (hydrocarbons) but also from the manufacturing industry, which encountered a favorable international environment that brought about an increase in nearly all prices.

In addition to this, the fiscal deficit was dramatically reduced over the past years, reaching less than 2% of GDP in 2005 (preliminary estimations). The most important situations contributing to this reduction included an increase in tax collection and a severe cut in government expenditure (termed the Austerity Program), which took place from August 2003. All these factors helped to neutralize the fall in the FDI; in addition and fortuitously, the large-scale social and political instability experienced since 2002 (the country had five presidents in five years) failed to exert a very strong influence on the economy.

It would be interesting to include data of these last years in the current analysis. Unfortunately, two main variables needed in the model, that is, sector-disaggregated Gross Production Value (GPV) (obtained from the Input-Output Matrix) and Real Exchange Rates, remain preliminary and could introduce a skew into the analysis if included.

Inflation and unemployment rates were not mentioned in the previous macroeconomic description because both variables will be analyzed in the following sub-section. For now, it is only important to note that inflation rates increased during the 2003-2004 period from 3.9-4.6%, and that the unemployment rate began to fall in 2004 after reaching its maximum percentage (9.2%) in 2003.

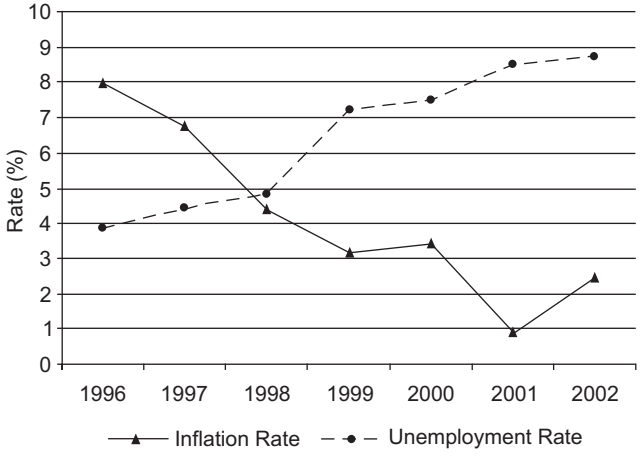
Relationship between Inflation and Unemployment from 1996-2002

The trade-off between inflation and unemployment rates as presented in Table 1 suggests a possible internal macroeconomic imbalance not yet examined in the national literature. It is clear that Bolivia's current macroeconomic imbalance is no longer caused by an inflation phenomenon, as it was in 1985. This time, economists must pay more attention to the unemployment rate.

According to Dornbusch and Fischer (1994), policymakers can choose different combinations of unemployment and inflation rates. For instance, these can have low unemployment as long as they put up with high inflation, or they can maintain low inflation by sustaining high unemployment. In other words, the more policymakers attempt to maintain low inflation rates, the more unemployment they will create.

The authors also explain how important it is to bear in mind the costs involved in unemployment. For example, society as a whole registers a loss from unemployment because total output is below its

Figure 1. Relationship between inflation and unemployment (1996–2002)



Source: Based on data contained in Table 1.

Figure 2. Phillips curve (1996–2002)

Source: Based on data contained in Table 1.

potential level. As well, unemployed individuals suffer both from their loss of income and from the low level of self-esteem that accompanies being unemployed. It has also been proven that unemployment affects the poor to a greater extent than the wealthy, thus worsening distribution problems within society. Figures 1 and 2 illustrate the relationships between inflation and unemployment during the 1996-2002 period.

Figure 1 shows a clear transition of both macroeconomic variables, providing the first signs of a possible internal imbalance in the unemployment zone. Figure 2 illustrates the classic Phillips curve, demonstrating empirical evidence of a trade-off between inflation and unemployment. This behavior is solely applicable in the short term and its stability can be affected by changes in expectations,[2] such as the values registered in 2000 and 2002 during which both rates increased simultaneously, distancing themselves from the traditional Phillips approach.

Regarding the inflation rate increase in 2000, this could be explained by the following events: *a)* 1999 was the worst year of the entire period, with GNP stagnation and a contraction of per-capita GDP. This could negatively influence the behavior of economic agents, who may have predicted a future crisis that they continued to associate mentally with a strong rise in prices due to the historic hyperinflation affecting Bolivia in the mid-1980s; *b)* given that the FDI continued to rise, it was possible to anticipate an excess of money in the economy (in the absence of sterilization measures) that could lead to a price increase, and *c)* finally, the devaluation —or variation of the nominal exchange rate— of the previous 4 years achieved its highest value in 1999 and continued to rise. This could eventually influence the inflation rate due to the *pass-through* effect that remains and that must be considered in the presence of large devaluations.[3]

On the other hand, the increase in the inflation rate in 2002 has two possible explanations: *a)* the presidential election took place that year, and voters entertained increasing uncertainty with regard to the forthcoming economic policy to be implemented by the winning candidate, and *b)* the sudden increase in the fiscal deficit, which began to be noticeable in 2001 when it nearly doubled in value in 1 year, triggering the fear of a possible monetary policy implemented by the upcoming administration for financing the deficit. As it is known, the unilateral non-cooperative reaction of private-sector agents on perceiving that public finances are not being well administered is to protect their activities by raising prices in anticipation of a possible

---

[2] According to Dornbusch and Fisher (1994), expected inflation can be introduced into the original Phillips curve as follows: $\pi_i = \pi^e + \lambda(N_i - N^*)$ where π_i is the inflation rate for a given year, π^e represents the expected inflation, λ is a constant determined by ε/N^*, N_i is the effective employment level for a given year, and N^* is the full employment level.

[3] For a complete analysis of the disaggregated *pass-through* effect between prices of tradable and non-tradable goods in Bolivia, see Cupé (2003).

(but in the case of Bolivia, a highly unlikely) increase in the domestic-credit mechanism to finance the gap.

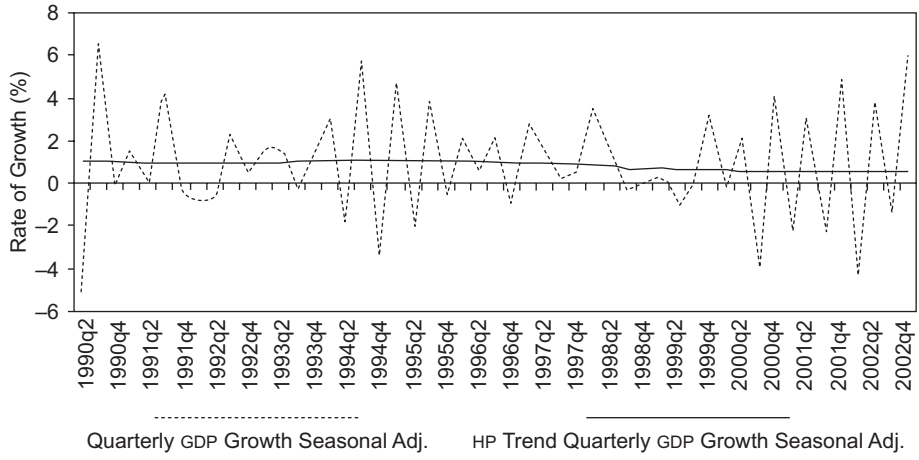
Returning to the behavior presented in Figure 1 and the data presented in Table 1, it is possible to anticipate a sign of a tentative short-term equilibrium in the Bolivian economy between 1997 and 1998. This is not only because the highest GNP and per-capita GNP growth correspond to this period, but also because both curves (inflation and unemployment) intersect at some point between these 2 years, suggesting a possible internal balance of the economy.

To prove this assumption, I will make use of the business cycle concept and the output gap notion. Turning back to Dornbusch and Fischer (1994), it is well known that inflation, growth, and unemployment are closely related through cyclical patterns. Output or GDP does not grow smoothly at its trend rate; rather, it fluctuates irregularly around trends in business cycles. Output deviation from the trend is referred to as the *output gap*, this gap measuring the distance between actual output and the output the economy could produce at full employment given the existing resources. These output gaps allow us to determine how great cyclical output deviations from potential output or trend output (both terms can be interchangeable) are.

Consequently, if we wish to identify the year when the economy was found at full employment we must first obtain the curve that describes potential output behavior and subsequently compare this with observed output during the period of analysis. The point at which the two curves converge —or where the gap is the shortest— represents the moment in time when factors were fully employed and therefore internal balance was achieved at natural unemployment and inflation rates.

To my knowledge, there have been only two rigorous attempts to determine this output gap for the Bolivian economy: one was developed by Hofman and Tapia (2003) on a yearly basis, and the second comprises the recent research of Hernaiz (2005) that considered short-term restrictions on a quarterly basis. The first of these papers estimates trend output with a Hodrick-Prescott filter and also a potential structural relationships-based output for nine Latin-American countries (including Bolivia) in the 1950-2001 period. The shortest gaps found in this research with respect to Bolivia's potential GDP in the 1996-2002 period occurred in 1996 and 2001. The second paper estimates a structural Vector Autoregressive (VAR) using quarterly series from 1991:01 through 2004:04. Results showed that the potential growth rate more particularly approached the observed growth rate in the period from 1992-1997, greater differences being present after 1998.

Figure 3. Growth rates of seasonal-adjusted series and trend

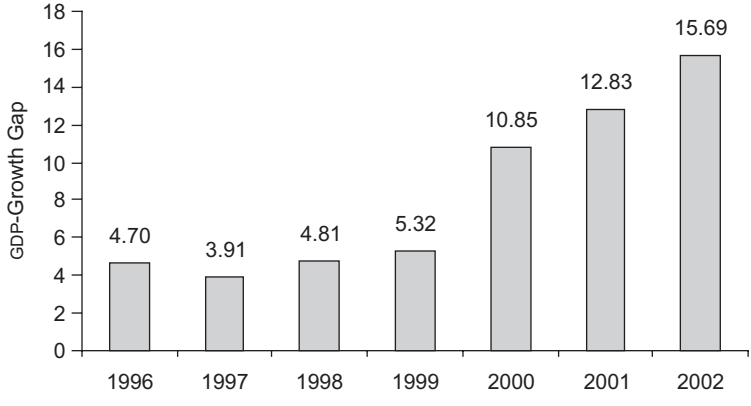


Source: Based on data contained in Table 1.

This information suggests that full employment of the economy was reached either in 1996 or during the 1992-1997 period. As a complement to these rigorous studies, I will estimate a simple output gap with respect to the economy's quarterly growth rate utilizing a Hodrick-Prescott filter in a 1990-2002 database.

Given that quarterly data present serious seasonal problems, the first step will be to remove this seasonal component with a simple additive moving-average technique. Then, the Hodrick-Prescott filter

Figure 4. GDP growth gaps



Source: Based on data contained in Table 1.

is applied to the seasonal-adjusted series to obtain the quarterly-GDP trend or the potential output. Graphs can be seen in Annex 1.

Afterward, the growth rate of both curves (the trend curve and the original seasonal-adjusted series) is computed to determine the gap. Figure 3 demonstrates the results in terms of growth rates.

Considering only the 1996-2002 period, gaps between both growth rates must be computed and then added on a yearly basis to approximate an annual value (see Annex 1 for details). Figure 4 shows the final gaps.

According to these results, the economy approached full employment in the years 1996, 1997, and 1998, the lowest gap registered in 1997.

Returning to the data presented in Table 1, unemployment and inflation rates corresponding to this year are 4.4 and 6.7%, respectively. However, taking the matching GDP growth rate observed in 1997 and 1998 (both 5% in Table 1) into account, we can infer that the characteristics of these 2 years were very similar and therefore, their unemployment and inflation rates must be closely related with natural rates. This assumption exhibits no problem with regard to the unemployment rate, because both percentages are very similar (4.4% in 1997 and 4.8% in 1998); however, this is not the case with the inflation rate because the range is definitely broader (6.7% in 1997 and 4.4% in 1998).

In this paper, I will adopt a natural unemployment rate equivalent to that observed in 1997 (4.4%). At present, it is only possible to assume that the natural inflation rate falls at some point between 4.4 and 6.7%.

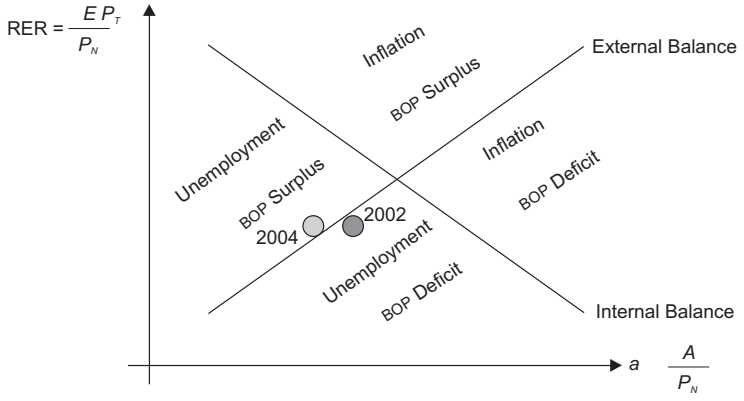
Internal and External Balance

One way to analyze the problem of imbalance between inflation and unemployment is by means of the Swan diagram.[4] This diagram provides a valuable theoretical framework that considers the interaction of absorption A (total consumption + total investment) and the price effects of tradable and non-tradable goods[5] (P_T and P_N, respec-

[4] T. Swan, W. E. Salter, J. Meade, and W. Max Corden were the pioneers in developing tradable and non-tradable models. The Internal/External Balance Model (IB-EB Model) is also known as the Australian Model, and as the Salter-Swan Model.

[5] Tradable goods are subject to international trade (meaning that they are importable or exportable) and can be produced inside or outside of the economy. On the other hand, non-tradable goods can only be consumed in the economy in which they are produced; they cannot be exported or imported (Sachs and Larrain, 1994).

Figure 5. Location of the economy in the Swan diagram



Source: Location of the economy in 2002 is based on data contained in Table 1. Location of the economy in 2004 is based on information obtained from INE and Central Bank.

tively) for bringing about simultaneous balance in the external and internal accounts.

This theory adopts the approach of small open economies. By small, it is implied that these economies are *price takers*, while open implies that the external flow of goods and capital exerts *a* direct and important impact on the economy. From this perspective, it is possible to pinpoint the economy in terms of its internal and external balance, as shown in Figure 5.

The Bolivian economy as revealed in Figure 5 was clearly in disequilibrium with respect to the internal balance (IB) due to the unemployment rate registered in 2002 (8.7%), this notoriously higher than the natural rate reached in 1997.[6] With regard to the external balance (EB), there is no clear evidence suggesting a major misalignment in 2002, given that the observed deficit in the balance of payments (BOP) (–3.7%) continues to be considered as falling within a tolerable equilibrium range. The position of the 2004 economy is also included in Figure 5 to expose the unchanging situation experienced in the subsequent 2 years.

In response to the evident deviation of the equilibrium, national authorities implemented more aggressive exchange-rate policies (devaluations) in an attempt to depreciate the RER[7] (and to approach an

[6] The same conclusion can be achieved from the inflation side, given that the 2.5% inflation rate registered in 2002 fell below the 4.4-6.7% range, which contains the natural rate.

[7] The real exchange rate (RER) is the relative price of tradable to non-tradable goods in domestic currency. Nonetheless, given that prices of tradables are exogenous (due to the *price-taker* characteristic) the transformation in the numerator requires use of the nominal exchange rate in order to homogenize units.

EB), as well as other measures mainly oriented toward stimulating the aggregate demand and encouraging an absorption recovery that could lead to an IB.

Over the last several years, attempts to activate the aggregate demand included the National Plan of Emergency Employment (Plane), the Special Fund of Economic Reactivation (FERE), the Financial Adaptation Program (PRF), the Strengthening Patrimonial Program (Profop), the HIPC II initiative, the restitution of housing contributions to Provivienda, the Bonosol payments (a direct subsidy to the elderly population proceeding from dividends of privatized state-owned enterprises), among others. Approximately 1,200 million $US were injected into the economy by means of these measures in 2001 alone. However, despite these efforts it appears that little has been accomplished in terms of the IB misalignment, forcing policymakers to explore new analytical tools based on the aggregate-supply approach.

The Dependent Economy framework[8] can aid in understanding the response of the economy in the presence of RER appreciations or depreciations, given that the RER is the relative price that determines resources allocation between two sectors (tradable and non-tradable). This might open new economic-policy alternatives that could eventually lead to a speedier return to equilibrium.

This paper attempts to face the problem of how to contribute to the national productive system's recovery by use of aggregate-supply analysis and its characteristic slow restructuring process, either along the production possibilities frontier (PPF) or through the unemployment zone.

I. Analytical Model

The presence of tradable and non-tradable goods affects every important feature of an economy, from price determination to output structure to the effects of the macroeconomic policy. Perhaps the most important implication of the presence of non-tradable goods lies in the fact that the internal production structure in an economy has a tendency to change when the trade balance changes; in particular, as absorption rises or falls relative to income (so that the trade balance rises or falls) the mix of production in the economy between tradable and non-tradable goods tends to change (Sachs and Larrain, 1994).

Corden (1989) established that if production factors are not suf-

[8] Theory broadly developed in Agénor and Montiel (1999).

ficiently flexible to be shifted from the declining to the expanding sector, there is a tendency for unemployment to increase and for output to fall. Utilizing the adjustment process that took place in Chile from 1979-1985, Sachs and Larrain (1994) demonstrated that some of these production shifts, which involve the movement of workers and capital between the non-tradable and tradable sectors, can be quite wrenching in their economic and even political impact, given that workers require retraining time to adjust their skills to the newly available jobs, and the occasional geographic reallocation of labor needs.

In brief, the presence of non-tradable goods in an economy renders the adjustment process (in response to recessions) more complex. This is because when worker displacement from one sector to another occurs it is likely that temporary unemployment will appear during the adaptation period the worker needs to accomodate himself to the new labor conditions required by the economy.

I.1. The Tradable-Non-tradable (TNT) Approach

The theoretical characteristics of a tradable-non-tradable model (or the TNT model, as referred to by Sachs and Larrain, 1994) are very similar to those studied in classic microeconomic theory: the procedure implies a separation of an economy's total production into two types of goods (tradable and non-tradable). This is very similar to the firm-production approach with two variable outputs and economies of scope.[9]

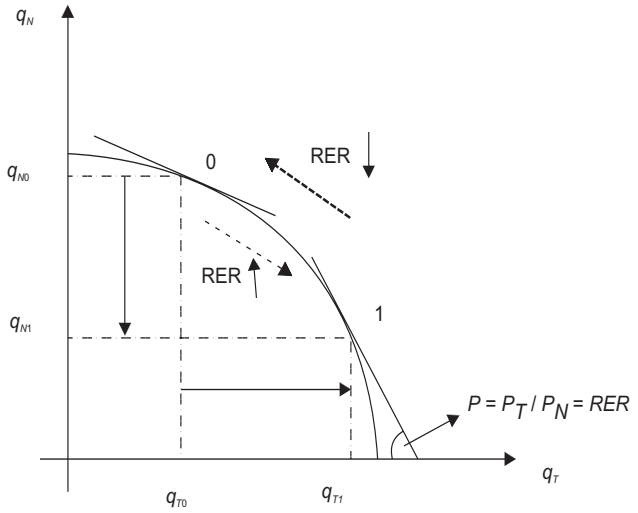
I.2. Real Exchange Rate (RER) and Reallocation of Resources

In the TNT model, the RER plays a significant role with regard to the signs it can provide for allocation of resources within the economy. This RER varies according to international prices of tradable goods (P_T* in foreign currency), the nominal exchange rate (E), and also the domestic prices of non-tradable goods (P_N). The mathematical equation for the RER in neoclassical trade theory is defined as follows:

$$RER = \frac{EP_T^*}{P_N} \tag{1}$$

[9] According to Pindyck and Rubinfeld (1998), economies of scope in general are present when the joint output of a single firm is greater than the output that could be achieved by two different firms, with each producing a single product. There is also no direct relationship between economies of scope and economies of scale.

Figure 6. Influence of the RER in the PPF



Source: Based on Sachs and Larrain (1994).

One of the main characteristics of Equation (1) is that if the ratio decreases, this implies that the RER has suffered an appreciation, while if the ratio increases the RER has experienced a depreciation.

I.3. Production Possibilities Frontier

Regarding aggregate supply, the TNT model adopts the production possibilities frontier (PPF) approach (known also as the product transformation curve). The PPF shows the maximum combination of tradable and non-tradable outputs that the economy can produce, given its resources constraint. The form of the curve and its relationship with the RER are shown in Figure 6.

A PPF curve's tangency slope for a given point is the relationship to which q_N must be reduced to obtain a greater amount of q_T (or vice versa) without varying the quantity of inputs used. This product-transformation relationship is equal to the relative price of P_T to P_N ($P = P_T/P_N$) affected by a negative sign, and it is precisely this ratio that is used to define the RER in local currency (in other words, the slope of the PPF is equal to the negative value of the RER).

This TNT-model property allows us to establish a direct relationship between changes in the RER and resources reallocation within the

aggregate supply, this now becoming a key aspect in this paper from this point forward.

In Figure 6, q_T and q_N represent the quantities of tradables and non-tradables, respectively. A RER appreciation will promote an intersectorial adjustment from the tradable to the non-tradable sector, given that production of non-tradables becomes more convenient due to their price, whereas an RER depreciation will constitute an incentive for the opposite reaction, also due to price changes. In other words, the P_T/P_N price ratio represents the relative incentive to produce tradables and non-tradables.

In mathematical terms and according to Henderson and Quandt (1995), PPF curves are concentric circles with their centers at the origin, as shown in Equation (2).

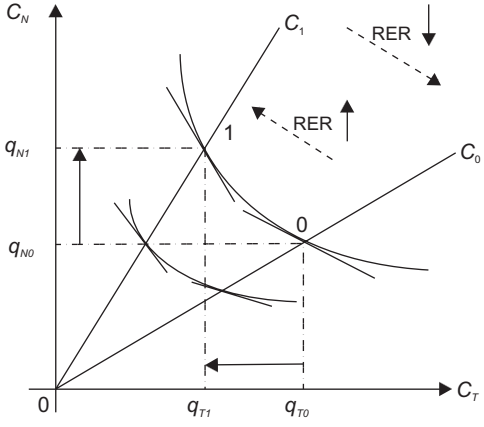
$$q_T^2 + q_N^2 = c^2 \tag{2}$$

From this perspective, the further the PPF curve lies from the origin the higher the proportion of inputs used becomes. The constant c is the radii of the circle.

I.4. Consumption in the TNT Model

Concerning aggregate demand and its relationship with the RER, analysis of consumption decisions is presented in Figure 7 based on Sachs and Larrain (1994).

Figure 7. Influence of the RER on consumption



Source: Based on Sachs and Larrain (1994)

In Figure 7, C_T and C_N are consumption of tradables and non-tradables, respectively, while family-consumption decisions correspond to lines OC_0 and OC_1. In this case, RER depreciation causes a shift in demand preferences from tradables to non-tradables[10] because the latter sector is now more convenient due to low prices. Likewise, RER appreciation modifies the preference change from non-tradable to tradable goods also because of prices. From this point of view, the slope of the indifference curve with a negative sign is equivalent to the marginal rate of substitution (MRS) and can be expressed as follows: $MRS = P_T/P_N$. The MRS represents the maximum quantity of non-tradable goods that a consumer would be willing to relinquish in order to obtain an additional unit of tradable goods. In contemplating the theory presented previously, one is able to observe clearly the manner in which RER appreciation or depreciation generates opposite responses in aggregate-supply and demand curves.

I.5. Combined Adjustment

Combined market-adjustment analysis after variations in tradable and non-tradable-goods prices (especially once an important RER appreciation has occurred) is presented in Figure 8.

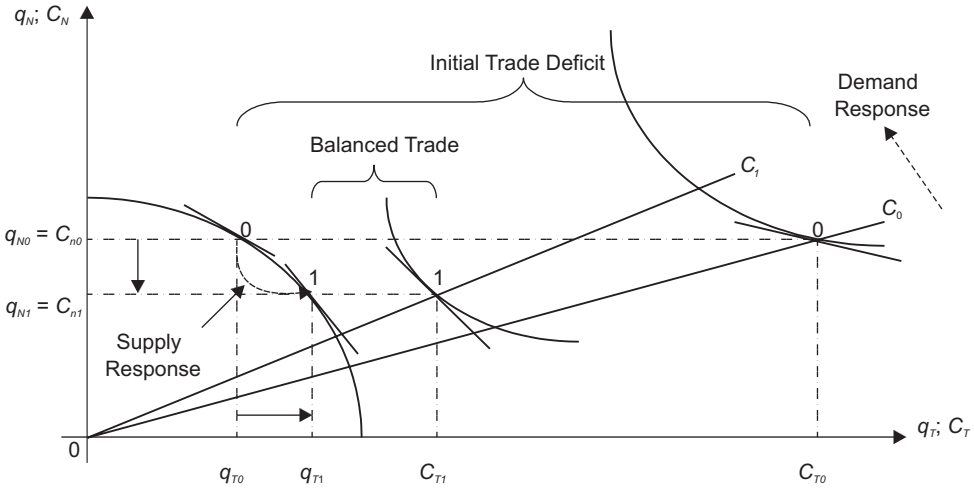
Once an important RER appreciation has placed the economy at point 0, the market-adjustment response that attempts to depreciate the RER to return to equilibrium at point 1 involves a demand adaptation until it reaches the non-tradable-goods level produced by the economy. This implies an indifference-curve displacement toward the origin and a consumption readjustment from OC_0 to OC_1. This demand reaction is much more flexible and immediate than the supply reaction, given that resources reallocation within the productive system (mainly labor) occurs not only along the PPF, but also through the unemployment zone due to the previously mentioned training period required by workers to adjust their capabilities to the new tradable-sector jobs available.[11]

---

[10] Demand is represented by the convex curve with respect to the origin (the indifference curve, as it is known in microeconomic theory). Additionally, it is important to note that traditional demand curves are obtained precisely from these indifference curves. For more details, see Pindyck and Rubinfeld (1998), Chapter 4.

[11] Also note that the adjustment process to new labor conditions may involve geographic movements of workers, rendering the transition even more complicated.

Figure 8. External adjustment with full employment



Source: Based on Figures 6 and 7, combined.

Finally, it is noteworthy that when the RER appreciates and tradable prices become more accessible, the trade deficit increases due to the decision of households members in opting to import some of these goods instead of purchasing goods at local markets. This change in the trade balance reduces over time because the RER depreciates up to the point where trade is again balanced.

As can be observed, the theoretical framework is based on the assumption that the economy has suffered an important RER appreciation during a specific time period. Evidence of this RER appreciation in the Bolivian case will be provided later.

Once this important RER appreciation has occurred, the alternatives a country possesses for depreciating the RER can be formally expressed by differentiating Equation 1 as follows:

$$\frac{d\,RER}{RER} = \frac{d\,E}{E} + \frac{d\,P_T^*}{P_T^*} - \frac{d\,P_N}{P_N} \tag{3}$$

In order to simplify the notation, I will group $dP_T^*/P_T^* = \pi_T^*$ (foreign inflation rate) and $dP_N/P_N = \pi_N$ (domestic inflation rate), thus obtaining Equation (4).

$$\frac{d\,RER}{RER} = \frac{d\,E}{E} + \pi_T^* - \pi_N \tag{4}$$

In a small price-taker economy, π_T^* would be exogenous. In addition, given the managed exchange-rate regime (or crawling-peg regime) established in Bolivia a real RER depreciation can be achieved quickly with a nominal exchange-rate devaluation, or slowly with a domestic-inflation reduction, equivalent to an increase in unemployment. In other words, this means that the real exchange rate ($dRER/RER$) can be quickly depreciated by means of a nominal exchange-rate devaluation ($dE/E > 0$) along the PPF curve, or alternatively, domestic inflation can change at a slower rate than the nominal-exchange rate and foreign inflation together ($\pi_N < dE/E + \pi_T^*$), producing a slow displacement of the economy through the unemployment zone.

$$\frac{d\,E}{E} > 0 \qquad \text{Devaluation}$$

$$\pi_N < \frac{d\,E}{E} + \pi_T^* \qquad \text{Unemployment}$$

II. Estimations

To approximate this transit of the economy through the unemployment zone, I will employ certain mathematical tools due to the restraint represented by the lack of consistent time-series in Bolivia that are needed to perform reliable econometric regressions. The behavior to be modeled requires a production function with the characteristics shown in Equation (5):

$$H\,(q_T, q_N, L, K) = 0 \tag{5}$$

where q_T and q_N are quantities of output variables (tradables and non-tradables, respectively) and L and K are the two input variables (labor and capital, respectively) that produce the total output level (tradables + non-tradables).

II.1. Real Exchange Rate Behavior

There are two official sources of RER indices in Bolivia: *a)* the Global-Multilateral RER Index (MRER), which is computed by UDAPE (Unit of Social and Economic Policy Analysis) considering Bolivia's total trade

partners, and *b)* the Real Effective Exchange Rate (REER) computed by the Central Bank, which takes into account Bolivia's eight most important trade partners.[12] These two indices are based on the purchasing power parity approach of the RER as follows:

$$RER = \frac{NERI_i \; CPI_i}{CPI_{Domestic}} \tag{6}$$

Both indices assume that $P_N \approx CPI_{Domestic}$ and that $P_T^* \approx CPI_i$ (Consumer Price Index of trade partner i in the corresponding currency). To make units compatible, CPI_i must multiply the Nominal Exchange Rate Index of country i defined as $NERI_i$ [domestic currency (in this case, *bolivianos* [Bs.]/currency of country i] = $NERI_{Domestic}$ [Bs./$US]/$NERI_i$ [currency of country i/$US].

Once the bilateral RER Index is calculated for each trade partner, there are different methodologies to aggregate the data and compute a unique and generalized RER Index. In the case of the Central Bank, each bilateral index is multiplied by the respective trade-share of each of the eight trade partners, obtaining a representative geometric average of the data that becomes the REER Index.

On the other hand, UDAPE computes the sum of each bilateral index multiplied by its respective trade-share (considering the main trade partners) in order to obtain the Global-Multilateral RER Index (MRER).[13] An alternative method to calculate the RER to be introduced in this paper is the ratio of the disaggregated Consumer Price Index (CPI) of tradable relative to the Consumer Price Index of non-tradable goods (CPI_T and CPI_N, respectively), both computed by the National Institute

Table 2. Real Exchange Rate Indices (1996 = 100)

Index	*1996*	*1997*	*1998*	*1999*	*2000*	*2001*	*2002*
REER (Central Bank)	100	95.9	97.5	96.2	98.1	100.1	99.1
MRER (UDAPE)	100	96.4	96.8	93.2	95.3	98.9	92.3
CPIRER (INE)	100	92.3	94.3	90.8	90.2	88.8	88.8

Source: INE, the Central Bank, and UDAPE.

[12] Bolivia's eight most important trade partners include Argentina, Brazil, Chile, Peru, Germany, the United Kingdom, Japan, and the United States of America.

[13] Detailed information on both indices is available on the Central Bank (https://www.bcb.gov.bo/pdffiles/Dic/Externo/caps7-8-9.pdf) and UDAPE (http://www.udape.gov.bo/dossierweb2005/htmls/c0201.htm) web pages.

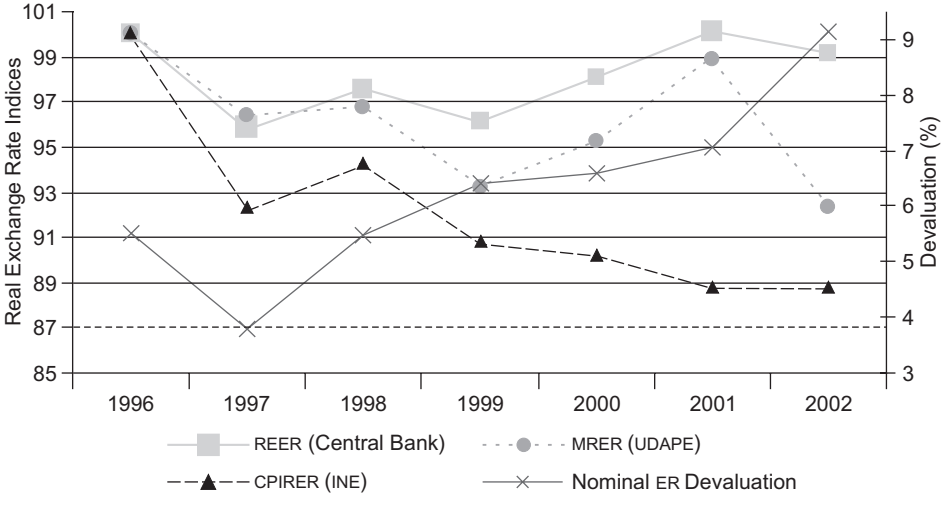
of Statistics (INE). In this case, the RER can be obtained through the following equation: *CPIRER (Consumer Price Index Real Exchange Rate)* = CPI_T/CPI_N. All three indices are presented in Table 2 after a transformation of base-years to 1996 to homogenize the data.

The information presented in Table 2 shows that years of RER appreciations comprised 1997, 1999, and 2002.[14]

The most important RER appreciation was caused by Bolivian trade-partner devaluations after the 1997 Southeast Asian financial crises. Another important event comprised the devaluation of the Brazilian *real* in 1998, which caused a contagion effect in other currency devaluations in the region. As a consequence of this international crisis, external demand for tradable goods fell, affecting international markets prices negatively and consequently the RER (through exports) of countries such as Bolivia.

A comparison between the RER appreciation level and the nominal exchange rate (NER) devaluation level is now needed to evaluate the Central Bank's response capacity. Figure 9 illustrates the behavior of both variables utilizing data contained in Tables 1 (variation of the nominal exchange rate) and 2.

Figure 9. Relationship between RER and devaluation



Source: Based on data contained in Tables 1 and 2.

[14] There is also a very good piece of research on the long-run Equilibrium Real Exchange Rate (LERER) for the 1990-1999 period that was carried out by Lora and Orellana (2000). In this work, the results obtained for the Bolivian LERER also show a slight and very smooth tendency toward an appreciation from 1996 through 1999.

As shown in Figure 9, the most alarming appreciation took place in 1997, this because the appreciation was accompanied by a decrease in the NER variation rate, thus reducing the possibility of neutralization. After 1997, the exchange-rate policy became more aggressive; nonetheless, the impact that the NER can have on the RER is unfortunately small, due to the Bolivian economy's high level of dollarization, under which even certain non-tradable prices are indexed in $US.

Despite this dollarization issue, there is no doubt that a stronger devaluation of the NER could have helped RER depreciation in 1997. We assume that this was the case in the 1997-1998 and 1999-2001 periods, during which REER and MRER indices presented similar tendencies to those of the NER variation.

II.2. Production with Two-Variable Outputs (T and NT)

In order to observe productive-system movements with respect to the PPF, it is necessary to separate production into two variable outputs (tradables and non-tradables). According to Sachs and Larrain (1994), goods included in the following activities: *a)* agriculture, hunting, forestry, and fishing, *b)* mining and quarrying, and *c)* manufacturing are roughly speaking typically tradables, while goods in the remaining categories are generally assumed to be non-tradables.[15]

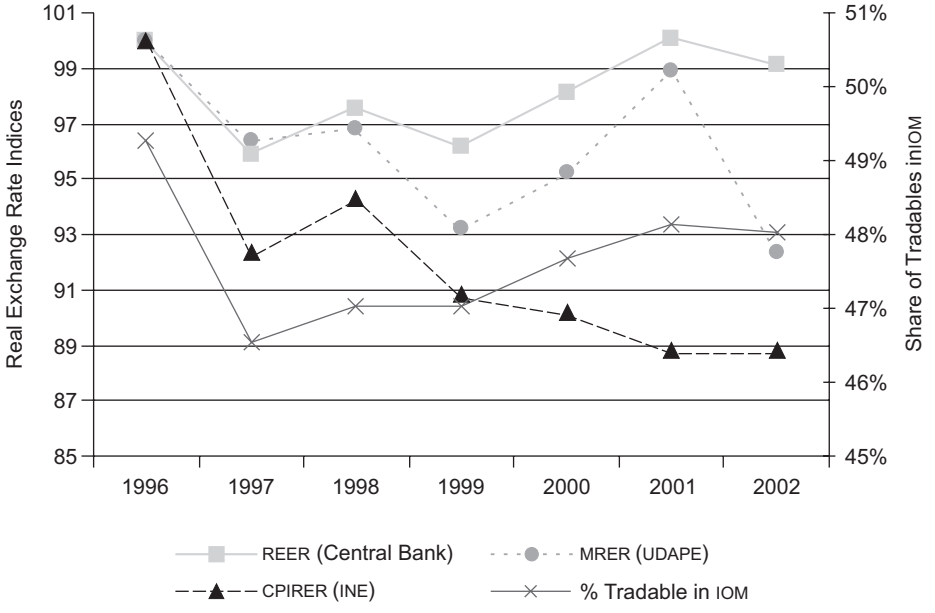
Table 3. Gross Production Value (GPV) disaggregated into tradable and non-tradable sectors

	Gross Production Value		
Year	*Tradables*	*Non-tradables*	*Total*
1996	16 260 040	16 734 917	32 994 957
1997	15 091 700	17 331 205	32 422 905
1998	17 712 121	19 947 207	37 659 328
1999	17 776 136	20 033 173	37 809 309
2000	18 442 809	20 251 176	38 693 985
2001	19 037 054	20 513 478	39 550 532
2002	19 566 671	21 166 192	40 732 863

Source: Author's own computation based on yearly Input-Output-Matrix (IOM).

[15] The mission of identifying purely non-tradable goods is becoming more difficult daily due to technological change and the globalization of the economy. Notwithstanding this and given certain remaining restrictions in transport-costs and labor-force mobility across borders, the option of a solid classification remains possible, especially in small open economies such as that of Bolivia.

Figure 10. Relationship between RER and the share of tradables produced in the economy



Source: Based on data contained in Tables 2 and 3.

If we match this criteria with the information contained in the national Input-Output Matrix (IOM) computed by the National Institute of Statistics (INE) at constant prices, two different GPV amounts can be obtained: one for tradable, and the other for non-tradable goods. Table 3 presents these results for the 1996-2002 period.

To prove data consistency for Table 3, Figure 10 presents the share of tradables produced in the economy together with the three RER indices.

The behavior illustrated in Figure 10 is consistent with the theory because whenever the RER appreciates, there is a reduction in the share of tradables produced in the economy and vice versa, with the exception of the CPIRER Index (from 1998-2002) given its special construction.

Beginning with the model description, Q_T and Q_N will represent production values of tradable and non-tradable goods, respectively. In other words, the sum of GPV_i for each i sector —and considering the classification established previously— will become the production value Q in domestic currency at constant prices. These aggregated production values

can also be obtained by multiplying the price P of each sector times its corresponding quantity q, as described in Equations (7) and (8):

$$P_T q_T \sum_{i=1}^{23} GPV_i \tag{7}$$

$$P_N q_N \sum_{i=24}^{35} GPV_i \tag{8}$$

Another assumption that must be made is that all RER indices presented in Table 2 represent a proxy of the ratio defined as P_T/P_N.[16]

$$\frac{P_T}{P_N} = RER\ Index \tag{9}$$

It is also assumed that the PPF curve, to which q_T and q_N correspond, assumes the form of a concentric circle with its center at the origin, as shown in Equation (2). Putting together Equations (2), (7), (8), and (9), a four-equation system can be formed:

$$\begin{cases} P_T q_T = \sum_{i=1}^{23} GPV_i \\ P_N q_N = \sum_{i=24}^{35} GPV_i \\ \frac{P_T}{P_N} = RER\ Index \\ q_T^2 + q_N^2 = c^2 \end{cases}$$

[16] It is important to mention that in the case of the INE-computed CPIRER index, there is some incompatibility with regard to the classification used to determine tradable and non-tradable goods (compared with the criteria used in Sachs and Larrain, 1994) because many prices considered by INE as non-tradables correspond to those of goods included in the activities of *a)* agriculture, hunting, fishing, and forestry; *b)* mining, and *c)* manufacturing. However, despite the skew that these prices could introduce into the analysis the CPI_T's absolute validity and the large share of service-prices included in the CPI_N allow us to maintain this index as part of the model.

In this system, $\sum_{i=1}^{23} GPV_i$ and $\sum_{i=24}^{35} GPV_i$ (or Q_T and Q_N, respectively) can be obtained from the IOM, while RER indices are shown in Table 2. In addition, prior knowledge has established that the constant c represents the radii of the circle in the PPF curve.

Given the impossibility of obtaining an aggregated value of the quantity of tradable or non-tradable goods in a single compatible unit, the solution to the system will be computed as a function of a constant c for each year of the period. Then, solving the system in terms of constant c[17] Equations 10 and 11 can be found with the following characteristics:

$$q_N = \frac{Q_N}{\sqrt{\frac{{Q_T}^2}{RER\ index^2} + {Q_N}^2}} c \tag{10}$$

$$q_T = \frac{Q_T}{RER\ index \sqrt{\frac{{Q_T}^2}{RER\ index^2} + {Q_N}^2}} c \tag{11}$$

Final values for q_T and q_N (in terms of c) are calculated by replacing Table 2 data and IOM data in Equations (10) and (11), these results can be found in Table 4.

The schematic behavior of the economy can be obtained by taking the values of q_T and q_N to the first quadrant of a graph, the axis of which must be expressed in terms of c.[18] Annex 2 presents these graphs

[17] The solving procedure can be summarized as follows: first q_T, q_N, and P_T are isolated from Equations (7), (8), and (9), respectively ($q_T = Q_T/P_T$; $q_N = Q_N/P_N$; $P_T = P_N$ RER); then, P_T is replaced in Equation (7) (that was rewritten) and afterward, q_T and q_N are introduced into Equation (2), yielding:

$$\frac{\frac{{Q_T}^2}{RER^2} + {Q_N}^2}{{P_N}^2} = c^2$$

Moving $P_N{}^2$ to the right side and c^2 to the left side and taking square roots, we obtain the equation for $P_N = (P_N \sqrt{(Q_T / RER)^2 + {Q_N}^2} / c)$, that can now be replaced in Equation (8) to obtain Equation (10). Finally, the new P_N can also be replaced in Equation (9) in order to find P_T in terms of P_N, and can be subsequently inserted into Equation (7) to obtain Equation (11).

[18] Note that the scales of the x-axis and the y-axis must be identical in all graphs to avoid misinterpretations.

Table 4. Quantities of tradable and non-tradable goods in terms of the constant *c*

	REER index Central Bank		*MRER index UDAPE*		*CPIRER index INE*	
Year	$q_T = f(c)$	$q_N = f(c)$	$q_T = f(c)$	$q_N = f(c)$	$q_T = f(c)$	$q_N = f(c)$
1996	0.69686	0.71721	0.69686	0.71721	0.69686	0.71721
1997	0.67235	0.74023	0.67036	0.74203	0.68605	0.72756
1998	0.67318	0.73948	0.67601	0.73689	0.68545	0.72812
1999	0.67812	0.73495	0.68953	0.72425	0.69873	0.71539
2000	0.68032	0.73291	0.69103	0.72282	0.71047	0.70372
2001	0.67994	0.73326	0.68428	0.72922	0.72243	0.69144
2002	0.68201	0.73134	0.70747	0.70674	0.72118	0.69275

Source: Author's own computation based on disaggregated IOM and data contained in Table 2.

for the entire analysis period considering all RER indices. Thanks to the information contained in these graphs, we can observe how the Bolivian economy experienced an important transition toward the non-tradable sector in 1997 (this consistent with the RER appreciation established in the analytical framework of this paper). In subsequent years (1998-2002), a slow return toward the tradable sector is evident, confirming the economy's hard restructuring process.

II.3. Production with Two-variable Inputs (K and L)

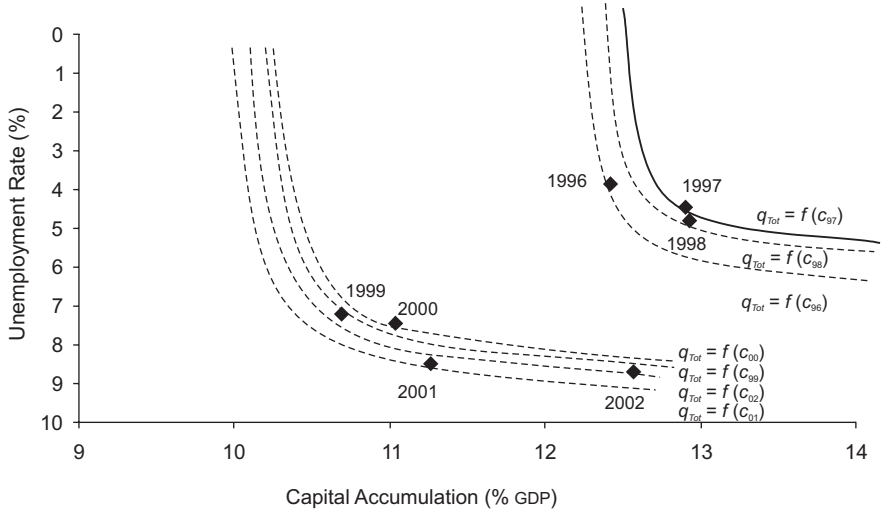
To complement the analysis, the two-variable-inputs approach requires explanation, with Capital and Labor represented by K and L, respectively. This production function possesses the characteristics presented in Equation (12).[19]

$$q_{Total} = f(K, L) \tag{12}$$

The macroeconomic account used to observe variations in Capital is the Capital Accumulation account (whose construction is described in Table 5) measured as a percentage of GDP. On the other hand, the previously utilized Urban Open Unemployment Rate will serve as an indicator of changes in Labor. Table 5 contains data of both variables.

[19] Note that q_{Total} represents the production of tradable and non-tradable goods taken together.

Figure 11. Production function with two-variable inputs



Source: Based on data contained in Table 5.

As shown in Table 5, there are two sources of unemployment rates with similar tendencies during the study period. Nevertheless, considering that INE is the only official source in Bolivia data computed by this institution will be used in this paper, while Center of Studies for Labor and Agricultural Development (CEDLA) rates are included in the Table solely as a reference.

Figure 11 can be obtained by plotting the data of both inputs and taking into account that a production function of this type possesses the shape of a convex-equilateral hyperbola.

Each of the hyperbolas shown in Figure 11 corresponds to a total level of production; the further the curve is located from the origin, the greater the magnitude of output (tradables and non-tradables) it represents.

It is very important to note that there is an inverse relationship between the Open Unemployment Rate and the use of Labor: the more Labor is employed the lower the unemployment rate will be. For this reason, the vertical-axis in Figure 11 must be inverted.

Finally, Annex 3 organizes the entire analysis in three representative graphs according to each RER index, and Figure 12 summarizes the main conclusion of this research.

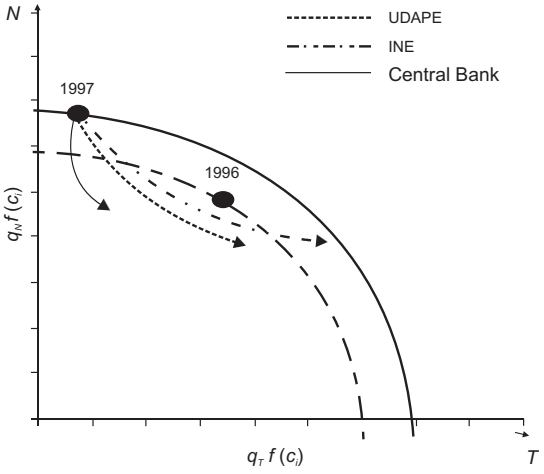
Comparing the behavior of the production functions (hyperbolas) shown in Figure 11 and the PPFs presented in Annex 3, we observe

Table 5. Capital and Labor used in total production*

Input	*1996*	*1997*	*1998*	*1999*	*2000*	*2001*	*2002*
Labor							
Urban open unemployment rate (INE)	3.8	4.4	4.8	7.2	7.5	8.5	8.7
Urban open unemployment rate (CEDLA)	3.8	4.4	4.1	6.1	7.5	11.1	12.0
Capital Accumulation (thousands of Bs.)	**4 660 236**	**5 375 061**	**6 056 901**	**5 151 095**	**5 731 798**	**6 057 040**	**7 144 579**
Variation of existences	22 842	276 106	212 245	–156 734	132 937	183 781	496 864
Gross formation of fixed capital	6 072 066	7 899 405	10 840 874	9 196 540	9 288 698	7 491 257	8 915 188
Non-physical asset purchase from the Rest of the World Net of Net-lending to the Rest of the World	–1 434 672	–2 800 450	–4 996 218	–3 888 711	–3 689 837	–1 617 998	–2 267 473
Capital Accumulation as a percentage of GDP	**12.4**	**12.9**	**12.9**	**10.7**	**11.0**	**11.3**	**12.6**

Source: INE (2005), Müller & Asoc. (2004), Central Bank, and CEDLA (Center of Studies for Labor and Agricultural Development).
* Unemployment rates for 1997 and 1998 remain very controversial in Bolivia. Two sources support the data presented in Table 5 for these 2 years: *a)* Müller & Asoc. (2004), and *b)* computations produced by the Ministry of Finance and published in the national economic weekly *Nueva Economía,* on June 24, 2002.

Figure 12. Final behavior of the aggregate supply



Source: Based on Figures shown in Annex 3.

that the order in which both groups of curves are set for every year coincides in the first three cases (1996, 1997, and 1998) regardless of the RER index used in PPFs construction. Most importantly, in all cases (production functions and the three PPFs) the curve located furthest from the origin corresponds to 1997. This consistent with the full-employment analysis described in subsection "Relationship betwen Inflation and Unemployment from 1996-2006", pages 110-115.

Concerning the order of the curves for the following years (1999, 2000, 2001, and 2002), the PPFs arrangement differs depending on the RER index employed (the behavior shown in Annex 3 utilizing the CI-PRER index is the closest to that observed in Figure 11) and probably also because of the constant *c* value for each year. However, the unquestionable location of these curves below the full-employment curve registered in 1997 (as summarized in Figure 12) validates the assumption established at the end of Chapter I and proves that the national productive system's restructuring process took place through the unemployment zone instead of along the 1997 full-employment PPF curve.

II.4. Foreign Direct Investment

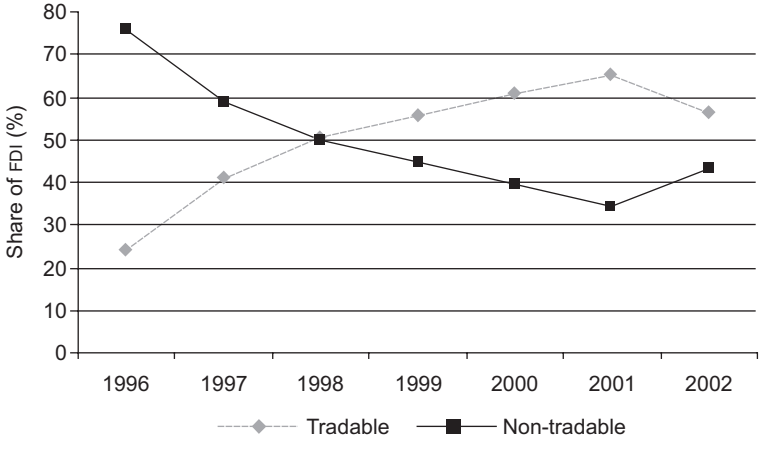
The FDI that entered the country after the capitalization process was certainly a very important aspect that promoted recovery of the

Table 6. Structure of Foreign Direct Investment (millions of $US)

Sector	*1996*	*1997*	*1998*	*1999*	*2000*	*2001*	*2002*
Foreign Direct Investment	**427.2**	**854.0**	**1 026.1**	**1 010.4**	**832.5**	**877.1**	**999.0**
Hydrocarbons	53.4	295.9	461.9	384.1	381.6	453.1	462.8
Mining	19.7	29.9	38.2	23.1	28.5	34.5	11.6
Industry and Industrial Agriculture Prod.	29.5	25.6	16.4	152.2	93.4	87.3	91.1
Total Tradables	**102.5**	**351.4**	**516.5**	**559.4**	**503.5**	**574.9**	**565.5**
Services	324.7	502.6	509.6	451.0	329.0	302.2	433.5
Total Non-tradables Share	**324.7**	**502.6**	**509.6**	**451.0**	**329.0**	**302.2**	**433.5**
Total Tradables (%)	**24**	**41**	**50**	**55**	**60**	**66**	**57**
Total Non-tradables (%)	**76**	**59**	**50**	**45**	**40**	**34**	**43**

Source: INE (2005).

Figure 13. Share of investment allocated for the tradable and non-tradable sectors



Source: Based on data contained in Table 6.

economy. Since 1996, FDI represents a significant share of total investment, displacing the amount invested by the public sector. On the other hand, Domestic Private Investment (DPI) remained constantly at low levels, presenting an important increase only in 1998. For the purpose of this paper, it is very important to understand the structure

of this FDI in terms of tradable and non-tradable goods. Table 6 contains this information.

As shown in Table 6, there is a clear decreasing tendency in FDI allocation in the non-tradable sector since 1997, while a similar decreasing tendency is evident also for the tradable sector starting in 1999. In terms of shares, tendencies exhibit the behavior presented in Figure 13.

Figure 13 shows a clear preference for the allocation of resources[20] in the non-tradable sector until 1998, after which the preference shifted toward the tradable sector where the main share corresponds to hydrocarbon products. The recovery of industrial and industrial-agriculture products in 1999 is also interesting.

II.5. Labor Flexibility

The last issue to be analyzed is that of the *de facto* labor flexibility observed during recent years as a consequence of the high unemployment rate. According to research carried out by the Center of Studies for Labor and Agricultural Development (CEDLA),[21] 45% of employees receiving a salary in Bolivia have an income below 800 *bolivianos* (minimum income estimated to support a household). This study indicates that given the strong economic recession at the beginning of the present decade employers have put into practice a cost-reduction strategy for survival in the market. Within this context, employees have been forced to accept temporary contracts with fixed schedules, additional working hours, lower salaries, and recurrent firing and rehiring. Considering these aspects and taking into account that salary is one of the most important non-tradable prices (of a production factor), it is logical to conclude that its *de facto* reduction represents one of the slow-adjustment economic mechanisms implemented to achieve a RER depreciation.[22]

---

[20] Remember that investment comes from Gross Fixed Capital Formation ± changes in inventories (the latter very small in relation to the former).

[21] This information was taken from the Report of the Week published by the newspaper *La Razón* on April 28, 2002.

[22] Note that if salaries fall, a share of the P_N falls, and given that this variable is contained in the RER equation denominator it reacts conversely and depreciates.

Final remarks

It has been proved that the tradable-non-tradable model is a very useful technique that aids in improving macroeconomic analysis from a different point of view, in that it considers reallocation of resources within the aggregate supply. Using this approach, the current unemployment imbalance in Bolivia could be a consequence of an economic restructuring process toward the tradable sector, this taking place after an important movement in 1997 of the quantity produced toward the non-tradable sector.

This aggregate-supply movement originated in the important RER appreciation in 1997, which was caused mainly by several currency depreciations of Bolivia's trade partners (after the 1997 Southeast Asian crisis) and also due to the fall of international prices for Bolivian exports. In addition, this appreciation was accompanied by a decrease in the variation of the nominal exchange rate and an important FDI entry that contributed to resources reallocation in the following two ways:

- The FDI share allocated for the non-tradable sector in 1996 and 1997 comprised 76 and 59%, respectively, stimulating significantly activity in this sector.
- From the demand perspective, the important FDI increase caused a boom in consumption because the existence of additional money in the economy increased the demand for both types of goods: tradable and non-tradable. This effect is very similar to that observed in the Dutch disease phenomenon, in which tradable-sector producers reallocate their resources in non-tradable activity to satisfy the growing demand for these non-tradable goods that can only be produced and consumed within the economy.

The importance of exogenous price-shock and capital flows (in the form of FDI) in a small open economy such as that of Bolivia is confirmed. Depending on the characteristics of these shocks, the aggregate supply can experience important deviations from the internal or external balance.

The possibility of rapidly influencing of the RER through nominal exchange-rate variations is very limited in view of the high dollarization of the Bolivian economy. Therefore, the alternate method for depreciating the RER involves a slow variation of domestic inflation at rates lower than the nominal exchange-rate devaluation. When this occurs,

the economy tends to return slowly to full employment through the unemployment zone.

The slow depreciation process in the case of Bolivia was also accompanied by a *de facto* labor flexibility that forced a reduction in salaries (one of the main non-tradable prices), and by a change in the FDI allocation to the tradable sector, mainly hydrocarbons, which unfortunately is not a labor-intensive sector and does not contribute to reduction in unemployment.

Due to the direct relationship between labor force output and employment, there is an inter-sector mobility of workers from tradable to non-tradable activities that requires a certain time period for workers to adjust their skills to the newly available jobs. These changes in resources allocation can only be faced by well prepared workers with good training, an aspect that continues to be one of the more important problems that affects the Bolivian population. Finally, considering that similar crisis periods will occur in the future, implementation of government interventions from the aggregate-supply sector side should be placed on the agenda immediately, to prevent the economy from experiencing long and painful adjustment processes through the unemployment zone.

Annex 1. Computation for the Quarterly Growth gap between seasonal adjusted GDP and its Hodrich-Prescott Trend

Observation	*Growth Quarterly GDP (Seasonal Adjusted)* a	*Growth HP Trend Quarterly GDP (Seasonal Adjuted)* b	*Quarterly Growth GAP If* a > b *then GAP* = *a* − *b If* b > a *then GAP* = b − a	*Yearly Accumulated Growth GAP*
1996q1	2.17	1.05	1.12	4.70
1996q2	0.52	1.04	0.51	
1996q3	2.14	1.02	1.12	
1996q4	–0.95	1.00	1.95	
1997q1	2.76	0.97	1.79	3.91
1997q2	1.93	0.94	0.99	
1997q3	0.17	0.91	0.74	
1997q4	0.48	0.88	0.39	
1998q1	3.66	0.84	2.82	4.81
1998q2	0.79	0.80	0.01	
1998q3	–0.29	0.76	1.05	
1998q4	–0.20	0.73	0.93	
1999q1	0.40	0.70	0.29	5.32
1999q2	–0.84	0.67	1.51	
1999q3	–0.15	0.64	0.79	
1999q4	3.35	0.62	2.73	
2000q1	–0.34	0.60	0.95	10.85
2000q2	2.14	0.59	1.56	
2000q3	–3.97	0.57	4.55	
2000q4	4.36	0.57	3.79	

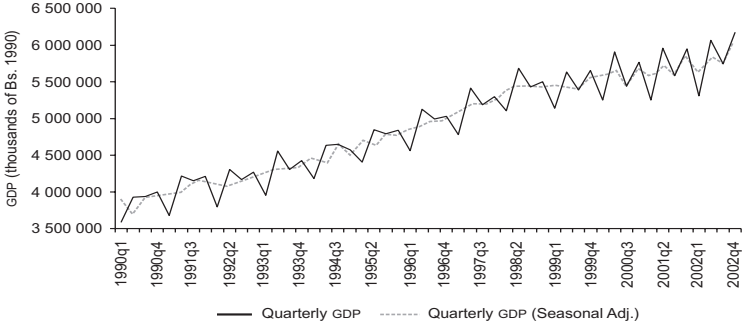
Annex 1. Computation for the Quarterly Growth gap between seasonal adjusted GDP and its Hodrich-Prescott Trend (Continuation)

2001q1	–2.31	0.56	2.87	12.83
2001q2	3.11	0.56	2.55	
2001q3	–2.41	0.56	2.96	
2001q4	4.99	0.56	4.44	
2002q1	–4.36	0.56	4.92	15.69
2002q2	3.96	0.56	3.40	
2002q3	–1.42	0.56	1.98	
2002q4	5.95	0.55	5.39	

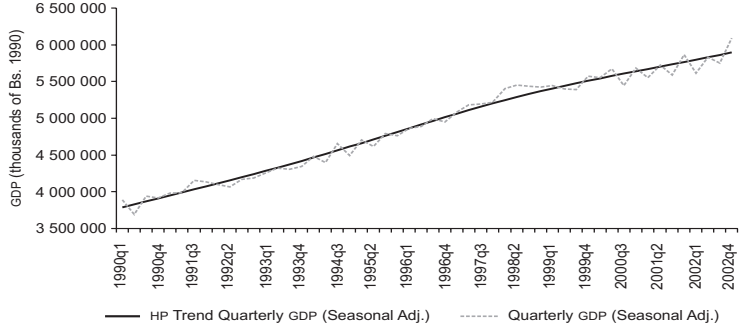
Source: Author's own computations.

Annex 1. Computation for the Quarterly Growth gap (continuation)

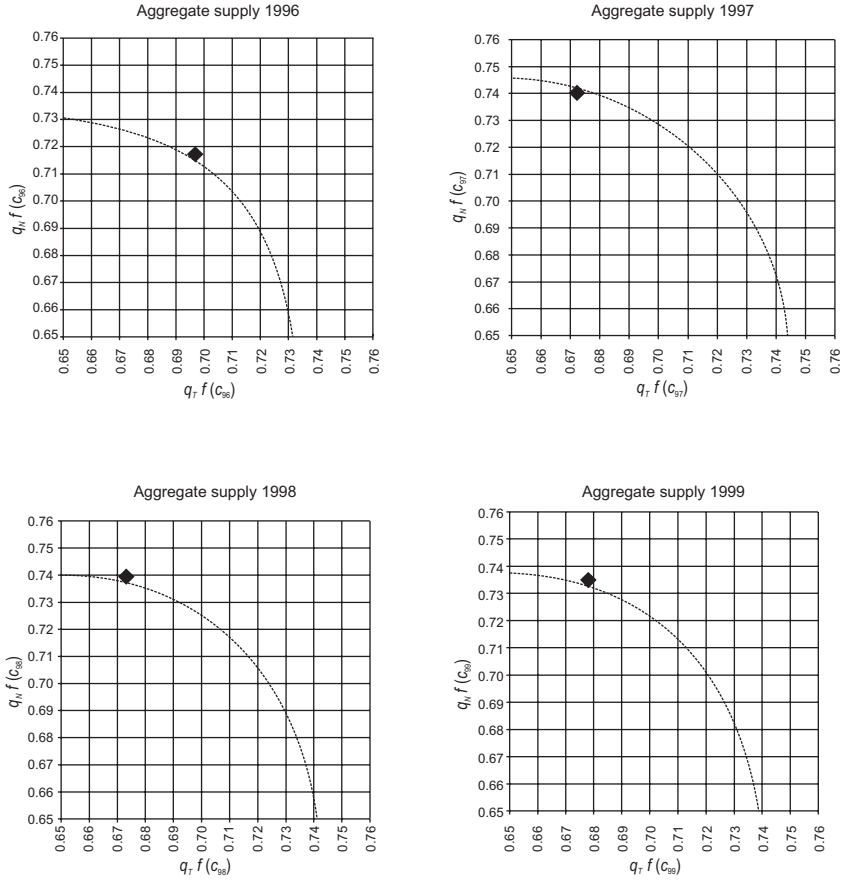
Comparison between quarterly GDP and seasonal adjusted quarterly GDP



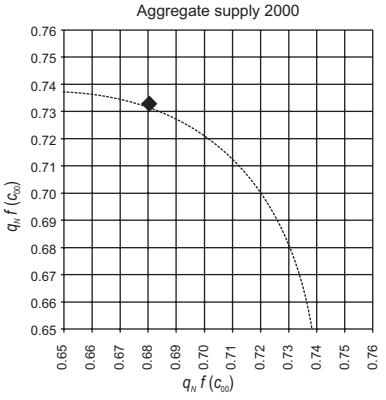
Comparison between quarterly GDP (seasonal adjust.) and its HP Trend

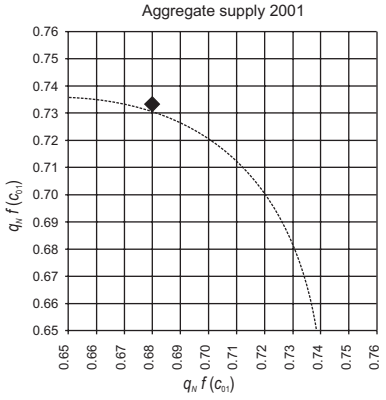


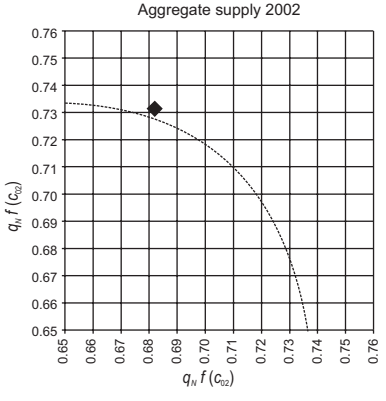
Annex 2a. Quantities supplied using the REER Index, computed by the Central Bank



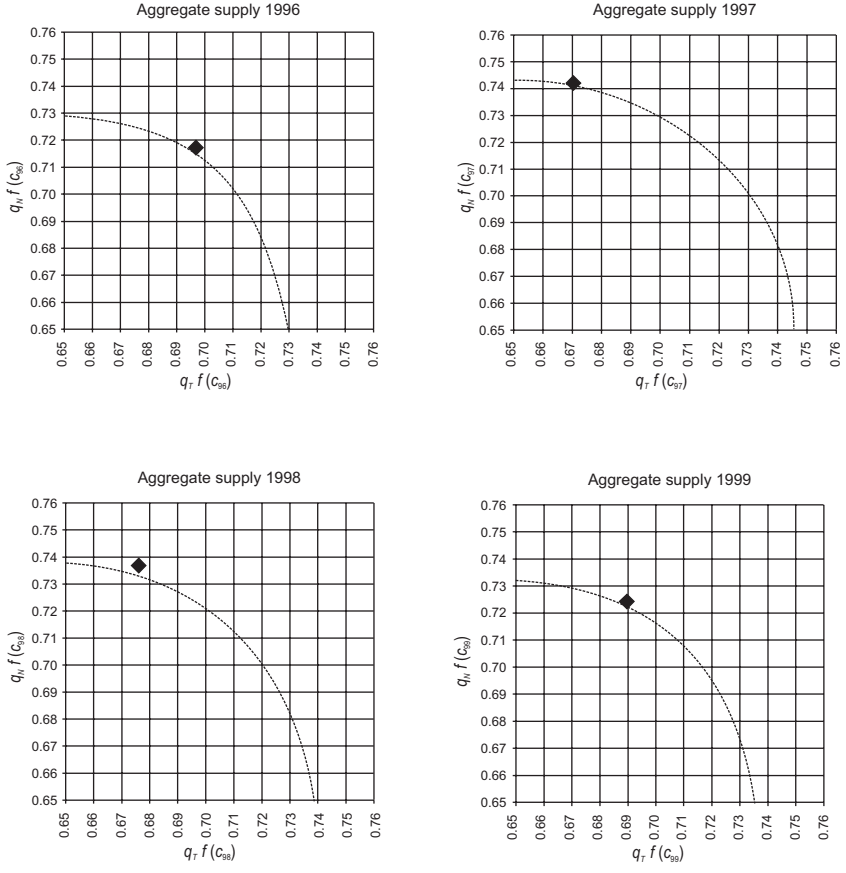
Annex 2a. Quantities supplied (continuation)



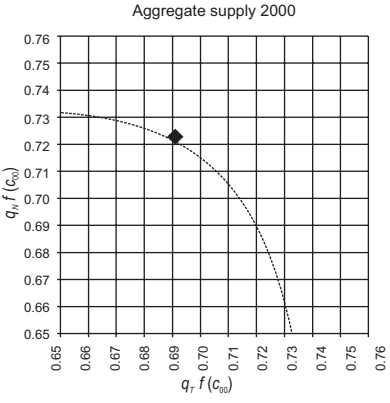


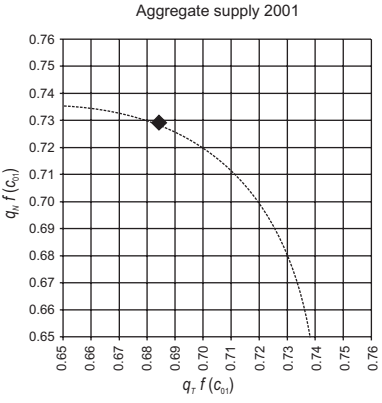


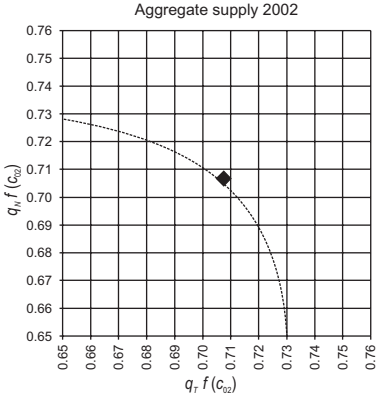
Annex 2b. Quantities supplied using the RER Index (MRER), computed by UDAPE



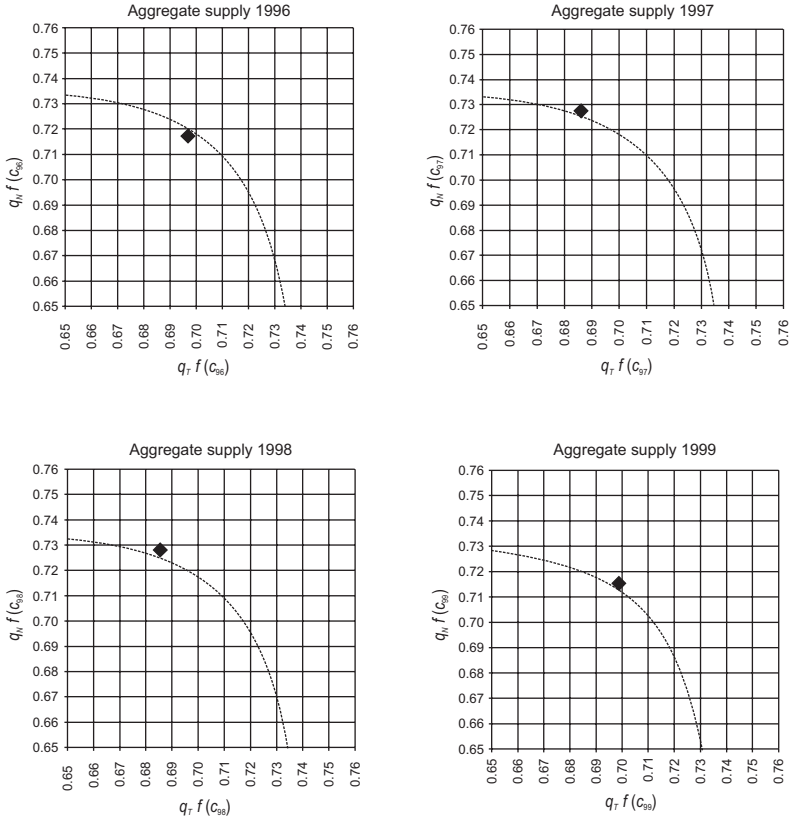
Annex 2b. Quantities supplied (continuation)



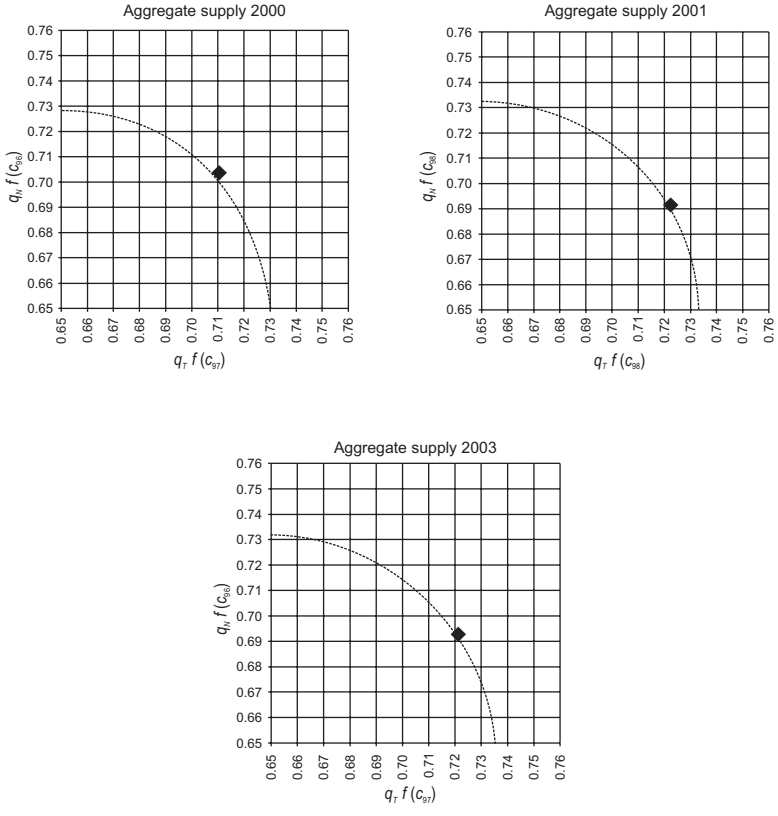




Annex 2c. Quantities supplied using the RER Index (CPIRER), computed by INE

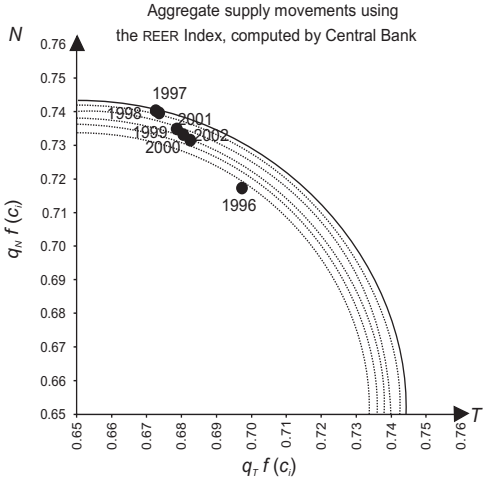


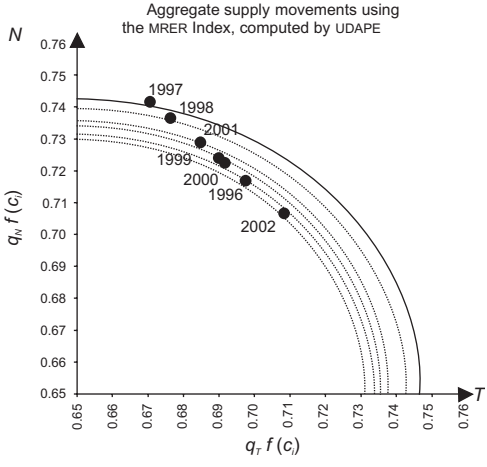
Annex 2c. Quantities supplied (continuation)



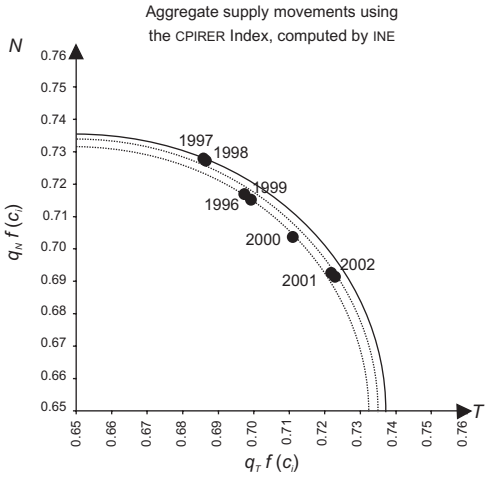
Source: Based on data contained in Table 4.

Annex 3. Aggregate supply movements according to different RER indices





Annex 3. Aggregate supply movements (continuation)



Source: Based on Figures shown in Annex 2.

References

Agénor, P. R. and P. J. Montiel (1999), *Development Macroeconomics*, second edition, New Jersey, Princeton University Press.

Corden, W. (1989), "Macroeconomic Adjustment in Developing Countries", *World Bank Research Observer*, Vol. 4, No. 1, January, pp. 51-64.

Cupé, E. (2003), "Efecto *pass through* de la depreciación sobre inflación y términos de intercambio internos en Bolivia", *Análisis Económico*, Vol. 10, junio, pp. 103-154.

Dornbusch, R. and S. Fischer (1994), *Macroeconomía*, sixth edition, Madrid, McGraw-Hill.

Henderson, J. M. and R. E. Quandt (1995), *Teoría macroeconómica*, third edtition, Barcelona, Ariel.

Hernaiz, D. (2005), *Una estimación del PIB potencial basada en restricciones de corto plazo*, Documento de Trabajo 09/2005 (diciembre). La Paz, Bolivia, Unidad de Análisis de Políticas Sociales y Económicas.

Hofman, A. and H. Tapia (2003), *Potential Output in Latin America: A Standard Approach for the 1950-2002 Period*, Statistics and Economic Projections Division, 25 (December), Santiago, Chile, ECLAC-United Nations.

Instituto Nacional de Estadística —INE— (2005), *Anuario Estadístico 2004* (abril), La Paz, Bolivia.

Lora Rocha, O. and W. Orellana (2000), "Tipo de Cambio Real de Equilibrio: Un Análisis del Caso Boliviano en los Últimos Años", *Revista de Análisis*, 3(1) junio, 41-79 (publicación del Banco Central de Bolivia).

Müller & Asoc. (2004), *Estadísticas Socio-económicas 2003* (julio), La Paz, Bolivia.

Pindyck, R. S. and D. L. Rubinfeld (1998), *Microeconomía*, cuarta edición, Madrid Prentice Hall Iberia.

Sachs, J. D. and F. Larrain (1994), *Macroeconomía en la Economía Global*, México, Prentice Hall Hispanoamericana.