

Capital flows and business cycles in Latin America during 1920s-30s. A second look from a neoclassical perspective*.

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Abstract

Developing economies have exhibited large macroeconomic volatility for a long time. Often, these wide macroeconomic fluctuations have been observed in the data in combination with sizeable swings in capital flows. This study focuses on external shocks to financial markets as the main driving force behind these stylized facts. The significant capital inflows and outflows experienced by Latin America in the 1920s and early 1930s, offer a perfect “historical experiment” to study the transmission mechanism by which external shocks turn into large capital flows and wider business cycles. In addition it offers the chance to assess the efficacy of countercyclical policies in the onset of a reversal of capital inflows, as these appear to have been widely used by monetary authorities in many Latin American countries during in the early 1930s. A DSGE model is built to rationalize the external forces that drive capital flows and, simultaneously, generate macroeconomic fluctuations. The role of banks and the existence of financial frictions are two key elements in the model as they become channels through which the foreign financial shocks and monetary policy are transmitted. Evidence of the role played by these two elements is presented also in a historical account of the period. The performance of the model is assessed by comparing its performance to data from Colombia, a representative Latin American country of this period. The model does well in matching the capital inflows/outflows and expansionary/contractionary phases in output dynamics between 1925 and 1931. In addition, when modified to allow for monetary policy, the model does account for part of the recovery by assigning a role to countercyclical policies. However, another part of this recovery appears to have been driven by relative price adjustments.

Keywords: Business cycles; Dynamic stochastic general equilibrium models; Small open economy models; Capital flows; Kalman filter; Financial frictions; Country-risk interest rate.

JEL classification: F41, E32, E44, N16, N26.

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1 Introduction

A well-recognized stylized fact about emerging markets in general, and Latin American economies in particular, is the large macroeconomic volatility they exhibit. A recent study by Aguiar and Gopinath (2007) covering a period from the 1980s, has shown that these economies exhibit, on average, a business cycle twice as volatile as that of their developed counterpart. And the number goes above two if one considers only the Latin American economies in their sample. A second striking feature in the emerging markets' business cycles is the strong countercyclicality of the trade balance relative to the one in developed markets. Furthermore, when looking at these regularities from a long-run perspective, other studies have not found any change in the pattern of large macroeconomic volatility. In their study of the Argentinean business cycle over the period 1900-2005, Garcia-Cicco, et.al. (2008) find no signs of moderation in the business cycle volatility in contrast to the remarkable "great moderation" experienced by the developed countries. Similar conclusions are obtained by Fernandez (2008) studying the Colombian economy over the period 1925-2006.

Researchers trying to account for these empirical regularities in emerging markets within a dynamic general equilibrium framework have centered their focus on the predominance of at least four types of shocks intrinsic to these economies. First, Mendoza (1995) expands, in a seminal paper, a real business cycle model to account for tradable/non-tradable goods and claims that stochastic shocks to the terms of trade process can account for 45 to 60 percent of the observed variability of GDP. Second, motivated by the frequent policy regime switches observed in emerging markets, Aguiar and Gopinath (2007) claim that these economies are subject to substantial shocks to the trend in the productivity process. Third, motivated by the literature on procyclical policies in Latin America (Agenor et.al (2000), Talvi and Vegh (2005) and Kaminsky et.al (2004)), Fernandez (2008) explores the role of fiscal shocks in amplifying the cycle. Fourth, and more importantly for this work, the argument of stronger real shocks has been extended to financial markets. The idea is that developing economies exhibit low levels of aggregate savings forcing them to rely heavily on foreign investment, via capital flows. Uribe and Yue (2006) explore the significant correlation between the business cycles in emerging markets and the interest rate that these countries face in international financial markets. They find that one third of business cycles in emerging economies are explained by disturbances in external financial variables (e.g. the foreign interest rate and the spread). Moreover, they find evidence of a further increase in the volatility of domestic variables because of the presence of feedback from domestic variables to country spreads. Similarly, Neumayer

and Perri (2005) find that eliminating country risk lowers Argentine output volatility by 27%. And Chang and Fernandez (2008) find evidence that models with interest rates shocks coupled with financial frictions perform better than models stressing other type of shocks.

A casual look at the business cycle data in five Latin American countries over the period 1910-2001 would seem to validate the fourth explanation emphasizing the role of capital inflows, at least for the episodes of higher business cycle volatility. In Figure 1.1 I plot the average business cycle assuming a three years-expansion followed by a three years-contraction. The black line plots the average cycle over the entire period showing that at the peak/through of the cycle, income deviates 2,5%/-3,3% above/bellow its long-run trend¹. The other lines depict the Latin American business cycle during the three episodes associated with large capital inflows and outflows to the region throughout the twentieth century: (i) the late 1920's and the years of the Great Depression; (ii) The late 1970s and early 1980s; and (iii) the 1990s. Three features deserve attention. First, the three episodes are characterized by sharper deviations from the trend relative to the entire period's average; second, the contraction is preceded by a large and sustained boom; and, third, the 20's-30s episode stands out for its magnitude in both the large boom and the steep recession.

The idea of foreign financial shocks affecting the Latin American business cycle has been present in the literature well before it received theoretical attention within a dynamic general equilibrium framework. Diaz-Alejandro (1983) highlights the similarities between the 1930s and 1970s episodes and underscores the role of financial shocks in the center affecting the periphery. In her extensive analysis of capital flows to Latin America during the twentieth century, Stallings (1987) concludes that because capital flows to Latin America appeared to be induced by external factors, most notably low US growth, and because they lead current account deficits in the region, they must have caused them. Furthermore, Calvo et.al (1993) stressed the role of external factors as the main driving force behind in the large capital inflows and accelerating growth in many Latin American countries during the early 1990s. They identify economic developments outside the region, most notably a fall in US interest rates, as the main cause that encouraged investors to reallocate resources to the Latin American region. More evidence on the transmission mechanism from foreign interest rates to domestic macroeconomic volatility is given by Gourinchas et.al. (2001) who find evidence that capital inflows triggered by external factors such as low levels of international real interest rates, spike during lending booms in Latin America. The authors stress the role of the banking system as it intermediates the funds by increasing credit to the private sector, raising

¹This is obviously an ad-hoc measure of the business cycle. However, the main results appear to be robust to other filtering methods (log-linear trend); to the size of the year-window (+/-2 ; +/- 4 years); and to larger sample of countries (including Peru, Uruguay and Venezuela).

both consumption and investment. More recently, further evidence favoring the importance of the interest rate channel in the transmission of US shocks to Latin America is given by Canova (2005) where US monetary disturbances are found to account for an important portion of the variability of Latin American macrovariables.

Despite the extensive literature on the role of capital flows and foreign interest rates as external driving forces of the Latin American business cycle, most of the analysis has been devoted to the latest episodes in the 1970s and 1990s. And, in the cases where the 1920s episode has been studied in detail, the analysis has been mostly done using a historical emphasis without much use of a theoretical model to rationalize the trends in the data and with a particular emphasis on the recovery part of the cycle². Yet, as shown in Figure 1.1, the capital inflows, and later outflows, experienced during this early episode appear to have had the strongest consequences over the business cycle in the region compared to the other episodes. And this impact seems to have been as strong in the peak as in the trough. In that respect, this episode seems to offer an ideal “historical laboratory” to study the transmission mechanism by which external shocks turn into large capital inflows with real effects that later reverse when the opposite shocks occur. Moreover, this episode presents additional interesting policy elements as casual evidence has been used to show the efficacy of the countercyclical monetary policy undertaken in the recovery phase (Diaz-Alejandro, 1983).

This work tries to fill this gap by using a framework that combines theory and empirical analysis in trying to understand the 1920s-1930s Latin American episode by focusing on a representative Latin American country during this episode: Colombia. On the theoretical ground, I construct a dynamic stochastic general equilibrium (DSGE) model of the Colombian economy aimed at capturing the dynamics induced by exogenous movements in foreign interest rates. I also expand the model to account for monetary policy shocks. In the empirical part, I assess the qualitative properties of the model by summarizing the impulse response functions of the model. And, on the quantitative part, I measure the extent with which the model-based dynamics, generated using the observed external and monetary policy shocks, match the dynamics observed in the macro aggregates.

The main findings show that the model does well in matching the expansionary/contractionary phases in output dynamics, in accordance with the main stylized facts observed in the business cycles in Latin American countries between 1925 and 1931. Two key transmission channels in the model through which capital inflows/outflows turn into economic booms/busts are interest rates

²Rigorous studies done by scholars of this period in Latin America, for example Thorp (1984), Della Paolera and Taylor (1999), or Diaz-Alejandro (1983) have a marked emphasis on the recovery phase of the cycle during the 1930s, and less attention is devoted to the expansionary phase of the 1920s.

and the banking system. Evidence of the role played by these two elements is presented in a historical account of the period as well. Furthermore, the active role of countercyclical monetary policy in the years that followed the great reversal of capital flows appears to have had real effects that are validated by the theoretical model. However, not all the recovery appears to have been driven by countercyclical policy, a result that is taken as indirect evidence of the role played by relative prices in the import substitution process that accompanied the strong recovery.

The paper is divided into six sections, including this introduction. The second section presents a brief historical account of Latin America economies, Colombia in particular, during the 1920s and 1930s with an emphasis in the role of capital flows. The third section lays out the DSGE model and its empirical performance is given in the fourth section. The role of countercyclical monetary policy is studied in the fifth section. Concluding remarks are given in the last section.

2 A Brief Historical Account

2.1 Capital Flows to Latin America in the 1920s-30s

In a thorough review of foreign capital in Latin America in the nineteenth and twentieth centuries, Taylor (2003) remarks that the region is certainly one whose economic fortunes have been most significantly shaped by external forces. The period ranging from 1920s-1930s clearly seems to be one of the best examples of this claim, because of the way external capital markets played a major role as engine of growth when capitals flew in and as a powerful destabilizing source when they flew out.

Before the First World War, portfolio and direct investments flowed to Latin America, mainly from Europe while U.S. investments were small and concentrated in the Caribbean and Central American regions (Diaz-Alejandro (1983)). But, after a period of considerable financial distress in the region during the war years³, the situation reversed. While the world capital market was gradually shifting from London to New York after the end of the First World War, a sharp shift toward more favorable conditions for US investments in Latin America occurred and they soared throughout the region. An improvement for Latin American borrowers was possible as the financial distress period came to an end. For example, Taylor (2003) notes, that this period was marked by the fact that no Latin American government was formally in default. To get a sense of the international investors' perceptions on financial conditions within the Latin American countries, Figure 2.1 plots the available data on government bond yields for five of these countries between

³In the years after World War I, Brazil defaulted in its sovereign debt, as did Uruguay and Mexico (see Taylor (2003)).

1919 and 1940. At least three comments deserve attention from this plot. First, a downward trend in government bond yields throughout the 1920s is observed in all the series signaling an increased confidence in foreign investors. This trend was nonetheless not uniformly synchronized across all the countries. It occurred early in the decade for some countries (e.g. Chile), late for others (e.g. Argentina and Uruguay), and steadily for the rest (e.g. Brazil). Second, there seems to be a positive co-movement between the government bond yields and the process for expected TBills yields in real terms. In fact, the correlation coefficient between an average of the regional bond yields and the US TBill rate is 0,5 and statistically significant. Third, there was a significant increase in all the bond yields in the early 1930s following the Wall Street crash in late 1929 and as the TBills rate peaked in the onset of the Great Depression. And, with the exception of Uruguay, the levels of government bond yields would remain at higher levels for the remainder of the period.

Other internal conditions favored the impression perceived by investors on the Latin American region. Among them, the most important were the structural reforms undertaken by many Latin American countries in the early 1920s. The reforms addressed a range of institutional topics from fiscal policy to the banking sectors and, most importantly, the foundation of central banks that would bring stability to the regional money and exchange rates markets. Just over the period between 1922 and 1929, nine central banks were created in the Latin American regions⁴. A central person in this process was E.W. Kemmerer, a Princeton professor who served as foreign economic adviser to many of the American missions that would provide technical assistance to the Latin American governments. To that respect most economic historians that have documented the work of Kemmerer in Latin America (see Rosemberg (1985) and Drake (1989)) agree that these reforms were aimed at ensuring a proper functioning of the gold standard that would serve as the “good house-keeping-seal of approval” (Bordo and Rockoff (1996)) required in order to gain further access to U.S. financial markets and ensure a constant flow of capitals to the region.

The combination of both external and internal factors allowed a period of unprecedented expansion of public borrowing in the New York bond market by Latin American countries and of US direct and indirect investment into the region. Using data from Avella (2007), Table 2.1 describes the boom in capital inflows of the 1920s by focusing on the Latin American share of the total new foreign bonds issues in US markets; and the distribution of the gross supply of US private funds to this region. The table is divided into four distinct periods observed between 1920 and 1935 for these two measures of capital inflows. After an initial boost in the early 1920s there was

⁴These were: Peru (1922); Colombia (1923); Nicaragua (1924); Uruguay (1924); Mexico (1925); Chile (1926); Guatemala (1926); Ecuador (1927) and Bolivia (1929). Source: Meisel (1991).

a pause in the pace of capital inflows during 1924-25. The most important period, the one that would accumulate almost 2/3 of the total inflow during the 1920s, would certainly be the years between 1926 and 1928. During this period the two measures peaked: the stock of Latin American foreign bonds issued in US markets doubled, and so did the flow of private funds into the region. In addition, it is important to point out that, while Argentina remained the first recipient of private funds throughout the 1920s, the distinctive surge in capital inflows during 1926-1928, was mainly due to the increase in the flow to other Latin American countries, most notably Brazil, Colombia, Chile and Peru. As emphasized by Avella (2007), the relevance gained by Latin America in terms of US investments was unprecedented at that time and would not be seen again until the 1970s. Finally a fourth period stands out for the years 1929-1935 with a sharp reversal of foreign bonds issues where Latin America took a large part of the blow⁵.

The period of capital outflows that started in the late 1920s in Latin America would set the stage to financial turmoil in the region. While much of the external debt was long-term denominated, the amortizations became harder to be honored as the drying up in foreign capital markets made rollover operations very difficult. In addition, as the world economy was entering into the Great Depression the regional terms of trade fell sharply, aggravating the availability of resources to honor the debt agreements. The situation became unsustainable starting late in 1931 when most Latin American suspended normal payments on their external debts and asked foreign creditors for conversations aimed at rescheduling and restructuring those debts (Diaz-Alejandro, 1983). These renegotiations were complex and in most cases took more than a decade to settle and would mark the beginning of a long period where capital flows never returned to the region until the late 1970s.

Despite the large macroeconomic consequences of the sharp reversal in capital flows, there seems to be a consensus about a rapid recovery from the economic downturn driven by a strong industrialization process (Thorp, 1984), and to the active role of countercyclical monetary policy (Diaz-Alejandro, 1983). The former had its origin in the permanent negative shock experienced by the regional terms of trade which encouraged a reallocation of resources to the incipient import-competing industrial sector. The latter, has been pointed as the key determinant in boosting internal demand in the wake of deflationary pressures and allowing a faster and less painful relative price adjustment. The abandonment of the gold standard in the early 1930s by some Latin American countries allowed them to pursue expansionary monetary policies and to devalue their exchange rate accelerating the adjustment towards the new equilibrium relative prices.

⁵According to Taylor (2003), during this period no other region in the world saw quite dramatic a retreat of foreign capital from such high levels.

This section has briefly highlighted some of the main stylized facts of the capital inflows and outflows to the Latin American region without emphasizing too much in the mechanisms linking the business cycles to the capital flows fluctuations. The next sections will tackle this issue by taking a closer look at Colombia. This will set the stage for the theoretical model to be laid out in the third section.

2.2 Colombia

Colombia could be viewed as a representative Latin American country in the 1920s. In the first half of the decade, it undertook a series of financial and fiscal reforms in order to guarantee the operation of the exchange rate regime under the Gold Standard. In the second half of the decade, it received a sizeable capital inflow and recorded an accelerating economic growth. The situation changed completely by the end of 1928 with a sharp reversal of the capital flows and a strong, albeit short, recession. By taking a closer look at the Colombian experience, this section will try to pin down the transmission mechanism from capital flows to the business cycle. It will be the working hypothesis that the interest rate and the banking system are the key channels to understand the mechanics by which capital inflows/outflows turn in economic booms/busts.

Following the advice given by a team of foreign experts led by E. W. Kemmerer in 1922, one year later, the Banco de la Republica, Colombia's central bank, was established. Monetary orthodoxy under the rules of the Gold Standard characterized the operation of the newly established institution. Sixty percent of the Bank's bills in circulation were backed by gold, one of the highest levels across central banks at the time, and rigorous sanctions were established in the event that the reserves fell below this level. To that respect, in its early years, the Banco de la República's role was limited to maintaining convertibility (Sanchez et.al. (2007)).

The success of the Banco de la Republica in stabilizing the exchange rate around the gold points, following the Gold Standard rules, in combination with the other fiscal and banking reforms undertaken by the Pedro Nel Ospina Administration (1922-1926), boosted international investor's confidence in Colombia and paved the road to a full access to foreign capitals. A part of this access can be quantified by Colombian bonds traded in the New York Stock Exchange given that the vast majority of Colombian foreign debt, 92%, was issued in the American market (Avella, 2007). While consolidated data on Colombian government bond yields is only available from 1934 (see Fig. 2.1), the first two columns in Table 2.2 collect the scarce data on the price of Colombian bonds in New York. The first column, taken from Patino (1981) shows the evolution of the 7% bonds from 1927, while the second, taken from the Commercial and Financial Chronicle, presents the data for the

6,5% Bonds and covers a wider period starting in 1923. It is immediate to see an inverted-V shape with the price of the bonds peaking between 1926 and 1928 and then sharply falling onwards.

Due to the lack of official balance of payments data, it is impossible to get an exact measure of the relative importance of the transfer of foreign wealth to Colombia. Yet, economic historians have come up with approximations and some of their estimates are presented in the rest of Table 2.2. According to Meisel (1990) the net capital inflows increased steadily as the share of total foreign income during the booming years, from 1923 to 1928. A notable exception was the large share recorded in 1923, explained by the first and largest payment from the US indemnity for the independence of Panama. According to Meisel (1990), the net capital inflows to Colombia increased their share of total foreign income from 7% in 1925 to 28,6% in 1928. And even bigger estimates have been suggested by others. For example, Ocampo (1994) finds that the total transfer of resources via capital account surpluses between 1925 and 1929 came close to 35% of the total exports income. This is remarkable, especially given that during this period export income was also rising as a result of increasing Colombian terms of trade. The last two columns in Table 2.2 use the data from Urrutia and Fernandez (2003) where the net capital inflows are quantified by two sources and find the same trend. The share of capital inflows with respect to GDP arrived to 3-4,1% during the years 1927 and 1928.

A clearer picture of the capital inflows process in Colombia can be seen from the data on the Colombian external debt compiled by Avella (2004) and plotted in Figure 2.2, as percentage of GDP. It is immediate to see the remarkable growth of Colombian external debt over the second half of the 1920s, from a low 4% in 1924 to close to 35% in 1931. In addition, Figure 2.2 brings new and relevant evidence from the large role played by the banking system. While the public debt had the largest share of the total external debt stock throughout the period analyzed, this share would decline because of the increasing relevance of external funds channeled to the banking system. This would be especially important during the period 1924-1930 when the banking system' access to foreign funds evolved from being virtually non-existent to have an external debt stock of US\$ 9M. in 1930, roughly one third of the Colombian external debt at the time. According to the history of the Colombian financial system by Caballero and Urrutia (2006), the increased availability of funds by the banking system fueled a period of unprecedented growth in this sector. As a raw measure of financial development, Table 2.3 presents the evolution of the total loans by the financial system to GDP between 1924 and 1936 in Colombia. From a record low 1% in 1924 the loans-to-GDP measure peaks at around 10% in 1930.

The real effects of this spectacular growth in the financial system will be the main driving force in the transmission mechanism from capital flows to the business cycle. On one hand, its increased access to external funds allowed the private banks to extend the credit lines for imports to its customers (Caballero and Urrutia, 2006). Some of the effects of this can be appreciated by the significant increase in the imports of machinery during this period (see Table 2.3). On the other hand, the increased availability of funds put downward pressure in domestic interest rates. Data collected on commercial mortgage annual interest rates by Patino (1981) and presented in Table 2.3 give evidence of this trend. It should be noted that the considerable reduction of the interest rate occurred despite the increased demand for real estate property (see also Table 2.2), giving a sense of the strong positive supply shock in the banking sector.

An illustrative case of this transmission mechanism can be found in the mortgage banking industry. An explicit goal of the financial reforms of the early 1920s was to promote the mortgage sector. And the leading bank in the industry would be the Banco Agrícola Hipotecario (BAH), a public mortgage bank created in 1925 with the objective of supplying funds to the agriculture and construction sectors. The novelty of the BAH was that, from its early beginnings, it was thought as a channel for external funds as it was meant to finance its entire operation through foreign borrowing. This strategy would be followed successfully by the other mortgage banks to the point that, by 1929, the mortgage sector loans accounted for 45% of the total amount of loans in the financial system. And, most importantly, this brought a significant reduction in the interest rates. No systematic data on the interest rates charged by the BAH are available, but Patino (1981) documents how this bank, lowered its interest rates on agricultural loans from 18-36% to 9% after it managed to access the US bond market during the two years after it started operation.

The role of external factors in the increase of Colombian debt should not be forgotten. Indeed, it should be kept in mind that an important share of this capital inflow was explained by external driving forces in the world capital markets and were not intrinsic to the Colombian domestic dynamics. Avella (2007), for example, documents the way representatives of the American investment banking firms in charge of issuing and trading Colombian bonds in the international markets could often be found “in pursuit” of more clients and encouraging Colombian agents to increase their debt leverage.

The increase in the availability of funds provided by the financial system as well as the lower interest rates on the loans were the main channels through which the large capital inflows to Colombia turned the period 1925-1928 into a booming economic period. Table 2.2 presents a

series of aggregated and disaggregated economic indicators that illustrate this economic cycle. The first national accounts data available since 1925 exhibit a record high growth of 8,6% per year between 1926-1928, with two consecutive years (1926-27) of growth over 9%, an event that would never be recorded again in the Colombian macroeconomic statistics of the twentieth century. The other macroeconomic indicators reveal that aggregate consumption and investment also experienced important growth. In addition, the economic boom was characterized by a countercyclical trade balance and a real appreciation of the exchange rate. The sector indices reveal that most of the economic growth was concentrated in the agriculture and construction sectors. Which comes at no surprise given that, as described above, these were the sectors that received most of the increase in loans. Other economic indicators presented in the lower panel of Table 2.3 reveal the widespread boom in the Colombian economy, among which the increase in the economic activities in the construction sector, as measured by new mortgages issues or new squared meters built, show a particularly active role. It is this type of increased economic activity in non-tradable sectors that explains the large real exchange rate appreciation experienced in the booming phase of the cycle.

Both internal and external reasons determined the sharp reversal of capital flows to Colombia. On the external side, initially, the Wall Street rally in 1928 generated enough incentives for foreign investors to start re-allocating some of their resources back to American markets (Avella, 2007). In addition, there was a widespread believe among investors about the dangerously high levels of debt in the Latin American region. Figure 2.1 reveals a break in the downward trend of the government yields in three out of the four Latin American countries with available data, from the second half of 1928. Around this time, in Colombia, Patino (1981) and Meisel (1990) document how the US government warned American investors about the excessive external debt levels in Colombia. Later, with the onset of the Great Depression, the US supply of private funds to Latin America drop extraordinarily. Table 2.1 presents evidence that Colombia was one of the most affected countries where foreign capitals virtually evaporated.

The major effect of the world crisis on Colombia was the sharp reversal of the capital account (see Table 2.2) yet the export sector was not severely affected, unlike other Latin American countries. Indeed, the evidence presented by Ocampo (1984) demonstrates that the expansion of coffee and gold exports during the 1930s was more than sufficient to counteract the decrease in other exports. In addition, the expansion of the aggregate export quantum counterbalanced the deterioration of the terms of trade, resulting in a relatively mild reduction in the export purchasing power. On the other hand, the domestic effects were severe and most of them were, once more, transmitted

through the banking sector via two channels. First, the inability to access external funds forced the banks to cut loans for import related activities. Evidence of this is presented in Table 2.3 by a large drop in machinery imports and by the extraordinary surplus in the trade balance during the crisis years. Second, under the Gold Standard rules the Colombian central bank reacted in defense of the gold parity by increasing its discount rate (Sanchez, et.al., 2007). From the data on mortgage interest rates (Table 2.3), it is immediate to see this contractionary policy significantly increased domestic interest rates levels between 1929 and 1931.

The real effects of these events were severe. On an aggregate level, GDP levels decreased consecutively during the year 1930 and 1931, by -0.9% and -1,6% respectively, with investment reducing even by half. Another important fact was that the contraction was mostly confined to the nontradable sectors as the economic indicators in Table 2.3 reveal. Another consequence of the crisis was a widespread insolvency in the financial system as banks confronted a situation in which collateral prices fell; many debtors declared bankruptcy; and no new fresh sources of funds were readily available. This forced the government to intervene by doing a large and expensive domestic bank bail-out that prevented a systemic internal crisis while most of the external debt was repudiated (Caballero and Urrutia, 2006).

In summary, this narrative account has taken a closer look at Colombia during the 1920s and early 1930s in order to highlight the crucial role played by capital flows in explaining the macroeconomic fluctuations. Importantly, casual evidence was given in favor of the interest rate and the banking system as being the key channels to understand the mechanics by which capital inflows/outflows turn into economic booms/busts. In the next section we build a theoretical model that rationalizes this transmission mechanism and its performance is modeled by comparing it to the dynamics observed in the Colombian data. Lastly, the reader should have noticed that little attention has been given to the role of countercyclical policy, especially in the contraction phase of the cycle. This issue will be addressed in later sections.

3 Model

This section builds a model of a representative Latin American economy during the booming 1920s, using Colombia as a benchmark. The model produces capital flows and business cycles generated by external forces. The basis of the theoretical model is the neoclassical general equilibrium growth model of a small open economy first suggested by Mendoza (1991). However, in the line of Neumeyer and Perri (2005) and Uribe and Yue (2006), it departs from the canonical version by modeling an

exogenous and stochastic process for the world interest rate in conjunction with the presence of financial frictions in the form of working-capital-in-advance constraints from the part of the firms. The former feature generates external random shocks to the cost of capital that percolate to the country interest rate, the rate domestic agents face in international financial markets, and creates opportunities for them to access foreign funds. The latter feature generates a need by the firms for working capital to finance the wage bill making demand for labor sensitive to the interest rate, and, thereby, creating a direct supply side effect that further amplifies the real effect of changes in the cost of borrowing in international markets. In conjunction, these two features produce external forces that drive capital flows and, simultaneously, generate the macroeconomic fluctuations, thus mimicking what that appears to be the dominant stylized fact that characterizes Latin American economies in the late 1920s and early 1930s in general, and the Colombian economy in particular.

3.1 Households

The model follows closely Uribe and Yue (2006). Consider a small open economy populated by a continuum of identical households indexed by i , where $i \in [0, 1]$. A representative household i has preferences described by the following utility function

$$E_0 \sum_{t=0}^{\infty} \beta^t U(c_t^i, h_t^i) \quad (1)$$

where c_t^i and h_t^i denote consumption and the fraction of time devoted to work by the representative household i in period t ; U is the single-period utility index assumed to be increasing in its first argument decreasing in its second argument, concave and smooth. The parameter $\beta \in (0, 1)$ denotes the subjective discount factor.

Households have access to two types of assets, physical capital and an internationally traded bond. The capital stock is assumed to be owned entirely by domestic residents. Households have three sources of income: wages, capital rents, and interests on financial asset holdings. Each period, households allocate their wealth to purchase consumption and investment goods and financial assets. The household's period-by-period budget constraint is given by

$$d_t^i = R_{t-1}^d d_{t-1}^i + c_t^i + i_t^i + \Phi(k_{t+1}^i, k_t^i) - w_t h_t^i - u_t k_t^i \quad (2)$$

where d_t^i denotes the household i 's debt position in period t , R_t^d denotes the gross interest rate faced by domestic residents in financial markets, w_t denotes the wage rate, u_t denotes the rental rate of capital, k_t^i denotes the household's stock of physical capital, and i_t^i denotes the gross domestic investment. The function $\Phi(\cdot)$ is used to induce adjustment costs to the process of capital

accumulation and it is assumed to satisfy $\Phi(0) = \Phi'(\cdot) = 0$. This is used in order to avoid excessive investment volatility.

The stock of capital evolves according to

$$k_{t+1}^i = (1 - \delta)k_t^i + i_t^i \quad (3)$$

where $\delta \in (0, 1)$ denotes the rate of depreciation of physical capital.

Household i chooses contingent plans $\{c_t^i, h_t^i, i_t^i, k_{t+1}^i, d_t^i\}_{t=0}^\infty$ so as to maximize his utility function (1) subject to the budget constraint (2), the law of motion for capital (3), and a no-Ponzi borrowing constraint of the form

$$\lim_{j \rightarrow \infty} E_t \frac{d_{t+j+1}^i}{j} \leq 0 \quad (4)$$

$$\prod_{s=0}^j R_{t+s}^d$$

taking as given the processes for $\{R_t^d, w_t, u_t\}_{t=0}^\infty$.

Letting λ_t denote the Lagrange multiplier on the expanded budget constraint, the first order conditions for household i 's maximization problem are (2), (3) and the set of standard first order conditions given by

$$U_1(c_t^i, h_t^i) = \lambda_t \quad (5)$$

$$-U_2(c_t^i, h_t^i) = \lambda_t w_t \quad (6)$$

$$\lambda_t = \beta R_t^d E_t \lambda_{t+1} \quad (7)$$

$$\lambda_t [1 + \Phi_1(k_{t+1}^i, k_t^i)] = \beta E \lambda_{t+1} (u_{t+1} + 1 - \delta - \Phi_2(k_{t+2}^i, k_{t+1}^i)) \quad (8)$$

3.2 Banks

Suppose that financial transactions between domestic and foreign residents require financial intermediation by domestic banks and assume there is a continuum of them of measure one that behave competitively. They capture funds from foreign investors at the country interest rate R_t and lend to domestic agents at the rate R_t^d . In addition banks face operational costs, $\Psi(d_t - \bar{d})$, for some $\bar{d} > 0$, that are assumed to be increasing and convex in the volume of loans made by banks, d_t and to satisfy $\Psi(0) = \Psi'(0) = 0$. It follows that the optimality condition for the banks is given by:

$$R_t^d = \frac{R_t}{[1 - \Psi'(d_t - \bar{d})]} \quad (9)$$

This assumption is introduced following Uribe and Yue (2006), and eliminates the unit-root in the debt process exhibited by small open economy models (Schmitt-Grohe and Uribe, 2003).

3.3 Firms

The productive sector of the small open economy is made of a continuum of identical firms indexed by f , where $f \in [0, 1]$. A representative firm f produces the one good using labor services, h_t^f , and physical capital, k_t^f , that it rents from the households in perfectly competitive markets, using a technology:

$$y_t^f = F\left(k_t^f, h_t^f\right) \quad (10)$$

where the function $F(\cdot)$ is assumed to be homogeneous of degree one, increasing in both arguments and concave. The production process is subject to a working capital constraint that requires firms to hold non-interest bearing assets to finance a fraction, η , of the wage bill each period. Formally:

$$\kappa_t \geq \eta w_t h_t^f; \quad \eta \geq 0$$

where κ_t is the amount of working capital held by the representative firm in period t .

The debt position of the firm evolves as follows:

$$d_t^f = R_{t-1}^d d_{t-1}^f - \kappa_{t-1} - y_t^f + w_t h_t^f + u_t k_t^f + \pi_t + \kappa_t$$

where π_t are profits distributed to households in period t and R_{t-1}^d is the same interest at which all households borrow and is defined by (9).

Defining the firm's total net liabilities at the end of period t as $a_t^f = R_t^d d_t^f - \kappa_t$, then assuming that the capital constraint always binds⁶, it is possible to express:

$$a_t^f = R_{t-1}^d a_{t-1}^f - \kappa_{t-1} - y_t^f + w_t h_t^f \left[1 + \eta \left(\frac{R_t^d - 1}{R_t^d}\right)\right] + u_t k_t^f + \pi_t$$

The firm maximizes the present value of profits discounted at the household's marginal rate of substitution of consumption between periods:

$$E \sum_{t=0}^{\infty} \beta^t \frac{U_1(c_t^i, h_t^i)}{U_1(c_0^i, h_0^i)} \pi_t$$

with the following two optimality conditions for the two inputs

$$w_t \left[1 + \eta \left(\frac{R_t^d - 1}{R_t^d}\right)\right] = F_2\left(k_t^f, h_t^f\right) \quad (11)$$

$$u_t = F_1\left(k_t^f, h_t^f\right) \quad (12)$$

plus the household's Euler condition 7 and the no-Ponzi condition for a_t^f similar to (4).

⁶This implies considering only cases where the interest rate is positive.

It follows from (11) that the financial friction created by the working-capital constraint distorts the labor market by introducing a wedge between the marginal product of labor and the real wage rate. In equilibrium, this distortion will make demand for labor sensitive to the interest rate.

Lastly, it should be noted that any process for a_t^f satisfying the firm's budget constraint is optimal. Thus an equilibrium for the firm consists in holding no liabilities at all times and implying zero profits:

$$\pi_t, a_t^f = 0; \forall t$$

3.4 Driving Forces

A key variable in the model is R_t , the gross interest rate faced by financial domestic agents (i.e. Banks) in international markets. Following Uribe and Yue (2006) it will be assumed that the equilibrium level of this variable will be a function of the domestic economic conditions; the evolution of the international interest rate; its own history and exogenous innovations. Formally:

$$\widehat{R}_t = R \left(\Gamma_t, \widehat{R}_t^*, \widehat{R}_{t-1}, \epsilon_t^R \right) \quad (13)$$

where Γ_t is a vector containing domestic variables that could provide a reasonable description of the business cycle in the domestic country, thus affecting the equilibrium level of R_t , and that might affect the rate at which foreign lenders might be willing to supply funds to domestic banks; \widehat{R}_t^* is the world interest rate; and ϵ_t^R are *i.i.d.* innovations to the country interest rate that can equivalently be interpreted as a country spread shock. A hat " $\widehat{}$ " over the variables R_t^* and R_t indicate log-deviations from their long-run means.

The process for the world interest rate is assumed to be stochastic and exogenous to the domestic variables in the domestic small open economy. Formally

$$\widehat{R}_t^* = R^* \left(\widehat{R}_{t-1}^*, \epsilon_t^{R^*} \right) \quad (14)$$

where $\epsilon_t^{R^*}$ are *i.i.d.* innovations to the world interest rate.

3.5 Competitive Equilibrium

Since all of the unit mass of households are identical, we have as equilibrium conditions that the aggregate levels of consumption, labor, investment and debt are:

$$C_t = c_t^i \quad (15)$$

$$H_t = h_t^i \quad (16)$$

$$I_t = i_t^i \quad (17)$$

$$K_t = k_t^i \quad (18)$$

$$D_t = d_t^i \quad (19)$$

Likewise, since all unit mass of firms are identical, equilibrium in the competitive markets for labor and physical capital imply that

$$K_t = K_t^f = k_t^f \quad (20)$$

$$H_t = H_t^f = h_t^f \quad (21)$$

Note that in an equilibrium for the firms that consists in holding no liabilities at all times, D_t represents the domestic country's net debt position and is, by construction, equivalent to the amount of debt intermediated by the financial system. Therefore, the trade balance of this economy can be defined as

$$TB_t = Y_t - C_t - I_t - \Phi(K_{t+1}, K_t) - \Psi(D_t - \bar{d}) \quad (22)$$

where $Y_t = F(K_t, H_t)$ is gross domestic product. A key variable that can be derived from the trade balance is the capital account, KA , measured as the amount of resources needed to finance the trade balance plus debt interest transfers:

$$KA_t = (R_{t-1} - 1)D_{t-1} - TB_t \quad (23)$$

To summarize: a competitive equilibrium for the domestic small open economy is then the set of processes for allocations

$$\{C_t, K_t, D_t, H_t, Y_t, I_t, TB_t, KA_t\}_{t=0}^{\infty}$$

and prices

$$\{w_t, u_t, R_t, R_t^d, \lambda_t\}_{t=0}^{\infty}$$

satisfying conditions (2)-(3), (10), (22)-(23), the optimality conditions associated to the household's problem (5)-(8) and to the firm's problem (11)-(12), the endogenous process for the interest rates R_t and R_t^d (9) and (13); given the exogenous process for R_t^* in (14) and country interest rate shocks $\{\epsilon_t^R\}_{t=0}^{\infty}$ and given initial conditions for $\{K_0, D_{-1}, R_0^*\}$.

3.6 Parameterization

Here I present the functional forms chosen to model the technology; the household's preferences, the investment and operational adjustment costs.

The technology available to the firm is a Cobb-Douglas type

$$F(k_t, h_t) = (k_t)^\alpha (h_t)^{1-\alpha}$$

The lack of reliable data on the aggregate capital stock makes it difficult to get systematic values for capital depreciation and shares. I therefore use a yearly value of $\delta = 0.1$ and $\alpha = 1/3$, which is somewhat standard in both the literature on developed and developing countries (see Mendoza 1991, 1995, respectively).

The instantaneous utility function assumed uses the preferences introduced by Greenwood et.al. (1988), usually labelled as GHH-type preferences:

$$u(c_t, h_t) = \frac{\left(c_t - \theta \frac{h_t^\omega}{\omega}\right)^{1-\sigma}}{1-\sigma}$$

These preferences have been used in open economy models since Mendoza (1991) and have been shown to improve the ability of dynamic stochastic general equilibrium models to reproduce some of the business cycles facts of small open developed economies (Correia et.al. (1995)) and developing economies (Aguiar and Gopinath (2007)).

The parameter σ governing the intertemporal elasticity of substitution, $\frac{1}{\sigma}$, is calibrated at 2 indicating the presence of relatively interest-inelastic consumption growth rates as has been suggested for developing economies (Ostry and Reinhart, 1992; Aguiar and Gopinath, 2007). The parameter ω , governing the elasticity of labor supply, $\frac{1}{\omega-1}$, is perhaps the hardest one to calibrate for developing countries given the virtual inexistence of systematic labor market databases. It is calibrated at 1.6 following studies for other developing countries that have set a lower elasticity, motivated by the higher degree of labor market imperfections observed in these economies⁷. Lastly, the coefficient θ is calibrated so as to give a steady state level of labor equal to 0.28 as in Aguiar and Gopinath (2007). Following Schmidt-Grohe and Uribe (2003) the steady-state level of debt, \bar{d} , is calibrated so as to match a long-run trade balance-to-income ratio, equal to -2% .

Standard quadratic cost functions are assumed for the capital accumulation process:

$$\Phi(k_{t+1}, k_t) = \frac{\phi}{2} (k_{t+1} - k_t)^2$$

and for the operational costs of banks

$$\Psi(d_t - \bar{d}) = \frac{\psi}{2} (d_t - \bar{d})^2$$

⁷For Argentina, Neumeyer and Perri (2005) set the elasticity at 1.51 and, in their calibration of the Mexican economy, Aguiar and Gopinath (2004) set it at 1.66.

and the two parameters governing the two functions are calibrated as in Uribe and Yue (2006): $\phi = 72.8$; $\psi = 0.001$. Likewise, the parameter η governing the intensity of the working capital constraint is set to be 1.2.

Following Neumeyer and Perri (2005) and Uribe and Yue (2006), the process for the foreign exogenous interest rate $R^*(\cdot)$ is assumed to follow an AR(1) process:

$$\widehat{R}_t^* \equiv \ln(R_t^*/R^*) = \rho_{R^*} \ln(R_{t-1}^*/R^*) + \epsilon_t^{R^*}$$

and ρ_{R^*} is estimated to be 0.776 using a proxy for real ex-ante interest rates. The estimation is done by OLS for the period 1920-1940 using data on secondary market TBill yields deflated by the US CPI-inflation. To (partially) capture the forward looking measure of inflation expectations we use a three year moving average (see Fig. 2.1). Results using less and more forward looking measures of ex-ante real world interest rates are robust and are gathered in the Appendix. In the estimation, the long-run mean of gross world interest rates R^* was set to be 1.04 as in Uribe and Yue (2006).

A challenge that the model presents lies in the lack of identification of the country interest rate process $R(\Gamma_t, \widehat{R}_t^*, \widehat{R}_{t-1}, \epsilon_t^R)$. What other researchers have done to overcome this is to estimate the process from *observed* time series of country interest rates in international financial markets. This is the approach followed by Neumeyer and Perri (2005) but they have no variables in the vector Γ_t . Uribe and Yue also follow this approach but they do include richer dynamics in Γ_t such as contemporaneous and lagged values of investment, income and trade balance. In this case, however, such approach cannot be undertaken because there are no consistent time series on interest rates for Colombian bonds in international markets for this period (see the scarce data collected in Table 2.2). Thus, it was decided to treat R_t as a latent variable and postulate and ad-hoc -and very simple- process for $R(\cdot)$ based on the findings from other studies. In particular, three considerations were taken into account. First, both Neumeyer and Perri (2005) and Uribe and Yue (2006) coincidence in postulating a high correlation between R_t and R_t^* . Second, for the case of Colombia, other studies have documented a *lagged* relation between foreign and domestic interest rates (GRECO, 2002). Third, all three studies find a high degree of persistence in the country interest process. On these three considerations, the process for the country interest rate $R(\cdot)$ is assumed to be:

$$\ln(R_t/R) = \rho_{R^*} \ln(R_t^*/R^*) + \rho_{R^*_-} \ln(R_{t-1}^*/R^*) \quad (24)$$

with $\rho_{R^*} = 0.85$, $\rho_{R^*_-} = 0.05$, and the long-run gross country interest rate, R , is assumed to be 1.11 assuming a "natural" spread level of 700 basis points over the US interest rate. Note that no

independent country spread dynamic are contemplated as this, while certainly relevant, is virtually impossible to capture given the available data.

4 Simulation Results

This section assesses the performance of the model in matching the main stylized facts of the Latin American countries described in the second section. The assessment is done both qualitatively and quantitatively. First, from a qualitative point of view, I ask whether the model delivers the dynamics observed in the data after an external financial shock. For that purpose, and in the spirit of Diaz-Alejandro (1983) and Calvo et.al. (1993), I simulate the impulse response functions after an exogenous negative shock to the world interest rate. Second, the model is assessed quantitatively by simulating the model using the *observed* process for the world interest rate as driving force. The simulated-based moments from the artificial time series are then compared to their empirical counterparts. Since the main purpose of the study is the analysis of the business cycle consequences of capital flows, particular attention is given to the dynamics of GDP. In particular, the observed dynamics of GDP are compared to the ones simulated by the model.

4.1 Impulse Response Functions

The model is solved by taking a log-linearization around its non-stochastic steady state and its state-space representation allows the computation of impulse response functions (IRF)⁸. Figure 4.1 plots the IRF of six key variables following a negative 100-basis points shock to the foreign interest rate, $\epsilon_t^{R^*} = 0.1$. The upper-left panel describes the first part of the transmission mechanism as the country interest rate deviates also negatively from its steady state. Note that while R_t reacts simultaneously with R_t^* , the full effect of the shock in R_t occurs one period after the shock. The upper-right panel shows the supply-side part of the transmission mechanism. On one hand, the drop in interest rates lowers the opportunity cost of investing and households increase the resources allocated to increasing the stock of capital. This is standard in neoclassical models. On the other hand, because of the financial frictions induced by the working capital constraint, the reduction in interest rates lowers the wage bill giving incentives to firms to increase their labor demand. The lower-left panel shows the full effect of the shock on the dynamics of output which raises by 2,5% with respect to trend. It is thus immediate to see that the supply side effects are non trivial. Last, but not least, the lower-right panel shows the imbalance created by these dynamics on the external

⁸The first order approximation and solution of the models are all done by adapting the MATLAB routines provided by Schmitt-Grohe and Uribe (2004). The codes used in this research as well as the entire dataset are available upon request.

front. As investment and consumption increases with the shock and the increase in income is not fully completed there is a temporary imbalance in the trade balance that must be financed by capital inflows. Later, once output has reached its peak, the external imbalance reverses.

Summarizing, on a qualitative perspective, an external shock to the world interest rate generates the main stylized facts observed business cycles in the Latin American countries during the 1920s: important capital account surpluses in conjunction with significant positive deviations from their long-run trend.

4.2 Simulation based on observed driving forces

The next issue evolves around the quantitative performance of the model. To do so I cast the log-linearized version of the model in its canonical form (see Schmitt-Grohe and Uribe (2004) for details):

$$\begin{aligned} x_{1,t+1} &= Mx_{1t} + v_{t+1} \\ x_{2,t} &= Cx_{1,t} \end{aligned} \tag{25}$$

where $\{x_1, x_2\}$ are the vector of states $\{K_t, D_t, R_t^*\}$ and controls $\{C_t, H_t, Y_t, I_t, TB_t, KA_t, w_t, u_t, R_t, R_t^d, \lambda_t\}$, respectively; v_{t+1} is a vector of structural perturbations driven, in this case, by the unique random shock to the world interest rate, $\epsilon_t^{R^*}$; and the matrices M, C are functions of the structural parameters. This system can be compactly written as a law of motion equation:

$$\Psi_{t+1} = \Phi\Psi_t + B\epsilon_{t+1}^{R^*} \tag{26}$$

On the other hand, having data on a vector X_t , this can be expressed as a non-invertible linear combination of the state variables in a measurement equation:

$$X_t = \Gamma\Psi_t \tag{27}$$

where Γ is a conformable matrix that maps the observable time series of the observable elements X_t to their theoretical counterparts in Ψ_t . The equations (26)-(27) are the starting point for a time invariant Kalman filter.

The experiment undertaken here uses data on the *observed* driving force, e.g. the world interest rate (see Figure 2.1), from the period 1920 to 1940, $X = \left\{ \widehat{R}_t^* \right\}_{t=1920}^{1940}$, and uses the Kalman filter to recursively construct one-step-ahead optimal forecasts of the entire vector, $\left\{ \widehat{\Psi}_t \right\}_{t=1920}^{1940}$. The simulated time series are then compared to the observed ones.

The first comparison is done by matching the empirical second moments against the simulated ones. As it is usually done in business cycles studies, both the simulated and empirical time series are filtered before using an HP-filter with $\lambda = 100$. Table 4.1 presents the results of this experiment. The upper panel shows the empirical moments computed using the yearly data on five of the macroeconomic variables presented for Colombia during the period 1923-1940 (see Table 2.3): aggregate output; consumption; investment; the trade balance share; and the real ex-ante world interest rate. The lower panel presents the simulated counterparts.

The model performs relatively well in terms of reproducing the observed second moments. First, the high volatility of consumption relative to output's, a main business cycle property in developing economies (Aguilar and Gopinath, 2007), is replicated successfully. The covariance and serial cross correlations with output are relatively well matched, although some are a bit over estimated. A notable success of the model is to capture the countercyclical trade balance share, specially with lead values of output. Likewise, the negative correlation of the world interest rate with lead income is well captured, but not the contemporaneous or lagged negative correlations. A drawback of the model is, however, the small volatility in investment that is not borne out in the data. In fact, while the model does capture the high serial correlation between investment and output, it does so at the cost of reducing the volatility of investment vis a vis the observed one.

The second comparison between the simulated model and the data is carried out by plotting the log differences in the time series for output. Figure 4.2 plots the model based log-differences for the simulated income and the Colombian data for the period 1925 to 1935 (this is the data shown in Table 2.3). As was described in the second section, like most Latin American countries, Colombian GDP exhibited an expansionary phase of the business cycle between 1925 and 1929. The recession occurred in the two years after, between 1930 and 1931. And a sharp recovery was observed from 1932 onwards. Two results are immediate from looking at the model performance. First, the model does a pretty good job at replicating the expansionary phase of the cycle from 1925 to 1929. It also reproduces a contractionary phase with a recession in 1931. Second, the model fails by a large extent in replicating the strong recovery experienced from 1932. In fact, it predicts a much bigger recession during the years 1932-1934, in sharp contrast to what is observed in the data.

Overall, the model does a good job in reproducing some of the key moments, and in particular, a countercyclical trade balance share, as well as the negative correlation of the world interest rate with lead income. In addition, the model does well in matching the expansionary phase and the fall in output dynamics that followed the capital inflows and outflows between 1925 and 1931. But

the model misses completely the strong recovery experienced after 1932. This, however, is not surprising because, as will be documented with some detail in the next section, the model does not incorporate two key elements that were crucial in some Latin American economies during the early 1930s: the active role of countercyclical policy in an environment with virtually no capital flows and the incentives for import-substituting activities offered by the relative price changes. These will be analyzed next.

5 The Role of Countercyclical Policy

While capital outflows and aggregate demand contraction for Latin American exports during the Great Depression had severe real effects in the region, the story of rapid recovery in many countries in the region is also a salient characteristic of the 1930s. This is probably the most dramatic conclusion in the papers collected in Thorp (1984). The views about the recovery mechanisms are, nonetheless, diverse among scholars. While some stress the role of exports recovery, others point out the important role played by countercyclical fiscal and monetary policies in conjunction with relative price adjustments. These views are brilliantly presented by Diaz-Alejandro (1983, 1984) for whom a distinction must be made between the large and “reactive” Latin American countries (i.e. Argentina, Brazil, Chile, Colombia, Mexico, Peru and Uruguay) where active countercyclical policies were adopted, starting with the abandonment of the Gold Standard parities; and small or very dependent countries (i.e. Cuba, Panama, and other Central American and Caribbean countries) that maintained their peg to the US dollar throughout the 1930s. Reactive countries, it is argued by Diaz-Alejandro, were able to devalue their nominal exchange rate, thereby accelerating the domestic relative price adjustment and encouraging a reallocation of resources toward the import-competing sectors. Importantly for him, this process was backed by expansionary monetary and fiscal policies that minimized the negative consequences on internal aggregate demand from deflationary forces.

Colombia could well be categorized as a representative illustration among the “reactive” countries. During the first two years of the international crisis, 1929-1930, the outflow of gold from the reversal of capital flows, worsened by the fall in the country’s terms of trade, led to very low levels of foreign reserves in the Banco de la Republica and, in accordance with the Gold Standard’s adjustment mechanisms, brought about the country’s strongest deflation in the twentieth century (Sanchez, et.al. 2007). The Banco de la Republica raised interest rates to defend the exchange rate parity, which had a transmission effect over the commercial interest rates, as can be seen

from Table 2.3. To further reaffirm Colombia's commitment to the Gold Standard, hoping this would lead to resumption of foreign-capital flows, government authorities once again turned to the "Money Doctor": E.W. Kemmerer⁹. But the continuous drop in foreign reserves together with the pressure of interest groups made impossible to defend the exchange regime and on September 24, 1931, a few days after England abandoned the Gold Standard, Colombia suspended the free trade of gold and the convertibility of the money supply, establishing controls over exchange operations (Sanchez, et.al. 2007).

Having direct control over the stock of international reserves, Colombia's monetary authorities pursued an expansionary policy immediately after the Gold Standard was abandoned. The reflationary policy was implemented by increasing the credit to the central government and by lowering the banks' discount rate¹⁰. Following Meisel (1991), Figure 5.1 presents the evolution of real money supply in Colombia for the period 1923-1936. It is immediate to see the extraordinary effect of the expansionary policy over the real money supply in the two years that followed the abandonment of the Gold Standard, from 1932 to 1933. In addition, it is important to note how this policy put downward pressure to the commercial interest rates, as can be seen from Table 2.3.

While the real effects of capital outflows between 1930-31 were severe relative to Colombia's long-run economic record during the twentieth century, comparative studies have found it to be one of the best stories of fast recovery among the Latin American countries during the Depression (Towmey, 1981). Partial evidence from key sector indicators in Table 2.3 reveals that this was the result of highly uneven performance among sectors. On one hand non-tradable non-agricultural activities were highly affected. The construction indexes, for example, exhibit decreases of over 40% between 1929-32. Evidence in Ocampo (1984) shows this was also true for other sectors such as internal transportation and a few manufacturing activities. On the other hand, agricultural and mining production did very well during the crisis, showing actually a real decrease only in 1931. In addition, industrial and manufacturing activities suffered only mildly between 1930-31, and, more remarkably, initiated an extraordinary boom from 1932. This industrialization has been one of the most widely known examples of structural changes emanating from this period in Latin America (Echavarria, 1999).

To what extent this successful story of fast recovery can be attributed to the countercyclical role of monetary policy explained above? On a general Latin American perspective, Diaz-Alejandro

⁹After a second mission, Kemmerer gave a series of proposals aimed at fighting deflation by expanding both the Banco de la República's monetary supply capacity to commercial banks, while remaining under the Gold Standard.

¹⁰In particular, the Central Bank's direct credit to the government was boosted after the partial financing of the expenditures during the brief war with Peru in 1932 (see Avella, 2004)). See Sanchez, et.al. (2007) for further details on the expansionary monetary policy measures implemented.

(1983) assigns a key role to these policies to the extent that they appear to have successfully contained the deflationary pressures that could have overwhelmed the incentives to invest in import substitution activities. In the Colombian case, Ocampo and Montenegro (1984) conclude that government policy was also very effective in reorienting demand towards internal production¹¹. To others the countercyclical demand oriented measures only complemented the natural adjustment that went under way during the last years of the Gold Standard whereby deflationary forces depreciated the real exchange rate and generated enough movements in relative prices (Sanchez, 1994). Evidence of private entrepreneurs that were responsive to price incentives is extensively presented in Echavarria (1999) for the industry sector. The next section tackles the role of countercyclical policy formally by modifying the general equilibrium framework developed earlier.

5.1 Model

The model in Section III is modified to formally explore the role of countercyclical monetary policy in the rapid recovery from the crisis in the early 1930 in Latin America, using, again, Colombia as a benchmark. The model is modified in the following three dimensions. First, money is introduced via a cash-in-advance restriction (Lucas and Stokey (1987)) but where the use of cash is restricted to the purchase of consumption goods only. Second, the economy is closed with no trading or financial links with the rest of the world. This is clearly an oversimplification but it is justified under the basis that: (i) the foreign financial flows, once the key in explaining the business cycle in the 1920s, were virtually gone by the early 1930s and the Latin American countries had no access to foreign financial markets; and (ii) the recovery, as was described above, was mostly driven by import-substituting activities more related to a closed than to an open economy. Also, this assumption gives more scope to monetary policy. Third, monetary policy is assumed to take place via a simple constant Friedman-type rule except that temporary deviations from it are driven by exogenous monetary policy shocks. The financial sector and the role of financial frictions in the previous model become now the channels through which monetary policy has real effects by allowing money transfers from the central bank to go directly to the financial system.

5.1.1 Households

The main modifications to the model follow McCandless (2008) closely. Consider now a *closed* economy populated by a continuum of identical households indexed by i , where $i \in [0, 1]$. A repre-

¹¹In particular, the presence of protectionist trade barriers is underscored by the authors. The analysis of these measures, however, goes well beyond the scope of this study.

sentative household i has preferences described by the same utility function as in (1). Households face now a cash-in-advance constraint on their consumption purchases. At the beginning of each period, households are holding money that they are carrying over from the previous period. They lend some of this money to a financial intermediary who lends it to the firms for working capital, and use the rest of this money to purchase consumption goods and invest in new capital. Formally, household i maximizes (1) subject to a cash-in-advance constraint

$$P_t c_t^i \leq M_{t-1}^i - N_t^i \quad (28)$$

a budget constraint

$$\frac{M_t^i}{P_t} + i_t^i = w_t h_t^i + u_t k_t^i + \frac{R_t^n N_t^i}{P_t} \quad (29)$$

and the capital law of motion (3); where the variables $\{k_t^i, w_t, h_t^i, i_t^i, u_t\}$ are as in the previous model; M_{t-1}^i is the amount of money holdings household i carries over from the previous period; N_t^i is the household's nominal lending to the financial intermediary in period t for which it receives a gross nominal interest rate equal to R_t^n ; and P_t is the price level in period t . Money is thus used for both paying for consumption goods and for deposits in the financial intermediary. The gross income from deposits appears in the budget constraint because it can be used to finance next period's capital or money holdings¹².

5.1.2 Banks

Banks continue to operate in a perfectly competitive market and to finance the firms' need for working capital. This time, however, given that the economy is closed, banks cannot capture funds from foreign investors. Instead they rely on deposits from households and (stochastic) injections of money from the central bank. Under a zero-profit condition, the banks's budget constraint implies that income from lending to firms the funds they receive each period must be equal to the interest rate paid to deposits. Formally

$$R_t^f (N_t + (g_t - 1) M_{t-1}) = \int_0^1 R_t^n N_t^i di \quad (30)$$

where R_t^f is the gross interest rate firms pay on the working capital they borrow from banks; N_t is the the aggregate level of lending by households to the financial system; M_t is the aggregate stock of money; and g_t is the gross growth rate of money whose dynamics will be specified later.

¹²The reader should observe also that capital adjustment cost are taken out from the household's budget constraint. The results from the previous model suggest so.

5.1.3 Firms

The productive sector operates similarly as in the previous model. It uses a technology equal to (10); its production process is subject to the same working capital constraint $\kappa_t \geq \eta w_t h_t^f$; $\eta \geq 0$. and operates under the following two optimality conditions

$$w_t \left[1 + \eta \left(\frac{R_t^f - 1}{R_t^f} \right) \right] = F_2 \left(k_t^f, h_t^f \right) \quad (31)$$

$$u_t = F_1 \left(k_t^f, h_t^f \right) \quad (32)$$

5.1.4 Central Bank

To close the model we assume a central bank that conducts a very simple Friedman-type monetary policy rule,

$$M_t = g_t M_{t-1} \quad (33)$$

where g_t , the gross growth rate of money in period t , is assumed to evolve according to an AR(1) process

$$\ln g_{t+1} = (1 - \rho) \ln \bar{g} + \rho \ln g_t + \varepsilon_{t+1}^g \quad (34)$$

and \bar{g} is assumed to be the long-run gross growth rate of the money supply and ε_{t+1}^g are *i.i.d.* innovations to the process that can be viewed as independent and transitory monetary policy shocks. Thus, while in steady state the central bank supplies money following an "exact" Friedman-type of rule, in the short-run, however, it temporarily deviates from it by producing exogenous monetary policy shocks.

I calibrate \bar{g} to be 1.084 using the mean growth rate for the money supply (M1) for the period 1920-1940 using data from the Colombian monetary history by Sanchez, et.al. (2007). Equation (34) is now the only driving force of the model.

5.1.5 Competitive Equilibrium

Market clearing conditions for allocations and inputs (15)-(18), and (20)-(21) from the previous model apply here as well. In addition

$$M_t = M_t^i \quad (35)$$

$$N_t = \int_0^1 N_t^i di \quad (36)$$

Also, an equilibrium condition for the financial market requires that all of the funds that households have lent to banks plus net financial injections or withdrawals from the monetary

authority are lent to firms to finance the working-capital needs:

$$N_t + (g_t - 1) M_{t-1} = P_t \eta w_t H_t \quad (37)$$

To summarize: a competitive equilibrium for the closed economy is the set of processes for allocations

$$\{C_t, K_t, M_t, H_t, Y_t, I_t, N_t\}_{t=0}^{\infty}$$

and prices

$$\{w_t, u_t, R_t^n, R_t^f, P_t\}_{t=0}^{\infty}$$

satisfying conditions (28); (29); (3); (10), (30), (37), all holding with equality; the three optimality conditions associated to the household's problem (not shown) and to the firm's problem (31)-(32), and the endogenous process for the money supply (33); given the exogenous process for g_t described by (34) and given initial conditions for $\{K_0, M_{-1}, g_0\}$.

5.2 Results

In this section the model is solved by taking a log-linear approximation around the non-stochastic steady state and using the same parameterization as in the previous case. Next, the same quantitative experiment undertaken in section III is replicated: the monetary model is assessed quantitatively by simulating the model using the *observed* time series for the money supply growth in Colombia as the driving force, $X = \{g_t\}_{t=1930}^{1940}$, and the Kalman filter is employed to recursively construct one-step-ahead optimal forecasts of income, $\{\widehat{Y}_t\}_{t=1930}^{1940}$. The observed dynamics of output are compared to the ones simulated by the monetary model. Importantly, the model is simulated only from 1930, i.e. one year prior the abandon of the Gold Standard and the year which marked the beginning of the recession and the inability of Colombia to access the international financial markets. In other words, the model is simulated for the most part, during the period where the monetary authority had effective control over the money supply.

Figure 5.2 plots the simulation results. Three aspects are worth noticing. First, the model is capable to reproduce the 1930-31 recession. This is, however, not too surprising because one should expect that under a Gold Standard regime, on a recession money supply follows closely the income process. Second, on the overall picture, the monetary model does reproduce the economic recovery in the years that followed after the reversal of the capital flows unlike the previous model. The monetary model does get a response of output after the countercyclical policy undertaken by the monetary authorities, particularly from 1933. Yet, third, the model is unable to capture the

timing of the fast recovery. And the year to focus here is 1932 when the model still predicts null aggregate growth but the economy exhibited a strong recovery with income growing over 6%. This particular year, looking once again to the economic indicators in Table 2.3, had two distinctive trends. On one hand this year is the beginning of the a period of accelerating industrialization driven by import-substitution activities with yearly growth averages of over 14%. On the other hand, this year appears as one in which the real exchange rate depreciation process consolidated with a fall of over 13% in this indicator.

In summary, the active role of countercyclical monetary policy in the years that followed the great reversal of capital flows to Colombia appears to have had a real effect that is validated by the theoretical model. Nonetheless, the implied monetary shocks do not appear to be enough to account for the early strong recovery, particularly in the first years of the 1930s. I view this fact, together with the other macroeconomic evidence (real exchange depreciation and the strong recovery in the industry sector) as indirect evidence of the important role played by relative prices in the import substitution process that accompanied the strong recovery in Colombia.

6 Concluding Remarks

A well-recognized stylized fact about Latin American economies is the large macroeconomic volatility they exhibit. This study has focused on one of the explanations to this fact offered by the literature: the relevance of external shocks to financial markets. The idea is that Latin American economies exhibit low levels of aggregate savings forcing them to rely heavily on foreign investment, via capital inflows. However, this makes them vulnerable to external shocks to financial markets that make capital flows highly exogenous to domestic conditions resulting in large macroeconomic fluctuations. Evidence of this is given by the sizeable economic fluctuations observed in the Latin American business cycles during three famous episodes of large capital inflows and outflows to the region throughout the twentieth century. In particular the episode of large capital inflows and outflows of the 1920s and early 1930s stands out for its magnitude in both the large boom and the steep recession recorded in most Latin American countries.

This study uses this "historical experiment" to study the transmission mechanism by which external shocks turn into large capital flows with sizeable macroeconomic fluctuations. In addition it studies the role of countercyclical policy undertaken in the recovery phase among many "reactive" Latin American countries. While an overview of the Latin American is offered, particular attention is given to Colombia which appears as a representative country in terms of the main trends observed

in the region.

The framework of analysis combines a historical account of the main stylized facts, with a theory for the transmission mechanism of external shocks and an empirical analysis. The historical account made the case that the interest rate and the banking system are the key channels to understand the mechanics by which capital inflows/outflows turn in economic booms/busts. The model rationalizes, within a dynamic general equilibrium framework, the external forces that drive capital flows and, simultaneously, generate macroeconomic fluctuations. It does so by relying on two key features: the presence of random foreign financial shocks and the presence of domestic financial frictions. An alternative version of the model is also offered to account for the role of countercyclical monetary policy in the recovery phase of the early 1930s. Lastly, the empirical analysis assesses the performance of the model in matching the main stylized facts in the data. It does so by running an experiment in which the observed processes for the model's driving forces, the world interest rate and the growth rate of the money supply, coupled with the dynamic nature of the model, serve as the basis for simulation. The simulated-based time series are then compared to their empirical counterparts. In particular, the observed dynamics of GDP are compared to the ones simulated by the model.

Using a full-fledged model to understand the macroeconomic fluctuations experienced by Latin American economies during this turbulent time forces, by construction, to obviate many other dynamics that were certainly important. Nonetheless it is shown that the models offer a reasonably good approximation to the observed dynamics. From a qualitative perspective, the model is able reproduce important capital account surpluses in conjunction with significant positive deviations from their long-run trend, in accordance with the main business cycles' stylized facts observed in the Latin American countries during the 1920s. From a quantitative perspective, the model does well in matching the expansionary/contractionary phases in output dynamics that followed the capital inflows/outflows between 1925 and 1931. Moreover, the active role of countercyclical monetary policy in the years that followed the great reversal of capital flows appears to have had a real effect that is validated by the theoretical model.

Many issues remain unresolved. On the empirical front, for example, the obvious extension is to assess the model performance with Latin American countries other than Colombia, and in particular for those countries on which data on government yields exist and could be used as proxies for the country interest rates. On the theoretical front, no serious attention was given to the repudiation of the sovereign debt by many of the Latin American countries, nor to the role of terms trade

fluctuations. It would be interesting to assess, for example, the connection between the business cycle and the debt dynamics along the lines of Mendoza and Yue (2008). Likewise indirect evidence of the important role played by relative prices suggests that a model with terms of trade, along the lines of Mendoza (1995), could improve the performance in the fast recovery period. I leave this for future research.

More generally, a central goal of this paper is the combination of theoretical general equilibrium modeling, time series analysis and historical evidence on Latin American business cycles in order to improve our understanding of business cycles in developing countries. This is a crucial step in the process of designing appropriate stabilization policies and sound macroeconomic management in these countries.

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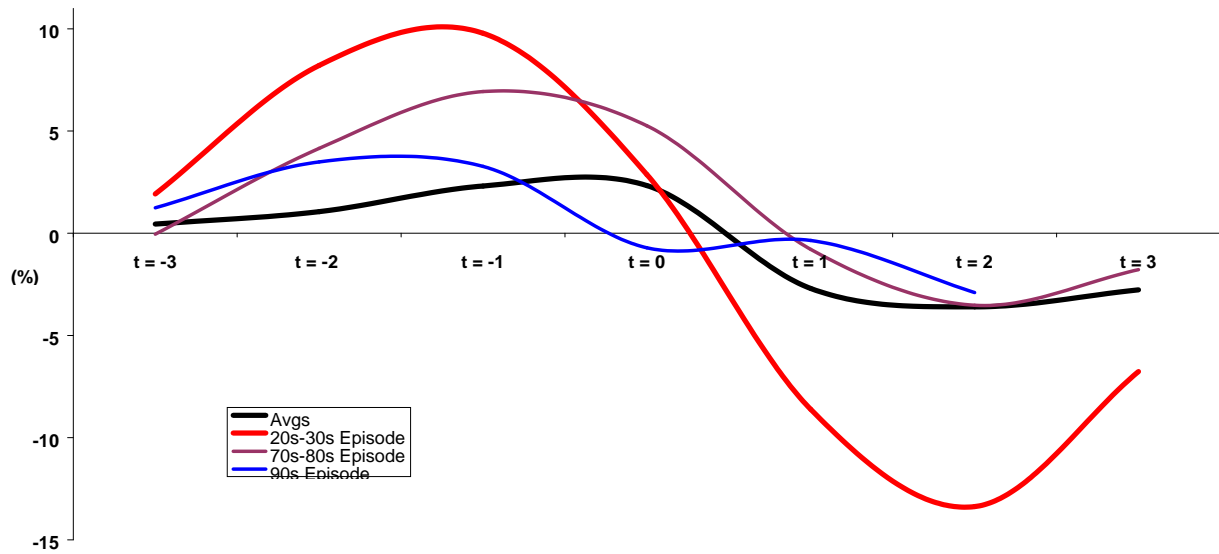
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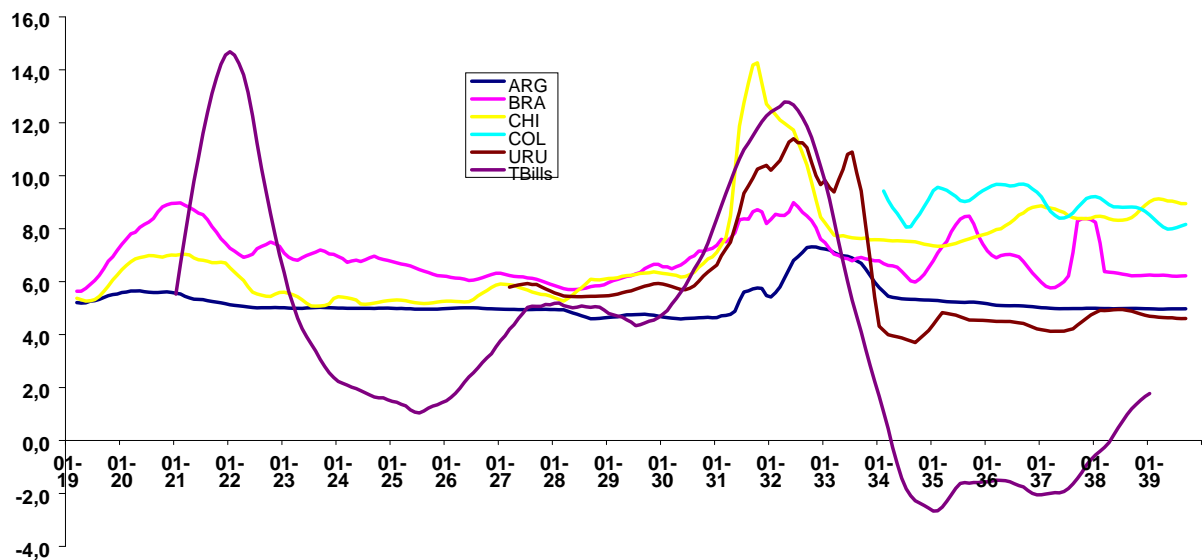
Appendix

Figure 1.1: Latin American Real GDPpc Cycle (HP-Filtered). Average (1910-2001) Vs Capital Inflows/Outflows Episodes(*)



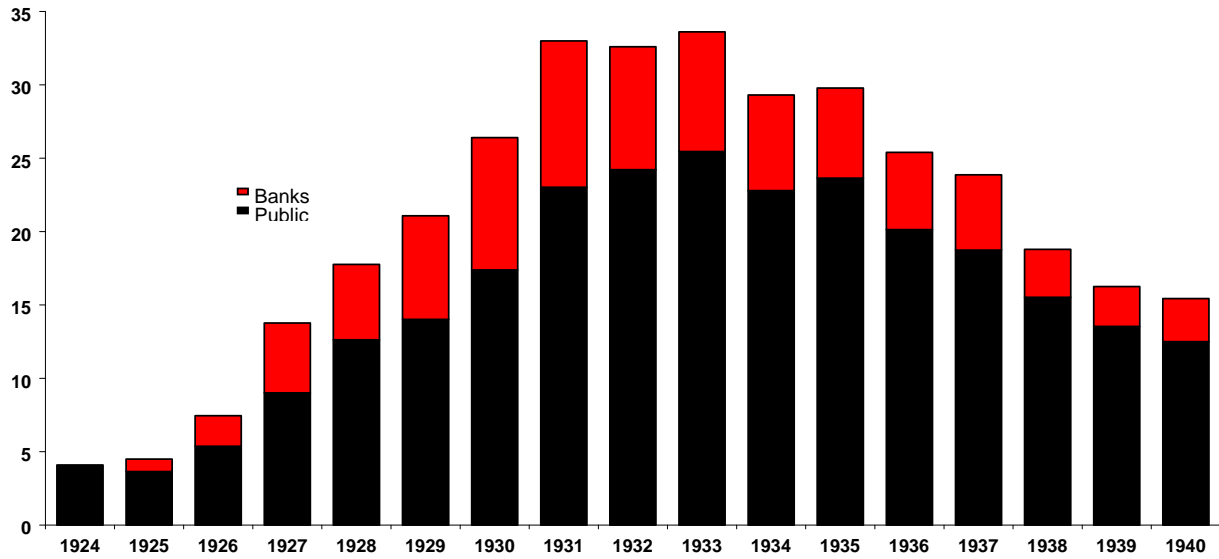
(*) Note: The countries included are: Argentina, Brazil, Chile, Colombia and Mexico. Source: Madisson (2007) and the author's calculations. The midpoint years in each of the three episodes are: 1931, 1982, 2000.

Figure 2.1: Governments Bond Yields in Latin American countries and Real (ex ante) Tbills Yield, 1919-1940(*)



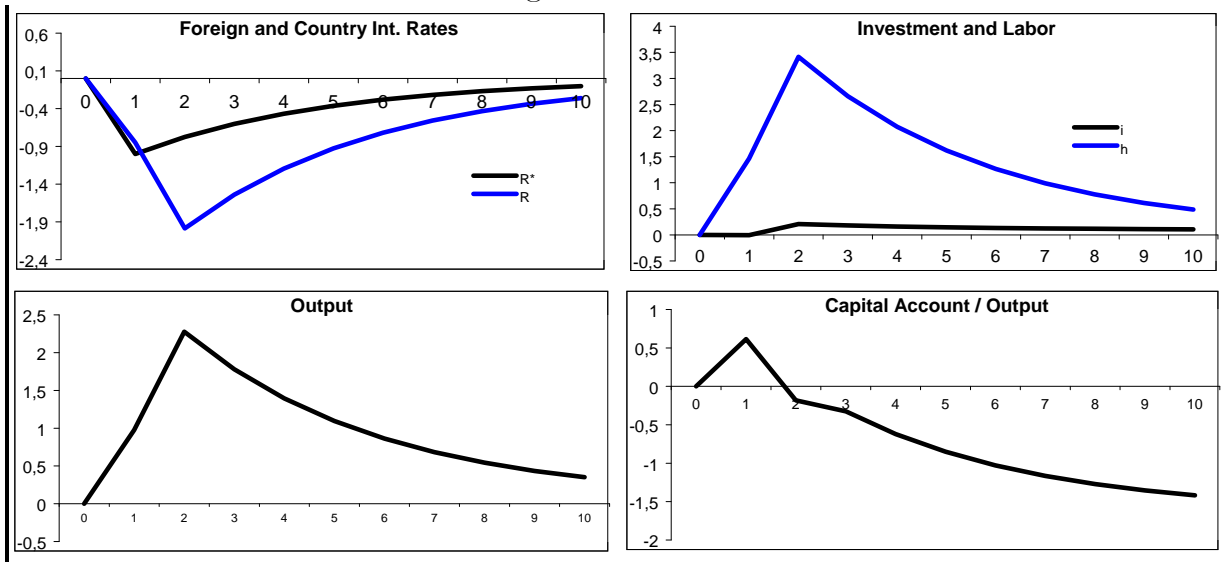
(*) Source: Global Financial Data.

Figure 2.2: Colombian External Debt as Percentage of GDP^(*)



(*) Source: Avella (2004) and GRECO (2002).

Figure 4.1: Impulse Response Functions after a negative 100-basis points shock to the Foreign Interest Rate^(*)



(*) Note: Values are percentage deviations from steady state levels.

Figure 4.2: Data and Model Based GDP Growth Dynamics: Colombia, 1925-35

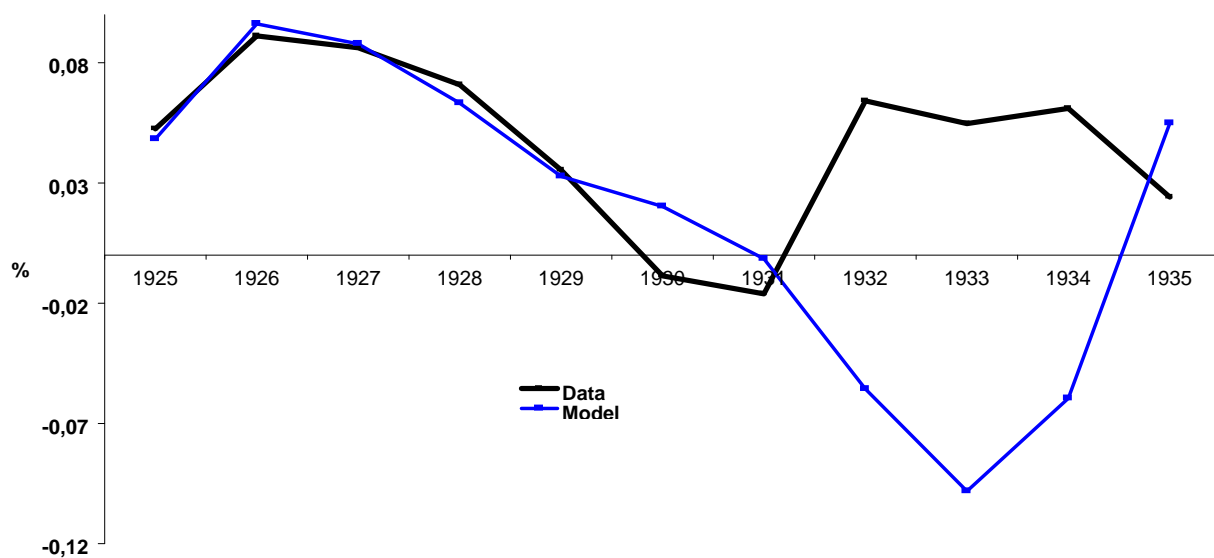
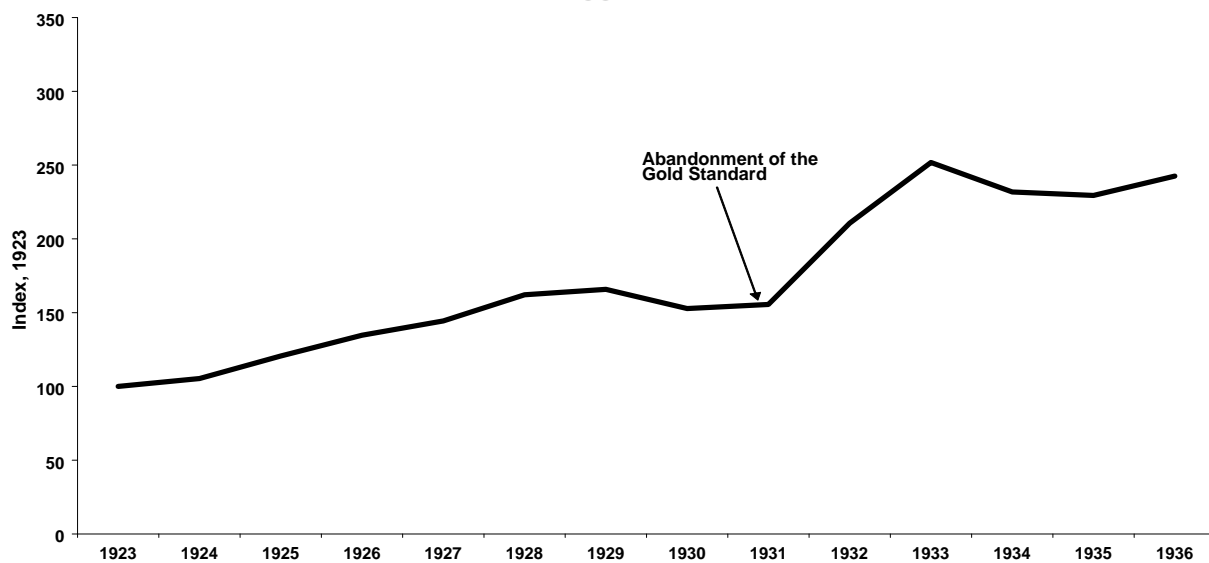


Figure 5.1: Real Money Supply in Colombia, 1923-1936(*)



(*) Source: Sanchez et.al. (2007) and GRECO (2002).

Figure 5.2: Data and Models Based GDP Growth Dynamics: Colombia, 1925-35

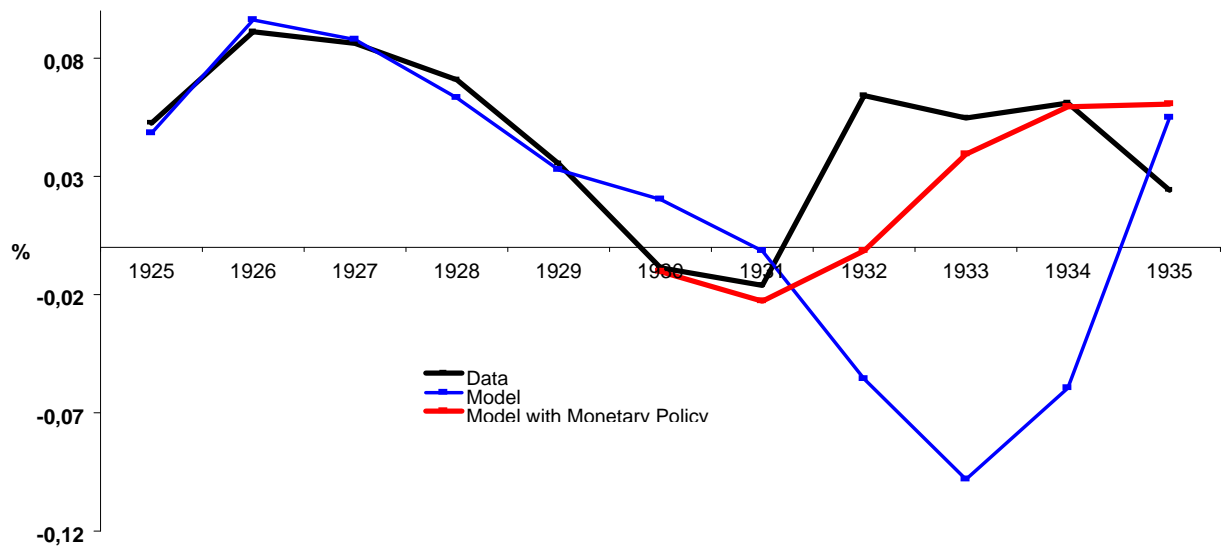


Table 2.1: Capital Inflows to Latin America, 1920-35. (Millions of Dollars)^(*)

Periodo	New Foreign Bonds Issues in US Markets		Gross Supply of US Private Funds to Latin America						
	TOTAL Gross Nominal Value	From Latin America	Total	Argentina	Brazil	Chile	Colombia	Peru	Others
1920	497	45	-	-	-	-	-	-	-
1921 - 1923	1808	568	411	151	139	62	7	3	50
1924 - 1925	2045	345	317	257	9	18	13	15	5
1926 - 1928	3713	1038	990	263	198	178	183	94	74
1929 - 1931	1805	377	288	171	41	64	2	2	8
1932 - 1935	85	2	-	-	-	-	-	-	-

(*) Source: Avella (2007).

Table 2.2: Colombian Bonds in US and Net Capital Flows to Colombia, 1923-1934^(*)

Year	Price Index of Colombian Bonds in New York (1927=100)		Net Capital Inflows to Colombia			
	7% Bonds	6,5% Bonds	Source: Meisel (1990)		Source: Urrutia y Fernandez (2003)	
			Total Value (Thousands of Dollars)	Share of Total foreign Income (%)	Using BoP data (% of GDP)	Using National Accounts Data (% of GDP)
1923		103,28	8655	12,2		
1924		108,61	8195	8,3		-1,8
1925		109,56	6708	7,0	2,0	2,2
1926		109,70	28164	18,4	0,8	1,0
1927	100,00	100,00	52957	28,0	3,7	1,9
1928	101,19	97,13	66235	28,6	4,1	3,0
1929	93,61	75,96			-1,3	-2,0
1930	80,30	66,12			-7,8	-6,3
1931	51,68	25,14			-11,0	-9,3
1932	17,66	33,33			-7,9	-5,3
1933	18,09	23,50			-2,9	-3,0
1934	17,44				-5,2	-6,2

(*) Note: Data on 7Percent and 6,5Percent bonds taken from Patino Roselli (1981) and The Commercial and Financial Chronicle Journal, respectively.

Table 2.3: Aggregate, Sectoral and Other Economic Indicators of Colombia: 1923-1936(*)

Year	Macro. Indicators					Sector Indicators		
	GDP	Private Consumption	Investment	Trade Balance to GDP (%)	Real Exchange Rate	Agriculture and Mining	Industry and Manufacturing	Construction
1923	90				120			
1924	95				106			
1925	100	100	100	2,3	100	100	100	100
1926	110	106	124	2,4	89	113	110	200
1927	119	110	147	-0,5	79	115	108	202
1928	128	110	180	-1,0	73	126	109	325
1929	133	119	152	3,7	83	128	113	246
1930	132	109	99	15,1	104	134	107	163
1931	130	113	81	14,6	110	127	105	139
1932	138	110	115	14,8	124	133	120	143
1933	146	132	95	11,9	141	139	140	177
1934	155	153	95	9,5	163	144	149	159
1935	159	148	113	12,1	187	146	164	202
1936	167	154	122	12,0	169	155	179	216

Year	Other Economic Indicators							
	Loans by the Financial System to GDP (%)	Tons of Cargo shipped through the Magdalena River.	Girardot Livestock Trade Fair	Machinery Imports to GDP (%)	Flow of exchanged checks	Real Estate: Squared Mts. Of New Licenses.	Real Estate: New Mortgages Issued	Mortgages: Annual Average Interest Rates (%)
1923		75	76	3,6			163	13,81
1924	1,1	87	93	4,0	40	61	145	13,89
1925	6,7	100	100	4,8	100	100	100	12,12
1926	7,1	126	130	4,8	143	158	96	11,23
1927	8,1	146	119	3,1	201	228	145	11,63
1928	8,0	158	114	1,2	194	366	180	11,19
1929	8,7	149	75	0,8	184	387	219	12,4
1930	9,6	105	68	0,8	136	231	210	15,08
1931	9,5	91	66	1,5	135	141	204	14,42
1932	7,7	101	42	2,3	151	128	65	10,63
1933	6,2	111	58	2,8	200	445	33	9,13
1934	4,0	135	79	3,1	217	464	27	10,02
1935	4,3	146	115	4,5	256	485	73	10,07
1936	4,7	158	128	4,1	273	483	76	10,64

(*) Note: Unless specified, all variables are in real terms using the GDP deflator by GRECO (2002) and are presented as indices using 1925 as the base year. Sources: GDP taken from GRECO(2002); Uses and Sectors of GDP taken from DNP using CEPAL (1957); Loans taken from Asobancaria; Machinery Imports taken from Ocampo y Montenegro (1984); All the other economic indicators taken from Patino (1981).

Table 4.1. Empirical and Simulated Second Moments^(*)

Variable (X)	s.d(X) / s.d(Y)	cov(X)	Cross Correlation of X_(0) with		
			Y_(-1)	Y_(0)	Y_(+1)
Empirical Moments: Colombian Yearly data, 1925-1940					
Y	1,0	0,61 0,063	0,61 0,063	1,00 0,000	0,61 0,063
C	1,9	0,39 0,263	0,22 0,549	0,55 0,081	0,54 0,108
I	6,3	0,50 0,145	0,44 0,203	0,89 0,000	0,67 0,034
TB/Y	0,7	0,57 0,088	-0,31 0,381	-0,74 0,009	-0,84 0,003
R*	1,1	0,57 0,000	-0,37 0,290	-0,26 0,444	-0,31 0,390
Simulated Moments					
Y	1,0	0,87 0,001	0,87 0,001	1,00 0,000	0,87 0,001
C	1,6	0,92 0,000	0,65 0,040	0,92 0,000	0,99 0,000
I	0,1	0,88 0,001	0,95 0,000	0,96 0,000	0,74 0,014
TB/Y	0,3	0,74 0,014	0,41 0,243	-0,04 0,906	-0,71 0,020
R*	1,1	0,57 0,000	0,77 0,010	0,44 0,180	-0,21 0,560

(*) Note: Moments taken from HP-filtered empirical and simulated variables. Small numbers are p-values for the Null of no significance.