THE BALASSA-SAMUELSON EFFECT

& EUROPE'S SOUTHERN PERIPHERY

BY

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Preface

"In an open economy, the exchange rate is probably the most important price and it is intimately related to the concept of purchasing power parity (PPP)."[1] PPP is a theory of exchange rate determination based on an extension to the law of one price (LOOP) applied to the aggregate economy.[2] In essence, the PPP hypothesis states that nominal exchange rates move with differences in relative prices between economies therefore there should be a high correlation in aggregate price levels.

The Swedish economist, Gustav Cassel, is the father of PPP's empirical application. PPP's practical application began with the end of the First World War, when world's financial system collapsed, stimulating a series of debates about reconstruction. Returning to pre-war exchange rates was out of the question given the fact that various nations had vastly differing inflation experiences during the war. Cassel whose work was highly influential at the time, stepped in encouraging the use of PPP as a way of attaining relative gold parities. He recommended calculating cumulative consumer price index (CPI) inflation rates from the beginning of 1914 and using these inflation differentials to calculate the exchange rate changes that were necessary to uphold PPP. Purchasing Power Parity theory has since received extensive consideration in economic literature since Cassell's "The Present Situation of Foreign Exchange Rates,"[3] and has become a theoretical backbone of many long-run international trade and finance hypotheses.

Kenneth Rogoff (1996)[4] gives an excellent account of the successes, failures and alternative resolutions to empirical purchasing power parity (PPP). Rogoff (1996) explains that

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[1] Asea, Patrick K., W. Max Corden (1994). "The Balassa-Samuelson Model: An Overview." *Review of International Economics,* Working Paper No. 710: pp. 2.
[2] The Law of One Price proposes that, in a perfectly competitive world economy (with no natural or regulatory barriers) arbitrage equalizes prices of identical goods across countries.
[3] Cassell, Gustav (1916). "The Present Situation of Foreign Exchange Rates." *Economic Journal*: pp. 62-65.
[4] Kenneth Rogoff (1996). "The Purchasing Power Parity Puzzle," *Journal of Economic Literature*, Vol. 34, No. 2 (June): pp. 647-668.

most economists do believe in some variation of long-run PPP. On the other hand, short-run PPP's empirical failure has left few economists to believe it equalizes international goods prices. This failure has been attributed to nominal wage and price stickiness, as presented in Rudiger Dornbusch's overshooting model[5], but evidence suggests that even this explanation is not complete since it implies PPP convergence within 1 to 2 years (since this is the speed of wage and price adjustment). Rogoff further explains how researchers were shamed for years by their difficulty in proving long-run PPP convergence (that is, they found it hard to reject that real exchange rates follow a random walk under floating exchange rate regimes)[6]. This was difficult to digest because all good theoretical models suggest that, even if there are short-term nominal price rigidities, there should be some sort of PPP convergence in the long-run when shocks to real exchange rates fade away. The embarrassment caused many to blame lack of test power for the failure to reject the random walk hypothesis, since slowly dampening PPP deviations may require many decades of real exchange rate data for successful unit root (random walk) rejection. Thus, with the use of long-horizons and cross sectional data, along with more advanced econometric techniques, evidence of mean reversion in real exchange rates (rejections of the random walk model) was finally achieved. A consensus among the studies on the half-life of PPP deviations was also reached, being 3 to 5 years or as Rogoff explains: "PPP deviations tend to damp out, but only at the slow rate of roughly 15 percent per annum." (pp. 658) And, in an attempt to reconcile this very slow rate of convergence to long-run PPP a major advancement in the literature was unveiled, namely the Balassa-Samuelson Hypothesis.

[5] Dornbusch, Rudiger. "Expectations and Exchange Rate Dynamics," J. Polit. Econ., Dec. 1976, 84(6), pp. 1161-76.

[6] see Froot, Kenneth A. and Rogoff, Kenneth. "Perspectives on PPP and Long-Run Real Exchange Rates," in Gene Grossman and Kenneth Rogoff, eds. 1995.

1. Introduction

1.1 The Balassa-Samuelson Hypothesis

Economists often point to two alternative theories in explaining long-run real exchange rate movements. The first is Purchasing Power Parity (PPP), where the real exchange rate must be stationary implying that persistent deviations from the real exchange equilibrium level cannot exist, only temporary ones can. In such a case PPP serves as a good first approximation to long-run exchange rate behavior. Empirical evidence supporting this proposition under the current float however have been mixed.[7] Thus in 1964 one of the most important models of long-run deviations from PPP (and thus the persistence of real exchange rate changes) was advanced by the two classic international economics articles of Bela Balassa[8] and Paul Samuelson[9], *The Purchasing Power Parity Doctrine: A Reappraisal*, and *Theoretical Notes on Trade Problems* respectively. Combined these two authors have become the godfathers of the Balassa-Samuelson model which explains why the absolute version of PPP is flawed as a theory of exchange rates. Absolute PPP relies on arbitrage in an integrated, perfectly competitive world economy to equalize the relative prices, in different currencies and locations, of a common basket of goods when quoted in the same currency. If the exchange rate, E, is defined as the number of units of domestic currency per unit of foreign currency and, P and P^* are the aggregate price level at home and abroad quoted in their respective currencies then absolute PPP predicts that in a frictionless market, the price of a common basket of goods in the two countries measured in a common currency will be equal at all times; in other words, $\frac{P}{EP^*} = 1$.

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[7] For instance, Parikh and Wakerly (2000) "Real Exchange Rates and Unit Root Tests" *Weltwirtchaftliches Archiv*, Vol. 136 (3): 478-490 found empirical evidence in favor of this theory, while Fleissig and Strauss (2000) "Panel Unit Root Tests of Purchasing Power Parity for Price Indices," *Journal of International Money and Finance*, Vol. 19: 489-506 rejected it.

[8] Balassa, Bela, "The Purchasing-Power Parity Doctrine: A Reappraisal." *Journal of Political Economy*, 72, 6:584-596, Dec. 1964.

[9] Samuelson, Paul A.(1964). "Theoretical Notes on Trade Problems." *Review of Economics and Statistics*, 46, 2: 145-154.

Balassa (1964) and Samuelson (1964) establish an important factor introducing systematic biases in the relationship between exchange rates and relative prices. Specifically, the authors' identify productivity differentials between (the dynamic) tradable and nontradable sectors since these differentials are important in altering a country's internal price structure. Balassa and Samuelson start by explaining how a high income country is more technologically advanced than a low income country; but the high income country's technological advantage is far greater in its tradable than its nontradable sector. Furthermore, the law of one price causes the equalization of tradable goods' prices across countries, which is an outcome that does not hold for the nontradables. Given this, an increase in productivity in the tradables sector, will cause an increase in this sector's real wages. However wages cannot rise solely in the tradable sector. Given equivalent worker skill and training, as well as a perfectly competitive and mobile labor markets, labor market equilibrium requires wage increases to also extend to areas with no such productivity increase in order to avoid worker flight from the nontradable sector. To accomplish this, the nontradable sector must raise its prices causing an increase in the relative price of nontradables. This outcome further implies that real wages will be highest in the countries where such productivity increases are greatest and that long-run productivity differentials lead to trend deviations from PPP. Since the differences in productivity increases are expected to be larger in high growth countries, the Balassa-Samuelson effect should be more evident in fast growing economies.

Now taking a common definition of the real exchange as the price of tradables divided by the price of nontradables (P_T/P_N), an increase in P_N, and therefore an increase in the real income of a country, makes the real exchange rate decrease (or appreciate). Moreover, if free trade is assumed to cause the equalization of the price of tradables across countries, then given similar nontradables productivity, countries with high real wages, meaning richer countries, will have higher costs of living. Similarly, given any numeraire currency, nontradables will be cheaper in

poorer countries (this is similar to the "Penn Effect"[10]). The Balassa-Samuelson framework has therefore been used to examine the effects PPP deviations have on inter-country income comparisons. For example, Summers and Heston (1991)[11] present results on an absolute interpretation of PPP by constructing absolute PPP data for a broad range of countries. Generally, the authors' data reveal striking differences in price levels between poor countries as a group and rich countries as a group, however, once divided into two groups, the within-group correlations between income and price level are much less apparent.

As indicated by Drine and Rault (2002)[12] the Balassa-Samuelson hypothesis can be decomposed into three main assumptions: firstly, the differential of productivities between the tradable and nontradable good sector and relative prices are positively correlated. Secondly, real exchange rate and the relative prices of non-tradable goods are positively correlated. Finally, purchasing power parity is verified for tradable goods. A combination of these assumptions causes the main result of real exchange rate appreciation or what has been commonly called a "catching up" process toward economic growth. Hence, the Balassa and Samuelson papers can be summarized in their two crucial insights, namely nontradables should be included in standard trade models if one wishes to understand what governs the relationship between the exchange rate and relative price, and systematic biases in the PPP-exchange rate relationship are caused by productivity differentials between the tradables and nontradables.

Finally, it is worth mentioning the important distinction between the Balassa-Samuelson effect and the related 'Baumol-Bowen' effect[13]. Baumol and Bowen argued that within a country, there is a broad tendency for service intensive goods (education, health care, auto repair, banking,

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[10] The Penn Effect describes the phenomenon that consumer price levels in wealthier countries are systematically higher than in poorer ones.

[11] Summers and Heston (1991): "The Penn World Trade (Mark 5): An expanded Set of International Comparisons, 1950-1988." *Quarterly Journal of Economics* 106, pp. 327-368 (May).

[12] Imed Drine and Christophe Rault (2002). "Does the Balassa-Samuelson Hypothesis Hold for Asian Countries? An Empirical Analysis using Panel Data Cointegration Tests," William Davidson Working Paper No. 504.

[13] see Baumol, William J., and William G. Bowen. 1966. *The Performing Arts: The Economic Dilemma.* New York: The Twentieth Century Fund.

etc.) to rise over time. Historically, productivity growth in services has tended to be much slower than in more capital intensive manufacturing industries. This argument is obviously closely parallel to a key building block of the Balassa-Samuelson model, since there is a heavy overlap between nontradables and service-intensive goods. Note, however, that the presence of a Baumol-Bowen effect is not necessarily sufficient to imply a Balassa-Samuelson effect.

1.2 Introducing Southern Europe's Development

The relationship between the real exchange rate and economic development is an important issue from both positive and normative points of view. Real exchange rate fluctuations affect economic activity in countries undergoing development mainly because of their dependence on imported capital intensive goods and their specialization in inferior good exports. Also, access to world financial markets plays a vital role since it helps to smooth consumption by financing trade imbalances. Evidence from countries undergoing development often firmly supports the idea that there is a relationship between real exchange rate misalignment and economic performance. Furthermore, good economic performance (i.e., growth) often results in the appreciation of the national currency and an improvement in the standard of living, whereas poor economic performance usually results in a depreciation of the national currency. But in order to assess the misalignment degree, one needs to investigate the equilibrium real exchange rate level and one of the most important hypotheses with respect to the equilibrium real exchange rate level is the Balassa-Samuelson hypothesis, where the real exchange rate level is positively correlated with the development degree of the economy. Specifically, this is due to the differential productivity growth between tradable and non-tradable sectors of the economy.

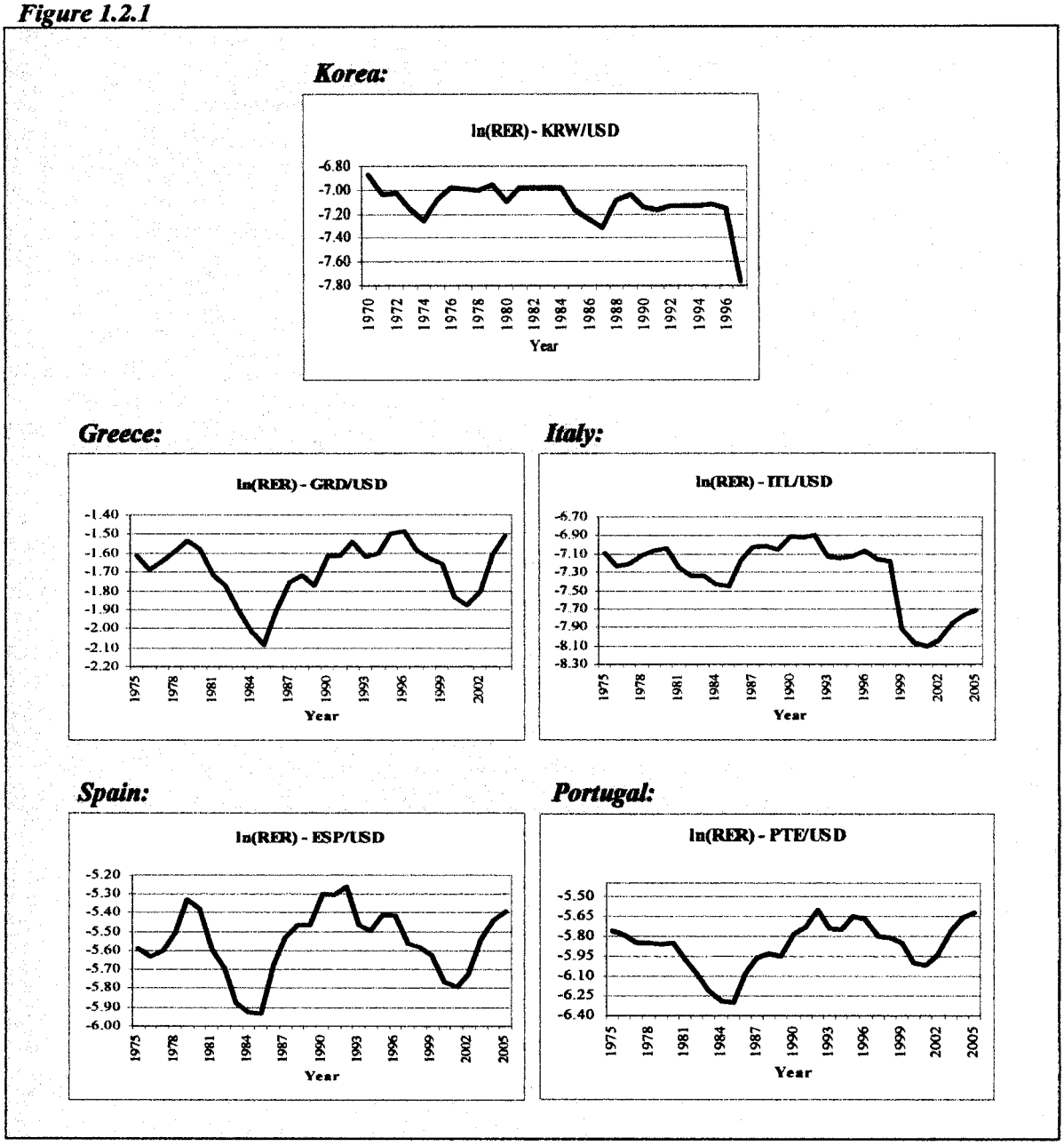
Most articles one encounters on developing countries that have gone down the path predicted by the Balassa-Samuelson hypothesis include South Korea, given its amazing economic performance from 1964-1997 (a detailed description Korea's political and economic background is provided in the case study of section 5.1). Examples of articles supporting this view include

Bahmani-Oskooee and Rhee (1996)[14], Ito, Isard and Symansky (1997)[15], Thomas and King (2005) as well as many others. Therefore, South Korea will become the benchmark case of comparison for the southern European nations under investigation.

The graphs of Figure 1.2.1 reveal large real exchange rate fluctuations for the four southernmost economies of Europe, namely Greece, Italy, Spain and Portugal, as well as for the benchmark case of South Korea. One should note however that the real exchange rate here is defined as $e = \frac{P}{EP^*}$ (where E is the nominal exchange rate and, P and P* are the domestic and foreign CPIs respectively), and so an increase implies a real exchange rate appreciation.

[14] Mohsen Bahmani-Oskooee and Hyun-Jae Rhee (1996). "Time-Series Support for Balassa's Productivity Bias Hypothesis: Evidence from Korea," *Review of International Economics*, Vol. 4 (3), pp. 364-70.
[15] Ito, Takatoshi, Isard, Peter and Steven Symansky (1997). "Economic Growth and Real Exchange Rate: An Overview of the Balassa-Samuelson Hypothesis in Asia." *National Bureau of Economic Research,* NBER Working Papers 5979.

Figure 1.2.1

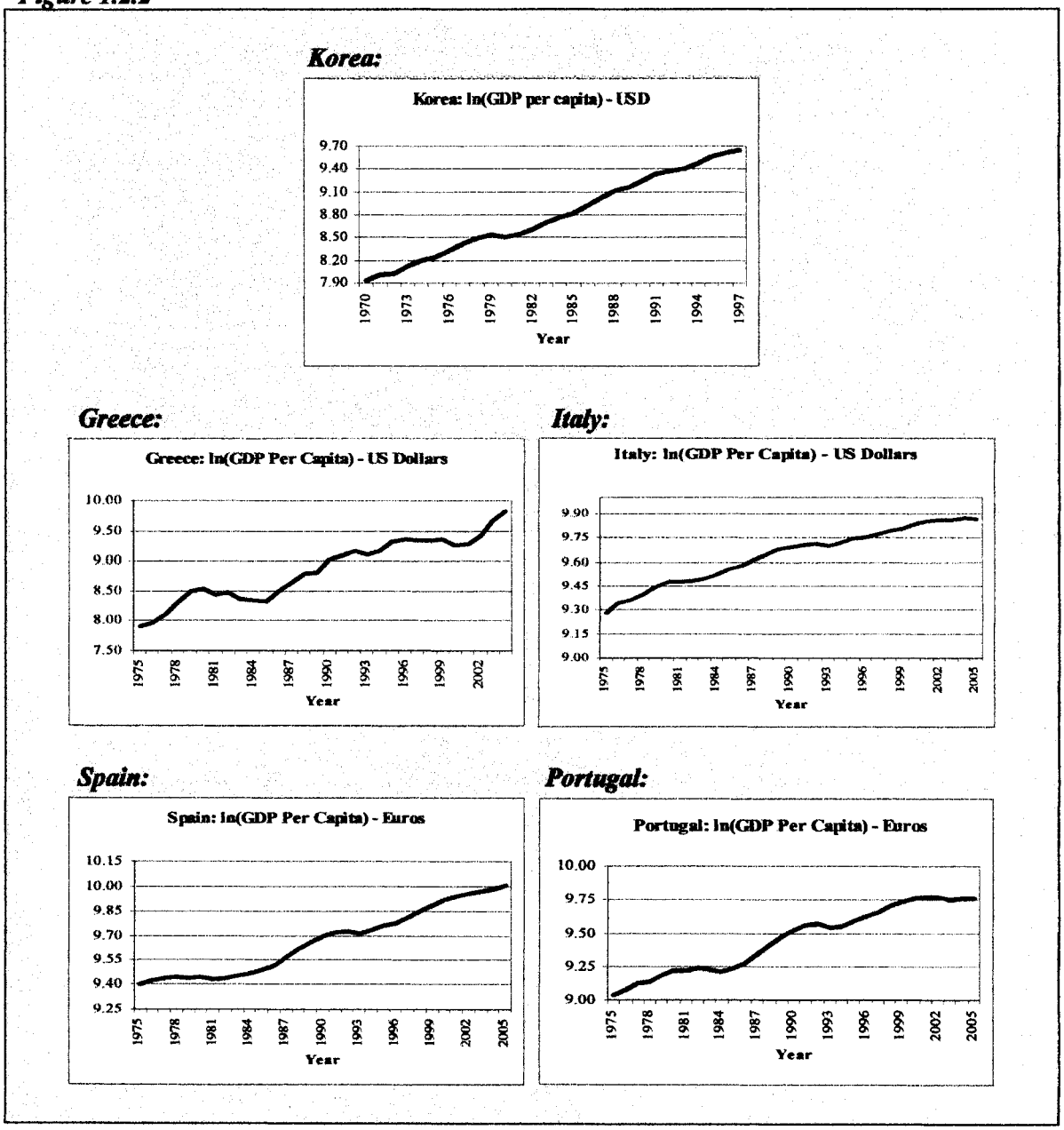


The fluctuations of the real exchange rates presented in these graphs of Figure 1.2.1 reflect deviations from equilibrium. Such misalignments adversely affect economic growth by: discouraging competitiveness given overpriced exports, causing the misallocation of resources from distorted domestic goods' prices relative to international prices and also by adversely affecting domestic financial markets.

One can easily understand then that real exchange rate behavior and economic growth are most certainly connected. In fact, it has been said that the real exchange rate expresses one link between economic policy and economic performance. Therefore, policies which aim to stabilize the real exchange rate around realistic levels usually encourage growth through this mechanism. On the other hand, large swings in the real exchange rate are usually connected to greater uncertainty with respect to relative prices and thus cause greater risks and shorter investment horizons. This leads to high adjustment costs because production alternates from the tradable to the nontradable sector, also given the financial instability the country faces, this causes increased interest volatility.

As stated earlier, for a thorough investigation of misalignment degrees to be undertaken, one first needs to evaluate the real exchange rate equilibrium level, and the Balassa-Samuelson hypothesis finds the real exchange rate and the development degree of the economy to have a positively correlated relationship. Because one commonly used indicator of economic growth is GDP per capita, the graphs of Figure 1.2.2 below show the progression of GDP per capita for the four countries under investigation as well as the base case of South Korea:

Figure 1.2.2



Though ideally the GDP per capita graph of South Korea would have extended as far back as 1964, data limitations prohibited that. It should be noted, however that from 1964-1997 real GDP per capita growth averaged more than 6% annually, standing at more than eight times its original level. Put in another way, at the start of that period the country's income level was below that of Bolivia and Mozambique and by the end of it, it was higher than that of Greece and Portugal.

The graphs of Figure 1.2.2 above indicate the four southern European nations' GDP per capita which also portrays the progression of these countries' economic development. It is evident that the level and speed of economic growth since 1975 varies from country to country. In the context of Balassa-Samuelson, this paper attempts to use traditional time series cointegration techniques as well as a vector error correction specification on Europe's four southernmost economies of Greece, Italy, Spain and Portugal and evaluate whether there is a long-run relationship between the real exchange rate and economic development (GDP per capita). Also, to tackle the Balassa-Samuelson hypothesis' implications more specifically, this paper then attempts to use a similar method to test whether there is a long-run relationship between the relative productivity differentials between traded and nontraded goods sectors and the long run real exchange rate in Europe's Southern periphery.

Interestingly, this study finds a long-run cointegrating relationship between the real exchange rate and GDP per capita for all the countries under investigation but when testing for a long-run cointegrating relationship between the real exchange rate and the relative productivity differentials between traded and nontraded goods, Spain is the only country out of the Southern European nations under investigation exhibiting signs of the Balassa-Samuelson effect. This indicates that though development and real exchange rate appreciation go hand in hand for Greece, Italy and Portugal, the Balassa-Samuelson effect does not really explain their progression due to a weakness in the theory's underlying assumptions. Also, this further highlights the need to always explicitly test for the Balassa-Samuelson effect, which some studies do not always do.

1.3 Motivation, Method and Contribution to the Literature

Existing studies concerned with the Balassa-Samuelson hypothesis (with the exception of Italy) have not really focused on the Greece, Spain and Portugal specifically. Greece, Spain and Portugal are the least developed in the European Union, having distinctly lower GDP per capita levels than other member states. Focus seems to have jumped from the exploration of the more

developed nations such as the United States and Germany, and/or Europe as a whole, straight to Asian economies and the European Union's newcomers, namely the transition economies of Central and Eastern Europe. Though the Asian and Central and Eastern European economies seem ideal candidates for the Balassa-Samuelson effect, due to their current development degrees, one should note that Greece, Italy, Spain and Portugal have also come a long way since the mid-1970s. Having outgrown their totalitarian regimes they have transformed into democratic republics, whose economies are now subject to the guidelines of the European Union and its Central Bank. I therefore find it important, given the availability of data reaching as far back as the mid-1970s, to investigate the long-run Balassa-Samuelson effect implications in their economies.

As Mihaljek and Klau (2003) have noted, many studies employing OLS estimates of the Balassa-Samuelson effect have often been accused of inaccuracy and implementation difficulties. This is due to a lack of consensus in econometric methods used as well as the considerable sample variation from study to study. Also, due to the lack of data availability many authors try to compensate for the short time series by pooling data from different countries. Such cross-country panels often include very heterogeneous economies, from transition economies in Central Europe to poorly developed central Asian economies. This paper relies instead on larger data samples, where the first tests rely on quarterly data for up to 29 years. This makes it possible to estimate the Balassa-Samuelson effect for individual countries rather than a panel of economies with different structural characteristics. For the second test, annual data is used for 24 years. Nevertheless the data samples are far from perfect since they are still very short (especially the second data set) and so this fact underlines the need to interpret the results cautiously. The data collected however is of good quality since it was gathered from reliable sources such as OECD and the IMF. Furthermore, many authors seem to agree that time series cointegration techniques are more robust when smaller samples are used; and small samples are almost inevitable in macroeconomic studies.

This paper also extends the existing literature in terms of the sectoral data used to estimate the Balassa-Samuelson effect. In much of the existing literature the sectoral data used is highly aggregated. The tradable sector includes industry – usually using only the manufacturing sector, or industries whose output is traded only to small extent, such as construction and electricity, gas and water supply, while the nontradable sector is often calculated by the residual (i.e., GDP less industry), or all services regardless of their traded content. Another frequent problem is the use of industrial production indices (which measure gross output rather than value added) in constructing labor productivity measures. To overcome these issues and obtain more reliable estimates this paper uses a disaggregated analysis (a description of which is provided in Appendix B) and so the coverage of traded and nontraded sector industries is much broader and more detailed than in previous studies.

Therefore, in an attempt to exploit the individual time series of the four Southern European countries of interest as well as the canonical case of South Korea, I will employ the conventional cointegration techniques and then further my analysis with a vector error correction model (VECM) to outline the short-run dynamics of the phenomenon in more detail. Specifically, I use these methods to first test for the Balassa-Samuelson effect in a very broad sense by estimating the relationship between development (measured by GDP per capita) and the real exchange rate. The second step involves testing the Balassa-Samuelson effect more directly, examining the relationship between relative productivity differential between traded and nontraded goods sectors and the real exchange rate. Hopefully my estimates will be insightful on the nature of these nations' long-run economic development. I chose to begin my time length in the mid-1970s because of the political and hence economic instability present in these nations. Given the unique backgrounds of the countries under investigation, the reader is provided with a brief description of each nation's political and economic history in the case studies below before the results are discussed.

The paper is constructed as follows: section 2 provides a review of the literature, section 3 presents the econometric methodology, section 4 gives the theoretical background of the Balassa-Samuelson effect theory. Section 5, provides the background and estimates for the canonical case of South Korea, while sections 6, 7, 8 and 9 provide case studies for Greece, Italy, Spain and Portugal respectively. Again, given the uniqueness of the nations at hand, the case studies include: a brief history of the politics and economics of the countries, as well as the results of the time series estimates for each nation. Also, because the United States is used as the foreign nation for my estimate, a background on the US economy and politics is provided in Appendix A. Finally, section 10 concludes.

2. A Review of the Literature

2.1 Time Series Literature

The Short and Medium Run

Given that the Balassa-Samuelson hypothesis is a long-run theory of PPP violations it is not surprising that short and medium term studies have not had convincing success. For example, Strauss (1998)[16] explores three critical assumptions of the Balassa-Samuelson productivity differential model for France, Germany, the UK and the US in the short and medium run. Basically, the Balassa-Samuelson productivity differential model assumes that in the long run there are competitive and mobile labor markets, real wages equalize across sectors and that PPP holds for traded goods, casing asymmetries between traded and nontraded sectors. This is because in the traded sector, domestic productivity growth equals real wage growth and growth in world prices equals growth in domestic traded prices. However, Strauss' results reveal that significant real wage and unit labor costs differentials exist across industries and sectors, implying incomplete labor mobility. Also, lack of arbitrage across labor markets means that workers possess skills, experience and compensation that are specific to their industry and not easily transferable across industries or sectors thus the data supports an industry/sector-specific factors model instead. Finally, Strauss (1998) finds that productivity does not equal the wage rate, domestic productivity and wage innovations explain relative prices in both the traded and nontraded sectors, and that world prices possess only a modest influence on domestic relative prices, leading him to the conclusion that the productivity differential model's explanation for relative price movements ignores an important explanatory variable, namely wage differentials. Therefore, the "Balassa-Samuelson productivity differential models' assumptions "may be reasonable in the very long run. However, in the short to medium run (defined as 1-4 years),

[16] Jack Strauss (1998). "Relative Price Determination in the Medium Run: The Influence of Wages, Productivity, and International Prices," *Southern Economic Journal*, 65(2), pp. 223-244.

industry- or sector-specific factors such as differing human capital across industries or sectors implies that impediments to labor mobility and competitive labor markets may exist." (p. 224)

In a previous study, Strauss (1995)[17] examines the source of real exchange rate nonstationarity given data for 14 OECD economies from 1960-1990 where he constructs traded and nontraded GDP price indices and productivity rates. By estimating a cointegrating error correction model using Johansen long-run parameter estimates Strauss (1995) finds that the relative price of nontradables significantly influences the real exchange rate in the short-run. Positive innovations in the domestic (foreign) relative price of nontradables cause an appreciation (depreciation) of the real exchange rate and, for most of the economies equilibrium adjustment is approximately three years. Strauss (1995) concludes that the nonstationary process of the real exchange rate and permanent PPP violations are caused by permanent innovations in the relative price of nontradables. Domestic and foreign productivity differentials between the traded and nontraded sectors of economies explain permanent shifts in real exchange rates, which explain the origin of the PPP violations. Finally, changes in relative prices are significant determinants of real exchange rates in both the short and long-run.

Another well cited paper is by Engel (1999)[18] who measures the proportion of US real exchange rate movements that can be accounted for by movements in the relative prices of nontraded goods. Specifically, Engel examines the average change and the variance of the change in these components at all horizons that the data allow, in some cases from horizons as short as one month to as long as 30 years. The accounting is performed with five different measures of nontraded-goods prices and real exchange rates, for exchange rates of the Untied States relative to a number of other high-income countries in each case. These different measures of nontradables' price indices include: the consumer price index (CPI); the OECD database of output prices; price

[17] Strauss, Jack (1995). "Real Exchange Rates, PPP and the Relative Price of Nontraded Goods," Southern Economic Journal, Vol. 61, No. 4, pp. 991-1005.
[18] Engel, Charles (1999). "Accounting for U.S. Real Exchange Rate Changes," *Journal of Political Economy*, 107(3), pp. 507-538.

deflators for personal consumption expenditures (where expenditure on goods measures traded-goods prices and services measures nontraded-goods prices); the producer price index (PPI) as a measure of traded-goods prices (along with the CPI relative to the PPI to measure nontraded goods prices); finally, some argue that a large amount of consumer prices comprise of nontraded marketing and distribution services, thus this is also used. Engel's (1999) results present evidence that the relative prices of nontraded goods appear to account for almost none of the movement of US real exchange rates at short and medium horizons. However, Engel (1999) does note that given the short 20-30 year samples used one would not be able to discern whether nontraded goods prices had a significant influence on real exchange rate movements in the very long run.

The Long Run

The results of the short and medium run estimations indicate that the longer horizon should be the primary focus of Balassa-Samuelson based tests. Most papers on the Balassa-Samuelson effect begin with Hsieh (1982)[19] work, since he was the first to look at the time series implications of the Balassa-Samuelson hypothesis. Hsieh's study focused on the Japanese and German real exchange rates vis-à-vis the United States for the years 1954-1976. Using this time series data, Hsieh finds some evidence favoring the Balassa –Samuelson model; he finds a significant effect of the productivity differentials between traded and non-traded goods sectors for both countries. More specifically, Hsieh found that the productivity differential variables were significant and of correct sign for both real exchange rates. Furthermore, the OLS regression results were robust in both correcting for serial correlation and in using instrumental variables techniques. It should be noted however that Hsieh's results may have been sensitive to his inclusion of the real wage differential, since it is closely correlated to the real exchange rate, as a

[19] Hsieh, D. (1982) "The Determination of the Real Exchange Rate: The Productivity Approach", *Journal of International Economics*, 12, 355-362.

right-hand-side variable and so Hsieh's results may very well be sensitive to the inclusion (or exclusion) of an "error correction" term.

Marston (1987)[20] looks at the yen/dollar real exchange rate over the period 1973-1983, and calculates traded and non-traded goods productivity differentials. Using OECD data, he disaggregates the economy into ten sub-sectors. Marston's aggregation approach designates two sectors as traded: manufacturing and agricultural (including hunting, fishing and forestry), while six sectors are regarded as nontraded: construction; wholesale and retail trade; restaurants and hotels; transport, storage and communication; finance, insurance, real estate; and finally, business services, community, social and personal services. Marston excludes the mining and quarrying, electricity, gas and water sectors because they are energy intensive and thus very sensitive to the OPEC pricing policies. Then, using sectoral employment data, Marston calculates the labor productivity differentials between traded and nontraded goods, and argues that these variables can explain the long-run real appreciation trend of the yen vis-à-vis the US dollar; he finds that the relative price of Japan's and the US' nontraded goods are related to the relative average labor productivity in each country.

Studying Norway and the United Kingdom, Edison and Klovand (1987)[21] use annual data from 1874-1971 in order to re-evaluate PPP's empirical performance. Particularly, Edison and Klovand ask whether productivity differentials between tradable and nontradable goods have the expected impact on the real exchange rate and they end up with an affirmative answer to this question; ceteris paribus, productivity advances in tradables leads to currency appreciation, while productivity advances in the nontradables leads to currency depreciation. *However*, this conclusion does not say that productivity in the tradables sector typically grows faster than that in

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[20] Marston, R.C., 1987. "Real Exchange Rates and Productivity Growth in the United States and Japan." In: Arndt, S.W., Richardson, J.D. (Eds.), Real-Financial Linkages among Open Economies. MIT Press, pp. 71–96.

[21] Edison, H.J. and J.T. Klovland (1987). "A Quantitative Reassessment of the Purchasing Power Parity Hypothesis: Evidence from Norway and the United Kingdom," *Journal of Applied Econometrics*, Vol. 2, No. 4, pp. 309-333.

nontradables, or as they put it: "[T]his hypothesis was not rejected when direct measure of productivity trends in the two countries was employed." (p. 325) Thus, their primary conclusion is real structural factors such as output growth rates and terms of trade shocks (which they treat as shocks to traded-goods productivity) are significant factors in explaining long run deviations from PPP.

Froot and Rogoff (1991)[22] note the accelerating momentum supporting a faster monetary union in Europe. However, they also note that "[o]ne of the most puzzling features of the EMS performance to date is that member countries have seemingly pursued very different inflation rate policies while allowing for only relatively small adjustments in their exchange rates." (pp. 2) Thus, Froot and Rogoff (1991) study intra-EMS real exchange rates in an inter-temporal maximizing model framework incorporating nontradables. They look at different factors to explain significant shifts in the real exchange rate for the years 1975-1990. Defining their variables for every country vis-à-vis the EMS average, they empirically test the influence of the following factors: shocks to labor productivity, imperfectly credible aggregated demand policy, debt gaps and shocks to government spending. Illustrating the example of Italy Froot and Rogoff (1991) show that from 1986-1991 Italy's CPI inflation rate exceeded Germany's by more than 15%, while the lira/mark exchange rate remained fixed. So they explore to what extent relative growth in Italian government spending accounts for this phenomenon and find that that it affects the real exchange the because it falls more heavily on non-traded goods than does private-spending bidding up their relative price. The real CPI exchange rate was regressed against various measures of productivity differentials and government spending as a ratio to GNP to find the government spending variable to enter consistently with a correct sign in all the individual country regressions and it is strongly significant in the pooled time series cross-section regressions. On the other hand, productivity in the traded and the non-traded sectors are found not

[22] Froot, K., and Rogoff, K. (1991) "The EMS, the EMU, and the Transition to a Common Currency." National Bureau of Economic Research Working Paper No. 3684.: 1-37.

to be significant. Froot and Rogoff (1991) therefore conclude that "divergent government spending trajectories provide a surprising plausible explanation of the apparent divergence of EC real exchange rates." (pp. 2)

In a later paper, Rogoff (1992)[23] explains how conventional explanations of the near random walk behavior of the real exchange rate base themselves on the near random walk behavior of underlying fundamental factors, such as tastes and technology. Rogoff (1992) does not find this argument totally convincing because many theories suggest that many of the variables involved in exchange rate determination are mean-reverting. To provide an alternative explanation, a neoclassical open-economy model with traded and non-traded goods was built, where agents can smooth their consumption of tradables over time through the international capital markets during transitory productivity shocks in the traded goods sector. Agents however, cannot smooth productivity shocks in the nontraded goods sector. The results contradict the Balassa-Samuelson predictions, because in the Balassa-Samuelson framework, factors are assumed perfectly mobile across sectors and government sending shocks have no effect on relative prices. In Rogoff's model though, aggregate supply *and* demand shocks can be important, causing highly persistent movements in the real rate. Applying the model to the real yen/dollar exchange rare over the floating period from 1975-1990, it ends up correctly predicting that traded goods productivity shocks alone will not help forecast the real exchange rate. Furthermore, Rogoff (1992) tries to see if lagged values of the government consumption spending help in forecasting, because government consumption spending tends to fall heavily on nontraded goods and its effects can therefore not be smoothed intertemporally. But Rogoff's data does not offering such positive evidence (he blames this on government spending shocks being borderline nonstationary, and on not including changes in the terms of trade effects).

[23] Rogoff, Kenneth (1992): "Traded Goods Consumption Smoothing and the Random Walk Behavior of the Real Exchange Rate," *National Bureau of Economic Research*, Working Paper #4119 (July 1992): 1-34.

Hondroyiannis and Papapetrou (1998)[24] use a sample of eight low inflation OECD countries over the period 1960-1995 in order to examine the causality between the price level and productivity in a temporal causal framework with the use of various time-series techniques such as unit-root testing, bivariate and multivariate cointegration and procedures in vector error-correction modeling (VECM). Hondroyiannis and Papapetrou's (1998) empirical evidence indicates that there is no long-run relationship between price level and productivity. They explain that their results may be due to a trend break in their unit root pretests, due to the oil price shock in 1973, revealing that inflation and productivity are integrated of a different order. Basically, all variables but the CPI are I(1), and the latter is I(2) in their sample, causing the bivariate relationship between inflation and productivity to be "spurious" and so cointegration is not possible. In a second step, they control for potential influences of output and monetary policy on the bivariate relationship between price level and productivity. Doing so, the empirical evidence of cointegration rules out the possibility that the estimated relationship between the CPI and productivity is "spurious" and implies that causality must exist in at least one direction. Finally, to detect the direction of causality, VECM estimation is used and shows that in some cases a unidirectional relationship from inflation to productivity growth may exist, as was found for five of their countries of Italy, Denmark, Germany, Japan, and USA.

MacDonald (1997)[25] examines the determination of the real exchange rate in a long-run setting with the use of co-integration tests for real exchange rate data on the US dollar, the Deutsche mark and the Japanese yen during the period 1974-1993. He presents a reduced-form model of real exchange rates consisting of two parts: a real interest differential and a set of fundamentals, including net foreign asset accumulation, productivity bias, and fiscal balances. MacDonald finds his model of the real exchange rate produces significant and sensible long run

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[24] Hondroyiannis, G.and E. Papapetrou, (1998). "Temporal Causality and the Inflation-Productivity Relationship: Evidence from Eight Low Inflation OECD Oountries." *International Review of Economics and Finance,* 7(1), 117-135.

[25] MacDonald, R (1997). "What Determines Real Exchange Rates? The Long and Short of It", *IMF Working Paper*, WP/97/21, January.

relationships for the real effective exchange rates of these currencies with the productivity differentials between the traded and the non-traded sectors.

Micossi and Milesi-Ferretti (1996)[26] regress the inflation differential between the traded and the non-traded sector in a country on the labor productivity differential in the two sectors, an EMS dummy, inflation (based on the GDP deflator) and the GDP growth rate for eight EU countries from 1966-1990. For about half of the regressions, Micossi and Milesi-Ferretti find a significant influence of the productivity differential on the inflation differential. Also tested was the relationship in a bilateral regression, where the real exchange rate (based on the GDP deflator) is explained by the real exchange rate (based on unit labor costs) and the productivity differential between traded and non-traded sectors for both countries.

Strauss and Ferris (1996)[27] explore four critical assumptions of Balassa's model of PPP violations for 14 OECD economies and demonstrate that some are weak and need further examination. Specifically, the general patterns and relationships between traded and nontraded productivity, real wages and relative prices is explored. By constructing GDP price indices, productivity measures and real wage compensation rates for the traded and nontraded sectors for the years 1970-1990, the data reveals the following results: there *is* greater productivity growth in traded than nontraded sectors and that these differences in productivity growth are substantial across countries. However, in most economies, wages are *not* equalized across sectors since, instead they are tied to productivity in each sector (this may be due to the fact that older workers are immobile due to human capital and job skills implying that intersectoral wage and productivity differences are not quickly arbitraged). Finally, Balassa's prediction about the relationship between unit labor costs and prices in the traded and nontraded sectors is *not* supported by the data. Thus, Strauss and Ferris (1996) believe that "the proportion that

[26] Micossi and Milesi-Ferretti (1996). "Real Exchange Rates and the Price of Nontradable Goods" *IMF Working Paper*, wp/94/19.
[27] Strauss, Jack, and Mark E. Ferris (1996). "The Role of Nontraded and Traded Wages in the Productivity Differential Model," *Southern Economic Journal* vol. 63(2), (October) pp. 327-338.

purchasing power parity violations are due to productivity differentials and movements of unit labor costs across economies should be reexamined." (pp. 338)

Alberola and Tyrväinen (1998)[28] evaluate the Balassa-Samuelson model in eight of the eleven EMU countries for the years 1975-1995. They explain that the Balassa-Samuelson model suggests that the dual inflation induced by productivity differentials between traded and non-traded goods sectors causes inflation differentials between countries. The standard Balassa-Samuelson model implies a cointegration relationship between relative prices and sectoral productivities. Alberola and Tyrväinen test for cointegration on both this standard as well as on an extended Balassa-Samuelson model. They note however, with the standard model, while the link between inflation and sectoral productivities generally seems to exist, the magnitudes of the parameter estimates are not in accordance with the theoretical model in most countries. Since the presumed uniformity of sectoral wages is rejected in most cases in extended model, relative wages are allowed to enter the estimation. Thus, with this extended model, they include wage differentials between the traded and the non-traded sectors, assuming that wages between the two sectors do not equalize. This extended Balassa Samuelson model is endorsed by the data in every country since they find evidence in favor of this assumption. Hence, Alberola and Tyrväinen's cointegration tests for these 11 EU members confirm a long-run relationship between inflation and productivity differentials for Germany, Spain and Belgium in the standard model, and for all countries but the Netherlands in the extended model.

In a very recent study, Katsimi (2004)[29] investigates whether and to what extent inflation differentials among euro area countries are due to the Balassa-Samuelson effect for 7 EU countries. , Katsimi (2004) explains how according to this effect, tradable and nontradable productivity differentials cause changes in the real exchange rate. A rise in the productivity of the

[28] Alberola and Tyrväinen (1998). "Is there Scope for Inflation Differentials in EMU? An Empirical Evaluation of the Balassa-Samuelson Model in EMU Countries. *Working Paper*, Bank of Spain.
[29] Katsimi (2004). "Inflation Divergence in the Euro Area: The Balassa-Samuelson Effect." *Applied Economics Letters*, 2004, Vol. 11, issue 5, pp. 329-332.

tradable sector increases wages in both sectors so nontradables producers can meet the higher wages only if they increase the relative price of nontradable goods. Thus, faster growing economies experience real exchange rate appreciation. Now, in a common currency area context this will manifest in inflation differentials. He uses cointegration techniques to explicitly test for the Balassa-Samuelson effect since with small samples they have been shown to be more robust. His results support the main predictions of the Balassa-Samuelson model for 6 out of the 7 countries. Productivity differentials between tradable and non-tradable goods sectors have a significant positive effect on inflation in the two biggest euro area countries, namely Germany and France as well as on the biggest pre-in country, the United Kingdom. In Italy, Belgium ad Denmark the Balassa-Samuelson predictions are supported by the data only if one allows for different wages across sectors. Finally, Katsimi stresses the policy implications embedded in the Balassa-Samuelson model: "To the extent that inflation differentials in the euro area stem from the catching-up process of economies within the EU, these differences will not affect competitiveness and should automatically disappear when real convergence is achieved." (pp. 332)

2.2 Cross-Sectional and Panel Data Literature

Cross-Sectional studies have also become increasingly popular in testing the Balassa-Samuelson hypothesis. For example, Canzoneri Cumby and Diba (1999)[30] use panel data for the period 1960-93 to test two aspects of the Balassa-Samuelson model to see how well the model explains real exchange rate behavior. The first component tested is if the relative price of non-traded goods (which should) reflect relative productivity of labor in the traded and the nontraded sectors. They find this hypothesis to fit the data quite well; their "results suggest that the relative price of non-traded goods and the relative productivities in the traded and non-traded goods

[30] Canzoneri M., Cumby R., Diba B. (1999). "Relative Labor Productivity and the Real Exchange Rate in the Long Run: Evidence for a Panel of OECD Countries," *Journal of International Economics*, Vol. 47, pp 245-266.

sectors are cointegrated and the slope of the cointegrating relationship is generally close to 1.0," (p. 263) as the theory suggests. So, in the long run, relative prices generally reflect relative labor productivities. The second component Canzoneri Cumby and Diba (1999) test is the hypothesis that long run purchasing power parity holds for traded goods but the evidence is considerably less favorable. When looking at US dollar exchange rates it is found that, even in the long run, PPP does not appear to hold for traded goods. The authors explain, however, that this conclusion may be sensitive to the reference currency used. For example, evidence on PPP in traded goods is less favorable with US dollar exchange rates but more favorable when the DM is used, since PPP seems to be a somewhat better characterization of traded goods prices given that the nominal and PPP exchange rates appear to be cointegrated and the slopes of the cointegrating regressions are generally close to one. Thus, they find that there *are* large and long-lived deviations from PPP in traded goods.

Chinn and Johnston (1997)[31] explore the long-run relationship between the real exchange rate, traded and nontraded productivity levels, and government spending for 14 OECD countries from the years of 1970-1991. To do so they "exploit recent developments in the econometric analysis of nonstationary variables in panel data. The results indicate that under certain assumptions it is easier to detect cointegration in panel data than in the available time series [analyzing the countries separately]; moreover, the rate of reversion to trend is estimated with greater precision." (pp.4) More specifically, Chinn and Johnston's results indicate the half-life of a deviation from trend is about four to five years and a one percent innovation in tradable sector productivity means an appreciation in the real exchange rate between 0.2 and 0.5. Finally, it is noted that using a productivity-based model causes smaller undervaluations of the U.S. dollar than a PPP-based model, where this phenomenon is the most pronounced with the dollar/yen case.

[31] Chinn and Johnston (1997). "Real Exchange Rate Levels, Productivity and Demand Shocks: Evidence from a Panel of 14 Countries," *IMF Working Paper,* WP/97/66 (May): pp. 1-32.

Asea and Mendoza (1994)[32] examine the long-run influence of productivity shocks on the relative price of nontradables; their work concerns "the cross-sectional implications of the Balassa-Samuelson model rather than its time series implications." (pp. 244) Basically, they investigate if relative labor productivities can explain relative prices of non-traded goods, and whether the latter explain cross-country real exchange rate differentials. ea and Mendoza's (1994) analysis is based on a dynamic two-country general equilibrium model that uses annual sectoral data to calculate relative traded goods prices for 14 OECD countries over the period 1975-1985; a Hodrick-Prescot filter implemented so the long-run component of the data is only accounted for. First, they regress the relative price of nontraded goods for each country against traded-nontraded productivity differentials, and then the cross-country real exchange rates against the relative price of nontraded goods (both actual and estimated). The authors find that, although the productivity differentials between traded and nontraded goods are extremely significant in explaining changes in the relative price of nontraded goods within each country, changes in nontraded goods prices account for only a small and insignificant part of real exchange-rate changes across countries (using either CPI or GDP deflators). Thus, the data reveal evidence of a Baumol-Bowen effect, the Balassa-Samuelson effect is more difficult to detect. It is concluded that the Balassa-Samuelson model does well as a theory of relative prices but poorly in accounting for trend deviations from PPP.

De Gregorio, Giovannini, and Wolf (1994)[33] reach a somewhat more positive conclusion than Asea and Mendoza concerning the ability of productivity differentials to explain real exchange rate changes across countries. The Balassa-Samuelson model is used to examine why nontradable inflation has been more rapid than that for tradables using sectoral data (20 sectors) of 14 OECD countries from 1970-1985, particularly comparing core EMS to non-core economies.

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[32] Asea, P.K., Mendoza E. (1994), "The Balassa-Samuelson Model : A General Equilibrium Appraisal", *Review of International Economics* Vol. 2, pp :244-67.

[33] De Gregorio J., Giovannini A., Wolf H.C (1994), "International Evidence on Tradables and Non-Tradables Inflation", *European Economic Journal*, Vol. 38, pp 1225-1244.

They present a cross-country panel regression that attempts to sort the importance of demand and supply factors. Like Asea and Mendoza (1994) these authors use the OECD intersectoral database to construct measures of productivity growth in the traded and non traded goods sectors and their data includes both real and nominal output allowing for the construction of sectoral price deflators as well as detailed input data so total factor productivity levels (which are calculated using Solow residuals) can be derived. Furthermore, De Gregorio, Giovannini, and Wolf (1994) test for the effect of government spending on the relative price of nontradables. The results are very interesting. It is observed that the correlation of inflation rates has increased within Europe, whereas the correlation of demand and supply side factors have increased for non-core, but decreased for core economies. Furthermore, the data suggests that the relative price of non-tradables has increased almost uniformly. Also, the regression results show that short run demand side factors, in particular income growth, contain most of the explanatory power of relative price changes; there is a highly significant positive coefficient on the real GDP variable, suggesting that the Balassa-Samuelson effect is indeed at work, and important. Finally, in the long run, most of the increase in non-tradables' relative price can be explained by a faster increase of total factor productivity in tradables, whereas the effects of demand factors (government spending and income) become less important.

In the same year, De Gregorio and Wolf (1994)[34] introduce a terms-of-trade variable to the regression in an attempt to examine the joint effect of productivity differentials and terms of trade movements on the real exchange rate for 14 OECD countries over the period 1970-1985. To do so, they decompose short-term real exchange rate movements into the components caused by changes in the relative price of nontraded goods (the Balassa Samuelson effect), and those caused by changes in the relative price of traded goods (changes in terms of trade) and run their short-term regressions with the real exchange rate and with the relative price of non-traded goods as

[34] De Gregorio, Jose and Holger C. Wold (1994). "Terms of Trade, Productivity, and the Real Exchange Rate," NBER Working Paper No. 4807 (July).

dependent variables. In the regressions with the real exchange rate as dependent variable, they find highly significant coefficients for total factor productivity. However, when taking the relative price of non-traded goods as dependent variable, the coefficient of productivity becomes insignificant. Thus, De Gregorio and Wolf (1994) find that terms of trade shifts account for a very substantial component of real exchange rate movements since its introduction causes the coefficient of the income variable to become statistically insignificant. Therefore, the income variable in the previous regression may be proxying for terms of trade shocks or as they put it: "the terms of trade affect the real exchange rate mainly through an income effect."(pp.10) Thus, a faster productivity growth in the tradable relative to the nontradable sector and an improvement in the terms of trade induce a real appreciation. The authors therefore conclude that if the Balassa Samuelson effect is important, it is only over longer-term horizons.

Drine and Rault (2003)[35] attempt to apply new panel unit root test and panel cointegration tests recently developed in econometric literature to reanalyze empirically the Balassa-Samuelson hypothesis. They consider annual data for 16 Middle Eastern and North American countries (Algeria, Bahrain, Egypt, Iraq, Iran, Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Saudi Arabia, Syria, Tunisia, United Arab Emirates, and Yemen) covering the 1960-1999 period and compare the panel data econometric results with those that would have been obtained with the usual time series unit root tests and cointegrating techniques. They use Im, Pesaran and Shin (1997) panel unit root tests and Pedroni's panel cointegration methodology (1995, 1997 and 1999). Drine and Rault's (2003) main conclusion is that new panel integration and cointegration techniques indicate strong evidence in favor of the Balassa-Samuelson hypothesis (there is a cointegrating relationship between economic development and real exchange rate appreciation) which has had mixed results with conventional time series cointegration tests. One must note however that for four countries (Kuwait, Oman, Saudi Arabia and the U.A.E.) the Balassa-

[35] Imed Drine and Christophe Rault (2003). "A Re-examination of the Balassa-Samuelson Hypothesis Using Recent Panel Data, Unit-Root and Cointegration Tests: Evidence from MENA Countries," *African Development Bank*, pp. 106-125.

Samuelson hypothesis was violated in their estimates because since they showed that economic development is means real exchange rate *depreciation*. They thus conclude "the Balassa-Samuelson hypothesis cannot be applicable to economies which are at the first stage of development and for which export increase comes from price competitiveness rather than from an increase in productivity in the tradable sector." (pp. 121)

In a previous comparison, along the same lines, Drine and Rault (2002) consider annual data for six Asian countries (India, Indonesia, Korea, the Philippines, Singapore and Thailand) covering the 1983-1997 period and compare the panel data econometric results with those obtained with conventional time series unit root tests and cointegrating techniques. Drine and Rault's (2002) econometric investigation shows that standard time series cointegration methods support the Balassa-Samuelson hypothesis, since they are able to give evidence of a significant long-run relationship between productivity differentials and the real exchange rate for five out of six countries. On the contrary, the recent panel cointegration techniques of Pedroni (2000) indicate strong evidence against such a relationship for the six Asian countries, leading them to examine the reasons for this failure and to analyze the Balassa-Samuelson hypothesis assumptions in detail. The authors find that for all countries the rejection is attributable to the non-existence of a significant positive relationship between productivity differentials and relative prices.

De Grauwe and Skudelny (2000)[36] use panel data for 13 of the 15 EU members from 1971-1995 in order to find whether the Balassa-Samuelson effect is important in EMU. They begin by specifying their model in first differences and estimating the long run effect of the productivity growth differential between the traded and non-traded goods sector on inflation by pooling the data for all the countries of their sample. Then, the authors estimate the model in a bilateral form to measure the effect of differences in the traded and non-traded goods sectors'

[36] De Grauwe, Paul and Frauke Skudelny (2000). "Inflation and Productivity Differentials in EMU", Discussion Paper 00.15, Katholieke Universiteit Leuven.

productivity growth differentials between two countries on their inflation differential. Their regression results are as follows: their one-country estimates are quite mixed since productivity growth differential have a significant and positive effect in only one case. This is blamed on the number of missing observations they have. On the other hand, the bilateral version of their model shows a significant positive effect of the long-run productivity differential on the inflation differential in most cases, which jives with the theory. More specifically, when they calculate the average inflation differential due to the productivity differential, it is found that the average effect goes up to 0.6%. The effect differs according to which indicator is chosen for total inflation (for example, it is somewhat smaller when the GDP deflator is used). Then, the effect of productivity shocks is calculated by taking the maximum of the countries' productivity differentials (and minimum when negative values are present) as a potential shock. What is found is that the total effect of a productivity sock on the inflation differential can be quite substantial, going up to an 8% increase in the inflation differential.

Canzoneri, Matthew, et al. (2002)[37] examine in a neoclassical long-run framework the inflation differentials of the euro area caused by differences in productivity growth across sectors and countries. Employing a variant of the Balassa-Samuelson "productivity hypothesis," relating sectoral productivity trends to trends in the relative price of home goods, the likely size of these differentials is estimated. They find the productivity hypothesis to be a good empirical explanation of observed cross country differences. The casual (average annual growth rate) evidence as well as the formal unit-root tests (based on a panel of EC countries) suggest that trends in real exchange rates (which under a common currency show up as cross-country inflation differentials) can be attributed to the trends in relative prices of home goods (where deviations from PPP in the traded sector do not contribute to these trends). And so, trends in cross-country inflation differentials (and real interest rate differentials) can be attributed to cross-country trends

[37] Canzoneri, Matthew, et al. (2002). "Productivity Trends in Europe: Implications for Real Exchange Rates, Real Interest Rates, and Inflation." *Review of International Economics*, Vol. 10(3): pp. 497-516.

in sectoral relative productivities. Canzoneri, Matthew, et al. (2002) calculated the trends in national inflation differentials rates that would be implied by observed trends in productivity and found them to be rather large. Furthermore, if these productivity trends continue, the underlying inflation differentials across the euro area could be as large as 2 or 3%. Performing a similar analysis for eight regions in the United States they found that the implied cross-regional inflation differentials were much smaller. Finally, it is noted that non-competitive forces (they call the "protected sector hypothesis") are not needed to explain their data set, however because their measures of productivity are endogenous, they do not rule them out.

Philipp Maier (2004)[38] notes how inflation differentials from EMU enlargement have primarily been discussed in the context of the Balassa-Samuelson effect, i.e., having resulted from inflation in nontradable goods. He, on the other hand, investigates the inflationary consequences of convergence of tradable goods' prices in an enlarged EMU. Maier (2004) does so because on average, tradable goods in new EU members account for more than 40% of the consumption basket. Thus, using disaggregate price level data, the simulations show that inflation in the new EU member states might on average be 1.5-3.5 percentage points higher than the rest of the current euro area with a considerable variation at the country level. Maier believes this inflationary effect to be due to convergence of prices of tradable goods which should thus be added to Balassa-Samuelson effect estimates (in fact his simulations exceed many estimates of the Balassa-Samuelson effect). Furthermore, Maier (2004) notes that the 'burden of adjustment' will rest mainly on the shoulders of the new EU members if the European Central Bank sets monetary policy in response to inflation developments in the entire currency area. In contrast, due to the small economic weight the new EU members carry, the impact on current euro area members will most likely be small.

[38] Philipp Maier (2004). "EMU Enlargement, Inflation, and Adjustment of Tradable Goods' Prices: What to Expect?" *De Nederlandsche Bank*: Working Papers 10.

2.3 Central and Eastern European Country Literature

"During the past decade we have witnessed some of the most dramatic political and economic changes in human memory with the collapse of the Communist regimes in Central, South and Eastern Europe. All of these countries are now in the process of restructuring their economies along market lines. The required restructuring and privatization are on a scale larger than anything that has been attempted in the past."[39] Hence, the inflationary trend noted by Maier (2004) [see above] along with an observed trend toward real exchange rate appreciation in Central and Eastern European countries (CEECs) over the past decade has not only raised the question as to whether the Balassa-Samuelson effect is in these countries but has also created an extensive literature on the subject, which has caused me to give it a subsection all its own.

MacDonald and Wojcik's (2002)[40] raised questions about the nature of the real appreciation observed in the CEECs. Their econometric tests seek to explain two dependent variables: the "internal exchange rate" (reconstructed using a data base giving prices by product) and the real exchange rate deflated by consumer prices. The main explanatory variable is the relative productivity of the two sectors, (the productivity of each of the sectors is taken to be labor productivity calculated by dividing value added by employment). The results show that the real exchange rate is linked to the productivity of the tradable goods sector rather than to the difference between the sectors, which runs counter to what is predicted by the Balassa effect.

Backé, Fidrmuc, Reininbger and Schardax (2002)[41] estimate the Balassa-Samuelson effect for CEECs, using productivity differentials, for the internal exchange rate. Their results show that the Balassa effect, brought about by the productivity differential is estimated to have been very large especially in Poland (where it stood at 9.8% between 1995 and 2000). This

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[39] Salvatore, Dominick (2001). "The Problems of Transition, EU Enlargement, and Globalization." *Empirica.* Jena, Vol. 28 (2), pp. 137.

[40] R. MacDonald and C. Wojcik (2002): "Catching up: The role of demand, supply and regulated price effects on real exchange rates of four accession countries," *Oesterreichische Nationalbank*, Focus on Transition 2002-2.

[41] P. Backé, J. Fidrmuc, T. Reininbger and F. Schardax (2002): "Price dynamics in Central and Eastern European EU accession countries", *Oesterreichische Nationalbank* Working Paper 61.

theoretical effect exceeded the rise observed of the relative prices of nontradables (5.3%), showing a narrowing of the margins of companies producing non-tradable goods over the period. This rules out the usual trend between prices and productivity that would have been expected.

But the Balassa-Samuelson effect estimated above is probably overestimated for two reasons. Firstly, to obtain the impact on the real exchange rate, on this domestic effect, we need to subtract the same effect in the euro area, even if this is slight. Rother (2000)[42] estimated this effect at approximately 1% per annum, or 0.4% to 0.6% for Germany for the 1995 to 2000 period. Secondly, labor productivity is used here. As the stock of capital was also renewed during this period, probably above all in the manufacturing sector, it is likely that the differences are smaller if total productivity is considered, but this bias is common in many studies. Nevertheless, the Balassa effect appears here to be particularly strong in Poland, for example, a figure of the same order (9.4%) was also cited by Kovacs (2002)[43] for the1992-1998 period in his survey of all of the available studies on the Balassa effect in Poland.

Egert, Drine Lommatszch and Rault (2003)[44] also used productivity differentials but obtain a much lower estimate for the same period in their Balassa-Samuelson effect in their investigation of 9 Central and Eastern European (CEE) transition countries. According to their results, even in countries where the increase in relative productivity in tradable goods has been very sharp, such as in Poland (5.5% to 9% depending on the definition of non-tradable goods used), the impact on relative prices compared to Germany (and therefore on the real exchange rate) remains moderate, between 1.2% and 2.4% per annum. Moreover, they find that their results are affected by the way sectors are classified, particularly whether or not agriculture is considered to part of the open sector. When the productivity differential between tradables and non-tradables

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[42] P. Rother (2000): "The Impact of Productivity Differentials and the Real Exchange Rate: An Estimation of the Balassa-Samuelson Effect in Slovenia", *IMF Staff Country Report* 00/56.
[43] M.A. Kovacs (2002): "On the Estimated Size of the Balassa Effect in Five Central and Eastern Europe Countries", *National Bank of Hungary*, Working Paper 2002/5.
[44] Egert, Drine Lommatszch and Rault (2003). "The Balassa-Samuelson Effect in Central and Eastern Europe: Myth or Reality?" *Journal of Comparative Economics*, vol. 31, pp 552–572.

is related to measures for relative prices using the CPI and PPI, no robust cointegrating vectors are detected. Given that the share of non-tradables in the CPI is very low, at close to 30% on average in these countries, and it is changing rapidly, this result is not surprising. Furthermore, regulated prices still account for between 15% and 25% of the CPI; these are likely to bias price changes because increases in administered prices may exceed rises in non-tradable inflation. Moreover, changes in administered prices may be erratic because they depend on politically motivated decisions. As long as goods with regulated prices are important input factors, e.g. energy and transport, increases in these may induce cost-push inflation in the economy as a whole. Therefore, Egert, Drine Lommatszch and Rault's (2003) results suggest that the Balassa-Samuelson effect may have a limited role to play in price level convergence and the real appreciation of the currency. However, with further progress in real convergence and thus a higher weight of services in the consumer baskets, the impact of the Balassa-Samuelson effect on CPI may increase. Nevertheless, the authors conclude that the Balassa-Samuelson effect will not pose serious problems to the achievement of nominal convergence as required by the Maastricht criteria and that further investigation is needed to determine the role played by other factors in the real appreciation of the currencies of accession countries.

Coudert (2004)[45] gives a detailed explanation on why the Egert, Drine Lommatszch and Rault (2003) estimate is so low. "Firstly, as it is an estimate of the Balassa effect on the external real exchange rate, and not on domestic inflation, we need to subtract the same effect for the euro area from the domestic Balassa effect of the CEECs. Égert *et al.* (2002) take Germany as the reference, where this effect is estimated to be between 0.4% and 0.5% annually over the period under review, i.e. 1995-2000. However, this factor only explains a small part of the de*via*tion observed between the two estimates." (pp. 35) Secondly, the authors judge that prices depend solely on labor productivity, where the share of labor is the same in the two sectors and where

[45] Coudert, Virginie (February 2004). "Measuring the Balassa-Samuelson Effect for the Countries of Central and Eastern Europe?" *Banque de France Monthly Digest* No. 122.

labor productivity replaces total productivity. This formulation can lead to the estimation of a lower effect than a formulation where the share of labor, greater in the services sector, increases the impact of the productivity differential. Finally, Coudert explains how the authors' approach considers the effects on the CPI, unlike previous studies who used the prices of value added. But the share of non-tradable goods in this price index is very small for the CEECs given that only 20% to 30% of the productivity differentials between sectors is passed on to consumer prices. "However, using the same services-based weighting, whether or not agriculture is included in tradable goods with respect to productivity gains, can interfere with the interpretation of the results. More fundamentally, taking a long-term perspective, we may expect the share of services in the price index to increase, catching up with that of euro area countries, which would automatically amplify the Balassa effect." (pp. 35)

Nevertheless, most of the estimates concerning the CEECs though use panel data, gives the short series available for individual countries. For example, De Broek and Slok (2001) regress the real exchange rate on the productivity differential between sectors for a range of CEECs; depending on the specifications used, the elasticities obtained vary between 0.2 and 0.6. Using a similar panel regression, Coricelli and Jazbec (2001) find an elasticity of about 0.5. The panel data papers are numerous, making it difficult to describe them all in detail. Breuss (2003)[46] summarizes the most recent estimates in a table such as Table 2.3.1 that follows:

[46] F. Breuss (2003): "Balassa-Samuelson effect in the CEEC: Are they obstacles for joining the EMU?", *IEF Working Paper*, No. 52.

Table 2.3.1

CEEC Study	Sample Size (Countries)	Time Period	Estimated Effect Size
Arratibel, et al. (2002)[47]	10	1995-2001	*Insignificant*
Begg, et al. (2003)[48]	9	1991-1998	0.4 - 1.4%
Coricalli and Jazbec (2001)[49]	19	1990-1998	0.7 - 1.2%
De Broek and Slok (2001)[50]	10	1993-1999	1.4 - 2%
Égert (2002)[51]	5	1991-2001	0.5 - 1.8%
Fischer (2002)[52]	10	1990-1998	1.9 - 2.6%
Halpem and Wyplosz (2001)[53]	8	1991-1999	2 - 2.2%
Pelksman, et al. (2000)[54]	10	1997-1999	3.8%

Table 2.3.1 shows that the average Balassa-Samuelson estimates fall within a bracket of 0.4% and 3.8% per annum. Furthermore, these results are difficult to use in that there is no consensus in the econometric method used to estimate the size of the Balassa-Samuelson effect given the considerable variation samples used from study to study. The majority of the CEEC studies accept a Balassa-Samuelson effect presence in the broad sense for CEECs. Most of these countries have been seen to exhibit a rise in the relative prices of services, an increase in relative productivity in the tradable goods sector and a trend appreciation of the real exchange rate.

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[47] Arratibel, O., Rodriguez-Palenzuela, D., and C. Thimann (2002): "*Inflation dynamics and dual inflation in accessive countries: A 'new Keynesian' perspective*", ECB Working Paper, No. 132.
[48] Begg, D., Eichengreen, B., Halpern L., Van Hagen, J., and C. Wyplosz (2003): "*Sustainable regimes of capital movements in accession countries*", CEPR Policy Paper, No. 10.
[49] Coricelli, F., and B. Jazbec (2001): "*Real exchange rate dynamics in transition economies*", CEPR Discussion Paper 2869.
[50] De Broeck, M., and T. Slok (2001): "Interpreting real exchange rates movements in transition countries", IMF WP 01/56.
[51] Égert, B. (2002): "Investigating the Balassa-Samuelson hypothesis in transition: Do we understand what we see?" A panel study, Economics of Transition, 10, pp. 273-309.
[52] Fischer, C. (2002): "Real currency appreciation in accession countries: Balassa-Samuelson and investment demand", Deutsche Bundesbank, Discussion Paper 19/02.
[53] Halpern, L., and C Wyplosz (2001): "*Economic transformation and the real exchange rates in the 2000s: The Balassa-Samuelson connection*", Economic Survey of Europe No. 1, United Nations Economic Commission for Europe.
[54] Pelksmans, J., Gros, D., and J. Nunez Ferrer (2000): "*Long run economic aspects of the European Union's enlargement*", Scientific Council for Government Policy, WP, No. 109.

Disagreement does however lie on the nature of these observed trends, which may be caused by other phenomena than the Balassa-Samuelson effect. For example, the gradual dismantling of systems of administrated prices might be a driving factor. Dubravko Mihaljek and Marc Klau (2003)[55] on the other hand criticize most studies for not testing the extent to which productivity differentials explain the differences in inflation between accession countries and the Euro area. Rather, they test a related "domestic" version of this hypothesis developed by Baumol and Bowen (1966), where service prices grow faster than manufactured goods prices due to faster productivity growth in manufacturing industries. Varying opinions also exist on the magnitude of the Balassa-Samuelson effect, where estimates range between 0.4% and 3.8% depending on the methods and samples employed.

[55] Dubravko Mihaljek and Marc Klau (October 2003). "The Balassa-Samuelson Effect in Central Europe: A Disaggregated Analysis." *Bank for International Settlements* Working Papers No. 143.

3. Background on Econometric Methodology

A vast majority of macroeconomic studies are based on time series techniques. Within these techniques it, viewing time series as relations of stochastic processes has become convention. By doing so, statistical inference can be used to construct and test equations that describe economic relationships between variables; one can test hypotheses and estimate relationships, derived from economic theory. An important concept that has furthered our understanding of macroeconomic time series' properties is nonstationarity which describes variables whose trend does not indicate a reversion to a linear trend or constant value.

Until the mid-1980s, statistical theory was based on creating and testing large simultaneous-equation models that were based on variable stationarity assumptions, where equations with nonstationary variables were estimated using regular linear regressions. Today, it is well known that doing so may very well lead to completely spurious[56] estimates. We can thank Clive Granger and Paul Newbold (1974)[57] for this critical insight; they were the first to point out that these type of tests may often convey a statistically significant relationship between variables when in reality such a relationship does not exist. Recognizing this possibility marked the beginning of Granger's quest to develop more useful econometric methods and models.

Initial econometric solutions of the problem of spurious regressions included using first differences or removing the linear trend. But most economic theories are formulated for variable levels rather than for differences and so relating the first differences of these variables would not make proper use of many theories. Also, the use of detrended variables seemed problematic because doing so requires the unrealistic assumption that variables follow separate deterministic trends. Furthermore, the use of both of these suggestions does not allow us to characterize the long-run dynamic relationships between variables.

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[56] In the unit root literature, when a stochastic error of a regression is unit root nonstationary, the regression is technically called a spurious regression. This is because the standard t-test tends to be spuriously significant even when the regressor is statistically independent of the regressand in Ordinary Least Squares.
[57] Granger, C. W. J. and Newbold, P. (1974) "Spurious Regressions in Econometrics," *Journal of Econometrics* 2, 111-120.

The solution posed by Granger (1981)[58] can be shown with this regression equation:

Equation 1: $y_t = \alpha + \beta x_t + \varepsilon_t$ where,

- y_t denotes the dependent variable,
- x_t denotes the single exogenous regressor, and
- ε_t denotes the white-noise, mean-zero sequence

He explains that an equation to be important, it must be consistent (explanatory/right hand side variable simulations should generate the major properties of the variable being explained). So, if ε_t is to be white noise and y_t is a seasonal variable, then x_t should also be seasonal variable. Furthermore, he defined the concept of a variable's integration degree, where given a variable such as z_t which can be made stationary trough d differences then it is integrated of order d, or I(d). Similarly, weakly stationary random variables are I(0). Thus, if $z_t \sim$ I(1), then $\Delta z_t \sim$ I(0). It should also be noted that I(1) variables dominate I(0) variables, thus if $z_t \sim$ I(1) and $w_t \sim$ I(0), then $z_t + w_t \sim$ I(1).

Now, assuming that both x_t and y_t from equation 1 are I(1), then, generally $y_t - \beta x_t$ is I(1) *unless* $\varepsilon_t \sim$ I(0), then $y_t - \beta x_t \sim$ I(0), meaning that the linear combination $(y_t - \beta x_t)$ has the statistical properties of an I(0) variable. In this special case, the coefficient β is unique and variables x_t and y_t are "cointegrated." Thus, if a linear combination of a set of I(1) variables is I(0), then the variables are cointegrated. Cointegration has become extremely important in nonstationary time series analysis.

The "Granger representation theorem," formulated in Granger and Weiss (1983)[59] exemplifies the importance of cointegration in nonstationary modeling and if one considers a bivariate autoregressive system of order p it can be illustrated as such:

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[58] Granger, C. W. J (1981). "Some Properties of Time Series Data and their use in Econometric Model Specification," *Journal of Econometrics* 16, 121-130.

[59] Granger, C. W. J. and Weiss, A. A. (1983) Time Series Analysis of Error-Correction Models," in S. Karlin, T. Amemiya and L. A. Goldman (eds), *Studies in Econometrics, Time Series and Multivariate Statistics, in Honor of T. W. Anderson*, Academic Press, San Diego, pp. 255-278.

$$x_t = \sum_{j=1}^{p} \gamma_{1j} x_{t-j} + \sum_{j=1}^{p} \delta_{1j} y_{t-j} + \varepsilon_{1t} \qquad \text{and} \qquad y_t = \sum_{j=1}^{p} \gamma_{2j} x_{t-j} + \sum_{j=1}^{p} \delta_{2j} y_{t-j} + \varepsilon_{2t}$$

where, x_t and y_t are I(1) and are cointegrated, and ε_{1t} and ε_{2t} are white noise. The Granger representation theorem says that this system can be written as:

Equation 2:
$$\Delta x_t = \alpha_1 (y_{t-1} - \beta x_{t-1}) + \sum_{j=1}^{p-1} \gamma_{1j}^{*} \Delta x_{t-j} + \sum_{j=1}^{p-1} \delta_{1j}^{*} \Delta y_{t-j} + \varepsilon_{1t}$$

$$\Delta y_t = \alpha_2 (y_{t-1} - \beta x_{t-1}) + \sum_{j=1}^{p-1} \gamma_{2j}^{*} \Delta x_{t-j} + \sum_{j=1}^{p-1} \delta_{2j}^{*} \Delta y_{t-j} + \varepsilon_{2t}$$

where at least one of parameters α_1 and α_2 deviates from zero. Both equations of the system are "balanced", that is, their left-hand and right-hand sides are of the same order of integration, since $y_{t-1} - \beta x_{t-1} \sim$ I(0).

Furthermore, if we suppose that $y_t - \beta x_t = 0$ defines a dynamic equilibrium relationship between the two economic variables, y and x, then $(y_t - \beta x_t)$ shows the degree of disequilibrium while the coefficients, α_1 and α_2, represent the strength of the disequilibrium correction; the system is therefore said to be in "error-correction" form. When a system is characterized by these two equations may be in disequilibrium at any point in time, but has the tendency to adjust itself towards the equilibrium.

Econometric models cannot therefore be specified without knowledge of variables' integration order and so various tests for unit root (nonstationarity) identification have been developed (such as those by Fuller (1976)[60], Dickey and Fuller (1981)[61], and Phillips and Perron (1988)[62], as well as others).

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[60] Fuller, W. A. (1976), *Introduction to Statistical Time Series*, Wiley, New York.
[61] Dickey, D. A. and Fuller, W. A. (1981) "Likelihood Ratio Statistics for Autoregressive Time Series with a Unit Root," *Econometrica* 49, 1057-1072.
[62] Phillips, P. C. and Perron, P. (1988). "Testing for a Unit Root in a Time Series Regression," *Biometrika* 75, 335-346.

The concept of cointegration however, is useless if a statistical theory for testing is not provided. It was not till Engle and Granger (1987)[63] that this necessity was presented. In this highly influential paper, they considered the problem of testing the H_0: No cointegration between a set of I(1) variables. They do so by estimating the coefficients of a static relationship between these variables via OLS and then applying unit root tests to the residuals. A rejection the null hypothesis (a unit root) proves evidence of cointegration. Today, it is possible to test the H_0 of a linear relationship between the I(1) variables as a cointegrating one (i.e., the errors are stationary) against the H_1 of no cointegration (i.e., the errors are nonstationary). Such tests, created by Shin (1994)[64] as well as others are based on Kwiatkowski, Phillips, Schmidt and Shin (1992)[65] well-known stationarity test.

Engle and Granger (1987) also revealed the vital contribution of a two stage estimation method for vector autoregressive (VAR) models with cointegration. This can be illustrated with the following VAR model of order p:

Equation 3: $$\Delta x_t = \alpha\beta' x_{t-1} + \sum_{j=1}^{p-1} \Gamma_j \Delta x_{t-j} + \varepsilon_t \qquad (t = 1,\ldots T)$$ where,

- x_t denotes an $n \times 1$ vector of I(1) variables
- $\alpha\beta'$ denotes an $n \times n$ matrix such that the $n \times r$ matrices α and β have rank r
- $\Gamma_j, j = 1, \ldots, p-1$ denotes $n \times n$ parameter matrices
- ε_t denotes an $n \times 1$ vector of white noise with a positive definite covariance matrix
- T denotes the number of observations

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[63] Engle, R. F. and Granger C. W. J. (1987). "Co-integration and Error-Correction: Representation, Estimation and Testing," *Econometrica* 55, 251-276.
[64] Shin, Y. (1994). "A Residual –Based Test of the Null of Cointegration Against the Alternative of No Cointegration," *Econometric Theory* 10, 91-115.
[65] Kwiatkowski, D., Phillips, P. C. B., Schmidt, P. and Shin, T (1992). "Testing the Null Hypothesis of Stationarity against the Alternative of a Unit Root: How sure can are we the Economic Series have a Unit Root?" *Journal of Econometrics* 54, 159-178.

Given the above, if $0 < r < n$, the variables in x_t are cointegrated with r cointegrating relationships $\beta' x_t$. Furthermore, Engle and Granger use Stock's (1987)[66] result [that $\hat{\beta}$ is superconsistent since, under certain conditions, the least squares estimator of β, $\hat{\beta}$, is consistent and converges to the true value at the rapid rate T^{-1}] and demonstrate how the maximum likelihood estimator of the remaining parameters α and Γ_j, (obtained by replacing β with $\hat{\beta}$) have the same asymptotic distribution as the estimator based on the true value of β. Furthermore, if the variables of x are cointegrated, the parameters can be estimated in two steps. Firstly, estimate the cointegrating space, β using a form of least squares and secondly, hold that estimate fixed and estimate the remaining parameters by maximum likelihood. By doing so, the estimators of α and $\Gamma_j, j = 1, ..., p - 1$, are consistent and asymptotically normal. Finally, one can test, with conventional statistical inference, hypotheses concerning these parameters and their values.

The 1987 Engle and Granger results generated a huge supply of applications, where the use of VAR models, created by Sims (1980)[67], increased dramatically since they now offered an alternative to simultaneous-equation models. Though Sims emphasized the use of unrestricted VAR models to model economic relationships, without unnecessary assumptions, the VAR model with cointegration is often based on the idea of a long-run, or moving equilibrium, defined by economic theory and characterized by the vector $\beta' x_{t-1}$ of equation 3. The short-term dynamics on the other hand, are given by parameter matrices Γ_j, and are free from restrictions as is the strength-of-adjustment matrix α which describes the contribution of the long-run disequilibrium to the adjustment process towards the moving target or equilibrium.

An extension and thus an alternative to VARs are vector error correction models (VECM). A VEC model is a restricted VAR designated for use with non-stationary series that are known to be cointegrated. The VECM has cointegration relations built into the specification so

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[66] Stock, J. H. (1987). "Asymptotic Properties of Least Squares Estimators of Cointegrating Vectors," *Econometrica* 55, 1035-1056.

[67] Sims, C. A. (1980). "Macroeconomics and Reality," *Econometrica* 48, 1-48.

that it restricts the long-run behavior of the endogenous variables to converge to their cointegrating relationships while allowing for short run adjustment dynamics. The cointegrating term is known as the "error correction" term since the deviation from long-run equilibrium is corrected gradually through a series of partial short-run adjustments. For example: Given a two variable system with one cointegrating equation and no lagged difference terms (for simplicity):

Equation 4: $y_{2t} = \beta y_{1t}$

The vector error correction is therefore:

Equation 5: $\Delta y_{1t} = \alpha_1 (y_{2t-1} - \beta y_{t-1}) + \varepsilon_{1t}$

$\Delta y_{2t} = \alpha_2 (y_{2t-1} - \beta y_{t-1}) + \varepsilon_{2t}$

In equation 5, only the right hand side is the error correction term. In long-run equilibrium this term is zero. On the other hand, if y_1 and y_2 deviate from long-run equilibrium, the error correction term will be non-zero and each variable adjusts to partially restore the equilibrium relation. Finally, the coefficient α_i measures the speed of adjustment of the i-th endogenous variable toward equilibrium.

Thus, one can say with ease that Engle and Granger's two-step method has revolutionized modern economic modeling via nonstationary cointegrated time series. One crucial development springing from the Engle and Granger contributions is the work of Johansen (1988)[68] and (1991)[69]. Johansen derived the maximum likelihood estimator of β (meaning the space spanned by the r cointegrating vectors in equation 3) using reduced rank regression. Also, he derived sequential tests for determining the number of cointegrating vectors. Johansen's method differs however, in the sense that it builds directly on maximum likelihood estimation instead of depending on least squares. Moreover, it is important to note that Hylleberg, Engle, Granger and

[68] Johansen, S. (1988). "Statistical Analysis of Cointegration Vectors," *Journal of Economic Dynamics and Control* 12, 231-254.
[69] Johansen, S. (1991) "Estimation of Hypothesis Testing of Cointegration Vectors in Gaussian Vector Autoregressive Models," *Econometrica* 59, 1551-1580.

Yoo (1990)[70] have extended the concept of cointegration to seasonally integrated variables and in applied work, it has become very common to treat a time series with strong seasonal variation stationary with seasonal differencing. For example, if x_t is a nonstationary quarterly series, its seasonal difference $\Delta_4 x_t = x_t - x_{t-4}$ may be I(0). If two nonstationary seasonal series x_t and y_t can be made I(0) by seasonal differencing and there exists a linear combination $y_t - \beta x_t \sim$ I(0), then the two series are called seasonally cointegrated. Finally, the concept of multicointegration was initiated by Granger and Lee (1990)[71] and has been found to be a useful tool.

[70] Hylleberg S., Engle, R. F., Granger, C. W. J. and Yoo, B. S., (1990). "Seasonal Cointegration," *Journal of Econometrics* 44, 215-238.

[71] Granger, C. W. J. and Lee, T. (1990). "Multicointegration," in G. F. Rhodes, Jr and T. B. Fomby (eds), *Advances in Econometrics: Cointegration, Spurious Regressions and Unit Roots*, JAI Press, New York, pp. 17-84.

4. Theoretical Background: The Balassa-Samuelson Hypothesis

4.1 A Preliminary Cointegration Test: The Real Exchange Rate and Economic Development

The implications of Balassa-Samuelson described in section 1 links the real exchange rate with economic development, often called the "catching up" process, giving them an interrelate long-run relationship. Thus the first (preliminary) cointegrating relationship that will be tested becomes: $\ln(e_t) = \gamma \ln(y_t) + \varepsilon_t$. Specifically, I test the long run cointegrating relationship between GDP per capita (often used as an indicator of development) and the real exchange rate: $\ln(RER_t) = \gamma \ln(\text{Per Capita GDP}_t) + \varepsilon_t$, were RER will be given by the natural logarithm of the real exchange rate.

The Variables Needed

- *E*: nominal exchange rate with respect to the US dollar (noting that the national currencies preceding the European Monetary Union will be used)
- *P*: the general domestic price index (the domestic CPI)
- *P** is the general foreign price index (the United States' CPI)

These three variables will be used to create *e*: the domestic real exchange rate, where the definition of *e* here is $e = \frac{P}{EP^*}$, the ratio between the domestic price level and the foreign price level (where the United States' will be used) deflated by the nominal exchange rate.

- *GDP per capita*: GDP divided by the population (Obviously quarterly population estimates are difficult, if not impossible to find thus I will extrapolate the population data making its quarterly growth rate linear.)

4.2 Balassa-Samuelson and Productivity Differentials Theoretically

As described earlier, the Balassa-Samuelson hypothesis can for the most part be decomposed into its three main assumptions. These assumptions include:

1. The productivity differentials between the traded and nontraded sector and relative prices are positively correlated.
2. The real exchange rate and the relative prices of nontraded goods are positively correlated.
3. Purchasing power parity holds for the tradable goods sector.

Drine and Rault (2002), (see above) though concerned with the panel data implications of Balassa-Samuelson in Asian countries, give a great description of the phenomenon in a partial equilibrium model context. I test the Balassa-Samuelson hypothesis using their framework for the countries of Europe's southern periphery (Greece, Italy, Spain and Portugal). Their theoretical formulation follows as such: Given a small open economy composed of homogeneous firms, the representative firm produces two types goods: those available to the world market, the tradable goods and those produced for available for domestic demand and consumption, the non-tradable goods. Tradable and nontradable good production requires the use of both capital and labor. Competition is assumed perfect, and so factors of production are paid at their marginal productivities. Also, because labor markets are perfectly mobile, workers of equivalent skill and training are guaranteed equal wages and the supply of labor is assumed constant. Finally, in the absence of nominal rigidities, equilibrium exchange rates will depend on a productivity differential and demand side factors are absent and all variables are expressed in terms of tradable goods.

The representative firm, given its technology and capital accumulation constraints, maximizes its intertemporal profit:

Equation 1: $Max \int_0^{\infty} (y_T(k_T, l_T) + py_N(k_N, l_N) - wl - i)e^{-rt} dt$, subject to: $\dot{k} = i - \delta k$, where

- y_T represents tradable good production

- y_N represents nontradable good production
- p denotes the relative price of non-tradable goods in terms of tradable goods
- i denotes investment
- w denotes wages
- k denotes capital
- l which is equal to $l_N + l_T$ represents the supply of labor
- r represents the foreign interest rate

Equilibrium can therefore be defined as:

$$\frac{\partial y_T}{\partial k} = p\frac{\partial y_N}{\partial k_N} = r, \qquad p\frac{\partial y_N}{\partial l_N} = \frac{\partial y_T}{\partial l_T} = w \qquad \text{and} \qquad \lambda = 1.$$

Given this, the following relationship between relative prices and the productivity ratio can be attained:

Equation 2: $$p = \frac{\frac{\partial y_T}{\partial l_T}}{\frac{\partial y_N}{\partial l_N}}.$$

For the Cobb-Douglas case, this relation becomes:

Equation 3: $$p = \frac{\alpha\theta_T}{\beta\theta_N}, \qquad \text{where}$$

- α represents the production-labor elasticity for the tradable goods sector
- β represents the production-labor elasticity for the nontradable goods sectors
- θ_N denotes the average labor productivity for the nontradable goods sector
- θ_T denotes the average labor productions for the tradable goods sector

Equation 3 shows how relative prices are a function of the productivity ratio of the two goods, and so a faster increase in the productivity of tradable goods productivity relative to nontradable

goods' productivity will cause an increase in the relative prices of nontradables. This is basically the first assumption listed above.

Now, the real exchange rate is defined as:

Equation 4: $e = \frac{P}{EP^*}$, where

- P represents a general domestic price index
- P^* represents a general foreign price index
- E represents the nominal exchange rate

and an increase therefore indicates an appreciation.

Then, under the assumption that the consumer basket contains both tradable and nontradable goods, the general domestic price index can be expressed as $P = P_T^{\varepsilon} P_N^{1-\varepsilon}$, while the foreign price index can be seen as $P^* = (P_T^*)^{\varepsilon}(P_N^*)^{1-\varepsilon}$. Furthermore, under the second assumption listed above where parity purchasing power is assumed to hold in the tradable goods sector we can get:

Equation 5: $\ln(e) = (1-\varepsilon)\ln(p) - (1-\varepsilon)\ln(p^*)$ where,

- p represents the relative domestic price for nontradable goods
- p^* represents the relative foreign price for nontradable goods

This equation basically conveys the information of the third listed assumption, the real exchange rate is positively correlated to the relative price of nontraded goods.

Finally, combining the three assumptions in the context just developed above a "general" Balassa-Samuelson relationship can be defined as: $\ln(e) = \phi + (1-\varepsilon)\left[\ln\left(\frac{\theta_T}{\theta_N}\right) - \ln\left(\frac{\theta_T^*}{\theta_N^*}\right)\right]$. This relationship expresses how relative productivity differentials determine the behavior of the long-term real exchange rate.

It follows from the above analysis of the Balassa-Samuelson effect that the econometric test that will be done can be written as:

$$\ln(RER_t) = c + \gamma \ln\left(\frac{\frac{\theta_{Tt}}{\theta_{Nt}}}{\frac{\theta^*_{Tt}}{\theta^*_{Nt}}}\right) + \varepsilon_t .$$

Essentially, a long -run relationship between the real exchange rate (where RER has the same meaning as before) and relative productivity differentials is sought and given predictions of the Balassa-Samuleson hypothesis, γ is expected to be positive since an increase of the real exchange rate implies an appreciation.

The Variables Needed

- E: the domestic nominal, pre-EMU, exchange rate given the US dollar
- P: the general domestic price index (the domestic Consumer Price Index)
- P^* is the general foreign price index (the United States' Consumer Price Index)

These three variables will be used to create e: the domestic real exchange rate, where the definition of e here is $e = \frac{P}{EP^*}$ where again a real exchange rate increase means an appreciation.

- θ_T: the average domestic labor productivity for the tradable sectors
- θ_N: the average domestic labor productivity for the nontradable sectors
- θ_T^*: average foreign (meaning the United States') labor productivity for the tradable sectors
- θ_N^*: average foreign (the United States') labor productivity for the nontradable sectors

For the four labor productivity variables just listed, the value added for each sector as well as employment data will be employed, since average productivities for tradable and nontradable sectors will be defined as the value added by each sector divided by employment in each sector.

5. Korea: The Canonical Case

5.1 Korean Economic and Political Background[72]

Over the last 42 years the economy of South Korea has been an impressive one. During these years, the country has had only two years of negative growth: in 1980, with the second oil shock and in 1997 with the Asian financial crisis. Korea's economic performance began to change in 1963 when Park introduced a wide range of economic reforms where (until the financial crisis in 1997), real per capita income growth, adjusted in purchasing power terms, averaged more than 6% annually, standing at more than eight times its initial level. In other words, in 1963 the country's income level was below that of Bolivia and Mozambique and by 1997, it was higher than that of Greece and Portugal. To really understand the Korean experience though, one needs examine its unique economic history.

Basically, South Korea gained its independence from Japan in 1948 where its president Rhee Syng-man made sure to exploit the state to generate rents, and politicize the distribution. From 1950 - 1953 the Korean War left the country devastated. During this period aid financed most of capital accumulation which peaked in the late 1950s, when it accounted for 85% of imports.

In 1961, a military government led by General Park Chung-hee gained control. The condition of the economy when Park took power can be summarized as such: gross domestic saving net of aid was pitiful, gross investment (primarily financed through aid) stood slightly over 10% of GDP, and the current account was roughly balanced. After two years of poor economic performance, the military government unified the existing multiple exchange rate system, devalued the currency, and instilled a series of reforms. After experimenting briefly with a floating exchange rate, the currency was pegged to the US dollar until 1980. Domestic saving net of aid began rising rapidly and domestic investment rose even faster.

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[72] Information for this section was gathered from www.wikipedia.org, and www.eiu.com.

Though Park's reforms marked an important departure from past practices, the state's role in the development process was also preserved with pervasive regulatory entry barriers and the encouragement of the "chaebol" (family-dominated conglomerates) to diversify into otherwise unrelated lines of business causing the socialization of risk. By the 1980s, the top 10 chaebol accounted for more than 20% of national income. The accumulation of capital contributed to a rapid technological upgrading as well as a transformation of output composition. In 1963 non-fuel primary products accounted for more than half of South Korea's exports, and human hair wigs became the third leading export. A decade later South Korea's exports were dominated by manufactures such as textiles, electrical products, iron and steel and only one primary product, fish, made the top ten. This capital accumulation was mostly financed by growing domestic savings, augmented with the significant inflow of saving from abroad, reaching almost 10% of GDP in 1971 and surpassing this level in 1974 after the first oil shock.

In 1972, under Park's third elected term, the "Yushin" (Revitalization) Constitution, made Park president for life. He initiated the intensive promotion of heavy industry through what came to be known as the Heavy and Chemical Industry (HCI) policy. Modest financial sector liberalizations that had been undertaken in the late 1960s were reversed in 1972, when interest rates were lowered and direct government control of the banking system was increased in order to channel capital to preferred sectors, projects, or firms. In order to finance large-scale projects, special public financial institutions were established, and private commercial banks were instructed to make loans to strategic projects on a preferential basis. By the late 1970s, the share of these "policy loans" had risen to 60%.

Park was assassinated in 1979, and General Chun Doo-hwan came into power, driven by narrow career interests rather than by any views of economic direction. The country's deteriorating economic performance worsened by the second oil shock and so Chun and his cronies turned to Western-trained economic technocrats to improve the economy. South Korea managed to avoid financial trouble until the early 1980s when world wide growth decelerated in

the wake of the second oil shock. Although the external debt and the debt service ratio had increased substantially in the late 1970s, Korea was able to resume high sustained growth by 1983. A combination of reduced imports caused a sharp (though brief) decline in income, and the real exchange rate depreciated via a 20% nominal devaluation, Chun's technocrats implemented macroeconomic stabilization policy through which they began to liberalize and deregulate the South Korean economy. From 1982-1986 a liberalization of the financial sector was initiated and was further extended from 1987–1991.

Until the 1980s, a capital channeling development strategy was pursued, resting on the twin pillars of financial repression and capital controls. These policies emphasized growth but not profitability given the socialization of risk. Also, the government's customary interventions promoted further borrowing. From the standpoint of the lender, the bigger the firm, the more creditworthy the firm was, because size increased the likelihood of government intervention if the firm faced financial trouble, which they often did. As growth continued, firms became highly leveraged and thus loans became the mechanism for growth and, paradoxically, debt signaled creditworthiness. This system of corporate financing encouraged extensive cross-shareholding, cross-loan guarantees, and non-transparency.

Over time, pressure for liberalization developed from both domestic firms, who were disadvantaged in international competition, and from the US government, which promoted the interests of American financial service providers. The outcome of this tension was a gradual, uneven, and problematic liberalization program that both contributed to and was overtaken by the 1997 financial crisis since many of the reforms were corrupted by special interests. Part of the process of unifying the financial markets had been the regularization and squeezing of traditional commercial banks whose share of deposits and lending steadily declined. This process accelerated in the mid-1990s when a new class of institutions emerged. These merchant banks played a significant role in the subsequent crisis both at home and abroad through connected lending to their chaebol owners.

Particularly, the South Korean investment boom from 1994-1996 was financed by mismatched foreign borrowing. Unlike in Southeast Asia, where the investment boom was concentrated in the real estate sector, much of the capital was flowing into manufacturing, presumptively giving less cause for concern. However, a substantial share was invested in industries that were already arguably characterized by excess capacity, and by the mid-1990s South Korea was experiencing slowing total factor productivity growth, deteriorating terms of trade, and declining profitability. South Korea's largest export market, Japan, went into recession in 1996, and the yen began to depreciate significantly against the dollar, generating an effective real appreciation of the won. Export growth slowed in 1996 and turned negative the following year and stock market prices, which peaked in 1994, began to decline.

Conditions only worsened in January 1997 when Hanbo Steel, the 17th largest chaebol collapsed, causing a series of bribery arrests including the arrest and conviction of President Kim Young-sam's son and political confidante, Kim Hyun-chol. This shook the political establishment and greatly damaged Kim senior. The Hanbo collapse was followed by the failures of two more chaebols, driving up interest rates in the large corporate bond market and imposing negative externalities on all corporate borrowers. During the second quarter of 1997, spreads on South Korean government bonds began to widen, and the market was signaling an increase in South Korean country risk.

The turning point arguably came in June with the failed nationalization of Kia, the country's third largest automaker. In the second half of 1997 South Korea was rocked by the shocks emanating from the financial crisis that had seized Southeast Asia and from an emerging banking crisis in Japan, its principal source of foreign loans. The South Korean economy was adversely affected through three channels: spillovers in real terms as the depreciations of its competitors (especially Taiwan) enacted competitive devaluations; contagion in financial terms; and the steep decline in rollover rates given the troubled Japanese banks. The result was a collapse in private capital inflows. These forces put considerable downward pressure on the won

in the latter half of 1997. South Korean authorities were therefore forced to spend billions of dollars to maintain their quasi-peg, but were unsuccessful and by December the exchange rate was set free, and went into a freefall. Developments in the currency market rebounded on the domestic financial system. As the exchange rate collapsed, financial and non-financial firms with unhedged foreign denominated debt were crushed and by the end of the year, in a matter of eight months, the stock market had more than half of its value.

Economic turmoil caused South Korea to seek assistance from the IMF and its collaborators who ended up providing South Korea with an enormous package. However, the macroeconomic conditionality imposed on South Korea was too severe and it needlessly intensified the recession; the growth rate collapsed from 7% in 1996 to –7% in 1998 before rebounding to more than 10% in 1999. Also, the South Korean economy was marked with significant structural problems and so considerable demands for structural reform were expected.

Since the crisis, South Korea has made considerable progress on economic reform, better than the other heavily affected Asian crisis countries and even Japan for that matter. This progress can be seen in the increase of FDI from 1999-2000 (though is has fallen considerably since then). Also, competition was brought into the financial sector with the increased role of foreigners through a variety of institutional arrangements. In 1998 the government announced its plan to liberalize all foreign exchange transactions and in 2002 it announced a full liberalization of foreign exchange regulations by 2011 as part of an attempt to establish South Korea as a regional business hub for Northeast Asia. Presently the exchange rate system is classified by the IMF as an independent float in an inflation-targeting framework. In recent years though, there have been considerable exchange rate interventions which appear to go beyond Fund goals, focusing instead on preventing the appreciation of the won.

5.2 Real Exchange Rate and GDP Per Capita Cointegration

The Test

Section 4.1 describes the first test that is conducted which looks for a long-run cointegrating relationship between the real exchange rate and GDP per capita. This test can be written as: $\ln(RER_t) = \gamma \ln(\text{Per Capita GDP}_t) + \varepsilon_t$.

The Data

Table 5.2.1 summarizes the data that was attained for Korea.

Table 5.2.1

Nominal Exchange Rate	Korean Won per US dollar	Quarterly	1970 Q1 – 1996 Q4	IMF, *International Financial Statistics*
Korean Consumer Price Index	CPI - All Cities	Quarterly	1970 Q1 – 1996 Q4	IMF, *International Financial Statistics*
Gross Domestic Product	GDP in KRW at constant 2000 prices	Quarterly	1970 Q1 – 1996 Q4	IMF, *International Financial Statistics*
Population	Total Population	Annual	1970 – 1996	IMF, *International Financial Statistics*
US Consumer Price Index	US CPI - All Cities	Quarterly	1970 Q1 – 1996 Q1	IMF, *International Financial Statistics*

One should note that because only annual estimates of the population were available, the population data was extrapolated and so this data set assumes a linear population growth between quarters. That said, the complete Korean data set ranges from 1970 Q1 – 1996 Q4, leaving a total of 104 observations for each variable.

The Results

When the correlation coefficient, *r*, is calculated for the two data sets (lrer and lgdp) for Korea one attains an *r*-value of 0.32325. This indicates that the direction of association between these

the real exchange rate and GDP per capita is a positive linear relationship. Furthermore, the strength of association implied here between the two time series is a weak one.

The results of the unit root tests are given in Table 5.2.2:

Table 5.2.2

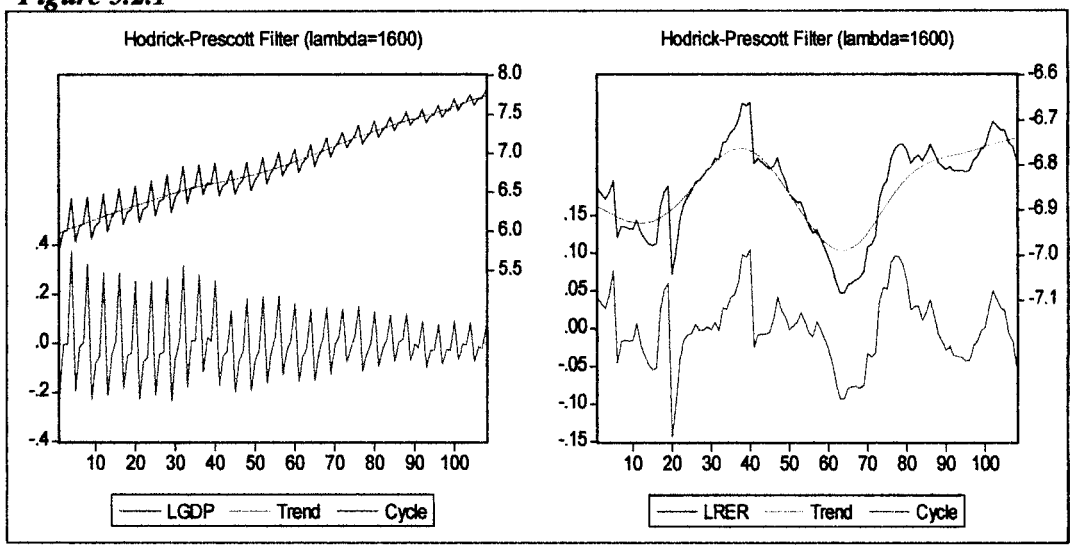
Test	Variable	Null Hypothesis	Alternative Hypothesis	Sign. Level	Test Statistic	Critical Values
Schmidt and Phillips (SP) Test	ln(RER)	Unit Root	No Unit Root	1%	-2.794	-3.61
	ln(GDP/Capita)	Unit Root	No Unit Root	1%	-10.5	-3.61
Kwiatkowski, Phillips, Schmidt and Shin (KPSS) Test	ln(RER)	Stationarity	Unit Root	10%	0.1786	0.119
				5%	0.1786	0.146
				2.5%	0.1786	0.176
				1%	0.1786	0.216
	ln(GDP/Capita)	Stationarity	Unit Root	10%	0.1614	0.119
				5%	0.1614	0.146
				2.5%	0.1614	0.176
				1%	0.1614	0.216
Augmented Dickey-Fuller (ADF) Test	ln(GDP/Capita)	Unit Root	No Unit Root	5%*	-0.163	-3.45
				1%*	-0.163	-4.04
* Taken from the G.S. Maddala and In-Moo Kim (1998) Table 3.1 (pp. 64)						

A unit root is found in the real exchange rate data for both the SP and KPSS tests. For the GDP per capita data, however, the SP and KPSS give contradicting results, where the SP test fails to accept the hull hypothesis of a unit root, while the KPSS rejects the stationarity hypothesis at the 2.5%, 5% and 10% levels. I therefore conducted a third unit root test (the ADF test), for the Korean GDP per capita data. The ADF test confirms a unit root for the GDP per capita data at both the 1% and 5% significance levels. I thus feel confident to conclude that a unit root is present in the Korean GDP per capita data set and so one can proceed with testing for cointegration.

Prior to testing for cointegration however, the data was run through a Hodrick-Prescott Filter in order to attain a smooth estimate of the long-term trend component of the series and

removing the effects of the business cycle. The changes to the data due to this filter can be seen in the graphs of Figure 5.2.1:

Figure 5.2.1



The cointegration estimates were then estimated. It is important to note now, that the theory recommends using estimates with a linear trend, since they are to reflect the non-tradable sector productivity evolution. Also, given the log likelihood estimates the optimal lag length chosen is zero. Thus, with the inclusion of a linear trend the Johansen test results are summarized in Table 5.2.3:

Table 5.2.3

Included observations: 107 after adjustments				
Trend assumption: Linear deterministic trend				
Lags interval (in first differences): No lags				
Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.01 Critical Value	Prob.**
None *	0.6741166	124.7135187	19.93710787	0.0001
At most 1	0.0433631	4.743453505	6.634896573	0.0294
Trace test indicates 1 cointegrating eqn(s) at the 0.01 level				
* denotes rejection of the hypothesis at the 0.01 level				
**MacKinnon-Haug-Michelis (1999) p-values				
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.01 Critical Value	Prob.**
None *	0.6741166	119.9700652	18.52001196	0.0001
At most 1	0.0433631	4.743453505	6.634896573	0.0294
Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.01 level				
* denotes rejection of the hypothesis at the 0.01 level				
**MacKinnon-Haug-Michelis (1999) p-values				

Given the results of the Johansen test provided above, a cointegrating relationship between the Korean real exchange rate and GDP per capita (the development degree of the economy) is detected.

The above result allows one to estimate a VECM to further understand of the short-run dynamics of these two variables. VECMs allow us to reintroduce (in a statistically acceptable way) the long-run information that is lost through differencing, where the error correction term produced provides the short-run adjustment to long-run equilibrium trends. These results are to be used as a canonical depiction of the Balassa-Samuelson effect for the Southern European countries interest. One should keep in mind, however that the Southern Korean experience is a more extreme one given the rapid development that this country experienced. Also, because

VECM estimates are very sensitive to lag length choice a number of lag lengths were tested (using the Akaike Information Criterion, Schwarz Criterion as well as the log likelihood and lag exclusion tests) and the ideal lag length for the filtered real exchange rate and GDP per capita data is zero. This lag length ends up being the ideal choice for all the countries tested here. The specific VECM results are provided in the Table 5.2.4:

Table 5.2.4

Vector Error Correction Estimates			***Vector Error Correction Estimates***		
Included observations: 107 after adjustments			Included observations: 107 after adjustments		
Standard errors in ( ) & t-statistics in [ ]			Standard errors in ( ) & t-statistics in [ ]		
Cointegrating Eq:	*CointEq1*		*Cointegrating Eq:*	*CointEq1*	
HPGDP(-1)	1.000000		HPGDP(-1)	1.000000	
HPRER(-1)	-18.21914 (1.11801) [-16.2961]		HPRER(-1)	4.506792 (0.05067) [88.9463]	
C	-131.7372				
Error Correction:	D(HPGDP)	D(HPRER)	*Error Correction:*	D(HPGDP)	D(HPRER)
CointEq1	0.001717 (0.00014) [12.6119]	0.000180 (0.00058) [0.31037]	CointEq1	-0.000682 (1.1E-05) [-64.0381]	-5.77E-05 (3.0E-05) [-1.93042]
C	0.016385 (0.00017) [96.5414]	0.001426 (0.00072) [1.97501]			
R-squared	0.602362	0.000917	R-squared	0.085458	-0.001893
Adj. R-squared	0.598575	-0.008599	Adj. R-squared	0.085458	-0.001893
Sum sq. resids	0.000324	0.005855	Sum sq. resids	0.000744	0.005871
S.E. equation	0.001756	0.007467	S.E. equation	0.002650	0.007443
F-statistic	159.0596	0.096327	F-statistic	NA	NA
Log likelihood	528.0905	373.1845	Log likelihood	483.5313	373.0342
Akaike AIC	-9.833468	-6.938027	Akaike AIC	-9.019277	-6.953911
Schwarz SC	-9.783508	-6.888068	Schwarz SC	-8.994297	-6.928931
Mean dependent	0.016385	0.001426	Mean dependent	0.016385	0.001426
S.D. dependent	0.002771	0.007435	S.D. dependent	0.002771	0.007435
Determinant resid covariance (dof adj.)		1.23E-10	Determinant resid covariance (dof adj.)		3.25E-10
Determinant resid covariance		1.18E-10	Determinant resid covariance		3.19E-10
Log likelihood		919.3378	Log likelihood		866.2279
Akaike information criterion		-17.07173	Akaike information criterion		-16.11641
Schwarz criterion		-16.92186	Schwarz criterion		-16.01649

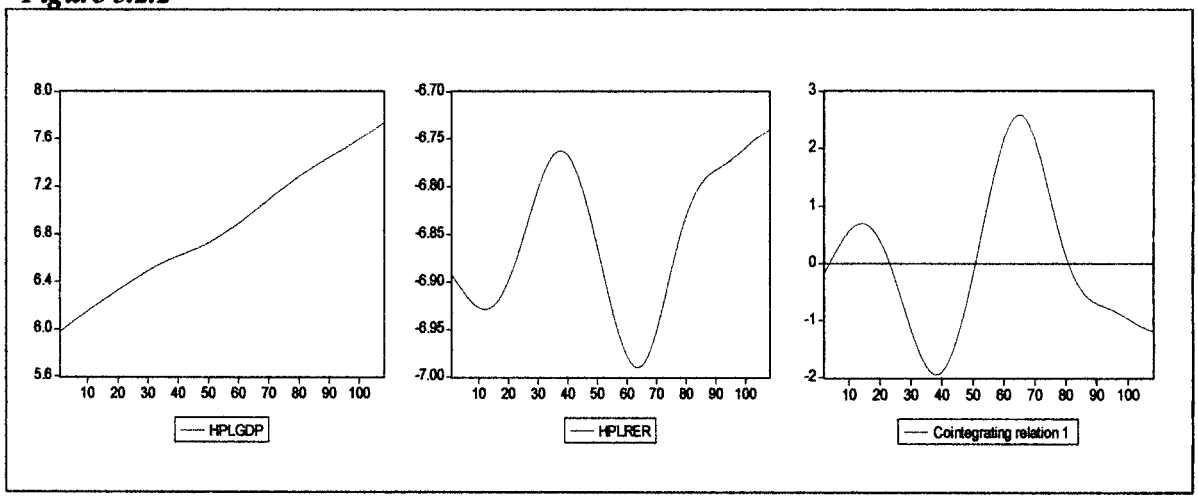
Once again, because theory recommends using estimates with a linear trend in order to reflect the non-tradable productivity growth, only the left hand side estimates will be taken under consideration. Substituting the coefficients into the model with a liner trend, we obtain the following two equations with their appropriate error correction term:

1. D(HPGDP) = 0.0017*(HPGDP(-1) - 18.2*HPRER(-1) - 131.7) + 0.016
2. D(HPRER) = 0.00018*(HPGDP(-1) - 18.21*HPRER(-1) - 131.7) + 0.0014

The error correction term is found significant only in the first of these two equations. This error correction term, often referred to as the "speed of adjustment factor," shows that in the short-run the first difference of GDP per capita converges to its long run equilibrium at a slow rate, at a percentage change of 0.2%.

Thus, for the years this test spans, from 1970 Q1 – 1996 Q4, the variables and the cointegrating relationships estimates can be seen in Figure 5.2.2 where they are graphed respectively.

Figure 5.2.2



These graphs seem to depict a situation where GDP per capita follows the real exchange rate at a very slow rate in the short-run, until long-run equilibrium is attained.

5.3 The Real Exchange Rate and Productivity Differentials

The Test

Though the results of the first cointegration test for Korea indicate that there is indeed a long-run relationship between GDP per capita and the real exchange rate, this result is insufficient for proving that the Balassa-Samuelson effect is at work. Therefore, as discussed in section 4.2 a second, more explicit test for the Balassa-Samuelson hypothesis will be conducted. This test can be summarized as:

$$\ln(RER_t) = c + \gamma \ln\left(\frac{\frac{\theta_{Tt}}{\theta_{Nt}}}{\frac{\theta^*_{Tt}}{\theta^*_{Nt}}}\right) + \varepsilon_t .$$

One basically tests for a cointegrating relationship between the real exchange rate and relative productivity differentials (between tradable and nontradable goods) given the home (Korean) and foreign nation (the United States).

The Data

Unfortunately, unlike the previous cointegration test, the data on Korean productivity differentials that was found only ran as far back as 1979 and ended in 2002. Thus, one should note that a different time period is being tested here which does not only include the pre-Asian crisis period for Korea. The data collected is summarized in the Table 5.3.1:

Table 5.3.1

Nominal Exchange Rate	Korean Won per US dollar	Annual	1979–2002	IMF, *International Financial Statistics*
Korean CPI	Korean CPI - All Cities	Annual	1979–2002	IMF, *International Financial Statistics*
Korean Labor Productivity	Labour productivity per hours worked (in 1000's of chained (1995) Won)[73]	Annual	1979-2002	Groningen Growth & Development Centre, *60-Industry Database*
US Labor Productivity	Labour productivity per hour worked (in chained (1995) Dollars)	Annual	1979-2002	Groningen Growth & Development Centre, *60-Industry Database*
US Consumer Price Index	US CPI - All Cities	Annual	1979-2002	IMF, *International Financial Statistics*

Most studies usually use labor productivity per total employees, but as one can see from Table 5.3.1 above, I did not use such a measure in order to avoid worker seasonality issues. Thus, labor productivity was measured using hours worked rather than with total employees. Finally, the distinction between the tradables and nontradables is provided for the reader in Appendix B.

The Results

The correlation coefficient, *r*, was then calculated for the real exchange rate (lrer) and relative productivity differential (lpd). For Korea the estimate attained was an *r*-value of -0.30259. This result is quite odd, since we would expect a positive linear relationship between the two variables, given the theory. However, this result is most likely due to the Asian crisis of 1997, and the 2001 terrorist attacks in New York City. For example, when one excludes these two years, the correlation coefficient, *r*, becomes 0.002051. Nevertheless, I will not exclude these dates because I feel that doing so would be a means of datamining since it will skew my results.

The next step of the testing is to see if there are unit roots in the two time series. The results of the unit root tests are provided in Table 5.3.2:

[73] One should note that the Labor productivity per hour worked variable is calculated by dividing the value added by the total persons engaged and then dividing this result by hours worked per employee.

Table 5.3.2

Test	Variable	Null Hypothesis	Alternative Hypothesis	Sign. Level	Test Statistic	Critical Values
Schmidt and Phillips (SP) Test	ln(RER)	Unit Root	No Unit Root	5%	-3.0883	-3.18
	ln(PD)	Unit Root	No Unit Root	5%	-1.2453	-3.18
Kwiatkowski, Phillips, Schmidt and Shin (KPSS) Test	ln(RER)	Stationarity	Unit Root	10%	0.1164	0.119
				5%	0.1164	0.146
				2.5%	0.1164	0.176
				1%	0.1164	0.216
	ln(PD)	Stationarity	Unit Root	10%	0.1369	0.119
				5%	0.1369	0.146
				2.5%	0.1369	0.176
				1%	0.1369	0.216
Augmented Dickey-Fuller (ADF) Test	ln(RER)	Unit Root	No Unit Root	5%*	1.15009	-3.6
				1%*	1.15009	-4.38
* Taken from the G.S. Maddala and In-Moo Kim (1998) Table 3.1 (pp. 64)						

As one can see from Table 5.3.2 above, the KPSS and the SP tests give contradicting results. Basically, the KPSS test fails to reject stationarity for the real exchange rate data (RER) while the SP test found unit root presence. Therefore, an ADF test was conducted to clear this contradiction. The ADF test results for the RER data indicate that indeed, this series is characterized by a unit root. These results allow the cointegration testing to proceed. One should note however, that the Hodrick-Prescott Filter was not used for these second set of tests because annual data was used and so the effects of the business cycle are not of a great concern.

The cointegration results are provided below in Table 5.3.3, where given the log likelihood estimates along with the Akaike information criterion, lag exclusion test estimates and the Schwarz criterion, the ideal number of lags indicated was zero:

Table 5.3.3

Included observations: 23 after adjustments				
Trend assumption: No deterministic trend				
Lags interval (in first differences): No lags				
Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.456901	22.2732512	20.2618396	0.026087
At most 1	0.300884	8.23259333	9.16454591	0.074925
Trace test indicates 1 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.456901	14.0406578	15.8920986	0.095523
At most 1	0.300884	8.23259333	9.16454591	0.074925
Max-eigenvalue test indicates no cointegration at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

The Johansen trace test[74] indicates that the real exchange rate and the relative productivity differentials for the base case of Korea are indeed cointegrated, indicating that the Balassa-Samuelson effect is indeed at work.

The above result of a cointegrating relationship between the real exchange rate and the relative productivity differentials allows for the estimation of a VECM to further understand of the short-run dynamics of these two variables. These results for South Korea are to be used as a canonical depiction of the Balassa-Samuelson effect for the Southern European countries interest.

[74] The difference between the trace and the maximum eigenvalue test is that the *trace test* tests the hypothesis that there are at most r cointegrating vectors, while the *maximum eigenvalue test* tests the hypothesis that there are $r + 1$ cointegrating vectors. The literature does not seem to specify a preference for one test over the other.

The VECM results for the Korean time series (given a lag length of zero) are provided in Table 5.3.4:

Table 5.3.4

Included observations: 23 after adjustments		
Standard errors in ( ) & t-statistics in [ ]		
Cointegrating Eq:	*CointEq1*	
LRER(-1)	1	
LPD(-1)	0.885121036 (0.359360067) [2.46305]	
C	5.938831527 (0.409474005) [14.5036]	
Error Correction:	D(LRER)	D(LPD)
CointEq1	-0.690420456 (0.161842856) [-4.26599]	0.13263539 (0.11504549) [1.15290]
R-squared	0.448035868	0.05230495
Adj. R-squared	0.448035868	0.05230495
Sum sq. resids	0.409024081	0.2066812
S.E. equation	0.136352498	0.09692575
F-statistic	NA	NA
Log likelihood	13.70338233	21.5532422
Akaike AIC	-1.104641941	-1.7872385
Schwarz SC	-1.055272628	-1.7378691
Mean dependent	-0.016603391	-0.0068522
S.D. dependent	0.183530256	0.09956458
Determinant resid covariance (dof adj.)		0.00017119
Determinant resid covariance		0.00015662
Log likelihood		35.4880045
Akaike information criterion		-2.6511308
Schwarz criterion		-2.4042843

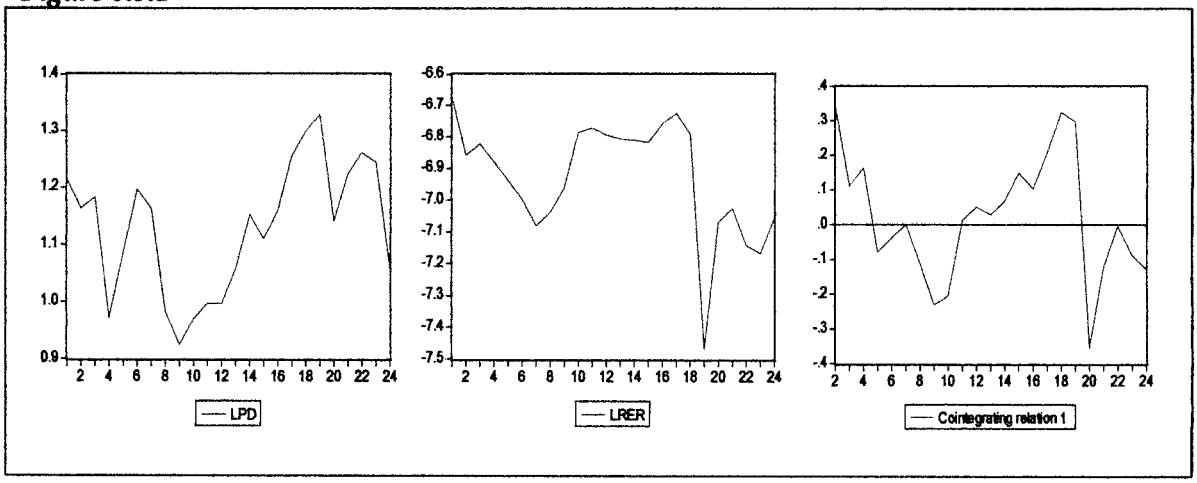
Now, substituting the appropriate coefficients one obtains the following two equations:

1. D(LRER) = - 0.690*(LRER(-1) + 0.885*LPD(-1) + 5.94)
2. D(LPD) = 0.133*(LRER(-1) + 0.885*LPD(-1) + 5.94)

Given the t-statistics, the error correction term is found significant for only the first of these two equations. It indicates that in the short-run, the first difference of the real exchange rate actually *diverges* at a rapid pace, at a percentage change of 69% as it moves toward its long-run equilibrium level.

Finally, one can see the variables of the Korean real exchange rate and relative productivity differentials along with their long-run cointegrating relationship for the years ranging from 1979-2002 respectively in the graphs of Figure 5.3.1.

Figure 5.3.1



6. Greece[75]

6.1 Greek Politics

Greek politics from WWI till the 1970s was characterized by a split between republicans and royalists and by the growth of communism. After decades of military rule, democracy was finally returned in 1974 when a referendum decided to keep the republican form of government. Basically, Political life in the post-dictatorship period has been dominated by two parties, both of which were founded in 1974: the conservative New Democracy (ND) party, headed by Constantine Karamanlis, and the left-wing Panhellenic Socialist Movement (Pasok), founded by Andreas Papandreou. Also, in 1975, the present Greek constitution was introduced, establishing Greece as a presidential republic and a parliamentary democracy. Conservatives basically dominated the 1970s, with Mr. Karamanlis serving two terms as Prime Minister before stepping up to the presidency in 1980.

In 1981, Greece became a member of the European Community (now the EU). Although the country was ill-prepared both economically and administratively for European Community membership and initially failed to use European funds efficiently, membership did help to bolster Greece's fragile democracy. Also, in 1981, the socialist Mr. Papandreou and his Pasok party won the general election to form Greece's first socialist government. The socialists held power for all of the 1980s and economic policy was characterized by income redistribution, efforts to establish a social security system with universal healthcare and pensions, and an expansion of the already large state sector. These policies were financed through heavy borrowing, and by the mid-1980s both the government finances and inflation were out of control. Following its re-election in 1985 Pasok sought EU balance-of-payments assistance, which required the party to implement an austerity program. The resulting financial hardship, combined with high-level corruption, was responsible for the steady erosion of the government's popularity in the late 1980s and its

[75] The information on Greece's political and economic history was compiled from the following websites: www.greekembassy.org, www.wikipedia.org, and www.eiu.com.

electoral defeat in 1989. There were three general elections and two hung parliaments in the space of ten months during 1989-90. In April 1990 ND, under the leadership of Constantine Mitsotakis, secured an absolute majority. ND sought to re-establish fiscal balance, but the government was forced to resign in 1993, before the end of its four-year term, because of parliamentary defections. The electorate, dissatisfied with ND's liberal policies, re-elected Pasok in October 1993. This third Pasok government was divided between populists, who wanted to return to the free-spending style of the early 1980s, and reformers, who sought to meet the criteria that would permit Greece to join the EU's economic and monetary union (EMU). The division was compounded by a bitter leadership struggle to replace Mr. Papandreou, whose health was rapidly deteriorating. In January 1996, after a period of government paralysis, Costas Simitis, a reformist and former economics minister, succeeded Mr. Papandreou. In September of the same year the new leader steered Pasok to victory in the general election of 2000. The government's primary objective became EMU membership at the earliest possible date. After rejection in 1998, Greece became the 12th member of the euro area on January 1st 2001, just two years after the single currency's launch.

Though Pasok won the general election on April 9th 2000, in opinion polls Pasok trailed behind the conservative opposition. New Democracy was successful in painting the socialists as concerned only with their own party interests and the perquisites of power, rather than the good of the public at large. Thus, in January 2004 New Democracy won the election. The new Prime Minister, Mr. Karamanlis, 47, has gathered a young cabinet team, promising to concentrate on a renewal of public life, which he claims has become complacent, arrogant and corrupt under the long years of socialist rule.

6.2 The Greek Economy

Greece has a small but open, mixed economy, with the state continuing to play a major role despite an ongoing privatization program. The industrial base has always been relatively

small compared with that of other EU countries. In recent years industry has contributed 20-22% of GDP, of which manufacturing contributes 10-12% of GDP (the figure for 2003 was 20.3% including mining and energy production, which were bundled together with manufacturing in the latest estimates). The state has historically controlled some three-quarters of all business assets. Monopolies existed in many sectors-notably energy and telecommunications-and other markets were tightly regulated. In 1998 the government began a program of privatization as part of its bid to join the EU's economic and monetary union (EMU) and has since reduced its ownership to abut one-half.

The performance of the Greek economy was weak in the 1980s, with annual real GDP growth averaging just 1.7%. In 1991-95 it fell to 1.2%, with a contraction of 1.6% in 1993 during the Europe-wide recession. During the period of convergence there was sustained recovery, with the Greek economy growing faster than its EU partners where from 1996-2000, growth averaged 3.4% per year. Also, though consumer price inflation has historically been high, averaging 14% in 1989-96, with a peak of 20.5% in 1990, during the period of convergence it decelerated steadily in response to tighter fiscal and monetary policies and averaged 4.9% in 1996-2000. After slowing to a record low of 2% year on year in August and September 1999, the national measure of consumer price inflation began to climb at a moderate rate which will be discussed in further detail below.

On January 1st 2001 Greece became the 12th member of the euro area, just two years after the launch of the single European currency. The convergence criteria for entry were deemed to have been met, although short-term administrative measures were used to achieve the inflation and public debt criteria. In fact, the immediate public-sector pay restraint was a major factor in helping to reduce inflation and stabilize the public finances so Greece could join the EMU. However, recently Greece has shown poor fiscal policy, also, inflation has accelerated. The higher rate of inflation has been in part been fueled by international oil prices, abnormal weather affecting the cost of fresh food, and price mark-ups by traders taking advantage of the

introduction of the euro. More importantly, inflation has been driven by the high rate of GDP growth which has remained strong, outstripping levels in the euro zone. Every year since it has joined the euro area, Greece has grown at a rate of near or just above 4% in real terms. Specifically, the national consumer price index has increased by 3.6% in 2003 (according to the EU harmonized index of consumer prices, the HICP, by 3.9%). According to the economy and finance ministry's latest macroeconomic forecasts, inflation is predicted as above 3% this year, but the consumer price deflator predicts an ease to 2.8% in 2005 and to 2.6% in 2006.

Furthermore, wage moderation and strong investment growth contributed to a substantial decline in real unit labor costs in 1997-2001. However, recently unit labor costs have risen. Also, productivity growth, which stood at 3.8% in 2002, fell back to 1.9% in 2003. Finally, one must also note that during the 1990s the annual average rate of unemployment rose steadily, to stand at a record 12% in 1999. According to official estimates this fell to 9.5% in 2003, and the government forecasts for 2004 is 8%. The New Democracy government has targeted a reduction to 6% by 2008. The new Labor Law of 2001 sharply increased overtime rates and reduced employers' social insurance contributions by 2% in an attempt to increase employment. The terms under which firms can lay off workers are also marginally easier. However, the rules regarding layoffs are still restrictive and are perceived to be a major stumbling-block to job creation, especially since businesses try to abstain from hiring new workers during periods of growth, given their fears of not being able to lay them off in periods of contraction.

6.3 The Real Exchange Rate and GDP Per Capita

The Test

As described in section 4.1 the first test for a long-run cointegrating relationship between the real exchange rate and GDP per capita can be written as:

$\ln(RER_t) = \gamma \ln(\text{Per Capita GDP}_t) + \varepsilon_t$.

The Data

Table 6.3.1 summarizes the data that was attained for Greece. One can see that the data availability on sectoral labor productivity is limited, since only 24 years of data was available:

Table 6.3.1

Nominal Exchange Rate	Greek Drachmas per US dollar	Quarterly	1975 Q1 – 2005 Q2	Global Insight, *WRDS*
Greek Consumer Price Index	Greek CPI-All Items	Quarterly	1975 Q1 – 2005 Q2	Quarterly National Accounts, *OECD*
Gross Domestic Product	Real GDP in (2000) US dollars	Quarterly	1975 Q1 – 2004 Q4	Global Insight, *WRDS*
Population	Total Population	Annual	1975 – 2003	World Development Indicators, *WB CD*
	Total Population	Annual	2004	National Accounts, *OECD*
US Consumer Price Index	Harmonized US CPI	Quarterly	1975 Q1 – 2005 Q1	Global Insight, *WRDS*

Thus the total data set on Greece ranges from 1975 Q1 – 2004 Q4, providing a total of 116 observations for each variable. Furthermore, it should be noted that because quarterly population estimates were not found, the total population data was extrapolated, making population growth linear.

The Results

Calculating the correlation coefficient, *r*, for the two data sets (lrer and lgdp) for Greece one attains an *r*-value of 0.35724. Thus, the direction of association shows that there is a positive linear relationship between the real exchange rate and GDP per capita, while the strength of association indicates a weak association between the two time series.

The unit root tests are summarized in Table 6.3.2:

Table 6.3.2

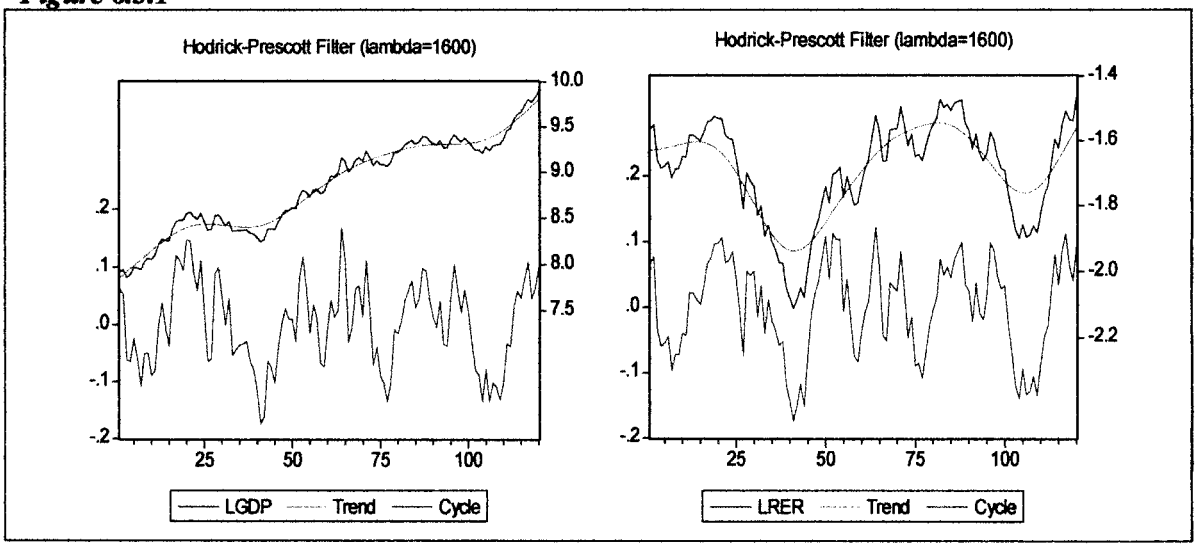
Test	Variable	Null Hypothesis	Alternative Hypothesis	Sign. Level	Test Statistic	Critical Values
Schmidt and Phillips (SP) Test	ln(RER)	Unit Root	No Unit Root	1%	-3.159	-3.61
	ln(GDP/Capita)	Unit Root	No Unit Root	1%	-2.846	-3.61
Kwiatkowski, Phillips, Schmidt and Shin (KPSS) Test	ln(RER)	Stationarity	Unit Root	10%	0.1854	0.119
				5%	0.1854	0.146
				2.5%	0.1854	0.176
				1%	0.1854	0.216
	ln(GDP/Capita)	Stationarity	Unit Root	10%	0.1144	0.119
				5%	0.1144	0.146
				2.5%	0.1144	0.176
				1%	0.1144	0.216
Augmented Dickey-Fuller (ADF) Test	ln(GDP/Capita)	Unit Root	No Unit Root	5%*	-3.104	-3.45
				1%*	-3.104	-4.04
*Critical Values taken from the G.S. Maddala and In-Moo Kim (1998)[76]						

A unit root is detected for the real exchange rate data for both the SP and KPSS tests. For the GDP per capita data, however, the SP and KPSS give contradicting results, where the KPSS test fails to reject stationarity. I therefore conducted a third unit root test (the ADF test), for the Greek GDP per capita data. The ADF test confirms a unit root for the Greek GDP per capita data at both the 1% and 5% significance levels. I therefore feel confident concluding that indeed a unit root is present in this data set as well.

The Johansen test was then used to test for cointegration between the two variables (GDP per capita and the real exchange rate). Before this test was conducted though, the Hodrick-Prescott Filter was in order to eliminate the effects of the business cycle. The effect of this filter on the quarterly series from 1975Q1 – 2004Q4 can be seen in the two graphs of Figure 6.3.1:

[76] Maddala, G.S., and Kim, In-Moo (1998). Unit Roots, Cointegration, and Structural Change. Cambridge University Press, Cambridge, United Kingdom.

Figure 6.3.1



The Johansen test of cointegration results where then estimated. It should be noted here that given the theoretical recommendation, a linear trend was added to incorporate the evolution of the non-tradable sector productivity evolution in the economy. Furthermore, given the log likelihood estimate the optimal lag length for the Greek data was zero. The Johansen test results are provided in Table 6.3.3:

Table 6.3.3

Greece: Johansen Cointegration Test				
Included observations: 119 after adjustments				
Trend assumption: Linear deterministic trend				
Lags interval (in first differences): No lags				
Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.01 Critical Value	Prob.**
None *	0.520739	88.289655	19.9371079	1.49E-06
At most 1	0.006399	0.763924	6.63489657	0.382102
Trace test indicates 1 cointegrating eqn(s) at the 0.01 level				
* denotes rejection of the hypothesis at the 0.01 level				
**MacKinnon-Haug-Michelis (1999) p-values				
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.01 Critical Value	Prob.**
None *	0.520739	87.525731	18.520012	9.50E-08
At most 1	0.006399	0.763924	6.63489657	0.382102
Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.01 level				
* denotes rejection of the hypothesis at the 0.01 level				
**MacKinnon-Haug-Michelis (1999) p-values				

The Johansen test indicates that a cointegrating relationship exists (at the 1% level) between GDP per capita (the development degree of the economy) and the real exchange rate for the Greek time series.

Then, a VECM was used (as with the base case of South Korea) because it restricts the long-run behavior of the endogenous variables to converge to their cointegrating relationships while allowing for short run adjustment dynamics. The cointegrating term embedded in the VECM is known as the error correction term since the deviation from long-run equilibrium is corrected gradually through a series of partial short-run adjustments. Given the log likelihood, lag exclusion test, Akaike Information Criterion and the Schwarz Criterion, the optimal lag length indicated for the Greek data was zero. The results for the Greek data, attained from the VECM, are reported in Table 6.3.4:

Table 6.3.4

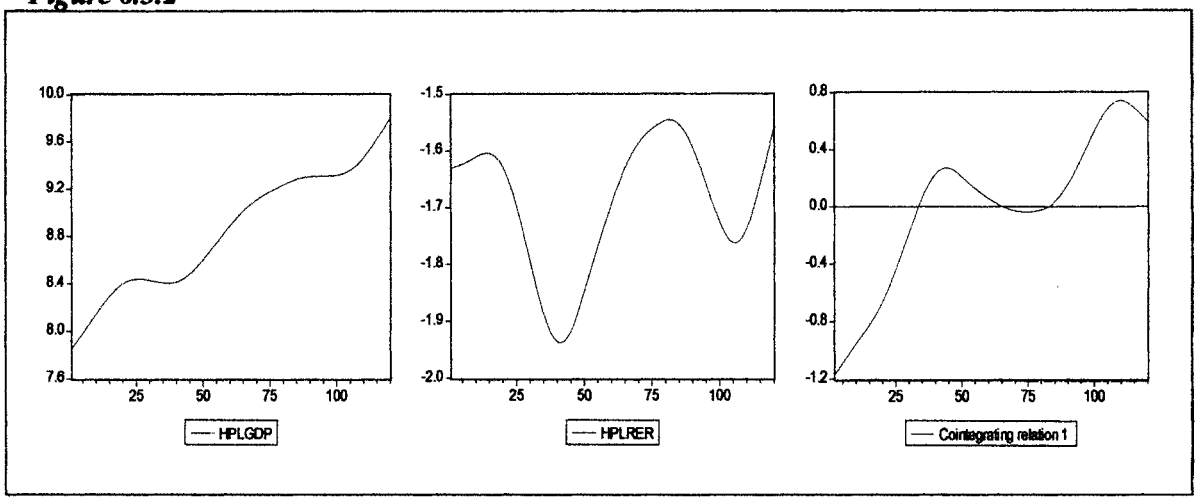
Vector Error Correction Estimates			**Vector Error Correction Estimates**		
Included observations: 119 after adjustments			Included observations: 119 after adjustments		
Standard errors in ( ) & t-statistics in [ ]			Standard errors in ( ) & t-statistics in [ ]		
Cointegrating Eq:	*CointEq1*		*Cointegrating Eq:*	*CointEq1*	
HPGDP(-1)	1.000000		HPGDP(-1)	1.000000	
HPRER(-1)	-2.79118		HPRER(-1)	-52.45576	
	(0.39092)			(2.25677)	
	[-7.14005]			[-23.2437]	
C	-13.57046				
Error Correction:	D(HPGDP)	D(HPRER)	*Error Correction:*	D(HPGDP)	D(HPRER)
CointEq1	-0.003805 (0.00224) [-1.69703]	0.005184 (0.00207) [2.50743]	CointEq1	0.000166 (1.2E-05) [14.0428]	6.21E-06 (1.1E-05) [0.57134]
C	0.016334 (0.00113) [14.4641]	0.000591 (0.00104) [0.56785]			
R-squared	0.024023	0.050996	R-squared	-0.027702	0.000150
Adj. R-squared	0.015682	0.042885	Adj. R-squared	-0.027702	0.000150
Sum sq. resids	0.017756	0.015096	Sum sq. resids	0.018697	0.015905
S.E. equation	0.012319	0.011359	S.E. equation	0.012588	0.011610
F-statistic	2.879922	6.287210	F-statistic	NA	NA
Log likelihood	355.3493	365.0051	Log likelihood	352.2766	361.8997
Akaike AIC	-5.938644	-6.100926	Akaike AIC	-5.903808	-6.06554
Schwarz SC	-5.891936	-6.054218	Schwarz SC	-5.880454	-6.042186
Mean dependent	0.016334	0.000591	Mean dependent	0.016334	0.000591
S.D. dependent	0.012417	0.011611	S.D. dependent	0.012417	0.011611
Determinant resid covariance (dof adj.)		2.63E-09	Determinant resid covariance (dof adj.)		6.02E-09
Determinant resid covariance		2.54E-09	Determinant resid covariance		5.92E-09
Log likelihood		839.7695	Log likelihood		789.5253
Akaike information criterion		-14.01293	Akaike information criterion		-13.20211
Schwarz criterion		-13.87281	Schwarz criterion		-13.10869

Substituting the coefficients for the results with a linear trend only, one attains:

1. D(HPGDP) = - 0.004*(HPGDP(-1) - 2.79*HPRER(-1) - 13.57) + 0.016
2. D(HPRER) = 0.0052*(HPGDP(-1) - 2.791*HPRER(-1) - 13.57) + 0.00059

The R^2 indicated above is very low for both error correction terms. Thus very little of the variation in either variable can be used in predicting the variation in the other. Nevertheless, the second error correction term is found statistically significant. It indicates that in the short-run the first difference of the real exchange rate converges by a small amount, a 0.5 percentage change, to correct for these variables' long-run equilibrium relationship. This result is very interesting because it shows that in the short run a very different mechanism is at hand than the one found for South Korea even though for both countries the real exchange rate and GDP per capita are cointegrated. Finally, the graphs indicating the two variables under consideration (GDP per capita and the real exchange rate) and their cointegrating relationship are shown in Figure 6.3.2:

Figure 6.3.2



Underneath this cointegrating relationship, the real exchange rate follows GDP per capita at a very slow pace, as the two variables move toward their long-run equilibrium levels.

6.4 The Real Exchange Rate and Productivity Differentials

The Test

The results for Greece in the first cointegration test shown above indicate that there is a long-run relationship between GDP per capita and the real exchange rate. However, I do not find this result adequate in proving that the Balassa-Samuelson effect explains the long-run development of the Greek economy. Thus, as discussed in section 4.2 a second test for the Balassa-Samuelson effect will be carried out. This test basically looks for a cointegrating relationship between the real exchange rate and relative productivity differentials (between tradable and nontradable goods) between the home (Greece) and foreign (US) economies:

$$\ln(RER_t) = c + \gamma \ln\left(\frac{\frac{\theta_{Tt}}{\theta_{Nt}}}{\frac{\theta^*_{Tt}}{\theta^*_{Nt}}}\right) + \varepsilon_t .$$

The Data

The data attained for Greece is summarized in Table 6.4.1 below:

Table 6.4.1

Nominal Exchange Rate	Greek Drachmas per US dollar	Annual	1979-2002	Global Insight, *WRDS*
Greek Consumer Price Index	Greek CPI-All Items	Annual	1979-2002	IMF, *International Financial Statistics*
Greek Labor Productivity	Labour productivity per hour worked (in chained (1995) Euros)	Annual	1979-2002	Groningen Growth & Development Centre, *60-Industry Database*
US Labor Productivity	Labour productivity per hour worked (in chained (1995) Dollars)	Annual	1979-2002	Groningen Growth & Development Centre, *60-Industry Database*
US Consumer Price Index	US CPI - All Cities	Annual	1979-2002	IMF, *International Financial Statistics*

The Results

The correlation coefficient, *r*, given the real exchange rate and the relative productivity differential data was estimated as 0.198932. This positive sign was expected since it indicated a positive linear association between the two variables.

The unit root tests were conducted and results obtained are summarized in Table 6.4.2:

Table 6.4.2

Test	Variable	Null Hypothesis	Alternative Hypothesis	Sign. Level	Test Statistic	Critical Values
Schmidt and Phillips (SP) Test	ln(RER)	Unit Root	No Unit Root	5%	-2.1164	-3.18
	ln(PD)	Unit Root	No Unit Root	5%	-0.9192	-3.18
Kwiatkowski, Phillips, Schmidt and Shin (KPSS) Test	ln(RER)	Stationarity	Unit Root	10%	0.1116	0.119
				5%	0.1116	0.146
				2.5%	0.1116	0.176
				1%	0.1116	0.216
	ln(PD)	Stationarity	Unit Root	10%	0.1953	0.119
				5%	0.1953	0.146
				2.5%	0.1953	0.176
				1%	0.1953	0.216
Augmented Dickey-Fuller (ADF) Test	ln(RER)	Unit Root	No Unit Root	5%*	-2.4866	-3.6
				1%*	-2.4866	-4.38
* Taken from the G.S. Maddala and In-Moo Kim (1998) Table 3.1 (pp. 64)						

As one may note from Table 6.4.2, the KPSS test and the SP test give contradicting results regarding the Greek real exchange rate data (the SP test found a unit root but the KPSS test failed to reject the null hypothesis of stationarity). Hence, an ADF test was conducted. This ADF test's results are also presented above. Basically, the ADF test shows the presence of a unit root in this data series and so the testing for cointegration can proceed. One should note however that the Hodrick-Prescott Filter was not used for the second cointegration test for the Greek data because annual data, instead of quarterly data, was used.

After experimenting with a number of lags, the log likelihood estimates reveal that the lag length should be two and the Johansen cointegration test results are presented in Table 6.4.3:

Table 6.4.3

Included observations: 21 after adjustments				
Trend assumption: No deterministic trend				
Lags interval (in first differences): 1 to 2				
Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None	0.252285	9.99856115	20.2618396	0.63999
At most 1	0.169219	3.89316008	9.16454591	0.42825
Trace test indicates no cointegration at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.252285	6.10540107	15.8920986	0.77607
At most 1	0.169219	3.89316008	9.16454591	0.42825
Max-eigenvalue test indicates no cointegration at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

Both the Johansen trace and maximum eigenvalue tests conducted reveal that the Greek real exchange rate and relative productivity differential time series do not have a long-run cointegrating relationship. Furthermore, this result indicates that when GDP is decomposed to its sectoral labor productivities between tradable and nontradable goods, the Balassa-Samuelson hypothesis does not describe the growth experience of the Greek economy. Also, this result shows that how use of only the first cointegration test may give a false indication of the presence of Balassa-Samuelson effect, further showing the importance of the second, more explicit test, of the Balassa-Samuelson effect.

But where does the Balassa-Samuelson effect fail to explain the Greek experience? To find out one must turn back to the assumptions that mold the effect. These assumptions can be summarized as: (1) The productivity differentials between the traded and nontraded sector (θ_T/θ_N) and relative prices of nontraded goods (p) are positively correlated. (2) The real exchange rate (RER) and relative prices of nontradables (p) are positively correlated, and finally, (3) PPP holds for the traded goods sector ($P_T = EP_T^*$).

In order to test the first assumption, a simple correlation coefficient was used, revealing an r value, for the productivity differentials and the value added deflator growth rate for the nontradable sector (as an indicator of relative nontradables' prices[77]), of 0.692. This result shows that for the Greek data the first assumption of the Balassa-Samuelson effect holds, given the strong positive association between these two variables. Moving in to the second assumption, the correlation coefficient for the RER and nontradables' prices is -0.162 which indicates a failure in the second Balassa-Samuelson assumption given the variables' weak negative association. Finally, for the last key Balassa-Samuelson assumption (that purchasing power parity holds for the tradable goods sector) to hold a cointegrating relationship between the nominal exchange rate and the PPP exchange rate is needed, where a unitary relationship between the two is implied by the theory. Using the PPP conversion factor to the official exchange rate ratio and the official exchange rate (period average Greek Drachmas per US dollar) from the World Development Indicators, *WB CD* the unit root test needed is summarized in Table 6.4.4:

[77] Using the value added deflator of the nontradable goods sector as an indicator of nontradables' prices was implied in Drine and Rault (2003). This variable was attained from the Groningen Growth and Development Centre,
60-Industry Database.

Table 6.4.4

Test	Variable	Null Hypothesis	Alternative Hypothesis	Sign. Level	Test Statistic	Critical Values
Schmidt and Phillips (SP) Test	PPPXR	Unit Root	No Unit Root	1%	-2.1592	-3.9
	NXR	Unit Root	No Unit Root	1%	-1.69	-3.9

As indicated in the results above, the two series, the PPP exchange rate and the nominal exchange rate both contain unit roots and so one may test for a cointegrating relationship between the two. The results are summarized in Table 6.4.5:

Table 6.4.5

Included observations: 23 after adjustments				
Trend assumption: No deterministic trend				
Lags interval (in first differences): No lags				
Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.66555	27.80427	20.26184	0.0038
At most 1	0.107398	2.613135	9.164546	0.6551
Trace test indicates 1 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.66555	25.19113	15.8921	0.0013
At most 1	0.107398	2.613135	9.164546	0.6551
Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

The Johansen tests conducted show that the series are indeed cointegrated. OLS estimates were then used to find whether the slope between these two variables is close to one. The test conducted is shown in Table 6.4.6:

Table 6.4.6

Method: Least Squares			
Coefficient	**Std. Error**	**t-Statistic**	**Prob.**
0.852880356	0.08782181	9.711486746	1.32E-09
R-squared	0.11042964	Mean dependent var	0.562125
Adjusted R-squared	0.11042964	S.D. dependent var	0.3053079
S.E. of regression	0.28795734	Akaike info criterion	0.3887649
Sum squared resid	1.90714689	Schwarz criterion	0.4378505
Log likelihood	-3.665179	Durbin-Watson stat	0.1240788

As indicated above in Table 6.4.6, the time series estimate given above is 0.85. This is relatively close to one and so one can conclude that the third Balassa-Samuelson assumption holds given the Greek data. Thus, testing these assumptions reveals that the Balassa-Samuelson hypothesis fails to explain development in the Greek economy (from 1979 - 2002) because the RER and the relative prices of nontradable goods are not positively correlated.

7. Italy[78]

7.1 Italian Politics

After WWI successive governments found it increasingly difficult to govern Italy successfully. In 1922 King Victor Emanuel III invited Benito Mussolini to form a government. Within two years he had dismantled the parliamentary system and established a fascist state. Mussolini's decision to side with Germany in WWII led to a devastating military defeat, leaving the country very weak internally and internationally. After WWII the Partito Socialista Italiano (PSI) and the Partito Comunista Italiano (PCI) joined coalition governments led by Alcide De Gasperi of the Democrazia Cristiana (DC). However, in 1947 as relations between the West and the Soviet Union intensified and so the US and the church strengthened their opposition to the PCI in government. The DC was thus forced to dissociate itself from the left and De Gasperi was determined that Italy would be firmly in US-led camp leading the DC to obtain the majority in parliament in the 1948 election.

For a quarter of a century the PCI, the largest communist party in Western Europe, was excluded from government. The party gradually distanced itself from the Soviet Union and in 1973 tried to salvage a role in government by joining the DC-led parliamentary majority in 1976. Given the intense political instability though, PCI was once again excluded in 1979, giving monopoly power to the parties of the center and center-right. Combined with a long history of patronage, public office corruption peaked in the 1980s. But with the collapse of communism in the late 1980s, the threat to liberal democracy was lifted, causing profound political change. The judiciary began to assert itself, cracking down on corruption within state institutions. No political party was untouched but the DC was most seriously affected and as a result, disbanded.

With the political class in turmoil, the task of governing was left to a series of caretaker administrations. The first such administration was formed in 1992 by Giuliano Amato, a senior

[78] Information on Italian politics and the Italian economy was gathered from the following websites: www.italyemb.org, www.wikipedia.org, and www.eiu.com.

PSI politician, but shaken repeatedly by corruption allegations, it only lasted till 1993. Mr. Amato still managed to push through major reforms and privatization programs. Nevertheless, he resigned and his successor, Carlo Azeglio Ciampi, formed an administration in 1993 consisting entirely of technocrats. The main achievements of the new government were placing Mr. Amato's privatization programs into effect and reforming the electoral system.

In 1994 a new right-wing alliance formed. It began with one of Italy's most prominent and richest businessmen, Silvio Berlusconi, unexpectedly entering the political arena before the 1994 general election and in just two months support shifted in favor of his center-right coalition, the Polo delle Liberta, consisting mainly of Mr. Berlusconi's Forza Italia, the Lega Nord, AN, and two Catholic centrist parties that had merged in 2002 to form the UDC. Mr. Berlusconi victory was fueled by his promise of more jobs and lower taxation. However, with Mr. Berlusconi in office the political scene was still unstable. He and the Lega Nord leader, Umberto Bossi, clashed frequently. Also, Mr. Berlusconi failed to divert himself from his media empire and was constantly in conflict with the public prosecution service that brought him up on corruption charges and eventually resigned. President, Oscar Luigi Scalfaro, thus designated Lamberto Dini, to lead another caretaker administration comprising technocrats in January 1995. He was tasked with a limited program of reforming the pension system. Mr. Dini's administration survived for just over a year tough, and a general election was called in April 1996.

The 1996 general election was won by the center-left Ulivo coalition formed by Romano Prodi. However, he failed to obtain an absolute majority in the lower house and thus had to rely on the external support of the far-left Partito della Rifondazione Comunista (PRC), forming an electoral alliance. But given the unbending positions of the PRC, in May 1998 the PRC began to distance itself from government, calling for a radical shift in economic policy, including the creation of public-sector jobs to tackle unemployment. By October 1998 the national political committee of the PRC voted not to support the 1999 budget, which led the government to collapse. Despite its difficulties, the Prodi administration had some significant achievements,

most notably the inclusion of Italy in EMU from its inception on January 1st 1999. It gave new momentum to the privatization program, began major reforms of the judicial and education systems, public administration, taxation and the labor market.

Following the collapse of the Prodi government Massimo D'Alema, the leader of the largest party in the centre-left coalition, the Democratici di Sinistra (DS), formerly the Partito Democratico della Sinistra (PDS), headed two short lived and unstable governments. Mr D'Alema resigned in April 2000 following local election reverses for the Ulivo. In May 2000 the president, Mr Ciampi, called on Mr. Amato, the Treasury minister in the D'Alema cabinet, to form another government, which survived until the end of the parliamentary term.

Mr. Berlusconi's Casa delle Liberta coalition returned to power when he won the 2001 general election convincingly. The leader of the AN, Gianfranco Fini, became deputy prime minister. In their first two years in office Mr. Berlusconi and his government were broadly popular but it became increasingly evident that Mr. Berlusconi was failing to deliver many of his promises. This was in part due to slower than expected economic growth that increased pressure on the public finances, leaving little surplus cash to spend on promised tax cuts and expensive infrastructure projects. The Casa has also become increasingly divided and in July 2004 the government came close to collapse when Mr. Fini forced the resignation of the Forza Italia minister of the economy, Giulio Tremonti, and the UDC threatened to withdraw from the cabinet. In April 2005 Mr. Berlusconi's coalition partners forced him to resign as prime minister and they formed a new cabinet, in which Mr. Tremonti appointed deputy prime ministers and Mr. Tremonti was eventually appointed economy minister again. The constant bickering between the Casa parties, the damage done to Italy's image and the credibility of the central bank by the Fazio affair and Mr. Siniscalco's resignation just a week before the cabinet was due to approve the draft 2006 budget has severely damaged the Casa's already diminished chances of winning the next general election of 2006. Mr. Berlusconi, whose leadership of the government and the Casa was called into question after the coalition's defeat in the regional elections, will struggle to hold the

coalition partners together. Indeed, if there were to be another serious dispute between the parties of the Casa, or if the Casa were to suffer a heavy defeat in the next general election, the disintegration of the alliance or the replacement of Mr. Berlusconi as its leader appear likely.

7.2 The Italian Economy

Overall, Italy's overall economic structure is comparable to that of most other advanced OECD economies, with services contributing close to two-thirds of gross value added. But, other than tourism and design, Italy is not internationally competitive in most services sectors. Its main strength has been in manufacturing, accounting for about 25% of GDP and about 90% of total merchandise exports. Italy has few large private companies in operation, and the major ones such as Fiat, Pirelli, and Fininvest, are controlled by a few affluent families, exerting control through financial allies allowing them to maintain ownership with a small shareholding. This situation *is* changing but very slowly, legislation now requires more transparency and seeks small shareholders' rights. The strongest components of the economy have been the small and medium-sized, (family-owned) enterprises (SMEs) producing high-quality consumer goods. Though traditionally export- oriented, SMEs face serious challenges from globalization's increased competition, where their unwillingness to go public and expand has hindered their growth and left some vulnerable to acquisition by larger foreign firms.

In the decades following WWII, Italy experienced strong growth, as the economy caught up with the more advanced economies of Europe. Although growth slowed in the 1980s, Italy continued to record strong growth rates, averaging 2.4% in 1980-89. This growth was largely sustained by loose fiscal policy, with widening budget deficits averaging 11% of GDP in 1980-89. Also, successive devaluations, giving a short-term boost to competitiveness, were used to postpone necessary reform. But by the late 1980s and early 1990s, wage increases and the hard exchange-rate policy used to fight inflation caused industry to struggle to remain competitive. By 1992 mounting imbalances led to the suspension of the lira from the EU's exchange rate

mechanism (ERM) and a sharp depreciation was pursued. The pending financial crisis forced trade unions to accept moderate wages to avoid an inflationary spiral. Also, the government had to tighten fiscal policy in order to join the EMU, which contributed to a sharp deterioration in Italy's growth where the economy between 1995 and 2001 expanded by an annual average rate of 1.9%, compared whole EU's 2.4%.

In 2000, fiscal policy was eased and real GDP grew by 3.2%, the best performance since 1988. However, in 2001 economic growth slowed sharply to 1.8%, and further, to 0.4% in 2002 and 2003, reflecting the deceleration of the world economy. The pace of expansion showed a modest improvement in 2004 with a rise of 1%, due to export growth. Industrial output still stagnated though after contracting in the previous 3 years, while business and consumer confidence indicators fluctuated during the year, showing only marginal improvements.

Italy's poor growth performance since the beginning of the 1990s is most commonly blamed on the severe fiscal tightening required by the Maastricht treaty's convergence criteria for EMU membership. This fiscal reform was long delayed and necessary for firmer macroeconomic stability. However, failure to achieve a reduction in the public debt in recent years means fiscal policy should be tight in the medium term. Other factors also blamed include: the sharp fall in interest income from government securities due to the interest-rate convergence with the rest of the euro area, the negative impact of the emerging-markets crisis in 1997-98, and the impact of perceived higher inflation following the introduction of euro notes and coins in 2002.

The emerging markets crisis of 1997-1998, and the appreciation of the euro against the US dollar from mid-2002 to the end of 2004 have affected major manufacturing activities such as textiles, clothing, leather goods and footwear, as well as some investment goods sectors that depend on exports. Also, supply-side inflexibility has and continues to have a depressing effect on growth (although there have been some improvements in this area since 1992). More recently concerns over Italian international competitiveness and the future growth prospects have shifted

toward the marked decline in Italy's productivity growth since 1995 as well as the low levels of investment in research and development, constrained by the predominance SMEs.

When it comes to inflation, the 1970s and 1980s Italy exhibited high rates of inflation, with average annual consumer prices of 13.2% and 11.1% respectively due to wage indexation and loose fiscal policy along with global price pressures. When the lira joined the ERM in 1979 though, inflation dampened, but a series of devaluations offset much of the benefit. In 1992 the lira was suspended from the ERM and depreciated sharply, triggering a tighter fiscal and monetary policy mix in order to contain inflation. In the same year the trade unions agreed to end wage indexation, and in 1993 they agreed to keep wage increases in line with government annual inflation targets. Combined with low international inflation and participation in EMU, these changes have kept inflation in low single-digit figures since then, but price instability has not been eradicated. Higher international oil prices and the continued weakness of the euro against the US dollar caused Italian consumer price inflation to creep up, as in other euro area countries, from mid-1999 to April 2001, when it reached 3%. Also, from mid-2002 till mid-2003, with the changeover to euro notes and coins, inflation rose again. Inflation finally eased in 2004 to 2.2% and the beginning of 2005 remained pretty much stable. Now, the inflation gap between Italy's and its main European trading partners, which was wide through the 1990s, has narrowed substantially given wage moderation, price-curbing in liberalized sectors, and adopted government measures to mitigate price increases (such as freezing some public tariffs). But the inflation differential widened again, to almost 1% in 2003, from less than 0.5% in mid-2002, but was completely eliminated by early 2004, as Italian inflation eased and euro area inflation edged up. In January-August 2005 the inflation differential was also negligible.

Finally, one must note that over the past decade there has been a very considerable reduction in the role of the state in the economy. For example, in 1992 the government initiated an ambitious privatization program transforming major state shareholding companies into joint stock companies as a preliminary step towards whole or partial privatization. Though the process

slowed in 1994 it was revived in 1995. Also, since the beginning of 1993 numerous small public-sector companies, principally in the steel, food processing and chemicals sectors, have been sold by private treaty.

7.3 The Real Exchange Rate and GDP Per Capita

The Test:

The first test conducted estimates whether a long-run cointegrating relationship between the real exchange rate and GDP per capita exists. This can be expressed as:

$\ln(RER_t) = \gamma \ln(\text{Per Capita GDP}_t) + \varepsilon_t$.

The Data

The data that was gathered for Italy is summarized in Table 7.3.1:

Table 7.3.1

Nominal Exchange Rate	Italian Lire per US dollar	Quarterly	1975 Q1 – 2005 Q2	Global Insight, *WRDS*
Italian Consumer Price Index	CPI-All Items for entire Population	Quarterly	1975 Q1 – 2005 Q2	Global Insight, *WRDS*
Gross Domestic Product	Real GDP in (2000) US dollars	Quarterly	1975 Q1 – 2005 Q1	Global Insight, *WRDS*
Population	Total Population	Annual	1975 – 2003	World Development Indicators, *WB CD*
US Consumer Price Index	Harmonized US CPI	Quarterly	1975 Q1 – 2005 Q1	Global Insight, *WRDS*

Thus, the complete Italian data set ranges from 1975 Q1 – 2005 Q1, leaving a total of 117 observations for each variable. Obviously quarterly population estimates were not available. The population data was therefore extrapolated as to assume a linear growth rate between quarters. Furthermore, because population estimates were not available for 2004 and 2005, the population is assumed constant from 2003 Q1 – 2005 Q1.

The Results

Given the time series available for the Italian real exchange rate and GDP per capita, the correlation coefficient, *r*, for these two data sets gives an *r*-value of 0.03678. The direction of association is therefore, positive, and the strength of association between the two variables is a very weak one.

The unit root tests for stationarity are presented in the Table 7.3.2:

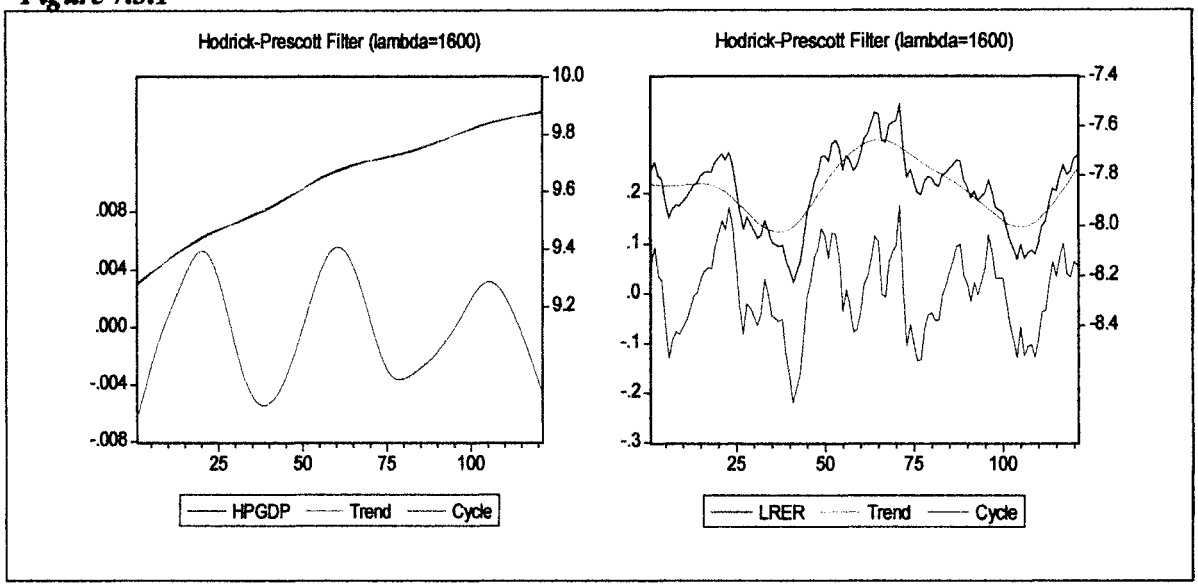
Table 7.3.2

Test	Variable	Null Hypothesis	Alternative Hypothesis	Sign. Level	Test Statistic	Critical Values
Schmidt and Phillips (SP) Test	ln(RER)	Unit Root	No Unit Root	1%	-3.498	-3.61
	ln(GDP/Capita)	Unit Root	No Unit Root	1%	-1.935	-3.61
Kwiatkowski, Phillips, Schmidt and Shin (KPSS) Test	ln(RER)	Stationarity	Unit Root	10%	0.186	0.119
				5%	0.186	0.146
				2.5%	0.186	0.176
				1%	0.186	0.216
	ln(GDP/Capita)	Stationarity	Unit Root	10%	0.4524	0.119
				5%	0.4524	0.146
				2.5%	0.4524	0.176
				1%	0.4524	0.216

The presence of a unit root is found for both Italian real exchange rate and GDP per capita data when the SP test was conducted. The same conclusion can be drawn with the KPSS test conducted on the GDP per capita data at all significance, levels. The KPSS test on the Italian real exchange rate data though shows unit root presence at the 2.5%, 5% and 10% significance levels. These results allow for the test of cointegration to proceed.

A Johansen test was conducted to test for cointegration. Before this test was conducted, however, a Hodrick-Prescott Filter to eliminate the effects of the business cycle. The effects of this filter on the two variables (GDP per capita and the real exchange rate) are portrayed in the two graphs of Figure 7.3.1:

Figure 7.3.1



Given the use of this filter, the Johansen test can proceed. The optimal lag length for the Johansen test ended up being zero given the lag likelihood estimates when different lag lengths were tried. Also, a linear trend is assumed to incorporate the evolution of the non-tradable sector productivity evolution in the economy. The results of the Johansen cointegration test for the data on Italy are given in Table 7.3.3:

Table 7.3.3

Italy: Johansen Cointegration Test				
Included observations: 120 after adjustments				
Trend assumption: Linear deterministic trend				
Lags interval (in first differences): No lags				
Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.01 Critical Value	Prob.**
None *	0.750111	166.66223	19.93710787	0.0001
At most 1	0.002112	0.2537456	6.634896573	0.614447
Trace test indicates 1 cointegrating eqn(s) at the 0.01 level				
* denotes rejection of the hypothesis at the 0.01 level				
**MacKinnon-Haug-Michelis (1999) p-values				
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.01 Critical Value	Prob.**
None *	0.750111	166.40848	18.52001196	0.0001
At most 1	0.002112	0.2537456	6.634896573	0.614447
Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.01 level				
* denotes rejection of the hypothesis at the 0.01 level				
**MacKinnon-Haug-Michelis (1999) p-values				

The results above reveal that there is a cointegrating relationship between the Italian real exchange rate and GDP per capita (the development degree of the economy). Then, after a lot of experimentation with lag length (and provided the Akaike Information Criterion, the Schwarz Criterion the log likelihood estimates and the lag exclusion test) lag length of choice for the VECM became zero. The VECM are summarized by Table 7.3.4:

Table 7.3.4

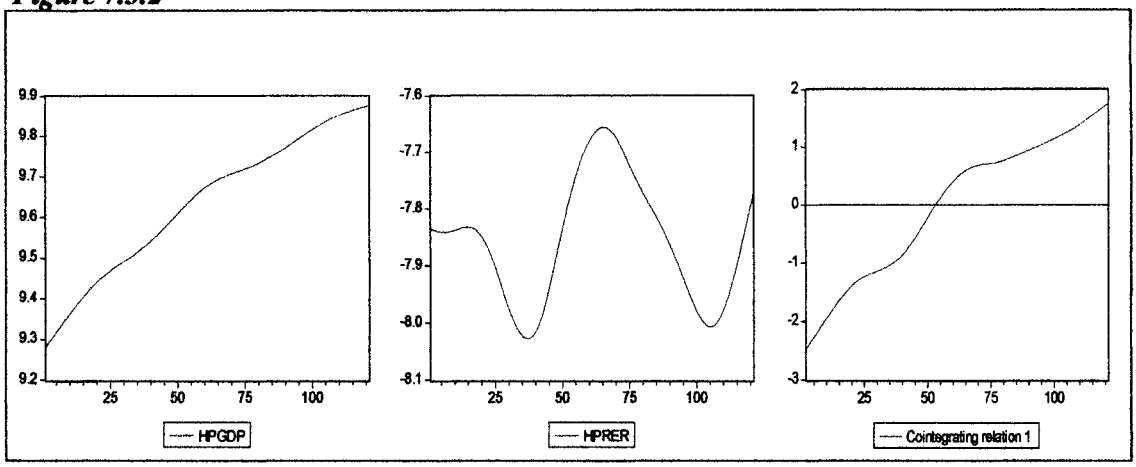
Vector Error Correction Estimates			**Vector Error Correction Estimates**		
Included observations: 120 after adjustments			Included observations: 120 after adjustments		
Standard errors in ( ) & t-statistics in [ ]			Standard errors in ( ) & t-statistics in [ ]		
Cointegrating Eq:	*CointEq1*		*Cointegrating Eq:*	*CointEq1*	
HPRER(-1)	1		HPRER(-1)	1	
HPGDP(-1)	7.025796 -0.37549 [18.7112]		HPGDP(-1)	0.758103 -0.00155 [489.988]	
C	-59.8262				
Error Correction:	D(HPRER)	D(HPGDP)	*Error Correction:*	D(HPRER)	D(HPGDP)
CointEq1	0.001186 -0.00088 [1.35053]	-0.001452 -8.90E-05 [-16.2573]	CointEq1	-0.000407 -0.00181 [-0.22453]	-0.008923 -0.00024 [-37.4792]
C	0.000512 -0.00105 [0.48870]	0.004966 -0.00011 [46.6375]			
R-squared	0.015222	0.691342	R-squared	-0.001569	0.47756
Adj. R-squared	0.006876	0.688726	Adj. R-squared	-0.001569	0.47756
Sum sq. resids	0.015516	0.000161	Sum sq. resids	0.01578	0.000272
S.E. equation	0.011467	0.001166	S.E. equation	0.011516	0.001511
F-statistic	1.823939	264.3001	F-statistic	NA	NA
Log likelihood	366.9305	641.1921	Log likelihood	365.9161	609.6155
Akaike AIC	-6.082175	-10.6532	Akaike AIC	-6.081935	-10.14359
Schwarz SC	-6.035716	-10.60674	Schwarz SC	-6.058706	-10.12036
Mean dependent	0.000512	0.004966	Mean dependent	0.000512	0.004966
S.D. dependent	0.011507	0.002091	S.D. dependent	0.011507	0.002091
Determinant resid covariance (dof adj.)		1.44E-10	Determinant resid covariance (dof adj.)		2.81E-10
Determinant resid covariance		1.39E-10	Determinant resid covariance		2.76E-10
Log likelihood		1021.068	Log likelihood		980.0886
Akaike information criterion		-16.9178	Akaike information criterion		-16.26814
Schwarz criterion		-16.77842	Schwarz criterion		-16.17523

Substituting the coefficients for the estimates with a linear trend in the data we attain:

1. D(HPRER) = 0.0012*(HPRER(-1) + 7.03*HPGDP(-1) - 59.83) + 0.0005
2. D(HPGDP) = - 0.0015*(HPRER(-1) + 7.026*HPGDP(-1) - 59.83) + 0.005

But given the t-stats, the error correction term of the second equation is only significant. The results of this equation indicate that in the short run, only the first difference of GDP per capita actually *diverges* by a very small amount from long-run (given the negative sign) by a percentage change of approximately 0.2%. This reaction of GDP per capita seems to be the opposite of that found in the South Korean case. Eventually though, both these series end converging to their long-run equilibrium levels since the Johansen estimates proved they are cointegrated. Visually, the cointegrating relationship in the Italian case, between the real exchange rate and GDP per capita, (from 1975 Q1 – 2005 Q1) is provided in the graphs of Figure 7.3.2:

Figure 7.3.2



7.4 The Real Exchange Rate and Productivity Differentials

The Test

The results of the first cointegration test for Italy showed that a long-run relationship between GDP per capita and the real exchange rate exists. As discussed in section 4.2 though a second, more explicit test for the Balassa-Samuelson hypothesis will be conducted. This test can be summarized as:

$$\ln(RER_t) = c + \gamma \ln\left(\frac{\frac{\theta_{Tt}}{\theta_{Nt}}}{\frac{\theta^*_{Tt}}{\theta^*_{Nt}}}\right) + \varepsilon_t .$$

This test is basically looking for a cointegrating relationship between the real exchange rate and the relative productivity differentials (between tradable and nontradable goods) given the home (Italian) and foreign (US) countries. If such a cointegrating relationship exists, it would give a far stronger indication of the Balassa-Samuelson effect.

The Data

The data collected for Italian is summarized in Table 7.4.1.

Table 7.4.1

Nominal Exchange Rate	Italian Lire per US dollar	Annual	1979-2002	Global Insight, *WRDS*
Italian Consumer Price Index	Italian CPI-All Items	Annual	1979-2002	IMF, *International Financial Statistics*
Italian Labor Productivity	Labour productivity per hour worked (in chained (1995) Euros)	Annual	1979-2002	Groningen Growth and Development Centre, *60-Industry Database*
US Labor Productivity	Labour productivity per hour worked (in chained (1995) Dollars)	Annual	1979-2002	Groningen Growth and Development Centre, *60-Industry Database*
US Consumer Price Index	US CPI - All Cities	Annual	1979-2002	IMF, *International Financial Statistics*

As one can see from the table above the data set for this second cointegration test is far shorter, ranging (at an annual frequency) from 1979-2002.

The Results

The estimated correlation coefficient, *r*, for the Italian real exchange rate and the relative productivity differentials is -0.24033, and even when one removes the year 2001 (given the

terrorist attacks in New York City), the correlation coefficient still remains negative, at a value of -0.14236. This sign contradicts what the Balassa-Samuelson hypothesis predicts, since it indicates a negative linear association between the two variables.

Despite this result, the unit root tests conducted are given in Table 7.4.2:

Table 7.4.2

Test	Variable	Null Hypothesis	Alternative Hypothesis	Sign. Level	Test Statistic	Critical Values
Schmidt and Phillips (SP) Test	ln(RER)	Unit Root	No Unit Root	5%	-1.5689	-3.18
	ln(PD)	Unit Root	No Unit Root	5%	-2.5392	-3.18
Kwiatkowski, Phillips, Schmidt and Shin (KPSS) Test	ln(RER)	Stationarity	Unit Root	10%	0.1788	0.119
				5%	0.1788	0.146
				2.5%	0.1788	0.176
				1%	0.1788	0.216
	ln(PD)	Stationarity	Unit Root	10%	0.1446	0.119
				5%	0.1446	0.146
				2.5%	0.1446	0.176
				1%	0.1446	0.216

As indicated in Table 7.4.2 above, the unit root tests indicate that a unit root characterizes both the real exchange rate and the productivity differential time series. These results allow for the cointegration test between these two variables to be conducted. One should note though that because annual data was used, the Hodrick-Prescott Filter was not implemented since the shocks caused by the business cycle are not of great concern.

Using the log likelihood estimates, the choice of lags for the Italian data was set to four and then the Johansen cointegration test was used. The results of this test are provided in Table 7.4.3:

Table 7.4.3

Included observations: 19 after adjustments				
Trend assumption: No deterministic trend				
Lags interval (in first differences): 1 to 4				
Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None	0.3040816	11.34834	20.26183964	0.50888
At most 1	0.209238	4.460406	9.164545912	0.34787
Trace test indicates no cointegration at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.3040816	6.887934	15.89209863	0.68315
At most 1	0.209238	4.460406	9.164545912	0.34787
Max-eigenvalue test indicates no cointegration at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

Both the Johansen trace and maximum eigenvalue tests show that at the 5% level, the Italian time series for the real exchange rate and the relative productivity differentials do not appear to have a long-run cointegrating relationship. This result is important because despite the fact that the first set of estimates show the development degree and the real exchange rate have a cointegrating relationship, the Balassa-Samuelson effect is not the source of Italian economic growth from 1979-2002.

In order to see where the Balassa-Samuelson hypothesis fails in predicting the development of Italy, a careful investigation of the theory's key assumptions is needed. These assumptions can be summarized as: (1) productivity differentials between the traded and nontraded sector and relative prices are positively correlated, (2) the real exchange rate and

relative prices of nontraded goods are positively correlated, and finally (3) PPP holds for the tradable goods sector.

Given the first assumption, the correlation coefficient for productivity differentials and the value added deflator growth rate for the nontradable sector (as an indicator of nontradables' prices) was calculated, yielding an *r* value attained was -0.89913. This shows that for the case of Italy the first assumption does not appear to hold given the strong *negative* relationship between these two variables. The second assumption was then tested by applying the same technique. The correlation coefficient between the real exchange rate and relative prices of nontradables (measured again with the value added deflator growth rate) was 0.158567, showing that though weakly associated there is a positive correlation between the two variables and so the second Balassa-Samuelson assumption appears to hold. Finally, a test of PPP was conducted to evaluate the third assumption. In order to hold, there needs to be a long-run relationship between the nominal exchange rate (NXR) and the PPP exchange rate (PPPXR), where their slope should be as close to one as possible. Thus, the Schmidt and Phillips (SP) Unit Root Test was used, the results of which are summarized in Table 7.4.4:

Table 7.4.4

Test	Variable	Null Hypothesis	Alternative Hypothesis	Sign. Level	Test Statistic	Critical Values
Schmidt and Phillips (SP) Test	PPPXR	Unit Root	No Unit Root	1%	-2.0501	-3.9
	NXR	Unit Root	No Unit Root	1%	-2.1751	-3.9

The chart above reveals that indeed these two series (PPPXR and NXR) are characterized by a unit root and so one can further test for a cointegrating relationship between the two variables:

Table 7.4.5

Included observations: 23 after adjustments				
Trend assumption: No deterministic trend				
Lags interval (in first differences): No lags				
Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.601809011	23.93749597	20.26183964	0.01489
At most 1	0.113023844	2.758555098	9.164545912	0.62674
Trace test indicates 1 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.601809011	21.17894087	15.89209863	0.00669
At most 1	0.113023844	2.758555098	9.164545912	0.62674
Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

The Johansen tests results of Table 7.4.5 above indicate that these two series are cointegrated confirming a long-run relationship between the two variables. But this result is not enough to prove PPP holds. One also needs to show that the slope between the two is close to 1.0. Using OLS a slope coefficient close to one (0.89) was confirmed for the Italian case, as can be seen in the results in Table 7.4.6:

Table 7.4.6

Italy: Time Series Test For CPI & Tradable Sector			
Method: Least Squares			
Coefficient	**Std. Error**	**t-Statistic**	**Prob.**
0.887423692	0.06357916	13.95777558	1.02E-12
R-squared	-1.1056978	Mean dependent var	0.784
Adjusted R-squared	-1.1056978	S.D. dependent var	0.1840123
S.E. of regression	0.26702065	Akaike info criterion	0.2377922
Sum squared resid	1.6399006	Schwarz criterion	0.2868778
Log likelihood	-1.8535064	Durbin-Watson stat	0.4207959

Therefore, through this explicit investigation of the Balassa-Samuelson assumptions, one can conclude that the Balassa-Samuelson hypothesis fails to explain the dynamics of development for Italy because the theory's assumption that productivity differentials and nontradables' prices are positively correlated does not hold.

8. Spain[79]

8.1 Spanish Politics

Spain's non-involvement in WWI (1914-1918) brought her an economic boom, but this coincided with growing social and labor unrest and the emergence of the anarchist movement. A military coup established a dictatorial regime and then the king himself was forced to abdicate in 1931 when a republic was proclaimed. The next few years marked continuing political instability, culminating in the outbreak of the Spanish civil war in 1936. The war lasted 3 years and ended with the victory of the rebel nationalist forces led by General Francisco Franco, who ruled Spain until his death in 1975. In November 1975, after Franco's death, Prince Juan Carlos of Bourbon, the grandson of Alfonso XIII, became the King of Spain.

In 1976 the king appointed a new Prime Minister, Adolfo Suárez and the changes following his appointment were rapid. Within months political parties were legalized and the first free election in more than 40 years was held. Also, in 1978 a referendum was held approving a new democratic constitution and repealing many Franco era laws. The first post-Franco democratic government was formed by the Union of the Democratic Centre (UDC), composed of a diverse group of reformers including liberals, social democrats, Christian democrats and conservatives. Although the UDC fell just short of a majority in the 1977 and 1979 elections, Mr. Suárez managed to remain Prime Minister with minority support in parliament. The Suárez administrations were characterized by an emphasis on consensus, which was seen as a means of consolidating Spain's newly born democracy.

Mr. Suárez resigned in January 1981 and a new Prime Minister, Leopoldo Calvo Sotelo, assumed control. However, given the upsurge in terrorism by Basque secessionists who launched a (failed) attempt to overthrow the democratic order, Mr. Sotelo was unable to hold the UDC together, and in the 1982 general election the Spanish Socialist Workers' Party (PSOE), led by

[79] The information on Spanish politics and the Spanish economy was attained from the following websites: www.spainemb.org, www.wikipedia.org, and www.eiu.com

Felipe González, took power with an overwhelming majority. The UDC vote collapsed and the party disintegrated, opening the way for the emergence of the more right of- centre politics of the Popular Alliance (now the Popular Party, PP).

Successive PSOE governments dominated the 1980s and early 1990s. The country's democratic institutions were consolidated, its economy boomed and its international status was restored, culminating in Spanish accession to the European Community (now the EU) in 1986. By the early 1990s, however, the PSOE was involved in a series of major political and financial scandals and the party lost its absolute majority in the 1993 general election and was finally voted out of office in 1996.

The 1996 general elections marked the end of the 13 year uninterrupted PSOE government and the beginning of a new era in Spanish politics. The centre-right PP emerged as the largest parliamentary force with José María Aznar being the 4th prime minister since the 1978 constitution. Despite fears that once in power the right would reveal an authoritarian streak, the new government quickly showed that it was moderate in its policy choices given its good relations with the independence-minded regions and the maintenance of consensual arrangements with the trade unions. Among the most important achievements of the first PP administration was qualification in 1998 for the euro. This caused interest rates to fall to historic lows, helping to stimulate strong economic growth, which Spain has enjoyed since. With the opposition in disarray and the economy booming, the PP was re-elected in March 2000, this time with an absolute majority. This showed that Mr. Aznar's support for the war in Iraq had relatively little electoral impact. PP fared unexpectedly well in local and regional elections in mid-2003. However, everything changed on March 11th, 2004 when Islamic terrorists killed almost 200 commuters on trains in Madrid. The attacks, 72 hours before polls opened, led to the PSOE victory, despite opinion polls predicting the opposite a week before.

The new administration, led by Mr. Zapatero, promised little real change in economic policy, except a more socially liberal agenda, and to immediately pull troops out of Iraq.

Inactivity has marked the new government's approach to economic policy, with no reforms that could be politically painful in areas such as the labor market and pensions.

8.2 The Spanish Economy

Spain is a small open economy where services account for two thirds of activity. The Spanish services sector (retailing, tourism, banking and telecommunications) has grown steadily since WWII, now dominating the economy, accounting for 68% of GDP in 2004. This expansion has meant a decline in agriculture, forestry and fisheries sectors, accounting for only 3.5% of GDP in 2004. The industrial sector has also been affected yet it still accounts for a 28.4% of GDP, one-third of activity, reflecting a boom in construction activity given strong demand for tourist-related buildings and second homes, high levels of investment in infrastructure and a structural shortage of quality housing.

Beginning with Spain's emergence from international isolation in the 1960s; GDP growth accelerated strongly, driven by tourism, foreign investment and growing industry. However, Spain's reliance on imported energy meant an economic slump during the 1970s oil crises. Growth remained sluggish till 1986 when Spain entered the European Community (EC, now the EU). Fixed investment grew after EC entry, boosted by a surge in foreign capital inflows and domestic demand driving up GDP growth. At the same time though, Spain current-account deficit was rising, resulting in a 1992-1993 recession. Luckily, the external sector improved which, along with the devaluation of the peseta meant an export boom and a sharp decrease in import growth. By 1994 the economy rebounded, the industrial sector picked-up feeding to the domestic demand of 1995-1996 and leading a new period of economic growth for Spain. By 1997 optimism spread to the rest of the economy causing growth in both investment and private consumption. Real GDP expanded by an annual average of 4.2% from 1997 to 2000 and domestic demand rose, averaging in a growth of 5.7% in 1998 and 1999.

Simultaneously, Spanish economic policy of the 1990s focused on meeting the convergence criteria of the Maastricht Treaty for the European Monetary Union (EMU) membership. These criteria meant a major fiscal adjustment in the mid-1990s, where public-sector balance went from a 6.7% of GDP deficit in 1993 to near-balance in 2001. Also, the economic expansion of the 1990s caused an initial slowdown in consumer price inflation, falling from 4.7% in 1995 to just 1.8% in 1998. This was due to a restrictive fiscal policy, lower world oil and commodity prices, the effect of liberalization measures in certain sectors of the economy, and moderate wage growth. Furthermore, exports of goods and services rose between 1994 and 2000 given by the competitive exchange rate (which was locked into EMU in 1999). Even during the slowdown in world trade in 1998-99, real export growth averaged 8% in these years.

At the same time, the (central) Bank of Spain, which received autonomy in 1994, implemented a cautious monetary policy, steadily lowering interest rates. This played a vital role in the macroeconomic stability during of the period causing Spain's economy to flourish and sealing its founding membership in the EMU in January 1999. Thus, on January 1st 1999 the peseta's bilateral exchange rate was locked irrevocably with the currencies of the 10 other EMU members, and all monetary responsibilities were transferred to the European Central Bank (ECB) which sets a single interest rate for the whole euro area, irrespective of the specific economic conditions in any one country.

The ECB's higher interest rates in 2000 along with higher oil prices caused the economy to run out of steam in 2001; the stock market fell from 2000-2003, losing almost 50% of its value. Consumer confidence fell given the modest growth in real wages and the rising political and economic uncertainty. Inflation picked up in 1999, reaching a six-year high of 4.2% in May 2001, showing the weakness of the euro against the US dollar. Inflation eased through the second half of 2001 in response to weaker domestic demand and sharply lower oil prices, but then rose again through 2002, because of higher prices in the service sector (especially in tourism), opportunistic rises associated with the introduction of euro cash in January 2002, and indirect tax increases.

The inflation rate fell almost uninterruptedly from mid-2002 to March 2004, standing at just 2.1%, reflecting the appreciation of the euro on the internationally traded sectors. However, since the first quarter of 2004, the effect of the strong euro has been more than offset by high international oil prices and inflation averaged 3% for the year as a whole. Economic growth reached a low point of 2.2% in 2002, a rate well above the other large euro economies, and in 2003-04 GDP growth accelerated, to reach 2.5% and 2.7% respectively.

8.3 The Real Exchange Rate and GDP Per Capita

The Test

I first test if a long-run cointegrating relationship between the real exchange rate and GDP per capita can be found. This can be written as: $\ln(RER_t) = \gamma \ln(\text{Per Capita GDP}_t) + \varepsilon_t$.

The Data

The data that was collected for Spain is summarized in the Table 8.3.1:

Table 8.3.1

Nominal Exchange Rate	Spanish Peseta per US dollar	Quarterly	1975 Q1 – 2005 Q2	Global Insight, *WRDS*
Spanish Consumer Price Index	Spanish CPI- All Items	Quarterly	1975 Q1 – 2005 Q1	Global Insight, *WRDS*
Gross Domestic Product	Constant PPP GDP in (2000) Euros	Quarterly	1975 Q1 – 2005 Q2	Quarterly National Accounts, *OECD*
Population	Total Population	Annual	1975 – 2003	World Development Indicators, *WB CD*
	Total Population	Annual	2004	National Accounts, *OECD*
US Consumer Price Index	Harmonized US CPI	Quarterly	1975 Q1 – 2005 Q1	Global Insight, *WRDS*

Therefore, the Spanish data set includes the dates ranging from 1975 Q1 – 2005 Q1, with a total of 117 observations for each variable. One should note that because the population data was only available in an annual frequency, the data was extrapolated to assume a linear population growth

between quarters. Also, because population estimates could obviously not be found for 2005, the population is assumed constant from 2004 Q4 – 2005 Q1.

The Results

The correlation coefficient for the Spanish real exchange rate and GDP per capita gives an r-value of 0.1283828. Hence, the direction of association indicated here is a positive relationship between the two variables though the strength of association is very weak.

Next, the unit root tests that were estimated are presented in Table 8.3.2:

Table 8.3.2

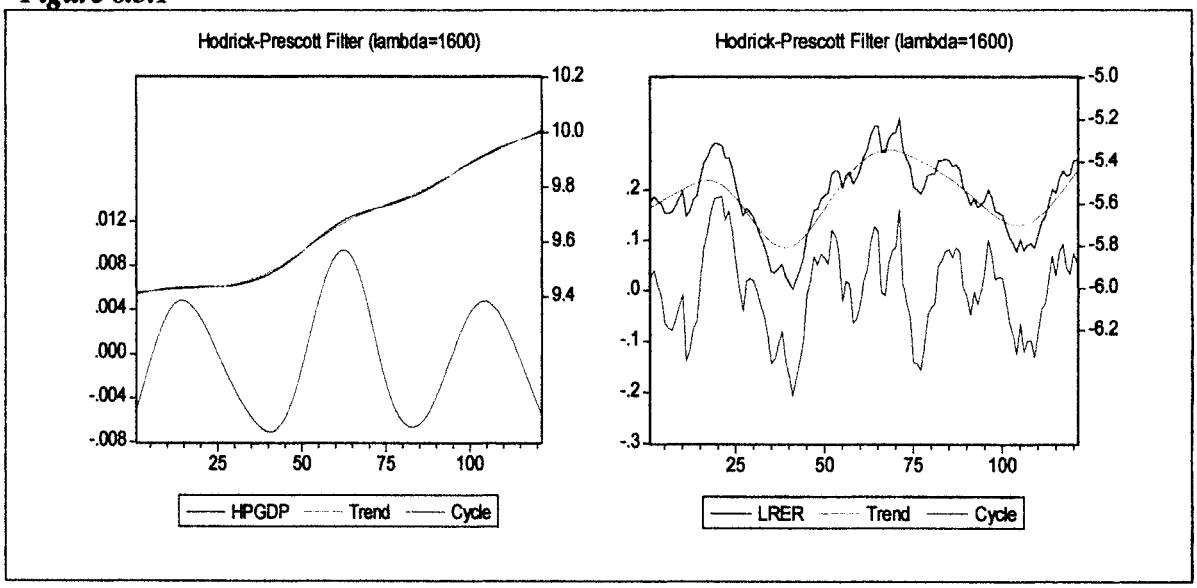
Test	Variable	Null Hypothesis	Alternative Hypothesis	Sign. Level	Test Statistic	Critical Values
Schmidt and Phillips (SP) Test	ln(RER)	Unit Root	No Unit Root	1%	-3.376	-3.61
	ln(GDP/Capita)	Unit Root	No Unit Root	1%	-1.9363	-3.61
Kwiatkowski, Phillips, Schmidt and Shin (KPSS) Test	ln(RER)	Stationarity	Unit Root	10%	0.1602	0.119
				5%	0.1602	0.146
				2.5%	0.1602	0.176
				1%	0.1602	0.216
	ln(GDP/Capita)	Stationarity	Unit Root	10%	0.3141	0.119
				5%	0.3141	0.146
				2.5%	0.3141	0.176
				1%	0.3141	0.216

The SP tests for both the Spanish real exchange rate and GDP per capita show that the time series are characterized by a unit root. The KPSS test reveals that at all levels of significance (1%, 2.5%, 5% and 10%) GDP per capita is characterized by a unit root. On the other hand, for the real exchange rate data, the conclusion of unit root presence is acceptable for the 5% and 10% level of significance.

Given the findings above, testing for cointegration can take place. Before this is done however, the data was run through the Hodrick-Prescott filter to eliminate the effects of the

business cycle. The effects of the filter on the two series (GDP per capita and the real exchange rate) can be seen in the following graphs of Figure 8.3.1:

Figure 8.3.1



The test for cointegration then used was the Johansen test. After much lag experimentation the lag length, giving the best log likelihood results was actually zero. Also, given that the theory recommends using a linear trend to incorporate the evolution of the non-tradable sector, one was assumed in the Johansen test that was run. The results are summarized by Table 8.3.3:

Table 8.3.3

Included observations: 120 after adjustments				
Trend assumption: Linear deterministic trend				
Lags interval (in first differences): No lags				
Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.01 Critical Value	Prob.**
None *	0.247318	34.108367	19.9371079	3.41E-05
At most 1	0.000124	0.0149196	6.63489657	0.90262117
Trace test indicates 1 cointegrating eqn(s) at the 0.01 level				
* denotes rejection of the hypothesis at the 0.01 level				
**MacKinnon-Haug-Michelis (1999) p-values				
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.01 Critical Value	Prob.**
None *	0.247318	34.093447	18.520012	1.49E-05
At most 1	0.000124	0.0149196	6.63489657	0.90262117
Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.01 level				
* denotes rejection of the hypothesis at the 0.01 level				
**MacKinnon-Haug-Michelis (1999) p-values				

According to the Johansen test, we can conclude that there is a cointegrating relationship between GDP per capita (the development degree of the economy) and the real exchange rate.

Furthermore, the VECM results given a lag length of zero are described in Table 8.3.4:

Table 8.3.4

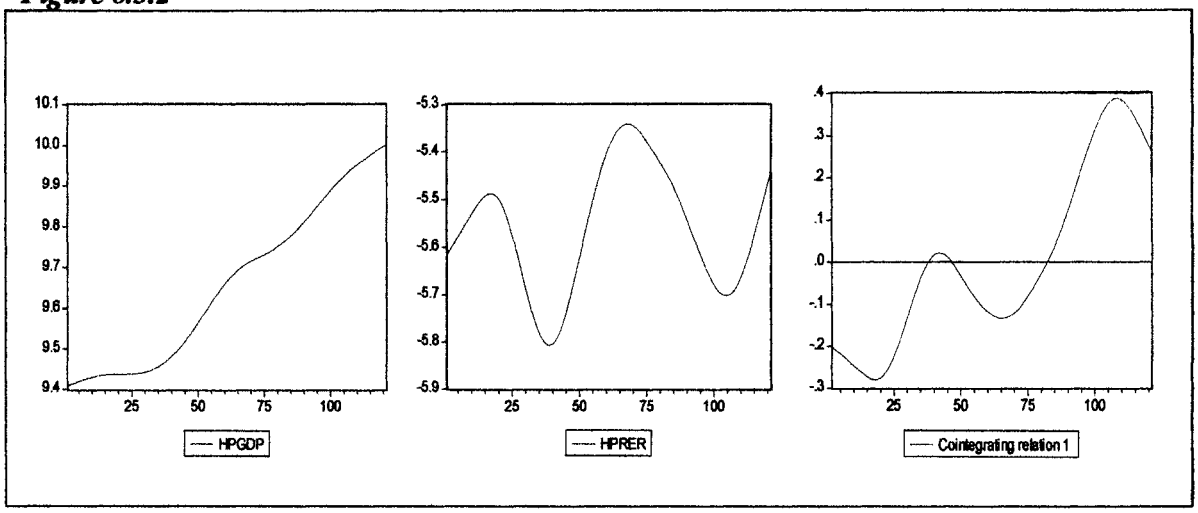
Vector Error Correction Estimates			**Vector Error Correction Estimates**		
Included observations: 120 after adjustments			Included observations: 120 after adjustments		
Standard errors in ( ) & t-statistics in [ ]			Standard errors in ( ) & t-statistics in [ ]		
Cointegrating Eq:	*CointEq1*		*Cointegrating Eq:*	*CointEq1*	
HPGDP(-1)	1.000000		HPGDP(-1)	1.000000	
HPRER(-1)	-0.807406 (0.25715) [-3.13986]		HPRER(-1)	1.091481 (0.03131) [34.8644]	
C	-14.14599				
Error Correction:	D(HPGDP)	D(HPRER)	*Error Correction:*	D(HPGDP)	D(HPRER)
CointEq1	0.006740 (0.00111) [6.08182]	0.007624 (0.00637) [1.19709]	CointEq1	0.001381 (7.1E-05) [19.3293]	0.000411 (0.00037) [1.11708]
C	0.004929 (0.00023) [21.4745]	0.001418 (0.00132) [1.07538]			
R-squared	0.238653	0.011998	R-squared	0.039683	0.000795
Adj. R-squared	0.232201	0.003626	Adj. R-squared	0.039683	0.000795
Sum sq. resids	0.000746	0.024634	Sum sq. resids	0.000941	0.024913
S.E. equation	0.002514	0.014449	S.E. equation	0.002812	0.014469
F-statistic	36.98849	1.433014	F-statistic	NA	NA
Log likelihood	549.0302	339.1953	Log likelihood	535.0997	338.5188
Akaike AIC	-9.117169	-5.619922	Akaike AIC	-8.901661	-5.625313
Schwarz SC	-9.070711	-5.573464	Schwarz SC	-8.878432	-5.602084
Mean dependent	0.004929	0.001418	Mean dependent	0.004929	0.001418
S.D. dependent	0.002869	0.014475	S.D. dependent	0.002869	0.014475
Determinant resid covariance (dof adj.)		1.11E-09	Determinant resid covariance (dof adj.)		1.39E-09
Determinant resid covariance		1.07E-09	Determinant resid covariance		1.37E-09
Log likelihood		898.5890	Log likelihood		884.0280
Akaike information criterion		-14.87648	Akaike information criterion		-14.66713
Schwarz criterion		-14.73711	Schwarz criterion		-14.57422

Using the results that include a linear time trend only (the left hand side of the table), we can substitute the appropriate coefficients to get the two equations below:

1. D(HPGDP) = 0.0067*(HPGDP(-1) - 0.807*HPRER(-1) - 14.146) + 0.0049
2. D(HPRER) = 0.0076*(HPGDP(-1) - 0.807*HPRER(-1) - 14.146) + 0.00142

The results from the Spanish data indicate that the error correction estimate from only the first equation is significant. This result is more similar to the canonical case of South Korea since the first difference of GDP per capita converges in the short-run. In fact, the rate of convergence is even faster than that of the Korean case since here the percentage change of GDP per capita is a 0.7%. Finally, one can graph out the long-run cointegrating relationship between GDP per capita and the real exchange rate (from 1975 Q1 – 2005 Q1) in order to see their long-run dynamics seem come to life in the graphs of Figure 8.3.2:

Figure 8.3.2



8.4 The Real Exchange Rate and Productivity Differentials

The Test

The results of the first cointegration test for Spain showed that GDP per capita and the real exchange rate were characterized by a long-run cointegrating relationship. As discussed in section 4.2 however, a more specific test for the Balassa-Samuelson effect will also be conducted. Summarizing this test one sees that the following equation will be tested:

$$\ln(RER_t) = c + \gamma \ln\left(\frac{\frac{\theta_{Tt}}{\theta_{Nt}}}{\frac{\theta^*_{Tt}}{\theta^*_{Nt}}}\right) + \varepsilon_t .$$

Indication of the Balassa-Samuelson effect would mean that a cointegrating relationship between the real exchange rate and the relative productivity differentials (between tradable and nontradable goods) given the home (Spain) and foreign (US) nations would exist. If such a cointegrating relationship exists.

The Data

The data set collected for the second cointegration test is far shorter than the one used for the first test of cointegration. Nevertheless, this Spanish data set is summarized in Table 8.4.1:

Table 8.4.1

Nominal Exchange Rate	Spanish Peseta per US dollar	Annual	1979-2002	Global Insight, *WRDS*
Spanish Consumer Price Index	Spanish CPI-All Items	Annual	1979-2002	IMF, *International Financial Statistics*
Spanish Labor Productivity	Labour productivity per hour worked (in chained (1995) Euros)	Annual	1979-2002	Groningen Growth and Development Centre, *60-Industry Database*
US Labor Productivity	Labour productivity per hour worked (in chained (1995) Dollars)	Annual	1979-2002	Groningen Growth and Development Centre, *60-Industry Database*
US Consumer Price Index	US CPI - All Cities	Annual	1979-2002	IMF, *International Financial Statistics*

The Results

The estimated correlation coefficient, *r*, for the real exchange rate and the relative productivity differential time series is -0.07591. This negative sign is note what Balassa and Samuelson would have predicted since it indicates a negative linear relationship between these two variables. But, as with the Korean case, when one removes the year 2001 given the terrorist attacks in New York

City, the correlation coefficient becomes the positive number of 0.016471. Despite this fact, I will not remove this year from the time series since doing would constitute data mining.

The unit root tests conducted on the two variables (the real exchange rate that the relative productivity differentials) are provided in Table 8.4.2:

Table 8.4.2

Test	Variable	Null Hypothesis	Alternative Hypothesis	Sign. Level	Test Statistic	Critical Values
Schmidt and Phillips (SP) Test	ln(RER)	Unit Root	No Unit Root	5%	-2.3857	-3.18
	ln(PD)	Unit Root	No Unit Root	5%	-0.7855	-3.18
Kwiatkowski, Phillips, Schmidt and Shin (KPSS) Test	ln(RER)	Stationarity	Unit Root	10%	0.1225	0.119
				5%	0.1225	0.146
				2.5%	0.1225	0.176
				1%	0.1225	0.216
	ln(PD)	Stationarity	Unit Root	10%	0.1874	0.119
				5%	0.1874	0.146
				2.5%	0.1874	0.176
				1%	0.1874	0.216

Table 8.4.2 above shows that a unit root was found to characterize both the variables for the years ranging from 1979-2002. Before the result of the results are presented, the reader should note that unlike the first cointegration test, the Hodrick-Prescott filter was not employed for the second set of tests; given the annual nature of the data used the effects of the business cycle are note of great concern.

Next, using the Akaike information criterion, the log likelihood estimates, the Schwarz criterion and the lag exclusion tests the lag length used for the series was zero. With this information, the Johansen and the VECM tests are positive. The results are given in Table 8.4.3:

Table 8.4.3

Included observations: 23 after adjustments				
Trend assumption: No deterministic trend				
Lags interval (in first differences): No lags				
Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None	0.51029914	18.14517	20.26183964	0.09529
At most 1	0.07221935	1.724079	9.164545912	0.83176
Trace test indicates no cointegration at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.51029914	16.42109	15.89209863	0.041305
At most 1	0.07221935	1.724079	9.164545912	0.83176
Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

The Johansen maximum eigenvalue test summarized in Table 8.4.3 indicates that at the 5% level there appears to be a long-run cointegrating relationship between the real exchange rate and the relative productivity differentials between tradable and nontradable goods for the Spanish data sets. This means that the Balassa-Samuelson effect may very well describe Spanish economic growth for the years of 1979-2002. As the reader will see later on, Spain will be the only country out of the four Southern European countries examined where such a result is found for the second, more explicit, test of cointegration. This shows once more that the Spanish experience is probably the closest to the South Korean one out of the countries investigated in this study.

This cointegration result found allows a VECM to be estimated for a better understanding of the short-run dynamics of these two variables. The VECM results are provided in Table 8.4.4:

Table 8.4.4

Included observations: 23 after adjustments		
Standard errors in ( ) & t-statistics in [ ]		
Cointegrating Eq:	*CointEq1*	
LRER(-1)	1	
LPD(-1)	0.547635576 (0.267348209) [2.04840]	
C	5.94809807 (0.14773656) [40.2615]	
Error Correction:	D(LRER)	D(LPD)
CointEq1	-0.229337465 (0.089055) [-2.57523]	0.132403059 (0.051644961) [2.56372]
R-squared	0.21494447	0.169996309
Adj. R-squared	0.21494447	0.169996309
Sum sq. resids	0.241323961	0.081159569
S.E. equation	0.104734287	0.060737726
F-statistic	NA	NA
Log likelihood	19.77117061	32.30298584
Akaike AIC	-1.632275705	-2.721998768
Schwarz SC	-1.582906391	-2.672629455
Mean dependent	-0.017033203	0.018206956
S.D. dependent	0.118205775	0.066668167
Determinant resid covariance (dof adj.)		3.32E-05
Determinant resid covariance		3.04E-05
Log likelihood		54.35350408
Akaike information criterion		-4.29160905
Schwarz criterion		-4.044762482

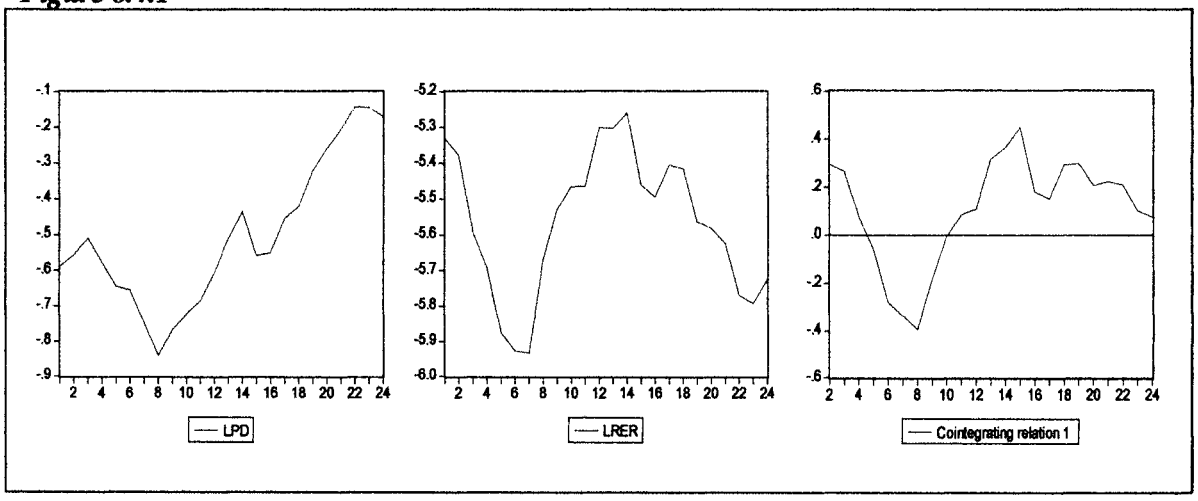
When the appropriate coefficients are substituted in one attains the following two equations:

1. D(LRER) = - 0.229*(LRER(-1) + 0.548*LPD(-1) + 5.95)
2. D(LPD) = 0.132*(LRER(-1) + 0.548*LPD(-1) + 5.948)

The error correction term for both of these equations is found significant (though the R^2 for the second error correction term is very low). Nevertheless, these results show that in the short-run, the first difference of the real exchange rate *diverges* (given the negative sign) by a percentage change of approximately 23%. Also, the relative labor productivity differentials, in the short-run *converge* by a percentage change of approximately 13%. This also shows that though the long-run dynamics of the Spanish economy may be similar to the South Korean experience, very different dynamics govern the real exchange rate and the relative productivity differentials in the short run.

Finally, given the Johansen cointegration results presented above, we know that theses two variables do have a long-run cointegrating relationship. As a visual representation of these variables and their cointegrating relationship, graphs are provided for the reader in Figure 8.4.1:

Figure 8.4.1



9. Portugal[80]

9.1 Portuguese Politics

The first Portuguese republic was established in 1910 when King Carlos I and his son were assassinated. This arrangement was unstable however and a revolt in 1926 ended parliamentary rule. Two years later power was placed in the hands of António de Oliveira Salazar, who became Prime Minister in 1932, holding this position for about 40 years. Portugal never became totalitarian but Mr. Salazar was an authoritarian arch-conservative, hostile towards both liberal democracy *and* communism, aiming to preserve Portugal's rural and religious character.

Portugal was basically uninvolved in WWII, but in the post-war era the economy went from affluence in the 1930s to decline in the 1960s. In 1968 Mr. Salazar died and was succeeded by another authoritarian, Marcelo Caetano. But given the curbs on basic freedoms and the high cost of maintaining the empire, a coup by army officers occurred in 1974, overthrowing the dictatorship and was replaced by Portuguese Communist Party (PCP). The PCP nationalized major sectors of the economy and granted independence to Portugal's African colonies. It remained in power till 1975, when the Socialist Party (PS) and the Popular Democrat Party (PSD) formed a new, more moderate government. After a failed military coup by left-wingers in late 1975 though, a parliamentary election was held and General António Ramalho Eanes, was elected President in 1976 and reelected in 1981, giving Portugal some institutional stability. However, the frequent changes in government made the political scene turbulent till the mid-1980s.

Portugal's first two democratic governments were led by the moderate Socialist leader, Mario Soares, who geared the country toward a more liberal democratic orientation by applying to join the European Community (EC, now the EU). The centre-right Democratic Alliance (AD) coalition, headed by the PSD leader, Francisco Sá Carneiro, achieved a parliamentary majority in

[80] The background on Portuguese politics and the Portuguese economy was found on the following websites: www.portugal.org, www.wikipedia.org, and www.eiu.com

the 1979 but was killed in an air crash in 1980. His successor, Francisco Balsemão, proved ineffectual and the PS returned as the largest party in the general election of 1983. But given the rapidly deteriorating economy, a national coalition between the PS and PSD was soon formed, with Mr. Soares as the Prime Minister. An IMF austerity program was soon agreed to and implemented while EC entry entered its final phase.

In 1985 a more stable period of government emerged with the new PSD leader, Anibal Cavaco Silva, who won three successive general elections and governed till 1995. Also, Mr. Soares was elected President in 1986 and remained President till 1996. Having both Mr. Cavaco Silva and Mr. Soares in power led to an era of political stability and economic progress. The PSD governments of this period quickly gained a reputation for efficiency, introducing widespread market reforms. The economy boomed, aided by generous EU funding and an inflow of foreign investment. But in 1992, Portugal entered into recession, marking the end of the prosperous era following EC entry in 1986. The 1995 general election and a presidential election in 1996 showed the start of a new political and economic era, with PS back in power after ten years of PSD rule. The PS was able to form a stable government with the leadership of António Guterres.

Mr. Guterres' first term was seen as a period of renewed economic vitality, with economic policy geared toward EMU entry. Although the PS was re-elected for a second term in 1999, the economic climate began to worsen, and the PS suffered defeat in local elections in 2001. Mr. Guterres resigned as Prime Minister and PS leader, causing a two year ahead-of-schedule general election in 2002. PSD won, and was able to form a coalition government called Convergência Democrática (CD) with the small Popular Party (PP), a right-of-centre populist group.

The CD set out a tough but ambitious program of political and economic reform to redress Portugal's economic imbalances with Mr. Durão Barroso as the Prime Minister. However, by 2004 his popularity dwindled given the persistent economic downturn and his stringent economic policies. The country was thrown into further political turmoil that year when, in the

middle of his term, Mr. Barroso announced his acceptance of the European Commission presidency nomination and thus he resigned from his position as PSD leader and Prime Minister. Nevertheless, there was a dire need for recognizing if stability was to be maintain given the precarious state of the economy. The Socialist President, Jorge Sampaio, therefore started the PSD would serve out its term in office with the newly elected PSD leader, Pedro Santana Lopes, who pledged to continue with the policies of his predecessor until the next parliamentary election in 2006.

9.2 The Portuguese Economy

Portugal is a small open economy which, compared to other EU economies, has markedly lower labor costs. Like its European neighbors though, Portugal has developed an increasingly service-based economy over the past 25 years, with the agricultural and fishing sectors have gone from accounting for 24% of GDP in 1960 to just 5.9% of GDP in 2003. Nevertheless, in 2001 this sector accounted for 12.1% of total production, well above the EU average. This shows the sectors importance and difficulties with efficient productivity resulting in a loss of competitive advantage to more efficient foreign producers. Instead, growth has been strong in construction and services sector (especially in the financial, retail and telecoms). Yet, for a developed country GDP per capita is low, standing at an estimated US$18,402 in terms of purchasing power parity in 2003 making it the second lowest in the EU (after Greece). Though during the decade after ascension the gap with other EU members has narrowed, it still stood at 73% of the EU average in 1996.

In 1993 the Portuguese economy fell into a recession only gaining positive momentum in 1995 when there was more vigorous expansion for the second half of the decade. From 1996-2000 real GDP grew by an average of 3.9% a year, peaking at 4.6% in 1998. Growth in domestic demand averaged at 4.8% a year in the same period and over 6% from 1998 -1999. Conversely, there was a negative rise in net external demand; real import growth soared, averaging 10.9%

from 1997-1999, far outstripping export growth which averaged 6.4% in the same period. This shows how unbalanced the composition of economic growth had become, relying heavily on the credit boom in domestic demand. Also, the increasing current-account deficit was a strong indication the economy was heading into trouble.

For the most part though, Portuguese economic policy of the 1990s focused mostly on the EU's convergence criteria for the EMU. After pursuing orthodox monetary and fiscal policies, the average rate of consumer price inflation fell from 13.3% in 1990 to just 2.3% in 1997, tracking the disinflationary trends evident throughout most of Europe over this period. Portugal become a founding member of the euro in January 1999. But the government's success was accompanied with new problems: in the run-up to the EMU interest rates reached historically low levels and the single currency abolished the country's traditional interest rate premium. However, the rise in consumer and business confidence caused an investment and consumption boom and credit demand soared (discussed above) along with the government's tax receipts causing an illusory wealth effect. The public finances *appeared* healthy, encouraging the government to expand the scope of public spending and investment instead of pursuing the much needed reforms in public administration. Furthermore, the current-account deficit soared to record highs (10.4% of GDP in 2000).

By 2001 though, consumer and business confidence declined as the government's financial problems were revealed, growth expectations dropped as the global economy slowed. Specifically, the fiscal revenue slumped declining by 5.9% in 2001 and the government was confronted with a severe budgetary crisis, pushing the general government deficit up from 2.9% of GDP in 1999 to 4.4% of GDP in 2001. This led the European Commission to open an "excessive deficit procedure" against Portugal, given the government's failure to implement meaningful structural reform and the squandering of buoyant tax receipts in the late 1990s. Also, the headline rate of inflation subsequently rebounded to 4.4% by 2001 in a delayed response to the economy's overheating in the late 1990s and businesses reacted rapidly to this new uncertain

climate. They curtailed investment, stagnating in 2001 and sharply contracting form 2002-2003. Luckily the resilience of the construction sector, which continued to expand until mid-2002 softened the downturn in fixed investment which could have been much worse since excluding construction, fixed investment fell by 2.5% in 2001 and 7.1% in 2002. The pessimism of the business community spread to the household sector. Private consumption growth dropped from an average of 5.2% in 1998-99 to just 0.7% in 2002 and then contracted by 0.6% in 2003, resulting in high levels of personal indebtedness (rising to more than 100% of disposable income). Furthermore, disposable income was also hit hard by rising job losses, high inflation, higher taxes, lower nominal wages, and losses in the stock market.

The government's restrictive fiscal policy only exacerbated the recession. Real public consumption expanded by an annual average of 4.3% from1998-2001, before the government's austerity program slowed it to 2.7% in 2002 and 2.1% in 2003. Furthermore, the indirect tax increases in mid-2002, combined with opportunistic price increases associated with the launch of euro coins and notes in January 2002, also contributed to higher prices in 2002, when inflation rose by an annual average of 3.6%. On a brighter note, the negative net contribution of the external sector of the late 1990s was gradually reversed in 2000-2001. Import growth fell back sharply from 2002-2003 (showing the weakness of domestic demand), while export demand expanded, providing some relief to the overall economy; overall in real GDP grew by just 0.5% in 2002, before contracting by 1.2% in 2003. Also, the weakness of domestic demand and the strength of the euro in 2003 helped reduce inflation over the course of the year. By end-2003 inflation had slowed to 2.4%, while the average inflation rate for the year as a whole was 3.3%. The global trend towards lower prices for industrial goods was an additional factor reducing Portuguese goods inflation, where the lowest rate of year-on-year inflation was in February 2004 at 2.1%. Unfortunately though, inflation in Portugal began to steadily rise again, driven by rising fuel costs and high agricultural prices (also part of a global trend) but the average inflation

differential between Portugal and the euro area has narrowed, showing that recent inflationary pressure was largely imported.

Signs of a promising recovery emerged in 2004. For starters, in April 2004 the European Commission removed Portugal from the EU's budgetary discipline procedure since its breach of the deficit limit in 2001 was followed by two years of fiscal rectitude. Also, the economy expanded by 0.6% quarter on quarter which was the strongest quarterly increase since the second quarter of 2002. This growth was led by a rise in domestic demand and private consumption, while private investment slowly recovered. However, grounds for concern still remain. Political turmoil in July along with persistently high international oil prices (Portugal relies entirely on imported oil), consumer and investor confidence is likely to have diminished. Also, import demand roes in the first quarter of 2004, and the external sector made a negative contribution of 0.8% of GDP. This is of particular concern, as global trade growth was strong in the first quarter, and it appeared to be a clear indicator of the falling competitiveness of Portuguese exports.

9.3 The Real Exchange Rate and GDP Per Capita

The Test:

The first estimated cointegration test seeks to find a long-run relationship between the real exchange rate and GDP per capita. Therefore, the test conducted can be written as:

$\ln(RER_t) = \gamma \ln(\text{Per Capita GDP}_t) + \varepsilon_t$.

The Data

The data that was collected for Portugal has been compiled and summarized in Table 9.3.1 below:

Table 9.3.1

Nominal Exchange Rate	Portuguese Escudos per US dollar	Quarterly	1975 Q1 – 2005 Q2	Global Insight, *WRDS*
Portuguese CPI	CPI-All Items	Quarterly	1975 Q1 – 2005 Q1	Global Insight, *WRDS*
Gross Domestic Product	Constant PPP GDP in (2000) Euros	Quarterly	1975 Q1 – 2005 Q2	Quarterly National Accounts, *OECD*
Population	Total Population	Annual	1975 – 2003	World Development Indicators, *WB CD*
US Consumer Price Index	Harmonized US CPI	Quarterly	1975 Q1 – 2005 Q1	Global Insight, *WRDS*

Hence, the total data set for Portugal includes the dates 1975 Q1 – 2005 Q1 and so the data provided for each variable includes 117 observations. The reader should note that because the population data was not available for 2004 and 2005, it is assumed constant from 2003 Q4 – 2005 Q1. Also, because quarterly population estimates were not found, the data was extrapolated and so it is assumed that there is a linear population grows from quarter to quarter, between each year.

The Results

For the data collected on Portugal, the correlation coefficient, *r*, between the real exchange rate and GDP per capita is 0.355318. Thus, the relationship indicated between the two variables is a positive one given the direction of association. Also, this figure also portrays a weak strength of association between the two time series.

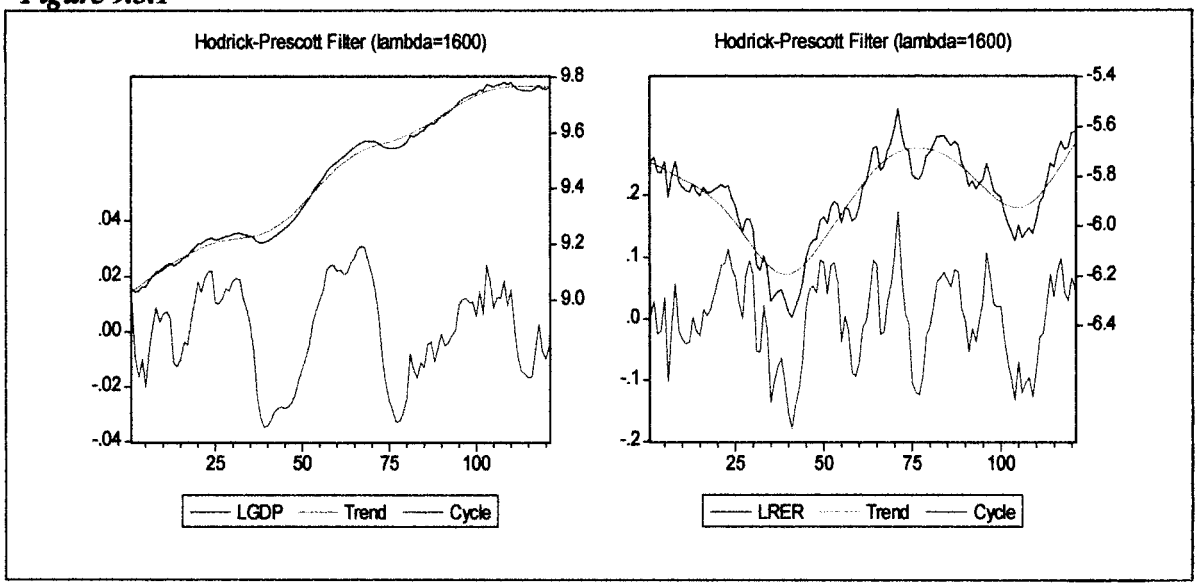
The unit root tests performed are summarized by Table 9.3.2:

Table 9.3.2

Test	Variable	Null Hypothesis	Alternative Hypothesis	Sign. Level	Test Statistic	Critical Values
Schmidt and Phillips (SP) Test	ln(RER)	Unit Root	No Unit Root	1%	-2.711	-3.61
	ln(GDP/Capita)	Unit Root	No Unit Root	1%	-2.9093	-3.61
Kwiatkowski, Phillips, Schmidt and Shin (KPSS) Test	ln(RER)	Stationarity	Unit Root	10%	0.2133	0.119
				5%	0.2133	0.146
				2.5%	0.2133	0.176
				1%	0.2133	0.216
	ln(GDP/Capita)	Stationarity	Unit Root	10%	0.171	0.119
				5%	0.171	0.146
				2.5%	0.171	0.176
				1%	0.171	0.216

When the SP test was conducted on the Portuguese data on the real exchange rate and GDP per capita it revealed the presence of unit roots for both the series. With the KPSS tests on the other hand, the real exchange rate data shows unit root presence at the 2.5%, 5% and 10% significance levels while the GDP per capita data indicates a unit root at the 10% and 5% levels. This finding allows one to proceed to cointegration testing. But before testing for cointegration, the Portuguese data was run through a Hodrick-Prescott Filter in order to eliminate the effects of the business cycle and so to smooth out the series. This smoothing out of the series can be seen in the following graphs of Figure 9.3.1:

Figure 9.3.1



Now, after filtering the data, the Johansen test is used to test for a cointegrating relationship between GDP per capita and the real exchange rate. One should note that the results below include the assumption of a linear deterministic trend because theory explains that this should be added to incorporate the evolution of the nontradables. Also, given the log likelihood estimates after, many tries of various lag lengths, indicate that no lags should be used.

Table 9.3.3

Portugal - Johansen Cointegration Test				
Included observations: 120 after adjustments				
Trend assumption: Linear deterministic trend				
Lags interval (in first differences): No lags				
Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.01 Critical Value	Prob.**
None *	0.3099416	44.791398	19.93710787	6.99E-07
At most 1	0.0022801	0.2739191	6.634896573	0.600713
Trace test indicates 1 cointegrating eqn(s) at the 0.01 level				
* denotes rejection of the hypothesis at the 0.01 level				
**MacKinnon-Haug-Michelis (1999) p-values				
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.01 Critical Value	Prob.**
None *	0.3099416	44.517478	18.52001196	2.61E-07
At most 1	0.0022801	0.2739191	6.634896573	0.600713
Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.01 level				
* denotes rejection of the hypothesis at the 0.01 level				
**MacKinnon-Haug-Michelis (1999) p-values				

Table 9.3.3 provides the results from the Johansen test conducted. These results indicate a cointegrating relationship between the Portuguese real exchange rate and GDP per capita (the development degree of the economy).

Next, a VECM (with no lags) was estimated. The results from this test are presented in Table 9.3.4:

Table 9.3.4

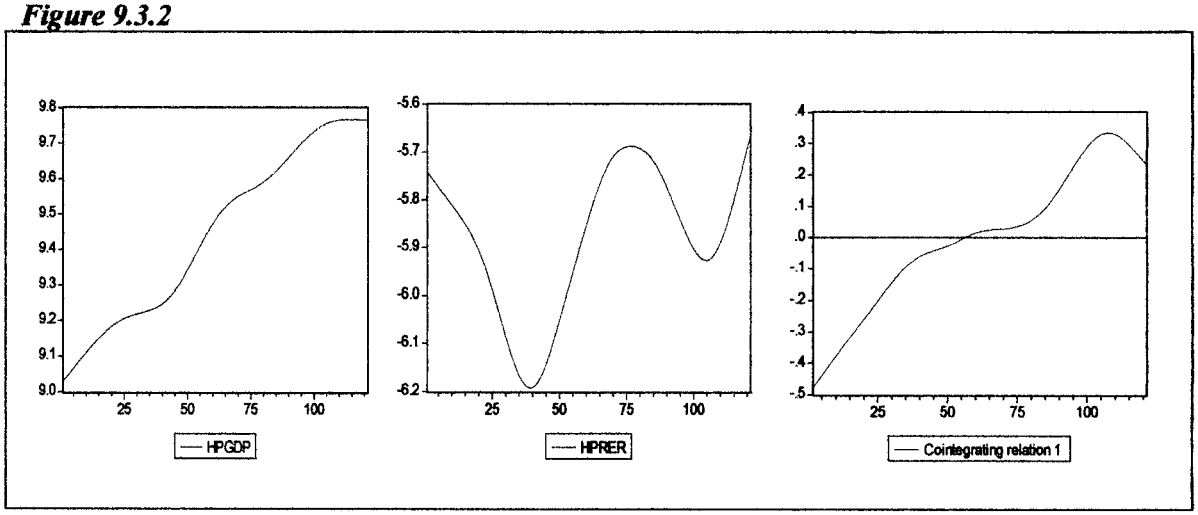
Vector Error Correction Estimates			**Vector Error Correction Estimates**		
Included observations: 120 after adjustments			Included observations: 120 after adjustments		
Standard errors in ( ) & t-statistics in [ ]			Standard errors in ( ) & t-statistics in [ ]		
Cointegrating Eq:	*CointEq1*		*Cointegrating Eq:*	*CointEq1*	
HPGDP(-1)	1.000000		HPGDP(-1)	1.000000	
HPRER(-1)	-0.453326 (0.20042) [-2.26189]		HPRER(-1)	2.030688 (0.02231) [91.0334]	
C	-12.11035				
Error Correction:	D(HPGDP)	D(HPRER)	*Error Correction:*	D(HPGDP)	D(HPRER)
CointEq1	-0.005805 (0.00144) [-4.01929]	0.022490 (0.00531) [4.23597]	CointEq1	-0.002426 (0.00013) [-18.8230]	-6.90E-05 (0.00049) [-0.14103]
C	0.006122 (0.00032) [19.3164]	0.000630 (0.00116) [0.54120]			
R-squared	0.120418	0.131992	R-squared	0.049300	-0.001987
Adj. R-squared	0.112964	0.124636	Adj. R-squared	0.049300	-0.001987
Sum sq. resids	0.001422	0.019217	Sum sq. resids	0.001537	0.022183
S.E. equation	0.003472	0.012761	S.E. equation	0.003594	0.013653
F-statistic	16.15468	17.94342	F-statistic	NA	NA
Log likelihood	510.3108	354.0947	Log likelihood	505.6457	345.4824
Akaike AIC	-8.471846	-5.868245	Akaike AIC	-8.410761	-5.741373
Schwarz SC	-8.425388	-5.821787	Schwarz SC	-8.387532	-5.718143
Mean dependent	0.006122	0.000630	Mean dependent	0.006122	0.000630
S.D. dependent	0.003686	0.013640	S.D. dependent	0.003686	0.013640
Determinant resid covariance (dof adj.)		1.71E-09	Determinant resid covariance (dof adj.)		2.26E-09
Determinant resid covariance		1.66E-09	Determinant resid covariance		2.22E-09
Log likelihood		872.5793	Log likelihood		854.9153
Akaike information criterion		-14.44299	Akaike information criterion		-14.18192
Schwarz criterion		-14.30361	Schwarz criterion		-14.08901

Now, substituting the coefficients for the estimates including a linear trend in the data one gets:

1. D(HPGDP) = - 0.0058*(HPGDP(-1) - 0.453*HPRER(-1) - 12.11) + 0.0061
2. D(HPRER) = 0.022*(HPGDP(-1) - 0.45*HPRER(-1) - 12.11) + 0.00063

Here both error correction results are significant (though their R^2 is very low). It appears that for Portugal, the first difference of GDP per capita *diverges* (given the negative sign) from long-run equilibrium by a percentage change of 0.5%. The real exchange rate, on the other hand, seems to compensate for this since in the short run, by converging in the short-run by a percentage change of approximately 2.2%. (This may be an indication of the Dornbusch's overshooting model, but is beyond the scope of this paper.) Lastly, one can graph out the variables and their estimated cointegrating relationship as seen in Figure 9.3.2:

Figure 9.3.2



9.4 The Real Exchange Rate and Productivity Differentials

The Test

As with all of the countries examined, the results attained for Portugal for the first cointegration test indicated that GDP per capita and the real exchange rate were cointegrated. But this finding is

not ample evidence of a Balassa-Samuelson effect presence in these economies. Thereofore, as section 4.2 describes, a second more specific for the effect is also conducted. This test can be summarized as:

$$\ln(RER_t) = c + \gamma \ln\left(\frac{\frac{\theta_{Tt}}{\theta_{Nt}}}{\frac{\theta^*_{Tt}}{\theta^*_{Nt}}}\right) + \varepsilon_t .$$

The equation above basically shows that in order to prove that the Balassa-Samuelson effect is indeed at work in Portugal, a cointegrating relationship between the real exchange rate and the relative productivity differentials (between tradable and nontradable goods) given the home (Portugal) and foreign (US) nations is needed.

The Data

The data attained for the second cointegration test contained far shorter time series, ranging at an annual frequency from 1979-2002. Nevertheless the data found is summarized in Table 9.4.1:

Table 9.4.1

Nominal Exchange Rate	Portuguese Escudos per US dollar	Annual	1979-2002	Global Insight, *WRDS*
Portuguese Consumer Price Index	Portuguese CPI-All Items	Annual	1979-2002	IMF, *International Financial Statistics*
Portuguese Labor Productivity	Labour productivity per hour worked (in chained (1995) Euros)	Annual	1979-2002	Groningen Growth and Development Centre, *60-Industry Database*
US Labor Productivity	Labour productivity per hour worked (in chained (1995) Dollars)	Annual	1979-2002	Groningen Growth and Development Centre, *60-Industry Database*
US Consumer Price Index	US CPI - All Cities	Annual	1979-2002	IMF, *International Financial Statistics*

The Results

The correlation coefficient, *r*, for the Portuguese data on the real exchange rate and the relative productivity differentials is 0.760605. This is the expected sign since the Balassa-Samuelson hypothesis would predict a positive linear relationship between the two variables.

Unit root testing was then conducted, the results of which are provided in Table 9.4.2:

Table 9.4.2

Test	Variable	Null Hypothesis	Alternative Hypothesis	Significance Level	Test Statistic	Critical Values
Schmidt and Phillips (SP) Test	ln(RER)	Unit Root	No Unit Root	5%	-2.213	-3.18
	ln(PD)	Unit Root	No Unit Root	5%	-2.1891	-3.18
Kwiatkowski, Phillips, Schmidt and Shin (KPSS) Test	ln(RER)	Stationarity	Unit Root	10%	0.1231	0.119
				5%	0.1231	0.146
				2.5%	0.1231	0.176
				1%	0.1231	0.216
	ln(PD)	Stationarity	Unit Root	10%	0.1164	0.119
				5%	0.1164	0.146
				2.5%	0.1164	0.176
				1%	0.1164	0.216
Augmented Dickey-Fuller (ADF) Test	ln(PD)	Unit Root	No Unit Root	5%*	0.35918	-3.6
				1%*	0.35918	-4.38
* Taken from the G.S. Maddala and In-Moo Kim (1998) Table 3.1 (pp. 64)						

As one can see in Table 9.4.2, the KPSS and SP test give contradicting results for the Portuguese productivity differential (LPD) data. The SP test found a unit root in the series while the KPSS test failed to reject stationarity at all levels of significance (1%, 2.5%, 5% and 10%). An ADF test was therefore conducted to clear up the confusion. The ADF test results (as seen above) indicate that a unit root characterizes the Portuguese productivity differential time series. The reader should note here that unlike the first test of cointegration, a Hodrick-Prescott Filter was not used

given the annual frequency of the data used, where the effects of the business cycle were not a main concern and so a smoothed out series was not needed.

Given the fact that unit roots were found for both the time series, the Johansen cointegration test could be conducted. Table 9.4.3 presents the results for the Johansen cointegration test:

Table 9.4.3

Included observations: 23 after adjustments				
Trend assumption: No deterministic trend				
Lags interval (in first differences): No lags				
Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None	0.274435	9.243943	20.26183964	0.713302
At most 1	0.077904	1.865432	9.164545912	0.804326
Trace test indicates no cointegration at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.274435	7.378511	15.89209863	0.623131
At most 1	0.077904	1.865432	9.164545912	0.804326
Max-eigenvalue test indicates no cointegration at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

Table 9.4.3 shows that at the 5% level there does not appear to be a cointegrating relationship between the Portuguese real exchange rate and the relative labor productivity differentials between tradable and nontradable goods. This further indicates that the Balassa-Samuelson effect is probably not a good explanation of the economic development of the Portuguese economy from 1979-2002, despite what the findings from the first cointegration test (between GDP per capita and the real exchange rate) may have implied.

One may question though, where does the Balassa-Samuelson hypothesis fail in explaining the Portuguese economic experience? To answer this question one needs to rewind and look to the theory's primary assumptions that: (1) productivity differentials (θ_T/θ_N) between the two sectors and relative prices (p) of nontradables are positively correlated, (2) the RER and nontradables' prices are positively correlated and lastly, (3) that PPP holds for the tradable goods sector ($P_T = EP_T^*$).

Starting with the first assumption, the correlation coefficient, r, between productivity differentials and value added deflator growth of the nontraded goods sector (which was used to reflect this sector's prices) is -0.76722. This result indicates that the first assumption does not hold, given the strong negative relationship between the two variables. Using the same method to test for the second assumption, the r value attained for the real exchange rate and nontradables' prices is -0.59113, indicating that the second Balassa-Samuelson assumption also fails for the Portuguese data. For the last assumption, the Johansen cointegration test was used to see whether the nominal exchange rate (NXR) and the PPP exchange (PPPXR) rate contain a long-run relationship. But a unit root is necessary in the two time series before this could be done. The Schmidt and Phillips unit root test is therefore summarized in Table 9.4.4 that follows:

Table 9.4.4

Test	Variable	Null Hypothesis	Alternative Hypothesis	Sign. Level	Test Statistic	Critical Values
Schmidt and Phillips (SP) Test	PPPXR	Unit Root	No Unit Root	1%	-2.1396	-3.9
	NXR	Unit Root	No Unit Root	1%	-1.3263	-3.9

As the table above indicates, a unit root is found to characterize both series and cointegration testing can proceed:

Table 9.4.5

Included observations: 23 after adjustments				
Trend assumption: No deterministic trend				
Lags interval (in first differences): No lags				
Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.695237534	31.56222833	20.26183964	0.00092
At most 1	0.168104288	4.233108409	9.164545912	0.37851
Trace test indicates 1 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.695237534	27.32911992	15.89209863	0.00054
At most 1	0.168104288	4.233108409	9.164545912	0.37851
Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

According to the Johansen test, presented in Table 9.4.5 above, it appears that the two series are cointegrated. The next step was to use OLS to estimate the slope coefficient, the results of which are provided in Table 9.4.6 that follows:

Table 9.4.6

Method: Least Squares			
Coefficient	**Std. Error**	**t-Statistic**	**Prob.**
1.19355548	0.08245094	14.47594755	4.81E-13
R-squared	-0.0659017	Mean dependent var	0.729875
Adjusted R-squared	-0.0659017	S.D. dependent var	0.2384405
S.E. of regression	0.24617193	Akaike info criterion	0.0752006
Sum squared resid	1.39381421	Schwarz criterion	0.1242862
Log likelihood	0.09759283	Durbin-Watson stat	0.3949171

The OLS estimates reveal a slope coefficient close to one (1.19) and so PPP appears to hold for the tradable goods sector.

Testing the Balassa-Samuelson assumptions for the case of Portugal indicates that the theory fails to explain the economic experience of the country (from 1979-2002) because two key assumption fail to hold, namely that productivity differentials and relative prices of nontradables are positively correlated and that nontradables' prices and the real exchange rate are positively correlated.

10. Conclusion

In the context of Drine and Rault (2003), this paper tests for the Balassa-Samuelson effect in four of Europe's Southern peripheral countries, namely Greece, Italy, Spain and Portugal. The canonical case of South Korea was included as a point of reference (since there appears to be a consensus in the literature that the country experienced the Balassa-Samuelson effect). Time series cointegration techniques are employed given the uniqueness of each nation at hand and also because cointegration tests have been found to give more robust estimates when shorter data sets are used. Each case study was split up into two sets of cointegration tests. The first set of estimates tested for the Balassa-Samuelson effect in a very broad sense, examining whether the real exchange rate and the development degree of the economy (GDP per capita) were cointegrated. For all four Southern European nations this was found to be the case, though the short-run dynamics (given the VECM estimates) differed for each nation. The second, more explicit, test of the Balassa-Samuelson effect sought a cointegrating relationship between the relative productivity differentials (between traded and nontraded sectors) and the real exchange rate. Interestingly, though the four nations under investigation share Europe's southern periphery, the second set of tests indicated that only one out of the four countries (Spain) experienced economic growth in a Balassa-Samuelson framework. This result highlights the need to decompose GDP to its relative sectoral productivities when testing for the Balassa-Samuelson effect, otherwise estimates attained can be very misleading (since economic development accompanied by real exchange rate appreciation does not always indicate the Balassa-Samuelson effect). As shown in this paper however, such direct tests of the connection between real exchange rates and relative productivities are difficult to perform given the relatively short time window for which most macroeconomic data is available. Finally, for the remaining countries, Greece, Italy and Portugal, the Balassa-Samuelson hypothesis does not explain their long-run development experiences because certain assumptions underpinning the theory fail to hold.

Furthermore, given the results of this paper, it is worth noting alternative explanations of real exchange rate and the GDP relationships that have been proposed such as the demand side explanation and the protectionist explanation. Testing some of these hypotheses may shine some light on the economies of the three countries where the Balassa-Samuelson effect results were not as convincing (Greece, Italy and Portugal). Demand side explanations obviously contend that PPP deviations can come from the demand side of the economy, rather than from the supply side as the Balassa-Samuelson model predicts. Basically, nontradable goods' prices are determined by a consumer's relative preference for them over money. Because high income consumers have more money, they are indifferent about higher prices relative to consumers in a low income area. Tradables' supply can shift from poor regions to rich ones, forcing price convergence, but nontradables' supply cannot do so. Therefore, in such models, price differences are caused by relative differences in money abundance and the initial sources of income difference are taken as given. Furthermore, in such models a random walk real exchange rate behavior occurs, as wealth trickles down to workers without requiring improved productivity because the rich bid up domestic prices. The protectionism explanation on the other hand is based on the idea that there is strong correlation between the barriers to free trade and the domestic price levels. If richer countries are more able to protect their producers than developing countries (especially with agricultural products), then a correlation between rising GDP and rising prices for goods in protected industries can occur. Thus, it would be interesting to investigate these theories, especially the protectionist argument (given EU members' high agricultural subsidies and strong employment protection legislation despite ongoing trade liberalization programs) for these four Southern European nations.

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Appendix A: *US Politics and Economics*

The United States has a powerful, diverse and technologically advanced economy that is by far the world's largest, with a GDP per capita of $40,100. U.S. firms are at, or near the forefront, in technological advances, especially in computers and medical, aerospace and military equipment and its financial services and media and entertainment sectors have true global presence. The largest industry of the U.S. is now the service sector, which employs roughly three quarters of the U.S. work force. The United States has many natural resources, including oil and gas, metals, and minerals such as gold, soda ash and zinc. In the agriculture, the U.S. is a top producer of corn, soy beans, wheat as well as other crops; the United States is a net exporter of food. The most important sector, responsible for the modernization of the U.S., is the manufacturing sector, producing cars, airplanes, steel and electronics, among other things. Nevertheless, a solid understanding of the economy's progression requires some historical insight.

From the end of Second World War till the late 1960s, American capitalism thrived. But, by the late 1960s it was clear this economic growth was coming to an end and by the early 1970s this slowdown was very apparent. The nation was overcome by stagflation, and under President Richard Nixon the US government tested out wage and price controls. By 1971 the lack of financial resources led Nixon to remove the US from the gold standard entirely, bringing the era of Bretton Woods to a close. In 1974, productivity decreased by 1.5%, though it soon recovered. Jimmy Carter won the Presidency in 1976 and he was later blamed for the even more troubling times that the US economy was destined for. Inflation soared, and the United States was faced with an enormous trade deficit, productivity growth slumped and interest rates remained high, peaking at 20% in January of 1981. The period's only praiseworthy memory seems to be the steadily dropping unemployment rate from 1975 – 1979, and even this began to deteriorate as it also began to rise.

During the 1980s and early 1990s, the republicans had a firm grip on US politics. Ronald Reagan was elected president in 1980 leading to the country's "Reagan Revolution." He quickly cut spending, taxes and government regulations, causing annual inflation to drop markedly from 13.5% in 1980 to 3% in 1983. Real GDP growth began to grow though unemployment continued to rise, peaking in late 1982 at 10.8%, but then dropping dramatically at the end of Reagan's presidency, in January of 1989, to 5.4%. Many criticized the Reagan Administration for a massive divide in the socioeconomic classes. Also, many point out that during Reagan's term, the federal debt *tripled*, reaching record high levels; going from $930 billion in December of 1981 to $2.6 trillion by September of 1988. As if these fiscal deficits were not enough, the nation also faced an ever growing trade deficit. As most economics text books explain, during Reagan's term the US went from being the world's largest creditor nation to becoming the world's largest debtor nation, and so during his second term in office, the Internal Revenue Code was passed. In 1988, Reagan's Vice President, George H. W. Bush, swept the election and his early policies were basically the Reaganomics of his predecessor. It was not until the early 1990s that Bush began back peddling on these policies and increased taxes. Also, under the Bush administration, the North American Free Trade Agreement (NAFTA) came into effect.

The democrats finally regained the political spotlight in the 1992 election, when Democrat Bill Clinton became president. However, the national debt did not improve. In fact, it doubled during the 1990s and the Clinton administration went on to pass welfare reforms in order to reduce the number of people dependent on government. This was reinforced by low spending promoted by the Republicans controlled Congress (who took over in 1994). The true effects of the economic policies undertaken are not clear though given the significant boost provided by the "dotcoms" and software industries that characterized the 1990s. Also, because the government statistical formulae were changed during the period, it is difficult to discern correct statistical predictions of the times. What we can gather, is that the national debt fell by 2% in 2000 thanks to the "borrowing" of about a trillion dollars from the Social Security Trust Fund. This caused a

sudden ado about the speed in which the US would pay its national debt given this sudden "surplus" and the expected surpluses over the next years; some were even concerned that about the *adverse* affects of paying off the debt too quickly and so thirty year treasury bonds were removed from the market. Both Democrats and Republicans were eager to spend the surplus (either on tax cuts or spending increases) despite the fact that public opinion polls showed the majority of Americans preferred using the surplus to pay down the national debt. Also, after several decades of U.S. taxpayer financing of research and development of the Internet, the Internet project was opened up for commercial traffic on its backbone in 1994 causing the years from 1994 to 2000 to witness solid increases in real output, low inflation rates, and a drop in unemployment to below 5%. The stock market soared, and some saw projected profits to earnings ratios of 200 to 300 which were first thought to be nonsense and it was not until the year 2000 that the economy witnessed the end of this booming psychology and performance, with a growth rate of only 1.4% in the last three months. One of the most striking examples of this decline is the sharp drop in computer entrepreneur, Bill Gates,' personal fortune.

The situation only worsened in 2001, under Republican George Walker Bush's first year as President. Output increased by only 0.3% and unemployment and business failures rose substantially. Luckily, the economy's response to the September 11th terrorist attacks was remarkably resilient, given that since the attacks the economy continued to grow, though at an uneven pace. According to the Bureau of Economic Analysis, economic growth sped up to 4% by the third quarter of 2004. Also, during his first out of two consecutive terms, Bush attained Congressional approval for three major tax cuts which have been asked to be made permanent. Nevertheless, according to the National Bureau of Economic Research, the economy suffered from a recession from March 2001 to November 2001. Also, under Bush's first 4 years in office, federal spending (in constant dollars) increased by 26% while non-defense spending increased by 18% during this time. These tax cuts, the recession, and the increases in outlays all contributed to the record budget deficit under his administration. Specifically, the annual deficit reached a

record (current-dollar) level of $374,000,000,000 in 2003 and $413,000,000,000 in 2004. National debt, the cumulative total of yearly deficits, rose from $5.7 trillion (58% of GDP) to $7.9 trillion (68% of GDP) under Bush, as compared to the $2.7 trillion total debt owed when Ronald Reagan left office (which was 52% of GDP).

On the other hand, inflation under Bush has remained near historic lows at about 2-3% per year. The recession and a drop in some prices, in fact concern about deflation arose from mid-2001 to late-2003; more recently though, high oil prices have caused concern about increasing inflation but so far the economy has withstood these threats. Private employment (seasonally adjusted) has decreased significantly under Bush according to the Bureau of Labor Statistics' Payroll Survey. It peaked in December 2000 at 111,680,000 and then dropped in mid-2003 to 108,250,000. This percentage drop in jobs was the largest since 1981-1983. After this point, from July 2003 to August 2005, the economy added private jobs, but the private employment level remained below the pre-Bush level till June 2005 when it reached 111,828,000, and when one considers the population growth, that still represents a 4.6% decrease in employment since Bush took office. Furthermore, under Bush, the seasonally adjusted unemployment rate based started at 4.7% in January 2001, peaked at 6.2% in June 2003, and retreated to 4.9% in August 2005. One should also note that the rise in GDP since the recession was muted by the substantial gains in labor productivity, in part due to layoffs of underutilized workers.

The long-run concerns of the US economy include inadequate investment in economic infrastructure, rapidly rising medical and pension costs of an aging population, sizable trade and budget deficits, and stagnation of family income in the lower socioeconomic groups.

Appendix B: ***Tradable and Nontradable Sector Classifications***

For the second set of cointegration tests, the literature indicated that the following classification for the tradable and nontradable sectors was appropriate: The *Tradable Sector* is composed of: Agriculture, Forestry, Fishing, Mining and Quarrying, Food, drink and tobacco, Textiles, Miscellaneous manufacturing, Transport (water and air), and Communications. The *Nontradable Sector* on the other hand is composed of: Electricity, gas and water supply, Construction, Wholesale and commission trade (except motor vehicles and motorcycles), Retail trade (except motor vehicles and motorcycles and repair of personal and household goods), Hotels and catering, Financial intermediation, Insurance, Real estate activities, Other business activities, Other community, social and personal services.

Abstract

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THE BALASSA-SAMUELSON EFFECT & EUROPE'S SOUTHERN PERIPHERY

Dissertation directed by Dominick Salvatore, PhD

In the context of Drine and Rault (2003), this paper tests for the Balassa-Samuelson effect in four of Europe's Southern peripheral countries, namely Greece, Italy, Spain and Portugal. The Korean experience is used as a canonical case since there appears to be a consensus in the literature that the country did in fact experience the Balassa-Samuelson effect. Using time series cointegration techniques two sets of tests are conducted for each country. The first investigates the Balassa-Samuelson effect in a very broad sense examining whether the real exchange rate and the development degree of the economies (GDP per capita) are cointegrated. While the second, more explicit, test of the Balassa-Samuelson effect searches for a cointegrating relationship between relative productivity differentials (between traded and nontraded sectors) and the real exchange rate. The results highlight the need to decompose GDP to its relative sectoral productivities when testing for the Balassa-Samuelson effect, otherwise estimates attained can be very misleading. Also, they show that only Spain experienced economic growth in a Balassa-Samuelson framework while for the remaining Southern Peripheral European countries, Greece, Italy and Portugal, the Balassa-Samuelson hypothesis does not explain their long-run development experiences because certain assumptions underpinning the theory fail to hold.

Vita

Elpida Tzilianos, daughter of Gerasimos Tzilianos, a Greek poet and playwright and Dr. Eftihia Cayanis, a research scientist at Columbia University, was born on January 15, 1982, in Queens, New York. After graduating in 1999 from Dominican Academy, she entered Fordham University where she received her Bachelor of Arts degree in 2003 in Economics and Political Science. She decided to continue her career at the Fordham University Graduate School of Arts and Sciences where she pursued a combined Master of Arts and Doctor of Philosophy degree in Economics.