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ITALY'S CURRENT ACCOUNT SUSTAINABILITY:
A LONG RUN PERSPECTIVE, 1861-2000

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Abstract

This paper analyzes the sustainability of Italy's current accounts from 1861 to 2000. Whether or not we find empirical support to sustainability depends on the statistical condition of stationarity of the current account series. Non stationarity of the current accounts implies the economy has violated its intertemporal budget constraint. Unit root tests to study the stationarity of Italy's current accounts suggest that in the long run (1861 to 2000) Italy's external position was sustainable: the Italian economy seems to have used the external deficits (surpluses) to smooth its aggregate consumption. The persistent current account deficits in the shorter 1861-1913 period were generated by foreign capital inflows that allowed investment to rise and, in turn, to prompt the nation's productivity and economic efficiency. Therefore, they do not seem to have curbed economic growth.

JEL Code: C22; F32; O1

Keywords: Current account sustainability, economic development, Italy, unit root tests, Granger causality

1. Introduction

The sustainability of current account (henceforth CA) has been receiving increasing attention from economists, policymakers and investors because it represents an indicator of a country's economic performance. The sustainability of an external deficit in the long run is related to the solvency constraint of the economy. An economy is solvent in the long run when its present-value budget constraint holds, in other words if the country can borrow to finance this deficit (Milesi-Ferretti and Razin 1996).

A well-known approach to deal with this issue is due to Thirlwall (1979). According to this view the balance of payments acts as a constraint on GDP growth. This view assumes that exports are totally exogenous, determined by core country demand for the nation's products, while imports are a function of the nation's GDP. In this scenario, the CA balance is seen as highly sensitive to the domestic rate of growth; if the rate exceeds some threshold level, the balance would be plunged into deficit. In the short run, this deficit can be financed by selling reserves or by importing capital. However, the only effective solution to a persistent CA deficit is a lower rate of growth.

In recent years, this Keynesian view has been superseded by the intertemporal approach to the CA. In this perspective, the CA derives from savings and investment decisions that are based on intertemporal considerations. The CA is an intertemporal phenomenon which smoothes the time profile of consumption in the face of shocks to output, investment, or government expenditures (Obstfeld and Rogoff 1995). According to this model, when current income deviates from its permanent level the economy finds optimal to borrow and lend in international markets in order to smooth consumption fluctuations. This borrowing and lending generates CA deficits and surpluses. These CA fluctuations respond to preferences for current consumption over future consumption and viceversa and act as a buffer against shocks to economic fundamentals. Thus, in this optimization framework, CA deficits should not require policy intervention and do not necessarily curb economic growth. Attention must be paid to the sustainability of the external deficit, which depends on the economic structure of the country involved (i.e., the degree of openness, the levels of savings and investment, the health of the financial system), the composition of the CA balance and how deficits are financed (Milesi-Ferretti and Razin 1996). If CA strengthens when output is high and weakens when it is low, its fluctuation is indicative o a nation's ability to smooth its consumption. An ongoing CA deficit in a rapidly growing economy may be an indication that investment and growth are not unduly constrained by domestic saving capacity, facilitating the country's convergence to steady state levels of output and capital intensity. In this latter case, there is no reason why a prolonged CA deficit should constrain economic growth as it prompts capital accumulation, increased efficiency in the use of production factors and higher total factor productivity that generate additional export revenues, thereby enhancing intertemporal solvency (Sachs 1981). A country may also run a large and resilient CA deficit if inflows of equity capital finance it, as the latter does not increase the external debt. Equity allows an economy to sustain larger CA imbalances than CA deficits that are financed by inflows of more liquid assets since it reduces the extent of trade surpluses which are necessary to pay back foreign creditors (Rossini and Zanghieri 2009).

Most of the empirical literature on CA has concentrated on developed countries, especially the high and growing US CA deficit (Trehan and Walsh 1991; Wu 2000; Edwards 2006; Holmes 2006a; Chen 2011a), and on developing countries (Holmes 2006b; Holmes et al. 2009; Kim et al. 2009; Bracke et al. 2010; Donoso et al. 2013; Chen 2011b).

Most of these studies focus on relatively short time spans generally starting from the 1960s, whereas the analysis of the external imbalances in a long run perspective has attracted much less attention.[1] The long run perspective is instead important because an economy may depart for several years from a sustainable CA path even though external debt may be sustainable, or violations of the sustainability condition (for the whole sample) may arise from sporadic deviations of the CA series from what can be regarded as a stationary path.

[1] One exception is Bajo-Rubio (2011).

The aim of this paper is to contribute to fill this gap by analysing the sustainability of Italy's CA in the long run, from its political Unification in 1861 to 2000. We think Italy is a good case study because it is a late-comer nation which caught up with industrialization in the late 19th century and then exhibited an excellent economic performance that enabled it to join the G-7 group in the 1970s. By focusing on a long time span of about 140 years, we analyse the sustainability of Italy's CA position across different stages of development, i.e., in the earlier stage when Italy was a developing economy and also in a later stage when it had become a developed economy.

This paper analyses Italy's CA sustainability by studying the statistical properties of the CA to GDP series. Non stationary behaviour of the CA implies that the country has violated its intertemporal budget constraint. As demonstrated by Trehan and Walsh (1991), the stationarity of the CA to GDP series is a sufficient condition for the intertemporal budget constraint to hold. Broadly speaking, stationarity is possible whether external deficits (or surpluses) are not too persistent over time.

Using integration, cointegration and Granger causation analysis we find the following results. CA to GDP series is stationary over the years 1861-2000, that is, Italian economy satisfies its intertemporal external constraint in the long run by using the external deficits to smooth domestic consumption. Hence, these deficits were sustainable and did not slow down economic growth. However, we also find that this result is not robust for the shorter 1861-1913 sub-period, when Italy was still a developing economy. In fact, we find that the CA to GDP series in this first sub-period is not stationary due to persistent deficits in the 1860s, in the 1880s, and in the five years prior to WW1. By contrast, stationarity is confirmed for the later 1929-2000 and 1948-2000 sub-periods, i.e., when Italy had become a developed economy. We test whether CA deficits constrained economic growth in the 1861-1913 sub-period by analysing the genesis of CA fluctuations, that is, whether the latter were generated by the dynamics of the GDP or by variations in capital inflows. The Granger causality supports for the second hypothesis. Italy's persistent CA deficits from Unification to WW1 seem to have been used to prompt the nation's productivity and economic efficiency and so they do not seem to have undermined the nation's intertemporal solvency.

The remainder of this paper is structured as follows. Section 2 presents the sources and data we have used in our analysis. Section 3 illustrates the evolution of Italy's CA balance from Unification in 1861 to 2000. Section 4 presents a theoretical model that implies a long run equilibrium between imports and exports and sets the statistical condition for the sustainability of the external deficits. This section also presents an econometric strategy to test the genesis of CA fluctuations in the years 1861-1913 and whether they constrained economic growth. Lastly, section 5 concludes.

2. Sources and data

In 1957 the Italian national statistical office produced the first estimate of Italy's balance of payments for the period 1861-1956 (Istat 1957). However, several objections were raised against these series, which proved unreliable and internally inconsistent. In particular, as far as the years prior to WW1 are concerned, Istat seems to have significantly overestimated the earnings of services, and especially of tourism (Marolla and Roccas 1992; Zamagni 1992). But, above all, Istat emigrants' remittances seem excessively variable. In fact, these estimates appear to be based on the gross *flow* of migrants, which similarly jumps up in 1901 and 1905, whereas remittances seem more reasonably tied to the savings by the *stock* of Italians abroad, which grew more smoothly from under one million in 1871 to some six million in 1911 (Fenoaltea 2011).

To tackle such criticism, Morys (2006) presented a new and more reliable series of Italy's balance of payments for the period 1868-1913. The major difference with regard to the Istat series concerns the criteria that have been used to estimate emigrants' remittances. In the absence of good data relating to the money transferred by Italian emigrants, Morys relied on the number of emigrants and approximated what an average Italian emigrant would transfer home in his first, second, third etc. years based on some general rules on what determines the pattern of remittances that have been discussed in the literature on emigration. As this author reconstructed also the remittances for Austria-Hungary – for which much better data are available – he could double-check his results and found that the series for this latter country was very close to the one he constructed by using the general rules presented in the literature. For the 1919-1931 years, a new series of Italy's balance of payments which revised the Istat one was instead presented by Falco (1995).

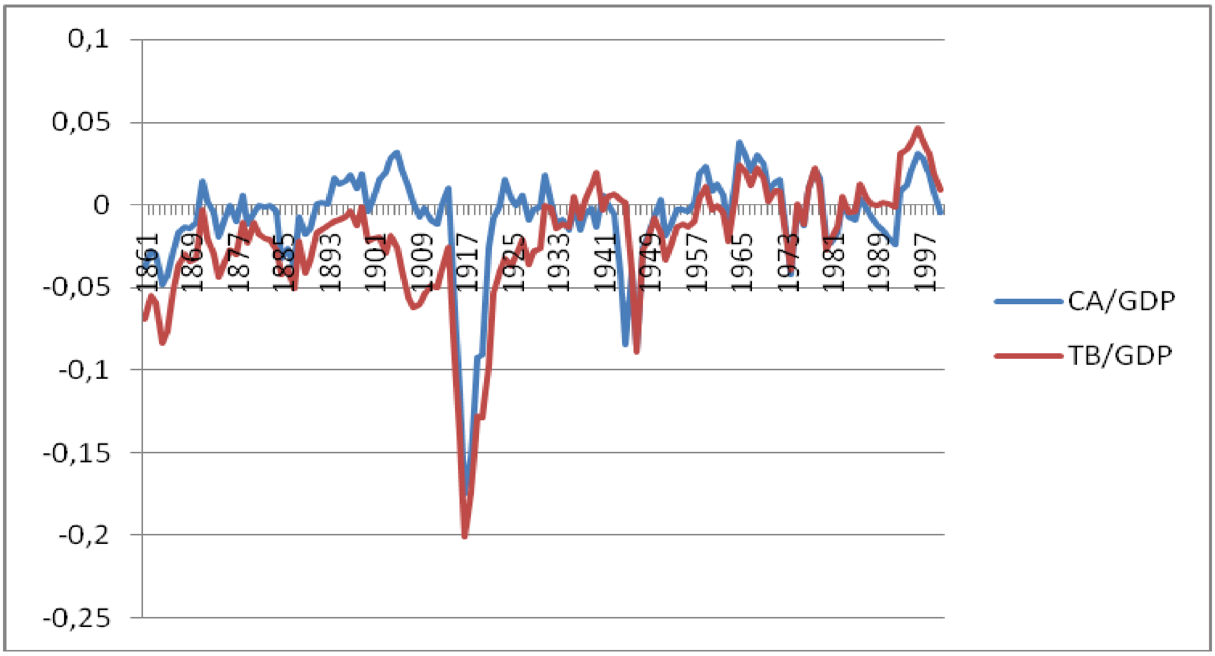
So, in this paper we use the CA data of the Istat series for the years 1861-1867 and 1914-1918, the Morys series for the years 1868-1913, and the Falco series for the years 1919-1931. For the years 1932-1946 we resort once again to the Istat series, as it is the only source available for this period. For the years from 1947 onwards the more accurate estimates of Italy's CA balance have been provided by the Bank of Italy. In this paper we use them in the versions that have been published in Masera (1970) and Banca d'Italia (2008, 2010).

We then use the new series of Italy's GDP that have been provided by the Bank of Italy for the 150th anniversary of the nation's political unification (Baffigi 2011). To proxy the impact of Italy's CA deficits on productivity growth we use data on real investment in machinery and equipment and on net capital stock. Baffigi (2011) provides us the series for the former, while data for the latter are drawn from Broadberry et al. (2011). Lastly, the series of Italy's real exchange – that we use to test the intertemporal approach for the 1861-1913 years – is from Fenoaltea (2011).

3. The evolution of Italy's current accounts

Figure 1 shows the evolution of Italy's balance of payments from 1861 to 2000. The dynamics of the CA to GDP and of the trade balance to GDP ratios are distinctly reported. The trade balance was constantly negative from Unification to 1936. Prior to WW1, this persistent deficit was reduced and in several years covered by other headings of the CA balance, above all remittances of Italian emigrants abroad. Another important source of earnings was tourism. As a result, the CA balance performed far better than the trade balance and was positive in 21 years out of 54. A persistent CA surplus was obtained for eighteen years in a row from 1891 to 1908. However, there were also three periods of persistent CA deficits: 1861-70, 1879-90, and 1909-13.[2]

Fig. 1 – CA/GDP and TB/GDP ratios in Italy (1861-2000)



Legend: CA/GDP = Current Account to GDP ratio; TB/GDP = Trade Balance to GDP ratio.

During WW1 both the balance of trade and the CA deficits rose to record values (-20% and -17% of GDP, respectively, in 1917) and were financed by increasing capital imports from allied nations, especially the US and the UK (Keynes 1919).

In the early 1920s both balances improved. While the trade balance remained negative uninterruptedly until 1935, the CA became positive for a few years in the mid 1920s and in the early 1930s.

In the 1930s the two balances started to move closer together. The CA balance as a share of GDP fluctuated on very low values, as capital controls were imposed and international financial markets

[2] By contrast, Spain showed persistent CA deficits from 1850 to 1890. These were followed by a period, between 1891 and 1913, in which surpluses prevailed, with the exception of the years 1899-1904 (Prados de la Escosura 2010).

shut down. This made it impossible to finance high and persistent surpluses, or deficits, with capital flows.

The final year of WW2 and its immediate aftermath saw another big CA deficit, fuelled by the war effort and by the needs of the immediate reconstruction. International relief aid – especially the Marshall plan – helped to fund this deficit. In the period from the late 1940s to 2000 the trade balance and the CA balance returned to move close together and Italy never faced large persistent CA deficits. Such a CA behaviour seems common to most countries in the post-WW2 years: a survey conducted on a large dataset of 120 countries has shown that large CA deficits tended not to be persistent, with few countries running large deficits for five years or more in a row (Edwards 2002).[3] As expected, the variation of the CA to GDP ratio was smaller in the Bretton Woods years, when capital flows were still heavily controlled, before rising in 1974-2000, when capital flows were liberalized and became more instable. There were also some years (i.e., 1974, 1981, the early 1990s) in which Italy's CA deficit jumped to particularly high levels. However, in all these occasions the Italian economy was able to set in motion some counterbalancing forces that promptly reduced the CA deficit and brought it to balance. A decisive role in this respect was played by the devaluations of the Italian lira, which – by boosting exports and compressing imports – enabled the nation to quickly restore its external position.

The reduction of the volatility of the CA to GDP ratio after WW2 occurred at a time in which the composition of Italy's trade changed. Exports boomed and became polarized in two groups, the first one pertaining to the sectors of the "Made in Italy" (personal and household goods such as textiles, clothing, leather goods, footwear, items made of wood, tiles, furniture, jewellery, cosmetics, musical instruments, toys and sports items), and the second one to some specialized engineering products (mostly motor-vehicles and machinery to make "Made in Italy" goods). Imports also

[3] However, there were also some countries (both developed and developing) that experienced persistent CA deficits which have no comparison with the Italian case. For example, Australia's CA balance was negative for 35 years in a row from 1960 to 1995 without curbing the nation's economic growth (Milesi-Ferretti and Razin 1996).

boomed and Italy became a net importer of road vehicles, chemicals and high-tech products. By contrast, emigrants remittances shrank as a consequence of the end of Italian mass emigration. At a same time, starting from the 1960s, intra-industry trade increased as a consequence of a growing division of labour among nations (Federico and Wolf 2011). The reduction of the CA balance as a share of GDP after WW2 was also a consequence of this latter process, which made the export and import series increasingly co-move together.[4]

4. Theoretical background and econometric strategy

4.1. The theoretical model

Empirical literature focuses on the implication of the sustainability of the CA unbalances which is a direct implication of the intertemporal approach to CA (Hakkio and Rush 1991; Husted 1992; Gundlach and Sinn 1992). As showed by Trehan and Walsh (1991), the statistical stationarity of the CA series is a *sufficient* condition for the intertemporal budget constraint to hold. In the following, we outline a testable model derived from a simple model of intertemporal budget constraint as in Bajo-Rubio (2011). It implies a long run equilibrium between imports and exports and hence the substainability of the external deficits. The individual current-budget constraint is

$$\boldsymbol{C}_0 = \boldsymbol{Y}_0 + \boldsymbol{B}_0 - \boldsymbol{I}_0 - (1 - \boldsymbol{r})\boldsymbol{B}_{-1}$$

where $\boldsymbol{C}_0, \boldsymbol{I}_0, \boldsymbol{Y}_0, \boldsymbol{B}_0$ and $\boldsymbol{r}$ are the current consumption, investment, output, international borrowing and one-period interest rate, respectively. $(1 - \boldsymbol{r})\boldsymbol{B}_{-1}$ is the initial debt. After several assumptions, Husted (1992) derives the following testable model:

$$\boldsymbol{Exp}_t = \alpha + \beta \boldsymbol{Imp}_t + \varepsilon_t \qquad (1)$$

[4] Pistoresi and Rinaldi (2012) find a strong bidirectionality between imports and exports in Italy from 1945 to 2004.

where Exp and Imp are, respectively, the GDP's ratio of the exports of goods and services and the imports of goods and services plus net interest payments and net transfer payments. Hence, we define the CA balance as a ratio to GDP as CA/GDP = (Exp – Imp). The intertemporal budget constraint implies a strong long run relationship between Exp and Imp, that in terms of equation (1) it requires $\beta = 1$ and ε_t stationary. If the time series of Exp and Imp are both non stationary variables I(1), the condition, $\beta = 1$ and ε_t stationary, implies the existence of a common trend (i.e cointegration) between Exp and Imp and the deviations from this common trend of the two variables are only temporary. Equivalently, this condition requires the stationarity of the CA/GDP.

4.2. Stationarity of Italy's current accounts

Now we perform unit root tests to determine the univariate properties of CA/GDP. We perform this analysis on different periods. In particular, we perform ADF tests (OLS/GLS) and KPSS test. The null of the ADF tests is non stationary series (unit root) while the null of the KPSS is stationary series. Hence, if both reject their nulls then we have no confirmation, but if test ADF rejects the null but test KPSS does not (or viceversa) we have confirmation.[5] Table 1 reports the ADF tests (OLS version) for the *levels* and *first differences* of the CA/GDP by using different specifications and lags. We perform these tests for the whole 1861-2000 period and for some sub-periods of interests: 1861-1913 (when Italy was a developing nation), 1929-2000 (from the Great Depression onwards), and 1948-2000 (from WW2 onwards). We strongly reject the null hypothesis of non stationarity of the ADF tests for the period 1861-2000: Italy's CA to GDP ratio is a stationary series, that is its

[5] See Dickey and Fuller (1979) and Kwiatkowski et al. (1992). Chen (2011) and Kim et al. (2009) summary different methods to test for CA sustanaibility (e.g different unit root tests and cointegration procedures).

deviations from the long run equilibrium due to exogenous shocks to imports and/or exports are only temporary. In other words, in the long run the Italian intertemporal budget constraint holds.[6]

Table 2 reports the ADF tests for several other variables we use in sub-section 4.3. The stationarity of the CA/GDP series is robust to the confirmation analysis sketched in the initial part of this section and also to the change in the estimator OLS vs GLS. Table 3 summarizes the final outcomes for the ADF (GLS) and KPSS tests. They confirm the results of the ADF (OLS) tests outlined in Table 1.[7]

However, the nation's solvency may not hold in the short run, that is over shorter time spans. In fact, we find that CA sustainability for the 1861-1913 sub-period is not guaranteed, since CA/GDP is not stationary due to persistent deficits in the 1860s, in the 1880s and in the five years prior to WW1. These persistent deficits may have constrained economic growth depending on whether they were generated by the dynamics of the GDP or by variations in capital inflows. By contrast, stationarity is confirmed for the 1929-2000 and 1948-2000 sub-periods.

4.3. The 1861-1913 sub-period: external deficits and economic growth

This sub-section addresses the role of the external constraint on Italy's economic growth for the sub-period 1861-1913. Persistent external deficits can constraint economic growth because they could increase the interest rates the nation has to pay to attract foreign capital, and they could impose an excessive burden on future generations increasing interest payments and lowering the standard of living. However, there are also cases in which persistent CA deficits are not linked to severe domestic macroeconomic imbalances and hence they do not curb economic development. As anticipated in the Introduction, Fenoaltea (2011) suggests that Italy's external deficits in the years

[6] Margani and Ricciuti (2009) – using a different dataset – find a similar result of stationarity for Italy's trade balance series in the years 1861-2004.

[7] The complete set of results is available on request.

1860-1913 were determined by capital inflows, that boosted the investment cycle, i.e., they financed the imports of machinery, technology and raw materials. These in turn boosted productivity and exports prompting economic growth and CA readjustment.

Hence, a CA disequilibrium appears because the nation imports more capital than before. As a result, the real exchange rate rises (as the currency appreciates, or the domestic price level increases relative to the foreign one). This surge in the real exchange rate in turn increases the CA deficit: the CA deficit and capital imports again rise together, and the real exchange rate rises too. A similar argument holds if the initial equilibrium is disturbed in the opposite sense, by a reduction in capital imports: the CA deficit and capital imports decline together, and the real exchange rate also declines.

Fenoaltea shows that, prior to WW1, the Italian currency was strong when the CA deficits and capital flows were high, and weak when they were low. With a brief exception in the early 1870s, the movement in the real exchange rate was parallel to that in the CA deficit and capital imports: the CA-deficit cycle was generated by the capital-import cycle, and not vice-versa.

The Fenoaltea's argument can be represented by this sequence of causation (henceforth, Fenoaltea's cycle):

↑↓ Foreign capital inflows → ↑↓ real exchange rate → ↑↓ trade deficits→ ↑↓ CA deficits→ ↑↓ productivity growth

This nexus among the changes in real exchange rate, CA deficits and productivity growth (which leads to economic growth) could be analysed in an econometric framework by using techniques appropriate for estimating long run equilibrium and testing causation. In the case of time series data a test for the direction of causation is suggested by Granger (1969). For simplicity, Equations (1) to (4) present the testing strategy for the bivariate case. A variable X improves the prediction of a variable Y, that is X Granger causes Y, if current Y can be predicted better by using past values of

X than by not doing so, given that all other past information in the information set is used. Suppose X and Y are linear *covariance stationary* time series.[8] Thus X and Y can be written as follows:

(1) $$X_t = \sum_{i=1}^{m} a_i X_{t-i} + \sum_{j=1}^{n} b_j Y_{t-j} + \varepsilon_t$$

(2) $$Y_t = \sum_{i=1}^{m} c_i Y_{t-i} + \sum_{j=1}^{n} d_j X_{t-j} + u_t$$

where ε_t, u_t are zero mean and finite covariance matrix random vector. The *causality test* is

a) X causes Y if $H_0 : d_j = 0, j = 1,..., n$ is rejected

b) Y causes X if $H_0 : b_j = 0, j = 1,..., n$ is rejected

Bidirectional causality occurs if both (a) and (b) hold. Unidirectional causality from X to Y occurs if (a) holds but (b) does not. In order to test these null hypothesis in (a) and (b), F statistics are calculated for jointly significance of the d_j in equation (1) and for b_j in equation (2).

For the Granger causation test, the hypothesis of covariance stationarity of the time series used is crucial to avoid spurious results. In general, the levels of the time series are not covariance stationary while their first difference are stationary. The growth rate of these variables (ΔX and ΔY) are stationary, while X and Y are not. If these are the statistical properties of the variables, we can only test for Granger causation by using first difference stationary models, that is

3) $$\Delta X_t = \sum_{i=1}^{m} a_i \Delta X_{t-i} + \sum_{j=1}^{n} b_j \Delta Y_{t-j} + \varepsilon_t$$

(4) $$\Delta Y_t = \sum_{i=1}^{m} c_i \Delta Y_{t-i} + \sum_{j=1}^{n} d_j \Delta X_{t-j} + u_t$$

[8] Time series are said to be covariance stationary if their moments up to the second order do not depend on time. Hence, for instance the mean must be constant and the shocks affecting stationary series have only temporary effects. These time series are also said I(0). By contrast a series is said to be difference stationary if its first difference is stationary but the series itself is not. A property of difference stationary series is that they do not have necessarily constant means and the variance grows with time without limit, moreover the shocks affecting them are permanent. These series are also said I(1).

However, the nexus among real exchange rate, CA deficit (or surplus) and economic growth or productivity growth may be a long run relationship. If this long run nexus exists but we do not include it in the estimation of models (3) and (4) we have mis-specification and "spurious causality". Hence, we have to test for Granger causation, to take into account the possible long run relationship among *the levels (values)* of real exchange rate, CA, economic or productivity growth among their short run dynamics. Granger type causality tests for a long run relationship are valid if the relevant variables are found to be *cointegrated*, that is they move together so closely over the long run that they share a stochastic (and possibly also deterministic) trend in common. In this latter case, as stressed by Granger (1988), there is a presumption for causality to run in at least one direction.

Suppose X is the CA ratio to GDP, Z Italy's real exchange rate (and Y is Italy's real GDP in logs). Moreover suppose these series are not covariance stationary, but they are cointegrated co-moving over time. In this case a three variables generalization of the Granger causality test, as in point (a) and (b) stated before, must be performed on the following ECM models:

(5) $$\Delta X_t = \sum_{i=1}^{m} a_i \Delta X_{t-i} + \sum_{j=1}^{n} b_j \Delta Y_{t-j} + \sum_{k=1}^{K} e_k \Delta Z_{t-k} + \delta ECT_{t-1} + \varepsilon_t$$

(6) $$\Delta Y_t = \sum_{i=1}^{m} c_i \Delta Y_{t-i} + \sum_{j=1}^{n} d_j \Delta X_{t-j} + \sum_{k=1}^{K} f_k \Delta Z_{t-k} + \delta ECT_{t-1} + \varepsilon_t$$

(7) $$\Delta Z_t = \sum_{i=1}^{m} g_i \Delta Z_{t-i} + \sum_{j=1}^{n} h_j \Delta Y_{t-j} + \sum_{k=1}^{K} l_k \Delta X_{t-k} + \lambda ECT_{t-1} + \eta_t$$

where ECT is the error correction term derived by cointegration analysis representing the long run equilibrium among the variables.

Suppose that the cointegration does not exists among these variables the ECM models above collapse in these short run specifications (ADL models)

(8) $$\Delta \boldsymbol{X}_{\boldsymbol{t}} = \sum_{\boldsymbol{i}=1}^{\boldsymbol{m}} \boldsymbol{a}_{\boldsymbol{i}} \Delta \boldsymbol{X}_{\boldsymbol{t-i}} + \sum_{\boldsymbol{j}=1}^{\boldsymbol{n}} \boldsymbol{b}_{\boldsymbol{j}} \Delta \boldsymbol{Y}_{\boldsymbol{t-j}} + \sum_{\boldsymbol{k}=1}^{\boldsymbol{K}} \boldsymbol{e}_{\boldsymbol{k}} \Delta \boldsymbol{Z}_{\boldsymbol{t-k}} + \varepsilon_{\boldsymbol{t}}$$

$$\Delta Y_t = \sum_{i=1}^{m} c_i \Delta Y_{t-i} + \sum_{j=1}^{n} d_j \Delta X_{t-j} + \sum_{k=1}^{K} f_k \Delta Z_{t-k} + \varepsilon_t \quad (9)$$

$$\Delta Z_t = \sum_{i=1}^{m} g_i \Delta Z_{t-i} + \sum_{j=1}^{n} h_j \Delta Y_{t-j} + \sum_{k=1}^{K} l_k \Delta X_{t-k} + \eta_t \quad (10)$$

To conclude, the causality testing procedure involves three steps. The first step is to test whether our variables of interests are stationary or not (*integration analysis*). If they are not stationary, the second step is to *test for cointegration*, that is for the existence of long run relationships among them. If cointegration exists, *Granger causality* must be tested on the ECM models 5-7, if cointegration does not exist on models 8-10.

Tables 2 and 3 summarise the results of the integration analysis (ADF test - OLS version) for the variables involved in the Fenoaltea's cycle: the CA to GDP ratio (CA/GDP), real exchange rate (ε) and different proxies for produttivity growth: real capital in machinery and equipment (logs) and real investment in machinery and investment (logs).[9]

Tables 2 and 3 suggest that all the variables are non stationary, in particular I(1), so we need to use in the analysis their first differences. Having all I(1) variable it is possible to perform cointegration analysis among them to search for common trends.

Table 4 shows that there is no cointegration in the sub-period 1861-1913: that is, the relationships among variations in real exchange rate, CA, real capital (or real investment) have a short-medium term nature. In other words, these variables do not share common trends in the long run.[10]

This result implies that to test for the Fenoaltea's cycle we have to use the ADL models 8-10. Tables 5 to 7 presents the results of Granger causality for different ADL spefications (lags). From all the specifications in all the tables the exogeneity of the real exchange rate strongly emerges: changes in CA/GDP and in productivity growth do not cause variations in real exchange rate. That

[9] The results of the integration analysis by using ADF (GLS) and KPSS are available on request.

[10] The no cointegration result is also obtained with DOLS and Johansen cointegration procedure The results are available on request. For DOLS see Stock and Watson (1993) while for Johansen procedure see Johansen (1991).

is, in the years 1861-1913 real exchange rate movements seem due to external shocks, i.e. in foreign capital inflows as suggested by Fenoaltea.

Moreover, Table 5 strongly suggests a unilateral Granger causation result: changes in real exchange rate cause movements in the CA. Tables 6 and 7 also include in the Granger causation analysis some proxies for productivity growth to close the Fenoaltea's cycle. In particular, Table 6 considers the growth in real capital in machinery and equipment and Tables 7 the growth in real investment in machinery and equipment. ADL specifications in these tables suggest unidirectional causation from real exchange rate to the CA/GDP to productivity growth. This result emerges for both proxies of productivity growth we have used, i.e., real capital growth (machinery and equipment) and real investment (machinery and equipment).[11]

In brief, our results seem to suggest that Italy's external deficits in the years 1861-1913 were determined by capital inflows, that were used to prompt investment, thereby boosting productivity and economic growth. Thus, they do not seem to have undermined the nation's intertemporal solvency.

[11] We also test the Fenoaltea's argument with respect to other variables: real GDP (logs), real total capital (logs) and real total investment (logs). The evidence of the unilateral Granger causality from CA changes to productivity growth emerges also for these proxies excepting for the GDP growth. Such a result might reflect the high weight of agriculture on Italy's GDP in the post-Unification years. In fact, in the 1860s agriculture was still the largest sector of the Italian economy accounting for about 45 per cent of the GDP. Its share declined slowly over time: it was still 40 per cent in 1890 and dropped below one third only at the eve of WW1 (Baffigi 2011). Agriculture was at once the largest sector, and the most variable. Ciccarelli and Fenoaltea (2007) identified a short cycle (roughly four years long) in Italy's GDP series that is essentially determined by its agricultural component. These short cycles were quite sharp until about 1890, then were much reduced. These wide agriculture-derived cyclical fluctuations of GDP have probably affected the result of our causality test on the link between external imbalances and GDP growth. So, the fact that we found no evidence that persistent CA deficits elicited economic growth does not rule out that they might nonetheless have prompted productivity and economic efficiency in the more modern sectors of the Italian economy. On the cyclical variability of Italy's GDP growth see also Sella and Marchionatti (2012). All these results are available on request.

5. Conclusions

This paper has analysed Italy's CA sustainability for the years 1861-2000. To assess the sustainability of the CA unbalances we use the fact that the economic notion of sustainability is linked to the statistical condition of stationarity: external deficits (or surpluses) are sustainable when the CA to GDP series is covariance stationary.

We find that the CA to GDP series is stationary over the period 1861-2000, that is, the Italian economy satisfies its intertemporal external constraint in the long run by using the external deficits to smooth domestic consumption. Hence, these deficits were sustainable and do not seem to have slowed down economic growth.

However, we also find that this result is not robust for the shorter 1861-1913 sub-period, when Italy was still a developing economy, due to persistent CA deficits in the 1860s, in the 1880s and in the five years prior to WW1. By contrast, stationarity is confirmed for the later 1929-2000 and 1948-2000 sub-periods, in which Italy had become a developed economy.

Finally, we test whether the persistent CA deficit in the 1861-1913 sub-period constrained economic growth by analysing the genesis of CA fluctuations, that is, whether these were generated by the dynamics of the GDP, as in the Keynesian view, or by variations in capital inflows, as in the intertemporal approach. We perform a Granger causality test that finds support for the second hypothesis. Italy's persistent CA deficits from Unification to WW1 seem to have been used to prompt the nation's productivity and economic efficiency and so they do not seem to have undermined the nation's intertemporal solvency. Such an inference is corroborated by the sustainability of the CA position Italy had reached in the later 1929-2000 and 1948-2000 sub-periods.

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Tables

Table 1. Stationarity of the current account to GDP ratio - ADF tests – (OLS)

Variable	Model 1 No constant included	Model 2 Constant included	Model 3 Constant and trend included	Presence of unit roots	Degree of integration
1861-2000, N = 139					
CA/GDP	ADF(0): -3.85(0.00)	ADF(0): -3.97 (0.00)	ADF(0): -3.97 (0.01)	NO	I(0)
CA/GDP	ADF(1): -4.10(0.00)	ADF(1): -4.20 (0.00)	ADF(1): -4.29 (0.00)	NO	I(0)
CA/GDP	ADF(4): -3.79(0.00)	ADF(4): -3.97 (0.00)	ADF(4): -3.97 (0.00)	NO	I(0)
1861-1913, N = 52					
CA/GDP	ADF(0): -2.91(0.044)	ADF(0): -2.88(0.055)	ADF(0): -3.02 (0.13)	NO/YES	I(0)/I(1)
CA/GDP	ADF(1): -2.33(0.018)	ADF(1): -2.29 (0.17)	ADF(1): -2.32 (0.42)	NO/YES	I(0)/I(1)
CA/GDP	ADF(4): -1.77 (0.07)	ADF(4): -1.74 (0.40)	ADF(4): -2.22 (0.47)	YES	I(1)
Δ(CA/GDP)	ADF(0): -8.63 (0.00)	ADF(0): - 8.54(0.00)	ADF(0): - 8.46 (0.00)	NO	I(0)
1929-2000, N = 72					
CA/GDP	ADF(0):-3.76 (0.00)	ADF(0): -3.81 (0.00)	ADF(0):- 3.95 (0.01)	NO	I(0)
CA/GDP	ADF(1): -3.11 (0.00)	ADF(1): -3.17 (0.02)	ADF(1): -3.31 (0.06)	NO	I(0)
CA/GDP	ADF(4): -2.70 (0.00)	ADF(4): -2.78(0.06)	ADF(4): -2.97 (0.16)	NO/YES	I(0)/I(1)
1948-2000, N = 53					
CA/GDP	ADF(0):- 5.17 (0.00)	ADF(0):- 5.08 (0.00)	ADF(0):- 4.80 (0.00)	NO	I(0)
CA/GDP	ADF(1): -4.94 (0.00)	ADF(1): -4.84 (0.00)	ADF(1): -4.51 (0.00)	NO	I(0)
CA/GDP	ADF(4): -4.13 (0.00)	ADF(4): -3.99 (0.00)	ADF(4): -3.61 (0.02)	NO	I(0)

Notes: I(0) means stationary series (no unit root is present). I(1) means non stationary series (i.e presence of at least one unit root).
ADF(p) indicates Augmented Dickey Fuller tests with differents lags p.
In parenthesis, next to the coefficients, find the p-values calculated by MacKinnon (1996)

Table 2. Stationarity of the real exchange rate, real capital stock in equipment and machinery (logs) and real investment in equipment and machinery (logs) - ADF tests – (OLS), 1861-1913, N = 52

Variable	Model 1 No constant included	Model 2 Constant included	Model 3 Constant and trend included	Presence of unit roots	Degree of integration
Real exchange rate, 1911 prices					
$\mathcal{E}$	ADF(0): 3.96 (0.99)	ADF(0): -0.11(0.94)	ADF(0): - 1.06 (0.92)	YES	I(1)
$\mathcal{E}$	ADF(1): 1.51 (0.96)	ADF(1): -1.13(0.70)	ADF(1): - 2.87 (0.18)	YES	I(1)
$\mathcal{E}$	ADF(4): 1.52 (0.96)	ADF(4): -0.23(0.93)	ADF(4): -2.04 (0.57)	YES	I(1)
$\Delta\,\mathcal{E}$	ADF(0): - 2.62(0.008)	ADF(0): -0.22(0.018)	ADF(0): - 3.19 (0.08)	NO	I(0)
Real capital stock (equipment and machinery) in logs, 2010 prices					
Lreal KE	ADF(0): 9.55 (1)	ADF(0): -1.21(0.66)	ADF(0): -0.89 (0.94)	YES	I(1)/I(2)
Lreal KE	ADF(1): 0.88 (0.89)	ADF(1): -2.28(0.17)	ADF(1): - 3.75 (0.09)	YES	I(1)/I(2)
Lreal KE	ADF(4): 1.32 (0.95)	ADF(4): -1.23(0.66)	ADF(4): -2.65 (0.27)	YES	I(1)/I(2)
Δ Lreal KE	ADF(0): -1.05 (0.29)	ADF(0): -1.55(0.49)	ADF(0): - 1.49 (0.00)	YES/NO	I(1)/I(0)
Real investment (equipment and machinery) in logs, 1911 prices					
Lreal IE	2.59 (0.99)	-2.19(0.20)	-1.46 (0.83)	YES	I(1)
Lreal IE	1.79 (0.98)	-2.07 (0.25)	-0.13 (0.64)	YES	I(1)
Lreal IE	1.34 (0.95)	-1.61 (0.47)	-1.91 (0.64)	YES	I(1)
Δ Lreal IE	-5.09 (0.00)	-5.70 (0.00)	-6.00 (0.00)	NO	I(0)

Note: I(0) means stationary series (no unit root is present). I(1) means non stationary series (i.e presence of at least one unit root).
ADF(p) indicates Augmented Dickey Fuller tests with differents lags p. In parenthesis, next to the coefficients, find the p-values calculated by MacKinnon (1996)

Table 3. Stationarity of the Italian current account to GDP ratio, real exchange rate, real capital stock in machinery and equipment (logs), real investment in machinery and equipment (logs)- A summary

Variable	Degree of integration from the ADF test - OLS	Degree of integration from the ADF test - GLS	Degree of integration from the KPSS test
Current Account: 1861-2000, N = 139.			
CA/GDP	I(0)	I(0)	I(0)
CA/GDP	I(0)	I(0)	I(0)
CA/GDP	I(0)	I(0)	I(0)
Current Account: 1861-1913, N = 52.			
CA/GDP	I(0)/I(1)	I(0)	I(0)
CA/GDP	I(0)/I(1)	I(0)/I(1)	I(1)
CA/GDP	I(1)	I(1)	I(0)
Δ (CA/GDP)	I(0)	I(0)	I(0)
Current Account: 1929-2000, N = 72.			
CA/GDP	I(0)	I(0)	I(0)
CA/GDP	I(0)	I(0)	I(1)/I(0)
CA/GDP	I(0)/I(1)	I(0)/I(1)	I(0)
Current Account: 1948-2000, N = 55.			
CA/GDP	I(0)	I(0)	I(0)
CA/GDP	I(0)	I(1)/I(0)	I(0)
CA/GDP	I(0)	I(0)	I(0)
Other variables: 1861-1913, N = 52.			
ε	I(1)	I(1)	I(1)
ε	I(1)	I(1)	I(1)
ε	I(1)	I(1)	I(1)
$\Delta\varepsilon$	I(0)	I(0)	I(0)
Lreal KE	I(1)/I(2)	I(1)/I(2)	I(1)
Lreal KE	I(1)/I(2)	I(1)/I(0)	I(1)
Lreal KE	I(1)/I(2)	I(1)/I(2)	I(1)
Δ Lreal KE	I(1)/I(0)	I(1)	I(0)
Lreal IE	I(1)	I(1)	I(1)
Lreal IE	I(1)	I(1)	I(1)
Lreal IE	I(1)	I(1)	I(1)
Δ Lreal IE	I(0)	I(0)	I(0)

Notes: I(0) means stationary series (no unit root is present). I(1) means non stationary series (i.e presence of at least one unit root). Note that the complete set of results for these tests is available in Tables 1-3 of a preliminary draft of the paper (Pistoresi and Rinaldi, 2013).

Table 4. Long run comovements (common trends) among current account to GDP ratio, real exchange rate, real capital stock in machinery and equipment (logs), real investment in machinery and equipment (logs)- Engle and Granger cointegration analysis - 1861-1913

Engle – Granger long run regression: $CA/GDP_t = \alpha + \beta_1 \varepsilon + \beta_2 LrealGDP_t + \eta_t$	
Variables	H_0 **: unit root in** η_t **(no cointegration, i.e no common trends)**
CA/GDP, ε	Test = - 2.65, p- value = 0.23, does not reject H_0 , NO COINTEGRATION
CA/GDP, ε, Lreal KE (Machinery and equipment)	Test = - 3.42, p- value = 0.13, does not reject H_0 , NO COINTEGRATION
CA/GDP, ε, Lreal IE(Machinery and equipment)	Test = - 3.00, p- value = 0.27, does not reject H_0 , NO COINTEGRATION

Notes: 5% critical values fot the Engle – Granger ADF test for cointegration: -3.80 (two regressors included) -4.16 (three regressors included) see Philips – Ouliaris (1990). P-values in Mac Kinnon (1996). The no cointegration result is also obtained with DOLS and Johansen cointegration procedure. For DOLS see Stock and Watson (1993) while for Johansen procedure see Johansen (1991).

Table 5. Italian current account to GDP ratio and real exchange rate - Granger causality - 1861-1913

$\Delta CA/GDP_t = \alpha + \beta_1 \Delta(CA/GDP)_{t-1} + ... + \delta_1 \Delta\varepsilon_{t-1} + ... + \eta_t$				
	H_0 **: the past of the exchange rate does not matter**	**F test – p-value**	**Outcome**	**Causality Conclusion**
ADL(1,1)	$H_0 : \delta_1 = 0$	p-value = 0.04	Reject H_0	Changes in exchange rate *cause* CA/GDP variations
ADL(2,2)	$H_0 : \delta_1 = \delta_2 = 0$	p-value = 0.02	Reject H_0	Changes in exchange rate *cause* CA/GDP variations
ADL(3,3)	$H_0 : \delta_1 = \delta_2 = \delta_3 = 0$	p-value = 0.00	Reject H_0	Changes in exchange rate *cause* CA/GDP variations
ADL(4,4)	$H_0 : \delta_1 = \delta_2 = \delta_3 = \delta_4 = 0$	p-value = 0.00	Reject H_0	Changes in exchange rate *cause* CA/GDP variations

$\Delta\varepsilon_t = \alpha + \beta_1 \Delta(CA/GDP)_{t-1} + ... + \delta_1 \Delta\varepsilon_{t-1} + ... + \eta_t$				
	H_0 **: the past of the current account does not matter**	**F test – p-value**	**Outcome**	**Causality Conclusion**
ADL(1,1)	$H_0 : \beta_1 = 0$	p-value = 0.77	Fail to reject H_0	Changes in CA/GDP *does not cause* exchange rate variations
ADL(2,2)	$H_0 : \beta_1 = \beta_2 = 0$	p-value = 0.99	Fail to reject H_0	Changes in exchange rate *do not cause* CA/GDP variations
ADL(3,3)	$H_0 : \beta_1 = \beta_2 = \beta_3 = 0$	p-value = 0.71	Fail to reject H_0	Changes in exchange rate *do not cause* CA/GDP variations
ADL(4,4)	$H_0 : \beta_1 = \beta_2 = \beta_3 = \beta_4 = 0$	p-value = 0.15	Fail to reject H_0	Changes in exchange rate *do not cause* CA/GDP variations

Notes: The no cointegration result implies we estimate an ADL models instead of an ECM models. Robust standard errors estimation.

Table 6. Current account to GDP ratio, real exchange rate and real capital stock in machinery and equipment (logs)- Granger causality - 1861-1913

$$\Delta \boldsymbol{CA/GDP}_t = \alpha + \beta_1 \Delta \boldsymbol{(CA/GDP)}_{t-1} + \dots + \delta_1 \Delta \varepsilon_{t-1} + \dots + \gamma_1 \Delta \boldsymbol{LrealKE}_{t-1} + \dots + \eta_t$$

	H_0 : **the past does not matter**	**F test – p-value**	**Outcome**	**Causality Conclusion**
ADL(1,1)	$H_0 : \gamma_1 = 0$	p-value = 0.29	Fail to reject H_0	Changes in KE growth *do not cause* CA/GDP variations
ADL(2,2)	$H_0 : \gamma_1 = \gamma_2 = 0$	p-value = 0.57	Fail to reject H_0	Changes in KE growth *do not cause* CA/GDP variations
ADL(1,1)	$H_0 : \delta_1 = 0$	p-value = 0.10	Reject H_0 (10%)	Changes in exchange rate *cause* CA/GDP variations
ADL(2,2)	$H_0 : \delta_1 = \delta_2 = 0$	p-value = 0.07	Reject H_0 (10%)	Changes in exchange rate *cause* CA/GDP variations

$$\Delta \boldsymbol{LrealKE}_t = \alpha + \beta_1 \Delta \boldsymbol{(CA/GDP)}_{t-1} + \dots + \delta_1 \Delta \varepsilon_{t-1} + \dots + \gamma_1 \Delta \boldsymbol{LrealKE}_{t-1} + \dots + \eta_t$$

	H_0 : **the past does not matter**	**F test – p-value**	**Outcome**	**Causality Conclusion**
ADL(1,1)	$H_0 : \beta_1 = 0$	p-value = 0.08	Reject H_0 (10%)	Changes in CA/GDP *cause* KE growth
ADL(2,2)	$H_0 : \beta_1 = \beta_2 = 0$	p-value = 0.00	Reject H_0	Changes in CA/GDP *cause* KE growth
ADL(1,1)	$H_0 : \delta_1 = 0$	p-value = 0.50	Fail to reject H_0	Changes in exchange rate *do not cause* KE growth
ADL(2,2)	$H_0 : \delta_1 = \delta_2 = 0$	p-value = 0.63	Fail to reject H_0	Changes in exchange rate *do not cause* KE growth

$$\Delta \varepsilon_t = \alpha + \beta_1 \Delta \boldsymbol{(CA/GDP)}_{t-1} + \dots + \delta_1 \Delta \varepsilon_{t-1} + \dots + \gamma_1 \Delta \boldsymbol{LrealKE}_{t-1} + \dots + \eta_t$$

	H_0 : **the past does not matter**	**F test – p-value**	**Outcome**	**Causality Conclusion**
ADL(1,1)	$H_0 : \beta_1 = 0$	p-value = 0.72	Fail to reject H_0	Changes in CA/GDP *does not cause* exchange rate variations
ADL(2,2)	$H_0 : \beta_1 = \beta_2 = 0$	p-value = 0.99	Fail to reject H_0	Changes in CA/GDP *does not cause* exchange rate variations
ADL(1,1)	$H_0 : \gamma_1 = 0$	p-value = 0.24	Fail to reject H_0	Changes in KE growth *do not cause* exchange rate variations
ADL(2,2)	$H_0 : \gamma_1 = \gamma_2 = 0$	p-value = 0.87	Fail to reject H_0	Changes in KE growth *do not cause* exchange rate variations

Notes: The no cointegration result implies we estimate an ADL models instead of an ECM models. Robust standard errors estimation.

Table 7. Current account to GDP ratio, real exchange rate and real investment in machinery and equipment (logs) - Granger causality - 1861-1913

$\Delta CA/GDP_t = \alpha + \beta_1 \Delta(CA/GDP)_{t-1} + ... + \delta_1 \Delta\varepsilon_{t-1} + ... + \gamma_1 \Delta LrealIE_{t-1} + ... + \eta_t$				
	H_0 : the past does not matter	**F test – p-value**	**Outcome**	**Causality Conclusion**
ADL(1,1)	$H_0: \gamma_1 = 0$	p-value = 0.04	Reject H_0	Changes in I growth *cause* CA/GDP
ADL(2,2)	$H_0: \gamma_1 = \gamma_2 = 0$	p-value = 0.36	Fail to reject H_0	Changes in I growth *do not cause* CA/GDP
ADL(1,1)	$H_0: \delta_1 = 0$	p-value = 0.06	Reject H_0 (6%)	Changes in exchange rate *cause* CA/GDP
ADL(2,2)	$H_0: \delta_1 = \delta_2 = 0$	p-value = 0.04	Reject H_0	Changes in exchange rate *cause* CA/GDP
$\Delta LrealIE_t = \alpha + \beta_1 \Delta(CA/GDP)_{t-1} + ... + \delta_1 \Delta\varepsilon_{t-1} + ... + \gamma_1 \Delta LrealIE_{t-1} + ... + \eta_t$				
	H_0 : the past does not matter	**F test – p-value**	**Outcome**	**Causality Conclusion**
ADL(1,1)	$H_0: \beta_1 = 0$	p-value = 0.30	Fail to reject H_0	Changes in CA/GDP *do not cause* I growth
ADL(2,2)	$H_0: \beta_1 = \beta_2 = 0$	p-value = 0.08	Reject H_0 (8%)	Changes in CA/GDP *cause* I growth
ADL(1,1)	$H_0: \delta_1 = 0$	p-value = 0.16	Fail to reject H_0	Changes in exchange rate *do not cause* I growth
ADL(2,2)	$H_0: \delta_1 = \delta_2 = 0$	p-value = 0.05	Fail to reject H_0	Changes in exchange rate *do not cause* I growth

$\Delta\varepsilon_t = \alpha + \beta_1 \Delta(CA/GDP)_{t-1} + ... + \delta_1 \Delta\varepsilon_{t-1} + ... + \gamma_1 \Delta LrealIE_{t-1} + ... + \eta_t$				
	H_0 : the past does not matter	**F test – p-value**	**Outcome**	**Causality Conclusion**
ADL(1,1)	$H_0: \beta_1 = 0$	p-value = 0.81	Fail to reject H_0	Changes in CA/GDP *does not cause* exchange rate
ADL(2,2)	$H_0: \beta_1 = \beta_2 = 0$	p-value = 0.89	Fail to reject H_0	Changes in CA/GDP *does not cause* exchange rate
ADL(1,1)	$H_0: \gamma_1 = 0$	p-value = 0.66	Fail to reject H_0	Changes in I growth *do not cause* exchange rate
ADL(2,2)	$H_0: \gamma_1 = \gamma_2 = 0$	p-value = 0.29	Fail to reject H_0	Changes in I growth *do not cause* exchange rate

Notes: The no cointegration result implies we estimate an ADL models instead of an ECM models. Robust standard errors estimation.

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