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BALANCE OF PAYMENTS CONSTRAINED GROWTH:

THE IMPORTANCE OF THIRLWALL'S LAW FOR THE U.S. ECONOMY

DURING THE POST WORLD WAR II ERA

A Dissertation

Presented for the

Doctor of Philosophy

Degree

The University of Tennessee, Knoxville

Hubert Hieke

August, 1995

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DEDICATION

To

(my dear friend)

Be Done

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I would like to express my thanks and profound appreciation to Professor Cole who brought me to the University of Tennessee, who constantly encouraged and helped me during all these years, and who finally saw me succeed. I would also like to thank my Doktorvater Professor Davidson for his unfailing constructive and sympathetic aid and guidance, and for his patience. Without these two gentlemen, I would not have finished this crucial experiment called "dissertation".

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ABSTRACT

Thirlwall's Law and the export led growth hypothesis offer important alternative views to the traditional long term supply side growth concepts. Nevertheless, these concepts have not yet been comprehensively tested with respect to the U.S. economy. The purpose of this thesis is to provide these analyses in order to determine the magnitute to which Thirlwall's Law and the concept of export led growth may be applicable to the U.S. economy.

Chapter three analyzes Thirlwall's Law, based on the U.S. import demand function; chapter four focuses on the Law, based on the U.S. export demand function. Chapter five focuses on the empirical validity of the export led growth hypothesis.

Throughout the empirical parts of the study, presented in chapters three to five, Thirlwall's Law and the export led growth hypothesis, both generally considered by its advocates as long term propositions, are analyzed with cointegration. Contrary to previous studies, the analyses also systematically accounts for potential impacts of the terms of trade and/or capital flows.

The findings of this study indicate that Thirlwall's Law and the export led growth concept may not provide a comprehensive explanation for the long term rate of growth of income of the United States during the post WW II era.

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1. INTRODUCTION

1.1. INTRODUCTION

The purpose of this study is to empirically analyze to what extent Thirlwall's Law is applicable to the U.S. economy during the post WW II era. According to Thirlwall's Law (Thirlwall, 1979), a nation's long term rate of growth of domestic income is crucially dependent upon the country's external sector. This argument is based on the presumption that most economies have not been confronted with domestic capacity constraints during the post WW II era. Rather, their long term rates of growth were, supposedly, restricted by their inablity to finance persistent balance of payments deficits on current account which potentially arise from efforts to pursue domestic expansionary policies.

Thirlwall (1979) has taken a demand oriented perspective in developing his arguments. Nevertheless, the hypotheses derived from Thirlwall's Law clearly deny that domestic components of demand play a significant role to the long term growth prospects of most economies.

Most empirical work on Thirlwall's Law has been based on cross section studies1. Atesoglu2, however, has recently argued in favor of evaluating Thirlwall's Law on a country by country basis. Such an approach is taken in this thesis with respect to the United States, particularly, because the U.S. as a, de facto, lender of

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1 For an extensive review of these studies, see McCombie and Thirlwall (1994).
2 Atesoglu (1993a, 1993b, 1993/4, 1994).

last resort during most of the post WW II era might not have faced balance of payments restrictions as suggested by proponents of Thirlwall's Law.

Subsequent to this chapter, a review of the literature is provided. The hypotheses of Thirlwall's Law are tested in chapters three, four and five of this thesis. Each chapter focuses on the Law from a different perspective. The empirical tests of chapters three are based on elasticity estimates derived from the import demand function; the findings of chapter four rely upon the elasticity values of the export demand equation. The analyses of chapter five focus on the hypothesized direct relationship between exports and domestic income. A summary of the results of this study, its limitations, suggestions for future research, and some conclusions are drawn in chapter six.

1.2. STATEMENT OF THE ISSUE

Throughout the post WW II period, neoclassical supply side growth concepts have dominated the research agenda of explaining a country's long term rate of growth of income3. These full employment models have considered long term economic growth as endogenous to the rates of growth of factor supplies.

Some economists have challenged this view, and have provided alternative demand oriented models. Among these concepts, a demand driven model originally suggested by Thirlwall in 1979 has received

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3 For a discussion of these models, McCombie and Thirlwall (1994, chapter 1).

considerable attention and support. Not surprising, this approach has also been criticized in several studies.

Advocates of Thirlwall's Law focus on the external sector and take a longer run orientation to explain a country's rate of growth of income. In particular, as McCombie and Thirlwall (1994, p. xv.) point out, "...no country can grow faster in the long run than that rate consistent with the balance-of-payments equilibrium on current account unless it can finance ever growing deficits." The claim that the U.S. might be in a position to finance external deficits due to its peculiar international financial position during the post WW II era4 has been denied by proponents of the Law, and they have argued that the U.S., in the long run must also obey to this external constraint. Referring to the late 1980s, e.g., McCombie (1993, p. 500) points out that the U.S. had to reverse its expansionary domestic policy course, because these policies led to balance of payments deficits which eventually became unsustainable.

In addition to the balance of payments constraint and the assumption that long term trade deficits cannot be sustained, Thirlwall's Law also assumes the terms of trade to be relatively stable in the longer run. These three assumptions represent the basis for Thirlwall's Law in its simplest form, which hypothesizes that a nation's long term rate of growth of income can be approximated by dividing the rate of growth of exports by the

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4 See, e.g., Davidson (1992, p. 218).

income elasticity of demand for imports5. The latter rate is usually referred to as the equilibrium rate of growth.

Empirical tests of Thirlwall's Law based on this specific hypothesis have been the most popular approach taken in the literature. Previous studies have estimated some form of an import demand function and utilized the income demand elasticity parameter for deriving the equilibrium rate of growth of income. Subsequently, the actual rates of growth of income are compared with the equilibrium growth rates to determine the validity of Thirlwall's Law. Chapter three follows this lead. Contrary to previous studies, however, the estimations of the import demand functions focus on establishing long term stable parameter estimates in reflection of Thirlwall's approach.

Estimations of the import demand function usually include a measure of relative prices. McGregor and Swales (1991) have criticized this empirical procedure in the context of Thirlwall's Law, because of Thirlwall's assumption that the terms of trade are relatively stable in the long run. Consequently, McGregor and Swales have suggested not to include the terms of trade in the import demand function when estimating the income demand elasticity. The empirical validity of this claim is addressed in chapter three.

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5 A formal analysis of this approach is presented in chapter two, infra.

Not only may relative prices be a significant variable when estimating the long term import demand function, but they could also have a direct impact on Thirlwall's equilibrium rate of growth. This issue is also analyzed in chapter three.

Similarly, the impact of capital flows may impact on Thirlwall's equilibrium rate of growth. Before assessing this claim, however, the validity of the long term assumption of the balance of payments constraint needs to be analyzed. In case that the balance of payments constraint provides an inappropriate or insufficient description of the actual performance of the U.S. external sector, capital flows must be considered as a potential source affecting Thirlwall's long term equilibrium rate of growth of income. This issue has not yet been addressed, however, in the literature.

A second procedure, for testing the validity of Thirlwall's Law with respect to the U.S. economy can be based on elasticity estimates derived from the export demand function. Williamson (1984) considers this approach as being preferable, because it provides more accurate findings compared to the approach based on the elasticity estimates of the import demand function. As discussed in chapter two, supra, the rational for Williamson's claim is drawn from the observation that estimates for Thirlwall's Law in its most simplified form require the use of ex-post values

of the rate of growth of exports which already incorporate possible terms of trade effects. Thirlwall has acknowledged this issue6.

Chapter four focuses on estimating the long term income and price elasticity parameters based on the export demand function in order to analyze the validity of Williamson's claim.

The results also allow comparisons between the equilibrium growth rate based on the income demand elasticity of exports and the income demand elasticty derived from the import function. Furthermore, the price elasticity estimates derived in chapter four, in conjunction with the price elasticity estimates derived from the import demand function allows us to analyze the validity of the Marshall-Lerner condition.

In addition, the effects of terms of trade changes and capital flows on the equilibrium growth rates, based on the export demand function are discussed in chapter four. Both issues have not yet received much attention in the empirical literature.

Whereas the analyses of chapter three and four take an indirect empirical approach, deriving Thirlwall's equilibrium growth rates from elasticity estimates of the export and import demand functions, the findings provided in chapter five are based on direct estimates of the potential long term relationship between

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6 Thirlwall and Hussain (1982) address this issue and state that estimating Thirlwall's Law by utilizing the rate of growth of exports is equivalent to "...incorporating into the analysis from the start any volume changes in exports from relative price movements."(p. 503).

exports and income, suggested by proponents of the export led growth model.

The export led growth concept hypothesizes the rate of growth of real income as being determined by the rate of growth of exports. This assumption, however, has been challenged in the literature (Afxentiou and Serletis, 1991). Chapter five provides a causality test to determine, if in fact exports "Granger cause" income, as suggested by the export led growth advocates.

Furthermore, it is analyzed in chapter five, whether the terms of trade and/or capital flows impact on the long term relationship between the long term rates of growth of income and exports.

Previous work in this area has often distinguished between the Bretton Woods and post Bretton Woods era. In order to allow meaningful comparisons of the findings of this study with previous work, the post WW II era is subdivided into two time periods, the earlier period ranging from 1950 to 1971 the latter from 1972 to 1992. In addition, the empirical tests covering the whole post WW II era are also performed.

Thirlwall's Law and the export led growth concept clearly represent longer term hypotheses. Consequently, all empirical analyses of chapters three to five take this perception into account. For this purpose, the concept of cointegration[7] is utilized for the empirical sections of this thesis. The technique of cointegration has been considered by Bairam (1993a) as a

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7 See section 2.8., infra.

potentially important tool for empirical evaluations of Thirlwall's Law, but this econometric method has so far only been applied in one cross section study not related to the U.S. economy (Bairam, 1993a).

1.3. IMPORTANCE OF THE ISSUE

Previous studies of Thirlwall's Law have tested its empirical validity of the Law. Most of these empirical studies, however, focused on cross section analyses. The only empirical analysis explicitly dealing with the appropriateness of Thirlwall's Law for explaining the U.S. long term rate of growth of income has been provided by Atesoglu (1993a, 1994). His studies, however, are based on first differenced data, his estimates are based solely on the import demand function, and he also does not address the impact of capital flows on the long term rate of growth of income.

In addition, concerning the closely related export led growth strategies proposed by McCombie (1985), no previous empirical study has provided a comprehensive account with respect to the post WW II U.S. economy.

More important with respect to the U.S. economy, no previous empirical study has tested Thirlwall's hypotheses by applying the econometric method of cointegration in order to determine the existence and appropriate functional specifications of the long term relationships proposed by the Law. Neither have some of the theoretical extensions of Thirlwall's Law been subjected to empirical tests in the form provided in this thesis.

Therefore, this thesis provides both a reexamination as well as empirical extensions compared to previously taken approaches for examining the validity of Thirlwall's Law with respect to the U.S. economy.

Depending on the outcome of the empirical analysis, it has to be determined if Thirlwall's Law and the closely related export led growth concept provide a sufficient and comprehensive approach to explain the long term rate of growth of domestic income of the United States during the post WW II era.

1.4. CONCLUSION

Thirlwall's Law offers an important alternative view in challenging the traditional long term supply side growth concepts. Nevertheless, this concept has not yet been comprehensively tested with respect to the U.S. economy. The purpose of this thesis is to provide this analysis in order to determine the magnitute to which Thirlwall's Law may be applicable to the U.S. economy.

Chapter two reviews the literature on Thirlwall's Law and the export led growth concept. Chapters three and four provide a comprehensive empirical analysis of Thirlwall's Law, including extensions with respect to the impact of the terms of trade and capital flows. Chapter five focuses on the empirical validity of the export led growth hypothesis. Some conclusions are drawn in chapter six.

2. LITERATURE REVIEW

2.1. INTRODUCTION

In a seminal paper, Thirlwall (1979) dismisses the neoclassical, full employment, supply side growth models and suggests an alternative demand oriented, long term approach for explaining a country's level of income. Based on Keynes' insight that it is primarily demand which determines the level of economic activity, Thirlwall raises the question why demand would grow differently among countries. However, quite contrary to Keynes, he denies the importance of a lack of effective domestic demand as a factor for this occurence and argues that for most open economies[8], including the U.S., demand is constrained by the balance of payments (p. 45)[9].

In essense, according to Thirlwall, a country is not able to reach its potential capacity or full employment level by stimulating domestic components of demand, if this results in a balance of payments deficit which cannot be sustained (p. 46). The latter generally arises because given the income elasticity of demand for imports, a higher level of domestic economic activity leads to a deteriorating trade balance, which, according to Thirlwall, cannot be eliminated by some exchange rate adjustment

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8 Thirlwall excludes supply constrained nations from his analysis.
9 Recently, Thirlwall has strongly criticized Keynes' closed economy framework, because it supposedly diverted the attention from the important long run foreign trade multiplier suggested by Harrod (McCombie and Thirlwall, 1994, xvi-xvii)

mechanism10. Domestic expansion, therefore, does not provide the key to accelerate a country's long term rate of growth as long as the nation is not supply constrained. The latter case, however, according to advocates of Thirlwall's Law, has been the exception among industrialized countries during the post WW II era. Consequently, export led growth becomes the crucial policy instrument that allows a nation to enhance its rate of growth of income, because it is the only effective mechanism that can potentially alter the existing relationship between higher levels of income and a deteriorating balance of payments (p. 46).

The next section outlines Thirlwall's basic approach. Section 2.3. reviews both the empirical evidence and the discussion between advocates and opponents with respect to the basic theoretical concept and the empirical findings derived from the import and export demand functions. Section 2.4. describes the extended version of Thirlwall's Law by taking potential terms of trade and capital flows effects explicitly into account. It also summarizes the empirical findings of this extended version of Thirlwall's Law. Furthermore, the connection between Thirlwall's Law and export-led growth is described in section 2.6. The empirical evidence for this concept is outlined in section 2.7. Finally, the econometric concept of cointegration utilized throughout the empirical part of

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10 This is another issue where Thirlwall's argument is clearly incompatible with the neoclassical exchange rate analysis.

this thesis is described in section 2.8., and some conclusions are provided in section 2.9.

2.2. THIRLWALL'S LAW

Thirlwall (1979) derives a simple model for determining the long term increase of the level of income. He starts out from the balance of payments equilibrium condition:

(2.2.1) $P_d X = P_f M$

where P_d and P_f are export and import prices11, both expressed in domestic currency, and M and X are the quantities of imports and exports, respectively. In other words, P_d/P_f are the real terms of trade12. Equation (2.2.1.) can also be expressed in rates of growth as:

(2.2.2.) $p_d + x = p_f + m$

where the lower case letters indicate rates of changes of the variables expressed in natural logarithms.

Furthermore, Thirlwall utilizes two standard import and export demand functions:

(2.2.3.) $M = (P_f/P_d)^g Y^h$

(2.2.4.) $X = (P_d/P_f)^v Y^{*w}$

where Y and Y^* are domestic and foreign (world) income, g and v are the price elasticities for imports and exports, and h and w are the income elasticities of imports and exports, respectively. g and v are assumed to be negative, h and w are positive.

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11 see also McCombie and Thirlwall (1994, p.234).
12 see Thirlwall and Hussain (1982, p. 500, fn. 1) and Thirlwall and Gibson (1992, p. 327).

Using natural logarithms and differenciating[13] equations (2.2.3.) and (2.2.4.), the rates of growth of imports and exports may be expressed by as:

(2.2.5.) $m = g(p_f - p_d) + hy$

(2.2.6.) $x = v(p_d - p_f) + wy^*$

where lower case letters indicate the rate of change of the variables.

Subsequently, Thirlwall substitutes equations (2.2.5.) and (2.2.6.) into equation (2.2.2.), which gives the equilibrium rate of growth (y_b) as:

(2.2.7.) $y_b = [(1+v+g)(p_d - p_f) + wy^*] / h$

As Thirlwall points out, estimating equation (2.2.7.) requires a large amount of data. However, he also (1979, p.49) argues that if the assumption can be made that "...the Marshall-Lerner condition is just satisfied or if relative prices measured in a common currency do not change over the long run..."[14], equation (2.2.7.) can be reduced to:

(2.2.8) $y_b = wy^* / h$

or, according to equation (2.2.6) and assuming relative stability of the terms of trade:

(2.2.9) $y_b = x / h$

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13 Taking logarithms assures that the variables represent elasticities. Differenciating with respect to time gives the rates of growth. See Bairam (1988, p. 1635/6).

14 Interestingly, in later versions of this paper, the statement referring to the Marshall-Lerner condition has been deleted, so that the focus has been on the assumption of relatively stable real exchange rates. See, McCombie and Thirlwall (1994, p.236).

Thirlwall (1979) tests the proposition stated in equation (2.2.9.) for a number of industrialized countries for the Bretton Woods era and finds that "... the rate of growth of exports divided by the income elasticity of demand for imports gives such a good approximation to the actual growth experience of major developed countries since 1950 that a new economic law might possibly be formulated."(p.46) In fact, his proposition has become known as "Thirlwall's Law".

2.3. EMPIRICAL EVIDENCE OF THIRLWALL'S LAW

Earlier studies analyzing the validity of Thirlwall's Law, which is also often referred to as the "Harrod foreign trade multiplier"15, are based on cross country comparisons, i.e. utilizing cross sectional data. As far as industrialized countries are concerned, the studies by Thirlwall (1979) and Bairam (1988) are considered the most important empirical contributions by advocates of Thirlwall's Law16. In both studies the elasticities of demand needed for deriving the predicted rate of growth (y_b) described by equations (2.2.8.) and (2.2.9), respectively, are taken from estimates of some version of an export and import demand function.

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15 "Thirlwall's Law" can also be derived from an alternative approach based on Harrod (1933). The assumptions are essentially the same. Consequently, many authors refer to Thirlwall's Law as the "Harrod foreign trade multiplier". See, e.g., Bairam, (1993a) and McCombie (1989).

16 See McCombie and Thirlwall (1994, p.232)

Thirlwall's (1979) study emphasized the Bretton Woods era and utilized import demand elasticity estimates originally derived by Houthakker and Magee (1969) for calculating the equilibrium rate of growth y_b, according to equation (2.2.9.). Thirlwall distinguishes two time periods17, the first covering the years 1953-1976, the latter the years 1951-1973. Irrespective of these time period, Thirlwall's results, all based on annual data for 18 industrialized countries, generally somewhat overstate the actual rates of growth of real income18. The author, however, defends these findings argueing that his estimates of the equilibrium rates of growth (y_b) are based on the elasticity estimates of Houthakker and Magee which are derived for 1951-1966, whereas Thirlwall's analysis and equilibrium rates of growth range up to the early 1970s.

With respect to the U.S.economy19, Thirlwall also derives two estimates of the equilibrium rate of growth of income utilizing the actual annual average percentage rates of growth of income (y) for 1951-1973 and 1953-1976 of 3.7 and 3.23, respectively, and the actual percentage rates of growth of exports (x) for the same time periods of 5.1 and 5.88, respectively. Based on these values, the balance of payments equilibrium rates of growth (y_b) according to

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17 In both cases, Thirlwall utilizes the elasticity estimates of Houthakker and Magee, which are derived from estimates of the import demand function.
18 See Thirlwall (1979, p. 51), Tables 1 and 2. It is outlined in the next paragraph that this observation is not valid with respect to the U.S.
19 See Table 1 and 2 of Thirlwall (1979, p.51).

equation (2.2.9) utilizing the income demand elasticity estimate20 of 1.51, yield values of 3.38 percent and 3.89 percent, respectively. Obviously, for the 1951-1973 time period, the value of the equilibrium rate of growth underestimates the actual U.S. income growth performance. For the later time period, however, the U.S. economy appears to have grown at a slower rate than the one suggested by Thirlwall's Law.

The empirical study by Baraim (1988) focuses on the flexible exchange rate era. The author measures both the export and import demand functions for 19 industrialized countries21, as expressed in equations (2.2.5) and (2.2.6) with annual, first differenced data over the period of 1970-1985, utilizing a two stage least squares approach.

Bairam's income demand elasticity results, derived from the export demand function generally appear to be at some variance with the predictions of the Harrod foreign trade multiplier (p. 1639), which the author justifies with some possible measurement errors from the data sources utilized (p. 1637). In discussing this finding, Bairam, nevertheless, stresses that for most country's included in his study, the estimated terms of trade parameters are

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20 Taken from Houthakker and Magee (1969).

21 For the post Bretton Woods era, Bairam (1990) and Bairam and Dempster (1991) have also tested Thirlwall's Law with respect to developing countries. As in Baraim (1988), the results derived from the import function, are generally consistent with the Law. However, the export functions do not provide clear evidence. All the analyses, based on annual data are performed with data expressed in first differences.

often insignificant. This observation leads Bairam (1988) to suggest "...that excluding (p_d-p_f) from the export equation... will not cause significant bias" (p.1637), although he does not provide explicit empirical evidence for this claim.

Bairam's equilibrium rates based on his elasticity estimates derived from the import demand function appear to be supportive of Thirlwall's Law, and his conclusions with respect to the relative price parameters are similar to the one discussed above22.

Bairam, focusing on cross country comparisons, does not explicitly discuss his finding with respect to the U.S. economy. Nevertheless, as far as the U.S. is concerned, his results are quite consistent with the hypotheses of Thirlwall's Law. For the 1970-1985 period, Bairam estimates an income elasticity of demand for imports of 2.32, based on equation (2.2.5.). Taking the actual annual average rates of growth of export volume (x) of 5.7 percent into account, his estimate of the U.S. equilibrium rate of growth of income (y_b) derived from equation (2.2.9.) equals 2.5 percent. Given the actual U.S. rate of growth of real income (y) of 2.5 percent during this time period, y_b, in fact, represents a very good approximation of y, supporting Thirlwall's hypothesis.

The U.S. income elasticity of demand estimated by Bairam from the export equation (2.2.6.) is 1.83. World income growth is

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22 Bairam points out that the terms of trade variable can be excluded from the analysis without affecting the findings, but as in the case of the export demand equation, he does not present explicit empirical evidence for this claim.

assumed to be 2.8 percent annually, so that the U.S. equilibrium rate of growth derived from equation (2.2.8.) is equal to 2.1 percent. This finding, therefore, underestimates the actual U.S. growth performance.

Bairam includes relative prices variables in both the U.S. import and export demand equations, but according to his findings, the price elasticities are insignificant23.

Whereas Thirlwall's study (1979) exclusively dealt with estimates derived from equation (2.2.9.), a third study by McCombie (1989), somewhat complementary to Thirlwall's, also income demand elasticity estimates from Houthakker and Magee (1969) to calculate a series of cross sectional estimates of Thirlwall's Law based on equation (2.2.8.) for the 1951-1973 time period. Hereby, McCombie does not provide a formal empirical test, but he argues that a visual comparison of the values of y_b with the actual growth rates generally supports Thirlwall's hypothesis.

McCombie (1989) estimates the U.S. equilibrium growth rate during the 1951-1973 time period, based on equation (2.2.8.)24, to be 2.9 percent.

In his study, McCombie analyzes potential statistical differences between the equilibrium growth rate and the actual rate of growth for major industrialized countries over the Bretton Woods era and finds that irrespective of whether the equilibrium rates of

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23 See Bairam (1988, pp. 1640/1, Appendix A and B).
24 McCombie assumes an annual rate world income growth (y^*) of 4.4 percent.

growth are derived from equation (2.2.8) or equation (2.2.9.), the results provide good approximations of the actual rates of growth for most of the industrialized countries.

The estimates of the import and export demand elasticities of Houthakker and Magee (1969) are based on annual data of merchandize trade. In natural logarithms, the export and import demand of equations (2.2.3.) and (2.2.4.) can be stated in level form as:

(2.3.1.) $\ln M = g \ln(P_f/P_d) + h \ln Y$

(2.3.2.) $\ln X = v \ln(P_d/P_f) + w \ln Y^*$

Equations (2.3.1.) and (2.3.2.) are similar to the one utilized by Houthakker and Magee. In estimating the respective import and export demand elasticities, however, Houthakker and Magee (p. 112) utilize different price terms in their respective equations. For McCombie (1989) to rely on price terms which do not have identical definitions, however, seems to be somewhat in variance with the propositions of his Law. In fact, as outlined in section 2.2., Thirlwall's Law requires identical definitions of the price terms in both the export and import demand functions.

Taking this issue into account, McCombie's approach, because it is derived from estimates of both the export and import demand equation, nevertheless, provides some new insights. He calculates ratios of the income elasticity of demand for exports to that of imports (w/h). As Davidson (1990/1, pp. 300-301) points out, assuming the validity of Thirlwall's Law, this ratio provides an indicator for the rate of growth of income a country can achieve

relative to the rate of growth of the rest of the world, without violating its balance of payments constraint. E.g., if w/h is smaller than one, the country is forced to grow at a rate smaller than the rate of growth of world income.

McCombie's estimate of w/h with respect to the U.S. for the 1951-1973 period is .66, indicating that the U.S. rate of income growth relative to the rest of the world was too high and had to lead to a secular decline in the balance of payments.

In essense, the cross sectional studies by Thirlwall (1979), Bairam (1988) and McCombie (1989) appear to provide support for Thirlwall's Law, although the evidence with respect to the U.S. is somewhat more ambiguous, particularly because these studies focus on cross country comparisons and do not provide formal tests concerning the U.S economy.

Until very recently, empirical studies of Thirlwall's Law have been exclusively based on cross country comparisons. Contrary to this approach, Atesoglu (1993a) alters this procedure and tests the validity of Thirlwall's Law from the perspective of a particular national economy. Atesoglu (1993a) tests Thirlwall's Law for the U.S. economy, with a two stage least square procedure utilizing first differenced data25. He estimates an import demand function, utilizing annual data for 1955-1990:

(2.3.3.) $m = a_0 + a_1 q + a_2 (p_d - p_f)_{-1}$

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25 Atesoglu's (1993a) study is based on the standard assumptions of Thirlwall's basic Law as outlined above.

where q, m, (p_d-p_f) all expressed in logarithms, are real GNP, real imports, and the ratio of domestic prices to import prices lagged by one period, respectively. a_0, a_1, and a_2 are a constant, and the income and price elasticity for imports.

According to Atesoglu's regression results, the value of a_1, the income elasticity is 1.941, and the estimate of a_2, the price elasticity is .364. Both terms are statistically significant (p.511).

Atesoglu notes that, for a singular country, equilibrium growth rates based on a single estimate with respect to a particular nation may yield results close to the actual rates because of sampling curiosity (p.508).

To avoid this shortcoming, Atesoglu calculates a series of predicted balance of payments constraint growth rates using equation (2.2.9), the first data points comprising the predicted average rate of growth between 1955 and 1970. He then calculates subsequent overlapping data points each one ranging over a sixteen year period, the last of these predicted growth rates covering the to 1975-1990 time period (p. 508). The estimated import demand elasticity is assumed unchanged during the period and the predicted rates of growth vary over time due solely to export growth rate changes. Atesoglu then matches these rates against the actual U.S. income growth rates. Because his analysis is based on annual data,

Atesoglu's procedure yields 21 data points26 for each of the two series.

Based on these series, Atesoglu (p. 511) runs a simple regression between the actual growth rates and his predicted growth rates and finds a significantly positive relationship between both rates

(2.3.4.) $q = 1.383 + .508q^*$ $\qquad R^2 = .209$

where q and q^* are the actual and predicted rates of growth. Both the intercept and the slope coefficient are significant. Although the slope coefficient is signifcantly positive, Atesoglu's finding, nevertheless, demonstrates that the hypothesized one-to-one relation between q and q^*, i.e., an intercept not significantly different from zero and a slope coefficient close to unity, is only partly supported by his empirical results.

Similar to Bairam (1988)27, but for a quite different reason, Atesoglu (1993a) also argues that his results support the view that ommitting the price term in the import demand equation does not

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26 Atesoglu (1993a), in discussing these data series, points out that during the earlier post WW II years, the estimated U.S. equilibrium rate of growth (q^*) has been below the actual U.S. average rate of growth (q), which is "...consistent with the balance-of-payments deficits (negative real net exports) observed during most of these years."(p. 511) Except for one sample period, however, Atesoglu's data (p.512, Table 1) shows that q has always been below q^* for the later thirteen observations, covering the sample observations from 1963-1978 to 1975-1990. Unfortunately, Atesoglu provides no conclusion for this later phenomema. Based on Atesoglu's reasoning concerning the earlier periods, the U.S., supposedly should have run a persistent balance of payments surplus, i.e., positive real net exports, throughout the post Bretton Woods era!

27 See the previous discussion of Bairam's study, supra.

bias the elasticity estimates (p.512). He derives this conclusion from the fact that although the price term in his estimated import demand equation is statistically significant28, the absolute value of the parameter is relatively small. Furthermore, he reestimates equation (2.3.3.) ommitting the price term, a_2, on the r.h.s. of the equation. The income elasticity now rises to 2.394, as compared to the earlier parameter value of 1.941. "These estimates are close in value...", according to Atesoglu (1993a, p. 513), so that ommitting the price term appears reasonable to Atesoglu29. In essense, Atesoglu claims that his 1993a study provides "...a successful explanation of the United States' long-term economic growth."30

The only study acknowledging the potential problems of estimating Thirlwall's Law based on differenced data is Bairam (1993a). Bairam indicates that previous studies did not test the order of integration of time series data under consideration. This implies an a priori assumption that empirical tests of Thirlwall's Law must be based on a dynamic specification instead of estimates derived from the level equations.

To determine the potential deficiencies of previous studies relying on differenced data, Bairam applies the technique of

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28 This finding is contrary to Bairam's (1988) results concerning the U.S. Whereas Bairam covers the 1970-1985 time period, Atesoglu's study, however, ranges from 1955 to 1990.
29 Nevertheless, Atesoglu does not alter his earlier regression estimate shown in equation (2.3.4.) supra, which is based on the initial income demand elasticity value of 1.941.
30 Quoted from Atesoglu (1994, p. 480).

cointegration31 to a data set for five European industrialized countries32. He estimates the import and export functions in levels33 as described by equations (2.3.1.) and (2.3.2.) for 1970-1989.

The levels of exports, imports, the terms of trade, and domestic and world income, all expressed in logarithms, are integrated of order one34. According to Bairam's findings, neither the export functions nor the import functions appear to be cointegrated35. Bairam concludes that the respective data series must first be differenced, i.e. be expressed as rates of growth, in order to estimate the respective import and export equations and the respective income and price elasticities. Applying first differenced data, the results of these tests now generally confirm the findings of Bairam's earlier study (1988). In particular, relative prices are now found to be not significant (Bairam, 1993a, p. 740). Although Bairam does not address this issue, in three out

31 This technique is described further below.
32 The countries comprise Belgium, France, Germany, UK, and The Netherlands. It is not evident from the study why countries like Italy or Spain are excluded.
33 Bairam appears to utilize annual data from the Economic Survey of Europe. This, however, would imply that each of his time series results are based on only 20 observations. Unfortunately, Bairam is not explicit on this issue.
34 Bairam does not indicate if he utilized quarterly data. If annual data has been used, the sample size would be extremely small for cointegration analysis. See, e.g., Engle and Yoo (1987).
35 The only case where cointegration can not be rejected is the export function of France (Bairam, 1993a, p. 741).

of five cases, the coefficient of relative prices of the level export equations are significant36.

Comparing the respective income elasticities from the level and the first differenced export and import demand equations, Bairam finds the results very similar, and he concludes that past empirical research on Thirlwall's Law has provided valid results and correctly specified procedures37.

2.4. CRITICISMS OF THIRLWALL'S APPROACH

Thirlwall's Law has triggered a debate between advocates and critics of the approach. The most challenging attack against some of the theoretical aspects of the Law has been provided in a series of articles by McGregor and Swales (1985, 1986, 1991).

Within the context of this thesis, McGregor and Swales (1991) strongly criticize the procedural empirical aspects adherents of Thirlwall's Law apply in order to derive the demand elasticities in their respective studies. They contend that Thirlwall's claim that the terms of trade are relatively stable in the long run and have no significant influence on the trade balance requires the

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36 Besides, he does not test the level equations without relative prices.

37 Bairam does not elaborate on the crucial issue that the dynamic specification may lead to a loss of information concerning the static long run solution. Furthermore, it is important to recall that Thirlwall's Law is a long term concept! Evidence of no cointegration must then be interpreted as a lack of evidence of the long term propositions hypothesized by the theoretical model! This, rather important and obvious conclusion is not recognized by Bairam. This issue, however, is a crucial part of this thesis and is addressed in more detail further below.

exclusion of the terms of trades from the regression equations when estimating the export and import demand functions.

In response to this criticism, McCombie and Thirlwall[38] point out that it is not relevant, if the relative price term is significant, but if it is quantitatively important. This somewhat contradictaory statement is further elaborated by McCombie and Thirlwall. As far as the terms of trade are concerned, McCombie and Thirlwall state that "...the crucial point, however, is not whether or not the coefficients of the relative price terms are significant but whether or not the impact of changes in relative prices on trade flows is *quantitatively* important in the long run." (McCombie and Thirlwall, 1994, p.366)

McCombie and Thirlwall stress that even when the price elasticities are highly significant, in both the export and import function, they may add up to unity, in which case the overall impact of changes in the terms of trade on the trade balance would be negligible (p.366). Clearly, this refers to the Marshall-Lerner condition, already stressed in Thirlwall's (1979) seminal study.

Nevertheless, McCombie and Thirlwall's rational for estimating the export and import demand equations by including the terms of trade is somewhat at variance with McCombie's own theoretical discussions in another study. In this study, McCombie (1989) stresses that the determination of the long term import

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38 See McCombie (1992), and Thirlwall and McCombie (1994, p. 366).

demand function should be based on the power import demand function:

(2.4.1.) $M=pY^h$

where p is a constant, and h the long run import elasticity of demand. According to McCombie, to derive the value of the long run demand elasticity for imports in consistent with Thirlwall's Law, the power function stated by equation (2.4.1.) is the appropriate function to be used[39].

Taking logarithms, equation (2.4.1.) can be expressed for estimation purposes in the following form:

(2.4.2.) $\ln M= a_1 + h \ln Y$

where a_1 is a constant.

Both equations (2.4.1.) and (2.4.2.), however, appear to reflect the functional form suggested by McGregor and Swales (1991)[40].

Williamson (1984) points to another potential shortcoming of Thirlwall's Law. According to equations (2.2.8.) and (2.2.9.), the

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39 See also McCombie and Thirlwall (1994, p.354f).

40 As discussed in chapter three to five, infra, the argument addressed by McGregor and Swales should not be ignored in the empirical analysis. Of course, even if the terms of trades are significant, McCombie is correct in stating that this does not necessarily imply quantitative effects on the balance of payments, if the Marshall-Lerner condition applies. Most empirical studies on Thirlwall's Law, however, do not explicitly address the Marshall-Lerner condition, partly because estimates for both the export and import demand functions are not always readily available. In addition, the criticism raised by McGregor and Swales is important in the context of this study, because it needs to be demonstrated, if stable long term import and export demand functions for the U.S. can be established without the inclusion of the price term as an exogenous variable.

equilibrium rate of growth can be derived from the export as well as the import function. Most previous studies have relied on estimates on equation (2.2.9.), partly, because of data restrictions, but also because the empirical findings seem to provide more reliable estimates[41]. Williamson argues, however, that the equilibrium rate of growth (y_b) should be calculated from wy^*/h rather than from x/h, because in the latter case, the rate of growth of exports (x), being an ex-post value may already incorporate any effects resulting from changes of the terms of trade[42].

McCombie (1989), however, has responded to this criticism, showing empirically that regardless of whether equation (2.2.8) or (2.2.9) are utilized, the statistical results appear to be quite similar[43].

2.5. THE IMPACT OF THE TERMS OF TRADE AND CAPITAL FLOWS

Thirlwall and Hussain (1982) derive an extended version of Thirlwall's Law. Their theoretical analysis as well as their empirical tests focus exclusively on developing countries[44]. Their model allows for a quantitative assessment of the terms of trade effects and capital flows for nations which are able to finance balance of payments deficits by continuous capital inflows. These

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41 E.g., Thirlwall (1979) is solely relying on estimates derived from the import demand function.
42 See also McCombie (1989), and McCombie and Thirlwall (1994).
43 McCombie does not provide a formal test for this claim, however. His study has been discussed in the previous section of this chapter.
44 The rational for their focus is outlined below.

capital inflows provide the nation with the potential to grow at a rate beyond the limit determined by Thirlwall's Law as expressed by equation (2.2.8) and (2.2.9.).

Thirlwall and Hussain develop a concept that can account for the effects of potential capital inflows. Since the growth effects due to capital inflows cannot, of course, be incorporated into the traditional export or import demand functions, and the demand and supply for capital flows are not necessarily related to the level or rate of growth of foreign or domestic income, the Thirlwall and Hussain approach seems quite reasonable.

In deriving the model, Thirlwall and Hussain expand the balance-of-payments contraint expressed in equation (2.2.1.) by adding net nominal capital inflows (CI) to the l.h.s. of the equation to get:

(2.6.1) $P_dX + CI = P_fM$

Taking rates of change, equation (2.6.1.), can be expressed as:

(2.6.2.) $(1-l)(p_d + x) + (l)ci = p_f + m$

where lower case letters represent growth rates of the variables, and l the share of the value of net nominal capital inflows expressed as a proportion of the total import bill (1994, p.246). Capital flows, defined in this way, always assert the export bill to be in balance with the import bill (p. 502).

Substituting (2.2.5.) and (2.2.6.) into (2.6.2.), Thirlwall and Hussain derive the following extended Harrod trade multiplier (y_{bbb})[45]:

(2.6.3.) $y_{bbb} = \{[(1-l)v+g](p_d-p_f)+(p_d-p_f)+(1-l)wy^*+l(ci-p_d)\} / h$

The four terms on the r.h.s. of this equation describe the following: (1) the impact of terms of trade changes on the quantities of imports and exports, (2) the pure terms of trade effect on real income growth (p. 503), (3) the exogenous export effect, and (4) the capital flows effect (p. 502).

In assuming the terms of trade to be invariant over time, equation (2.6.3.) can be simplified as:

(2.6.4.) $y_{bbb} = [(1-l)wy^* + (l)(ci - p_d)] / h$

or

(2.6.5.) $y_{bbb} = [(1-l)x + (l)(ci - p_d)] / h$

According to equation (2.6.5.) y_{bbb}, the extended balance of payments equilibrium growth rate now describes a country's rate of growth as being equal to the weighted[46] sum of the rate of growth of real capital inflows, $(ci-p_d)$, and the rate of growth of exports, (x), divided by h.

Thirlwall and Hussain stress several potential important divergencies between this extended version of Thirlwall's Law given

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45 Thirlwall and Hussain (1982, p.502/3).

46 Thirlwall and Hussain (p.503) stress the point that only if the share of capital inflows were equal to exports, the rate of growth of capital inflows could simply be added the export growth rate on the l.h.s. of equation (2.6.2.).

by equation (2.6.5.)47 and the basic Law described by equation (2.2.9.). In comparing the relative accuracy of y_{bbb} and y_b, Thirlwall and Hussain distinguish three primary cases (p.503), all of which consider $(ci-p_d)$ and l greater or equal to zero.

Given initial balance of payments disequilibrium, Thirlwall's Law expressed by equation (2.2.9.) will underpredict the actual rate of growth (y), if, in real terms, $ci>p_d+x$, but overpredict y, if $ci<p_d+x$. When $ci=p_d+x$, y_b and y_{bbb} are equivalent (p.504).

The authors do not mention the possiblity of initial current account equilibrium with rising capital inflows. In this case, the real rate of growth of capital inflows $(ci-p_d)$ would ultimately become infinite and the extended Thirlwall Law would clearly be inapplicable. For estimation purposes, however, the weight of real capital inflows would be zero. More importantly, Thirlwall and Hussain mention but do not further discuss the case of l and $(ci-p_d)$ having negative values48. Nevertheless, in applying equation (2.6.5.) in the empirical part of their analysis to twenty developing countries49, a fourth of the countries analyzed in their study exhibit such results.

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47 The authors limit their primary empirical analysis to equation (2.6.5.), although some statistical references also refer to equation (2.6.3.)

48 In their cross section study, five out of twenty developing nations analyzed in their study, however, show a negative rate of of growth of capital inflows (Thirlwall and Hussain, 1982, p. 505, Table 1). But none of these countries could be considered supply constraint.

49 For empirical purposes, Thirlwall and Hussain rely on ex-post values of the rate of growth of exports. However, variations for

It must be emphasized that Thirlwall never claimed the Law to be applicable to all nations, i.e., it would not be applicable to potentially supply constraint countries. In view of the fact that all of the developing nations studied by Thirlwall and Hussain are faced with persistent levels of underemployment and a considerable degree of idle resources, however, capital outflows are in obvious contradiction to the theoretical concept of balance of payments constraint growth50. This can be concluded from the fact that capital outflows require the balance of goods and services to be in surplus and advocates of Thirlwall's Law have pointed out that the approach does not apply to such cases (Thirlwall and McCombie, 1994, p.241). With respect to the developing countries analyzed by Thirlwall and Hussain, in particular, persistent underemployment and idle resources are hardly an indicator for a domestically triggered supply constraint or an internal capacity ceiling.

Thirlwall and Hussain address the fact that the terms of trade aspect in their model potentially allows to incorporate these effects into the analysis. Although the potential terms of trade effects are discussed, their empirical analysis, focuses on the capital flows effects, however, and does not explicitly account for

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the terms of trade are discussed. Nevertheless, no rigorous formal test for equation 2.6.3. is applied.

50 Of course, net capital outflows from developing nations are not a novel phenomena. However, Thirlwall's Law is clearly contradicted in such cases.

these effects51. Furthermore, Thirlwall and Hussain do not consider empirical tests based on equations (2.6.3.) or (2.6.4.)52.

In this context it must be stressed the issue is not explicitly addressed by Thirlwall and Hussain, clearly, the Marshall-Lerner condition, which conveniently applied for equation (2.2.7) now does not apply any more. This conclusion can easily be derived from a closer inspection of equation (2.6.3). Even if the absolute value of the sum of the import and export price elasticities h and v is equal to one, as long as the share of capital flows (l) is different from zero, i.e., if capital flows are significant, the impact of terms of trade changes on the quantities of exports and imports do not not exactly balance with the pure terms of trade effect on real income growth. Therefore, even if the sum of the price elasticities are equal to one, the first two terms on the r.h.s. of equation (2.6.3.) do not cancel out.

There seems to be no a priori reason not to apply the extended Thirlwall's Law to industrialized countries and, in particular, the U.S. economy. In fact, the primary reason why previous studies neglected this issue may be due to the following observation by

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51 In fact, the terms of trade effects are considered as a residual effect, and, although Thirlwall and Hussain discuss the issue, the effects are not explicitly accounted for within a comprehensive empirical framework.

52 A discussion of their specific empirical results is bejond the scope of this thesis. Nevertheless, these findings indicate a considerable impact of capital flows on the equilibrium growth rates.

Thirlwall and Hussain (p.498). Refering to previous empirical evidence, the authors claim that "...so many advanced countries seemed to approximate this simple rule suggested that for most countries capital flows are relatively unimportant...and that relative price changes...play only a minor role....It is largely real income (and employment) that adjusts..."(p.498). Consequently, Thirlwall and Hussain applied their extended model only to developing countries.

McCombie and Thirlwall (1994) also have specifically addressed the impact of the significant U.S. deficits on current account in recent years, but arrived at the conclusion, that "...even the U.S. was not immune from the balance-of-payments constraint."(p. 454)

In view of the recent experience surounding the discussion of the size impact causes and sustainablility of persistent U.S.trade deficits, particularly with respect to the post Bretton Woods, there seems to be ample reason for testing whether the arguments concerning terms of trade effects and capital flows can enhance the accuracy of Thirlwall's simple proposition.

The previously discussed studies on the Harrod foreign trade multiplier have not provided explicit evidence for terms of trade stability or the irrelevance of capital flows. Bairam's (1988) study, e.g., focusing on the post Bretton Woods era, plainly assumes the validity of these conditions. This is somewhat suprising given that even a cursory look at the U.S. external

balances indicates significant deficits after the Bretton Woods era.

During the Bretton Woods era, the U.S. external accounts were relatively balanced, although, as Helkie (1987) indicates, net exports expressed in real terms showed a secular decline. During the flexible exchange rate era, the U.S. merchandize trade balance, expressed in both real and nominal terms moved into considerable deficit. Net exports of goods and services followed the same pattern. Particularly, in the mid 1980s, the balance of goods and services reached record deficits. During these years, the U.S., previously the world's largest creditor, became the world's largest net debtor nation.

2.6. THE CONCEPT OF EXPORT LED GROWTH

The arguments concerning the balance-of payments constraint of Thirlwall's Law have their logical counterpart in the export-led growth strategy proposed by proponents of the Law. Obviously, with respect to most industrialized nations, a country's ability to run persistent long term current account deficits is limited. Similarly, exchange rate devaluations to alter these deficits may not be very effective. If this is the case, the conclusion that the only way to achieve a higher long term rate of economic growth without running into a balance of payments constraint lies in a higher long term rate of growth of exports.

McCombie and Thirlwall have argued that for some nations, the growth of output may be supply constrained53. This, however, has not been the case for the U.S. during the post WW II era. In addition, as far as the U.S. is concerned, although during the 1980s, the U.S. went from being the world's largest creditor to the largest debtor position, it, nevertheless, according to McCombie (1993, 500) has not been able to finance persistent trade deficits, so that according to McCombie and Thirlwall, capital flows can safely be ignored as far as advanced countries, including the U.S., are concerned (1994, p. 395).

Instead of testing the validity of Thirlwall's Law as described in section 2.2. above, McCombie (1985)54, and McCombie and Thirlwall (1994) suggest an alternative, direct theoretical and empirical procedure, that accounts for the fact that balance of payments restrictions confine most nations, including the U.S., to the rate of growth of income lower than potentially possible given idle domestic resources. McCombie and Thirlwall stress, "[c]ertainly, a failure to find a statistically significant relationship between the growth of GDP and the growth of exports could be taken as a refutation of the hypothesis that the growth of exports play a crucial role in determining the growth of output." (1994, p. 396).

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53 According to McCombie and Thirlwall, Japan has been in such a situation among industrialized countries (1994, p. 361).
54 This article has been reprinted in a revised version in McCombie and Thirlwall (1994).

McCombie and Thirlwall point out (1994, p. 395) that only Kaldor and Thirlwall have recognized the importance of considering the relationship between the rates of growth of exports (x) and income (y) stated as

(2.6.1.) $y = a_0 + a_1 x$

as a reduced form of the Hicks supermultiplier (1994, p. 394/5). whereby, acording to McCombie and Thirlwall[55], the rate of growth of exports provides the key to the rate of growth of income (1994, p. 416). They point out that based on cross section data, the evidence for the validity of the export led growth strategy as described by equation (2.6.1.) was relatively strong during the Bretton Woods era, but was weaker during the flexible exchange era (1994, p. 397).

In discussing the short run and long run effects of the export led strategy, McCombie and Thirlwall point to the following example. In the short run, according to the McCombie and Thirlwall (1994, p.406), an increase in autonomous exports leads to an increase of income depending on the size of the foreign trade multiplier. Imports are induced, based on the propensity to import. Assuming that the trade multiplier effects dominate the import effects a trade surplus will result in the short run from export led growth policies. However, in the long run (p. 406-407), according to McCombie and Thirlwall, the supermultiplier

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55 The parameter a_1 represents 1/h, where h is the income elasticity of demand. See also p. 408/9.

operates56, inducing a higher level of domestic activity57 until the balance of payments is restored. Only if the induced domestic autonomous demand components do not grow fast enough, however, a trade surplus would result58.

Consequently, except for supply constraint nations, in the long run, income will increase, until the balance of payments is brought back into equilibrium. Therefore, according to export led growth proponents, equation (2.6.1.) representing the direct causal relationship between the rate of growth of exports and income, x and y, is not a misspecified form of the Harrod foreign trade multiplier, but rather a reduced form equation of the Hick's supermultiplier.

McCombie and Thirlwall (1994 p. 403) point out that "[i]t may be questioned why an increase in exports should have any greater impact on the level of economic activity than an equivalent increase in other autonomous expenditures." Yet, their argument implies that, in the long run, exports are the sole factor determining the level of income, and that capital flows play only a temporary role. McCombie and Thirlwall (1994, p. 403) stress "...that growth of exports is the only element that simultaneously relaxes the balance of payments constraint while increasing the

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56 The supermultiplier is defined as 1/h, where h is the income demand elasticity of imports (p.407/8).
57 E.g., because of a higher rate of capital accumulation, or increases in government expenditure. See McCombie (p.407).
58 McCombie and Thirlwall (1994, p. 361) refer to Japan, which according to their view has clearly been supply constraint, so that domestic components of demand could not be increased.

growth of income. Consumption led growth, on the other hand, by eventually precipitating a balance of payments crisis..." cannot be sustained.

Based on the argument above, as long as the balance of payments constraint restricts the rate of growth of income below the potential capacity level59, empirical evidence should provide evidence of a long term structural relationship between exports and income, and should be interpretated as the Hicks' supermultiplier effects.

2.7. EMPIRICAL EVIDENCE OF THE EXPORT LED GROWTH HYPOTHESIS

Atesoglu (1993/4) tests the export-led growth concept for Canada, incorporating the potential impact of exports, capital flows, and relative prices. Contrary to his earlier study, he now claims that an empirical testing of economic growth models based on Thirlwall's Law requires the analyst to eliminate cyclical fluctuations60 from the data series (p.290).

His estimated equation, describing the Harrod foreign trade multiplier is the following61:

(2.7.1.) $y = a_0 + a_1x + a_2(c-p) + a_3 (p-p_f) + u$

where x, c-p, and $p-p_f$ are the rates of growth of the volume of exports, real capital flows, and relative prices expressed in a

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59 I.e., the balance of payments constraint holds.
60 Atesoglu removes these fluctuatons by applying a sixteen year moving average process.
61 Equation five of Atesoglu (1993/4, p.292)

common currency, respectively. u represents a stocastic error term, and a_0, a_1, a_2, and a_3, are a constant, and three parameters.

Atesoglu claims that while the expected sign of a_1 is positive, the values of a_2 and a_3 can only be determined empirically. The author utilizes annual data for the 1945-1991 period and his estimates, due to a fairly long moving average period of sixteen years, span from 1961-1991.

Testing equation (2.7.1.), Atesoglu distinguishes between the 1961-1976 and 1977-1991 time periods. According to his findings, neither capital flows nor relative prices are significant during the earlier subperiod. For the later time period, both the coefficients of exports and relative prices are significant, whereby the relative prices, have a significantly negative impact on the rate of growth of income62.

In a subsequent article on the U.S. economy also related to Thirlwall's Law63 , Atesoglu (1994) points out that due to considerable capital inflows in recent years, an empirical analysis based on the expanded Harrod foreign trade multiplier may provide further insights on this issue (p.482). However, he does not integrate this ussue into his analysis.

Two other studies by Kugler (1991) and Afxentiou and Serletis (1991) analyze the potential empirical impact of exports on domestic income of industrialized countries. Both studies are of

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62 I.e., the value of a_3 is negative.
63 In this article, Atesoglu focuses on a growth model, that integrates also domestic compoments of demand.

particular importance in the context of this study, because they utilize cointegration techniques.

Afxentiou and Serletis examined the direct causal long term relationship between real exports and real GNP of sixteen industrialized countries, including the U.S. Utilizing the method of cointegration, they measure the following structural relationship:

(2.7.2.) $y = a_0 + a_1x + u$

where y, x, and u, are real GNP and real exports, both expressed in logarithms, and an error term. a_0 is a constant and a_1 a parameter64.

The authors estimate equation (2.7.2.) with annual data over the 1950-1985 period. Except for three countries, they find no evidence of a secular relationship between exports and income. With respect to the U.S., their evidence clearly shows that cointegration analysis is the correct procedure, i.e. the time series of both GNP and exports possess unit roots. Accordingly, there is no indication of a structural, long term relationship between exports and income. In other words, the claim of a structural, long term relationship between exports and income cannot be verified by this study with respect to the U.S. data. Nevertheless, a_1, has a statistically significant value of .183

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64 As outlined above, according to the assumptions made by Thirlwall's Law, the equation reflects the export led groth concept, and a_1 can be considered equivalent to 1/h, i.e. the Hick's supermultiplier.

(Afxentiou and Serletis, 1991, p. 173)65. After differencing the data, Afxentiou and Serletis also analyze potential short run causality between exports and GNP. Their results with respect to the U.S. indicate a bi-directional relationship between the variables (p. 175).

Kugler (1991) takes an indirect approach for analyzing the impact of exports on income. He argues that according to recent, more demand oriented models66, both real consumption and real investment are secularly related to real income, i.e., both are potentially cointegrated with GDP (p.74). Kugler points out that if exports, however, have a significant impact on the rate of growth of GDP, export would also have to be included as a variable to explain the long term rate of growth of income.

Kugler's empirical work utilizes quarterly, seasonally adjusted data of six major industrialized countries, including the U.S. economy, ranging from 1970(1) to 1987(4). He estimates two respective sets of equations. The first one incorporates all four variables, i.e., real GDP, real consumption, real fixed investment and exports. In the second set, exports are excluded, in order to determine, if the remaining three variables are still cointegrated. If this is the case, Kugler points out, exports are insignificant in their impact on GDP.

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65 In McCombie's (1985) interpretation, this value should represent 1/h, the Hick's supermultiplier. But because no cointegration is found, the value of a_1 must not be taken too seriously.
66 He refers to recent works by neoclassical economists.

Although his empirical method somewhat varies from the one applied by other authors[67], Kuglers findings provide further evidence for questioning the nexus between exports and income. In four out of six cases, exports are not required to establish a structural relationship among the variables. In particular, for the U.S., there is no indication that exports and income move along a common trend (p.79).

2.8. TESTING LONG-TERM RELATIONSHIPS - THE METHOD OF COINTEGRATION

The empirical part of the analyses provided in the following chapters is based on the method of cointegration[68], because this econometric method provides a powerful tool for testing potential long term relationships of non-stationary variables. Although the method has been widely utilized in the literature in recent years, the procedure has only been applied in a few studies dealing specifically with issues surrounding the discussion of the empirical validity of Thirlwall's Law. More important, advocates of Thirlwall's Law, although proposing hypotheses which they consider as particilarly relevant from a long run viewpoint, have rarely[69] considered the method of cointegration for empirical analyses. Because cointegration is a relatively new econometric tool, it is briefly described below.

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67 Contrary to the studies outlined above by Bairam (1993a), Rose and Yellen (1989), and Afxentiou and Serletis (1991), Kugler (1991) utilizes Johannsen's cointegration procedure.

68 PC-Give was utilized for the regression analyses throughout chapters three to five.

69 Except Bairam (1993a).

In principle, an OLS regression has traditionally been one of the easiest econometric procedures to perform to test the empirical relationship among a set of variables. Econometricans have recognized, however, that classical regression analysis with non-stationary variables may lead the dubious results. On the other hand, differencing integrated variables to achieve stationarity and then applying some regression analysis may lead to a loss of long-run information (Nelson and Plosser, 1982, Charemza and Deadman, 1992, p. 143).

Because most macroeconomic variables are non-stationary (Nelson and Plosser, 1982), hypotheses about the long-run[70] relationship among them should be based on an alternative econometric approach. The recently developed method of cointegration provides such a technique. Cointegration was first comprehensively described by Engle and Granger (1987). The procedure suggested by these authors has been widely utilized in the empirical literature in recent years[71]. The empirical analyses of this dissertion follows the lead of these studies.

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70 The purpose of this study is to identify potential long term relationships.

71 Although the method of cointegration has been further developed in the theoretial literature, the original procedure has been applied in many empirical studies. See, e.g., Miller and Russek (1991), Bairam (1993a). Various aspects on the method of cointegration are discussed in Chamerza and Deadman (1992), Cuthbertson (1992), Dickey et.al. (1986), Dickey and Fuller (1981), Jerger (1991, 1993), Kennedy (1992), Perron (1988), and Stock and Watson (1988).

Stationarity or non-integration of a time series implies fluctuations around a constant mean so that a time series shows a trend reverting behavoir and that its variance does not become infinitely large72. However, most macroeconomic variables do not exhibit such mean reverting behavior; they are integrated.

The most widely used procedure to test for the degree of integration of a time series are the Dickey-Fuller (DF) and Augmented Dickey-Fuller (ADF) tests:

(2.8.1) DF: $y_t = a + by_{t-1} + e_t$

(2.8.2.) ADF: $y_t = a + by_{t-1} + \sum c \; y_{t-i} + e_t$

The advantage of the latter test is that it accounts for possible autocorrelation of the error term e_t.

In the empirical sections of this study, equations (2.8.1.) and (2.8.2.) are utilized. In other words, a constant is always included. Furthermore, the ADF test with up to four lags is applied in order to adjust for serial correlation.

Generally, most non-stationary variables drift apart from each other in time and the deviations of the long-run movements of each level series do not exhibit stationarity73. There are cases, however, when time series move along a common trend. In these cases, the set of variables is called "cointegrated".

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72 A random walk is the simplest example of a non-stationary process.

73 This implies that the time series depart from one another and that the means and variances are not constant over time (Charemza and Deadman, 1992, p.118).

The procedure to test for cointegration is similar to the integration test which has to be performed initially on all variables. Firstly, based on the result that the variables are integrated of order one[74], an OLS regression is run on the level series. In the bivariate case the level regression can be described as follows:

(2.8.3.) $y_t = a + b\, x_t + u_t$

and an DF/ADF test[75], is applied to test for possible stationarity of the estimated residuals u_t. If the residuals u_t of the level regression are stationary, the non-stationary variables y and x are cointegrated.

The procedure is equivalent for the multivariate case[76].

2.9. CONCLUSION

By denying the importance of the equilibrating force of the gross substitution effect and the long term full employment assumption of neoclassical economics, the demand oriented concepts of Thirlwall's Law provides an alternative long term view of the determination of the external balance and the level of income.

The theoretical concept and its underlying assumptions, however, have not yet been compehensively tested with respect to the U.S. economy. Furthermore, the econometric procedures applied

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74 Generally, the level equation for testing possible cointegration requires all variables to be integrated of the same order.
75 The procedure is equivalent to a DF test if no lags are required to adjust for serial correlation.
76 Engle and Yoo (1987) provide critical values for the cointegration tests.

in most of these studies have not applied the econometric method of cointegration, although Thirlwall's Law explicitly provides long term hypotheses and cointegration analysis focuses on these particular aspect.

Bairam (1990, p.712) claims that the policy implications of Thirlwall's Law "...are quite clear. In an open economy relevant economic management is the one that manipulates the income elasticities of exports and imports. A successful economic policy that increases the value of [v] and /or reduces the value of [h], relaxes the balance of payments constraints and, eventually accelerates economic growth."77 The following three chapters focus on whether such an unconditional statement is appropiate with respect to the actual post WW II experience of the U.S. economy.

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77 v and h refer to parameters of equations (2.2.8.) and (2.2.9.) of this thesis.

3. THIRLWALL'S LAW BASED ON THE IMPORT DEMAND FUNCTION

3.1. INTRODUCTION

According to Thirlwall's Law, most industrialized nations are confronted with a balance of payments constraint that limits the rate of growth of domestic income. The external sector, therefore, becomes the only mean to enhance a country's long term rate of growth, because under conditions of underutilized resources, expanding domestic demand must lead to balance of payments deficits which cannot be permanently financed and, therefore, cannot be sustained.

Advocates of Thirlwall's Law suggest that the U.S., irrespective of its peculiar position within the global economic environment, has been confronted with this international payments constraint throughout the WWII era[78]. According to previous studies[79], the income elasticity of demand derived from the U.S. import demand function provides a good estimate for deriving Thirlwall's long term equilibrium rate of growth. This rate, according to the findings of these studies, closely reflects the actual rate of growth of the U.S. economy.

The purpose of this chapter is to comprehensively analyze the empirical validity of this claim based on the estimated income elasticities derived from the U.S. import demand function. In doing so, the analysis of this chapter is strictly based on this indirect

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78 See McCombie and Thirlwall (1994)
79 See chapter two, supra.

approach of estimating the validity of Thirlwall's Law outlined in the previous chapter. By utilizing the econometric technique of cointegration80, this chapter, in contrast to previous studies in this area dealing with the U.S. economy, is based on an econometric procedure which emphasizes the long term propositions81 expressed by Thirlwall's Law.

In the next section, the U.S. import demand functions for both the Bretton Woods era and the flexible exchange rate post Bretton Woods period are estimated. In accordance with the arguments by McGregor and Swales (1991), the significance of the terms of trade in deriving the respective income elasticities of demand is discussed. Based on these results, the equilibrium growth rate for each period is determined in section three. The impact of the terms of trade on these equilibrium rates of growth is further analyzed in section four. The fifth section focuses on whether domestic income and relative prices in fact determine the volume of imports in a period, as it is implicitly assumed by Thirlwall's Law. Sections six and seven focus on whether the level of domestic economic activity has in any systematic way been determined by capital flows. This requires an assessment of the validity of the balance of payments assumption, which is provided in section six. Some interpretations of the results and conclusions are drawn in the final two sections.

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80 The concept of cointegration is summarized in the chapter two.
81 See, e.g., McCombie (1985, p.68), a major proponent of the model.

3.2. THE IMPORT DEMAND FUNCTION

As far as the U.S. economy is concerned, Thirlwall's proponents argue that, in the long run, the size of trade relative to capital flows renders the latter irrelevant for analytical purposes[82]. Advocates of the Law have followed this lead in analyzing the empirical validity of Thirlwall's Law[83]. Therefore, the analysis of this section abstracts from potential capital flows effects.

As discussed in chapter two, empirical analyses of Thirlwall's approach with respect to the U.S.economy, have been based on estimates from the import demand function and have almost exclusively relied on first differenced data[84]. Bairam (1993a) has acknowledged this issue in pointing out that with respect to previous empirical studies on Thirlwall's Law, "[u]nfortunately, so far in the literature it has been ignored that, before the model is specified and estimated, it is important to test the order of

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82 Some economists have argued that the United States, compared to other nations, has been in a unique international economic and financial position during the post WWII era (Davidson, 1992). Nevertheless, the potential implications of this position does not, a priori, imply that Thirlwall's Law as stated in its simple form by equation (2.2.9) cannot be applied to the U.S., particularly, because advocates of Thirlwall's Law have denied this view. E.g., McCombie's (199) claim that the U.S., in the longer run, has not been able to escape the balance of payments constraint.

83 The Law only holds for countries, which are not supply constraint, but proponents of the Law have stressed that this restriction does not apply to the economic experience of the U.S. during the post WW II era.

84 One of the exceptions are studies based of data estimated by Houthakker and Magee (1969). Houthakker and Magee, however, did not utilize the cointegration approach to determine if their level equations are appropriately specified.

integration by testing the (log) levels and (log) differences of the series under consideration for unit roots." (p. 739)85. Bairam's observation recognize recent arguments in the literature on cointegration86 that there is no, a priori, reason to use first differenced data for estimating a secular, long term relationship, such as the one suggested by Thirlwall's Law. In fact, only if it was shown that all variables are I(0) or that the variables are unit roots but are not cointegrated utilizing first differences may be an appropriate model specification. Utilizing first differenced data in the latter case, however, may still lead to a loss of long term information. Consequently, the data series utilized in the import demand functions must be tested for their respective degree of integration.

Discussing the appropriate form of the import demand function to be estimated, McCombie (1992) argues that relative prices can not be excluded, a priori, because they may impact on the volume of imports87. According to this argument, and in line with most studies in this area88, the import demand function in levels and using natural logarithms89, may be expressed as:

(3.2.1.) $\ln M = a - g \ln(TOT) + h \ln Y$

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85 Because prevoius studies were based on annual data, this is not surprising.
86 See section 2.8., supra.
87 But not necessarily the trade balance, if the Marshall-Lerner conditions apply. See the discussion chapter two, supra.
88 Usually, import demand functions are estimated including at least an income and a relative price variable. E.g., see Krugman and Baldwin (1987) and Goldstein and Khan (1985).
89 See Bairam (1993a) for the only example of cointegration.

where M, Y, and ToT are real imports, real domestic income, and the real terms of trade, respectively, g is the price elasticity for imports (g>0)90, and h is the income demand elasticity for imports.

In order to evaluate the impact of relative prices and the appropriateness of the claim by McGregor and Swales (1991), who strongly argue for excluding relative prices from the import equation91, the level import demand function may alternatively by stated in terms of logarithms as:

(3.2.2.) $\ln M = a + h \ln Y$

where the variables are defined as in equation (3.2.1.).

Equation (3.2.1.) also reflects the argument by Bairam (1993a) and Atesoglu (1993a) who have concluded in their studies that omitting relative prices from the import demand function would not significantly bias the estimation results92.

For estimating equations (3.2.1.) and (3.2.2.), it is evident that one should take a broad measure of imports. Otherwise, it could be argued potential imbalances are due to a narrow definition of imports. Therefore, contrary to some previous studies (Thirlwall, 1979; McCombie, 1989), the respective elasticities derived from the import demand function should reflect not only

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90 Contrary to equations (2.2.3.) and (2.2.4.) in section 2.2., in the following, the terms of trade are defined as export over import prices in both equations demand equations so that the price elasticity of demand for imports (g) is expected to be positive. However, this change does not effect the the theoretical arguments or the empirical results in any way.

91 See also McCombie's reply, supra.

92 See the discussion of their studies, chapter two, supra.

merchandize trade but trade of goods and services, in order to capture the whole import bill.

As a first step to analyze equations (3.2.1.) and (3.2.2.) utilizing cointegration, the DF/ADF test described in section 2.8. was performed on each variable in levels, as well as in first differences in order to determine the degree of integration of the variables appearing in the respective regression equations. Three data periods are taken into account. In accordance with studies covering the whole post WW II era (Atesoglu, 1993), the first chosen period ranges from 1950(1) to 1992(2). Data for the Bretton Woods era are from 1950(1) through 1971(4); the post Bretton Woods era ranges from 1972(1) through 1992(2). The year 1972 was chosen, because it was the first year the U.S. was confronted with flexible exchange rates. This data division also closely coincides with previous studies93.

All data are taken from the Survey of Current Business. Income (Y) is defined as real U.S. GDP94, and imports (M) are defined as the volume of imports of goods and services. The terms of trade (TOT) are defined as the ratio of export prices over import prices95.

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93 Previous studies on Thirlwall's Law utilized annual data. The tests of this thesis are based on quarterly data.
94 See Thirlwall 1994, p.393. Because factor income are not included, GDP is the appropriate variable.
95 The data are taken from Table 1.11. McPeters and Stronge (1979, 1982) have utilized the same data set in their discussion of the terms of trade. The Survey of Current Business data is the only quarterly data set covering the terms of trade of the whole post WW II period.

All variables are expressed in logarithms. Except for TOT, all data are seasonally adjusted at source. All unit roots tests are performed as outlined in section 2.8.; a constant is always included96, and up to four lags are used in order to account for serial correlation. The results of the unit roots tests are reported in Table 3.1.

The test results demonstrate that irrespective of the chosen time period, all variables, except ToT for the post Bretton Woods era, are integrated of order one at the 5% level of significance. Furthermore, regardless of the time period, all variables, when expressed in differences are stationary at the 1% level.

As far as the terms of trade are concerned, there seems to be some indication of stationarity, however, only at the 10% level, during the post Bretton Woods era. This may give some validity to Thirlwall's proposition that the price term is relatively stable in the long run. It also confirms Krugman's with claim (1989) that nominal exchange rates may have moved in line with domestic price movements so that the U.S. real terms of trade have been relatively stable during the flexible exchange rate period.

On the other hand, with respect to the U.S., Bahami-Oskooee (1992) finds the levels of the real terms of trade to be integrated of order one for the Post Bretton Woods era. Several other studies

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96 Because the mean of the data series may not be zero (Gulley, 1992, p.56)

Table 3.1. Unit Roots Test: The Import Functions, 1950-1992, 1950-1971, 1972-1992

Variable	Level	First differenced
1950(1)-1992(2)		
lnY	-1.63(1)	-8.428(0)*
lnM	-1.286(0)	-7.318(3)*
lnTOT	-1.541(1)	-9.544(0)*
1950(1)-1971(4)		
lnY	-.8808(1)	-5.965(0)*
lnM	-.9998(1)	-6.421(4)*
lnTOT	-1.663(1)	-6.854(0)*
1972(1)-1992(2)		
lnY	-.7741(1)	-6.076(0)*
lnM	-.3939(1)	-7.295(0)*
lnTOT	-2.783(1)***	-6.673(0)*

* Significant at the 1 percent level.
** Significant at the 5 percent level.
*** Significant at the 10 percent level.
Critical values are taken from Engle and Yoo (1987). Numbers in parentheses correspond to lags required to adjust for serial correlation.

based on the concept of cointegration and dealing with the U.S. economy for the flexible exchange rate era found relative prices also not to be stationary, but integrated of order one97.

Overall, the results provided in Table 3.1. demonstrate that all the variables can be considered integrated in levels98, but stationary when first differenced. This is contrary to previous studies dealing with Thirlwall's Law. Hence it is not only appropriate, but necessary to estimate the import demand function in level form for possible cointegration and to determine the long

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97 Rose and Yellen (1989), Wyplosz and Cohen (1991), and Kraeger (1992). The definitions of the terms of trade vary among these studies.
98 Other studies also use cointegration techniques, even though some of the variables do not found to be integrated of the same order. See, e.g., Kraeger (1992).

term price and income elasticities of demand for imports. In fact, if cointegration exists, i.e. there is evidence of a secular relationship among the variables, differencing is not only inappropriate, but also potentially implies the danger of neglecting the long term effects. In view of the fact that Thirlwall's propositions are explicitly longer term hypotheses, the approach taken previously in the empirical literature, i.e., differencing the data series without consideration of the degree of integration of the variables appears to be a particularly questionable approach.

The results of the cointegration tests[99], given in Table 3.2. show that the OLS level regression on lnGDP and lnM alone are not

Table 3.2. Cointegration Test: The Import Functions, 1950-1992, 1950-1971, 1972-1992

Cointegrating equation	slope coefficients lnY	lnTOT	D-W	R2	DF/ADF
1950(1)-1992(2)					
lnM	1.9929		.291	.989969	-2.772(1)
lnM	2.0193	.23508	.318	.990768	-2.23(1)
1950(1)-1971(4)					
lnM	1.9051		.417	.970112	-3.154(0)
lnM	1.6629	.89512	.602	.979377	-3.869(0)***
1972(1)-1992(2)					
lnM	2.2509		.217	.967286	-2.921(1)
lnM	2.3010	.70872	.703	.987277	-4.434(1)**

* Significant at the 1 percent level.
** Significant at the 5 percent level.
*** Significant at the 10 percent level.
Critical values are taken from Engle and Yoo (1987). Numbers in parentheses correspond to lags required to adjust for serial correlation.

99 A constant is always included.

cointegrated over the period 1950-1992. Over the whole post WW II period, therefore, there is no evidence of a secular relationship between income and imports, if the terms of trade are excluded from the r.h.s. of the OLS level regression. Adding the terms of trade to the OLS level regression for the 1950-1992 period leads to an absolute decline of the ADF statistic, and results in an ADF value considerably below the critical one suggested by Engle and Yoo (1987). The Durbin-Watson statistic also hardly improves and remains relatively low. Consequently, the parameters of the import demand function and, therefore, the income and price elasticity parameters have not been stable throughout the post WW II era. This is in accordance with many other studies (Thirlwall, 1979, McCombie, 1989, Bairam, 1988) which distinguish between the Bretton Woods and the post Bretton Woods flexible exchange rate era. On the other hand, the findings appear to cast doubt on the reliability of the parameter estimates of Atesoglu's (1993a) study, which focused on the post WW II U.S. economy.

As far as the 1950-1971 and 1972-1992 time periods are concerned, the results of Table 3.2. show that the terms of trade are significant and need to be integrated into each of the cointegration equations in order to achieve stationarity of the residuals of the OLS level regressions. The stationarity of the residuals is reflected by the DF/ADF statistics which demonstrate that including the terms of trade according to equation (3.2.1.) improves these values significantly. In other words, for these two

time periods, the DF/ADF statistics reject the null hypothesis of non cointegration at the 10% level for the Bretton Woods era and at the 5% level for the 1972-1992 period for equation (3.2.1).100 In addition, when the term of trade are included, the Durbin-Watson statistic also rises considerably as compared to the two estimates derived from equation (3.2.2.), and although the latter statistic is generally considered to be a relatively weak indicator for cointegration analysis (Engle and Yoo, 1987), it provides further evidence for the claim that these results indicate a long term structural relationship for each of the two import demand functions.

Including the terms of trade variable into the cointegrating regression according to equation (3.2.1.) leads to a significant decline of the income demand elasticity during the Bretton Woods era compared to the non cointegrated bivariate estimates. This is not the case, however, for the later 1972-1992 period. As indicated, however, the income elasticity estimates derived from the bivariate system (3.2.2.) are not reliable, because the null hypothesis of no cointegration cannot be rejected, so that there is no evidence that the bivariate OLS level regressions represent a long term stable relationship.

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100 Compared to the bivariate, not cointegrated OLS level regression (3.2.2.), the overall fit, although already quite high, improves for the estimates derived from equation (3.2.1.). This is, however, not an indicator for cointegration. However, in case of several competing cointegrating equations, one should choose the one with the highest R^2 (Miller and Russek, 1991, and Hall 1986)

Consequently, not including the price term into the respective demand equations as suggested in previous studies (Atesoglu 1993a) may not just lead to considerable bias, but, more important, implies a incorrect model specification.

In addition, the price elasticities for each of the time periods are .89512 and .70872, respectively. This clearly implies that they are quantitatively important on the volume of imports, as acknowledged by McCombie101.

The regression results for the two subperiods provided in Table 3.2. also show that the import demand elasticity for the post Bretton Woods era as compared to the 1950-1971 period, is considerably higher. The results of Table 3.2. are in accordance with previous studies that have demonstated a significant increase of the U.S. import demand elasticity in more recent years102. Consequently, according to Thirlwall's Law, the long term growth prospects, ceteris paribus103, of the U.S. declined during the post Bretton Woods era.

In essense, the results of the cointegration tests do not lend support for a bivariate, secular relationship between real GDP and the quantity of imports over any of the three time periods considered in this section104. When the real terms of trade are

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101 Of course, the Marshall-Lerner condition cannot be discussed.
102 See Davidson (1992, p.228) Not surprisingly, this parameter shift provides an explanation, why there exists no long term secular relationship for the 1950-1992 time period.
103 Given the rate of growth of exports.
104 It would misleading to conclude that in these cases the equation should be reestimated and first differenced data,

added to the analysis, cointegration among the three variables can be established for the Bretton Woods as well as for the post Bretton Woods era. Contrary to previous studies focusing on the U.S. economy (Atesoglu, 1993), however, the empirical findings of this section appear to refute the hypotheses of a stable long run relationship among the quantity of U.S. imports, the terms of trade and real domestic income.

3.3. THE DETERMINATION OF THE EQUILIBRIUM RATE OF GROWTH

Based on the outcome of the cointegration tests of the last section, and in accordance with previous studies, Thirlwall's equilibrium rate of growth (y_b) can be derived, based on equation (2.2.9.), by dividing the rate of growth of exports of goods and services (x) by the income elasticity of demand for imports (h). The results for the 1950-1971 and 1972-1992 time periods are given in Table 3.3. Hereby, the equilibrium rates of growth (y_b), utilize the values for h from Table 3.2., based on the two cointegrated import functions discussed in the last section105. Because the import demand function for the 1950-1992 time period was found not to be cointegrated, it would be misleading to derive a similar estimate for the whole post WW II era.

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ommitting the price term should be applied. Not only may it lead to a loss of long term information, it would also overlook the issue that a relevant variable may have been ommitted in the regression.
105 The import functions including the terms of trade.

Table 3.3. Equilibrium Growth Rates; The Import Functions, 1950-1971, 1972-1992

Variable	Actual Average Rate of growth(y) (annualized data106)	Equilibrium Rate of growth(y_b)
1950(1)-1971(4)		
y	.037404	.0295821
x	.049192	
1972(1)-1992(2)		
y	.024076	.0278575
x	.0641	

In Table 3.3., the right hand column gives the equilibrium rate of growth while the middle column gives the value of the actual average growth rate (y) and the actual average rate of growth of real exports of goods and services (x). The results show that during the earlier time period, the actual rate of growth of GDP (y) lies considerably above the equilibrium growth rate (y_b). This result confirms the previous result by Thirlwall's (1979, p.). With respect to the post Bretton Woods era, U.S. income actually rose less than the potential rate hypothesized by the equilibrium growth rate, although the divergence between the two rates is less significant for the this time period.

Based on the results of Table 3.3., it appears that for the Bretton Woods period, the actual U.S. rate of growth has forced the U.S. into balance of payments constraint position. For the post Bretton Woods period, on the other hand, the U.S. seems to have grown below its potential suggested by Thirlwall's Law. This

106 The growth rates represent the first differences of the annualized level series expressed in logarithms.

result, however, appears to be at variance with the observation that the U.S. run significant balance of payments deficits and has become the world's largest debtor nation since the breakdown of the Bretton Woods system.

Hereby, the high rate of growth of exports during the post Bretton Woods era appears to have a considerable impact on this result. Obviously, the increase of this rate relative to the Bretton Woods era almost compensates for the rising income demand elasticity of demand of the post Bretton Woods era, so that the equilibrium growth rates do not differ considerably.

Atesoglu (1993a)107 has argued that findings like the one presented in Table 3.3. represent only a single arithmetic value for each time period; a rather weak indicator for rejecting or comfirming the validity of Thirlwall's Law and he has proposed an alternative test. Therefore, we adopt Atesoglu's suggestion for an additional empirical test for estimating the association between the actual and predicted rates of growth (p.511). A simple regression for each time period is developed based on a series of respective average values of the actual rates of growth of income (y) and the predicted rates of growth (y_b), the latter calculated according to equation (2.2.9.). The respective values for y and y_b are derived similar to Atesolgu's (1993) approach. For the 1950-1971 time period, the first equilibrium growth rate ranges from 1950(1) to 1959(4). Subsequently, 49 overlapping data points are

107 For details see chapter two above.

derived, the last one covering the 1962(1)-1971(4) time period[108]. The U.S. actual growth rates (y), matching the predicted rates (y_b) are also calculated. The same procedure is applied for the post Bretton Woods era yielding 43 observations for y and y_b, respectively. The data[109] is shown in Appendixes 3.1. and 3.2.

The regression results for both the Bretton Woods and post Bretton Woods era are:

(3.3.1.) $y = .019321 + .46413\ y_b$

$\qquad\qquad (5.753) \quad (4.517) \qquad R^2 = .302711$

(3.3.2.) $y = .025411 - .081277\ y_b$

$\qquad\qquad (14.267) \quad (-.857) \qquad R^2 = .0176032$

According to Atesoglu (1993, p. 511), we would expect the constant to be zero, and the slope coefficient positive and close to one, to provide clear evidence of a one to one relation between the two series. The results for the Bretton Woods era, shown in equation (3.3.1.), are relatively satisfying. The slope coefficient is significant and has the correct sign, indicating a positive relationship between y_b and y, although, the absolute value of the slope coefficient, is significantly lower than one. The intercept

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108 Compared to Atesoglu, the quarterly data set used in this thesis allow to derive a larger data set, whereby each data point is also based on more observations. In addition, the data allows a subdivision between the 1950-1971 and 1972-1992 time period. The time range for each data point is ten years; quite reasonable for a long term approach. Due to the overlapping procedure, each data point is based on 40 observations.

109 Appendix 3.1. covers the Bretton Woods era; Appendix 3.2. the flexible exchange rate era.

is significant and close to zero, a result consistent with the hypothesis of Thirlwall's Law.

The results for the post Bretton Woods era, shown in equation (3.3.2.), indicate a negative relationship between the actual and the equilibrium growth rate. Also, the slope coefficient is insignificant, and the value of R^2 is extremely low. Consequently, Atesoglu's test does not support the hypotheses of the Harrod foreign trade multiplier.

3.4. THE IMPACT OF THE TERMS OF TRADE

It has been demonstrated in section 3.2., that the terms of trade cannot be excluded from the two long term import demand function, representing the 1950-1971 and 1972-1992 time periods. Therefore, the equilibrium growth rates provided in Table 3.3., were based on the income demand elasticity estimates derived from equation (3.2.1.), above. The significant price elasticity effects, however, were not incorporated into the equilibrium rates of growth; i.e., theses rates were solely based on equation (2.2.9.).

Thirlwall (1979) has acknowledged that measuring the equilibrium rate of growth by utilizing equation (2.2.9.) implies that according to equation (2.2.7) either the Marshall-Lerner condition is satisfied, or the terms of trade are relatively stable110. This argument by Thirlwall clearly refers to the total effect emanating from parameters of the export and import demand function. The analyses of this chapter, however, focuses on

110 See section 2.2., supra.

estimates, solely derived from the import demand function, so that the assumption has to be made that according to equation (2.2.6.), the rate of growth of exports (x), being an ex post value, incorporates the impact of the price elasticity of demand for exports occuring due to possible changes in the terms of trade[111].

Therefore, at this stage of the analysis, the total impact of terms of trade changes on the equilibrium rate of growth cannot be assessed by applying equation (2.2.7.) directly[112]. Nevertheless, given the assumption stated by equation (2.2.6.), the question arises, if terms of trade changes soley impacting via the price elasticity of demand for imports can explicitly be incorporated into the present analysis to determine if they have a significant impact and, therefore, may provide a more accurate estimation of Thirlwall's equilibrium growth rate[113].

Taking these arguments into account, and abstracting from capital flows effects at the present stage, it apprears quite feasible to explicitly study this effect of a possible terms of trade change based on Thirlwall's assessment of the import demand

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111 See also Williamson (1984, fn 6).
112 Consequently, it is not possible to discuss the Marshall-Lerner condition. This discussion is provided in chapter four, where export demand elasticities are estimated.
113 In this context it should be emphasized that Thirlwall (1979) himself stressed that equation (2.2.7.) provides a more accurate estimate, of his equilibrium growth concept as compared to equation (2.2.9.), although it requires a larger ammount of data.

function. This has not yet been explicitly derived in the literature[114].

Rearranging equation (2.2.6.)[115]:

(3.4.1.) $wy^* = x - v(tot)$[116]

and substituting equation (3.4.1.) into (2.2.7)[117] we get:

(3.4.2.) $y_{bb} = [(1-g)(tot) + x] / h$

where y_{bb} is the equilibrium rate of growth based on the import demand function but including the terms of trade effects[118].

It was shown in the last section, that relative prices had a significant impact on the volume of imports. Consequently, the import price elasticities (g) needed to calculate the equilibrium rate of growth (y_{bb}) are taken from Table 3.2., infra. For the Bretton Woods era, g is .89512 and for the 1972(1)-1992(2) period g is .70872. Taking the annual average rates of growth of the terms of trade (tot) into account, equation (3.4.2) yields the

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114 Although it is closely related to Williamson's argument (1984, p. 75). See section 2.4., supra.

115 Since $\ln(p_d/p_f)=\ln p_d-\ln p_f$, the rate of growth of the terms of trade (tot) are equal to p_d/p_f.

116 Where tot equals the average rate of growth of TOT.

117 As outlined in section 3.2. above, the use of an identical terms of trade variable, measured as export prices over import prices, in both the export and import demand function implies g>0, i.e., a positive price elasticity coefficient. The coefficients of the price elasticities of the respective import demand functions of Table 3.2., therefore, show positve values. this, in turn is reflected by the negative sign for g in equation (3.4.2.).

118 Given the assumption that the rate of growth of exports (x), incorporates the relative price effects emanating from the export demand function, i.e., the effects of the terms of trade via the price elasticity of demand. Obviously, this eliminates the term [v(tot)] in equation (3.4.2.).

Table 3.4. Equilibrium Growth Rates; The Terms of Trade, 1950-1971, 1972-1992

Variable	Actual Average Rates of growth (annualized data119)	Equilibrium Rate of growth (y_{bb})
1950(1)-1971(4)		
y	.037404	.0299191
x	.049192	
tot	.005344	
1972(1)-1992(2)		
y	.024076	.0267283
x	.0641	
tot	-.008492	

equilibrium rates of growth (y_{bb}) for the 1950-1971 and 1972-1992 time period.

These results are presented in Table 3.4. The average real terms of trade for the U.S. increased by about one half of one percent p.a. during the Bretton Woods period, but declined by almost one percent during the post Bretton Woods era.

The results demonstrate, that the first term of the r.h.s. of equation (3.4.2), which expresses the impact of terms of trade changes, does not have a decisive impact on the equilibrium rates of growth, y_{bb}, in either one of the time periods under consideration. In fact, comparing these rates provided on the r.h.s. column of Table 3.4. with the equilibrium rates of growth y_b, presented in Table 3.3. above, the differences among these values are almost negligible for both the Bretton Woods era and the flexible exchange rate period. Nevertheless, for both chosen time

119 The growth rates represent the first differences of the log level series, annualized.

periods, the changes due to the terms of trade effect lead to marginal improvements of the estimates. For the Bretton Woods era, the terms of trade effect leads to an increase of the equilibrium rate of growth, y_{bb}, relative to the value y_b, shown in Table 3.3. of section 3.3.. Therefore, y_{bb} somewhat closes the gap between the equilibrium rate of growth and the actual rate of growth (y). With respect to the post Bretton Woods era, the terms of trade effect leads to a decline of the value of y_{bb} in comparison to y_b derived in the last section, and, therefore, also provides an estimate closer to the actual rate of growth than the one derived from equation (2.2.9.). In both cases, however, the improvements are of no considerable magnitute, and the gaps between y_{bb} and y remain relatively large.

The relatively high import price elasticities (g) appear to be the primary reason for the small improvements of the estimated equilibrium growth rate reached by applying equation (3.4.2.) relative to x/h. Put differently, if g was equal to one, the pure terms of trade effect would be totally compensated by the volume effect relative price changes impose on the balance of payments constrained income growth. I.e., whereas the terms of trade improvement during the Bretton Woods era relaxed the balance of payments constraint, the increase in export prices over import prices led to higher real imports, which restricted the balance of payments constraint by an almost equal amount. The reverse argument holds for the post Bretton Woods era.

Similar to the analysis of the previous section, we estimate two regressions of the respective values for y and y_{bb}, because of Atesoglu's argument (1993) that the single values shown in Table 3.4. above for each exchange rate period may lead to arbitrary results. The data series are derived as described in section 3.3., infra. The values for y and y_{bb} are provided in Appendixes 3.1 and 3.2., respectively120.

The regressions for both the Bretton Woods and post Bretton Woods era give the following results:

(3.4.3.) $y = .019486 + .45166\ y_{bb}$

(5.36) (4.118) $R^2 = .265102$

(3.4.4.) $y = .023467 + .026203\ y_{bb}$

(12.931) (.273) $R^2 = .00181437$

In comparison to the findings of the last section, including the terms of trade effects does not improve the regression results for the Bretton Woods era, as demonstrated by comparing equation (3.3.1) and equation (3.4.3.). In particular, the slope coefficient now declines slightly and R^2 is below the value estimated by equation (3.3.1.), above. Nevertheless, as in section 3.3. above, the regression result again provides evidence in favor of Thirlwall's Law. Comparing the regression results of equations (3.3.2.) and (3.4.4.) of the flexible exchange rate period, the slope coefficient of equation (3.4.4.) now has the right sign;

120 The first Appendix covers the Bretton Woods era, the latter the era of flexible exchange rates.

however, its value is close to zero and statistically insignificant.

In essense, including the terms of trade effects into the analysis does not lead to a significant improvement of the findings, with respect to the hypotheses of Thirlwall's Law.

3.5. CAUSALITY TEST: THE IMPORT FUNCTION

Most studies estimating import demand functions assume the volume of imports to be determined by domestic income and relative prices. The cointegration tests of section 3.2. have provided evidence of a long run secular relationship among the volume of imports, real GDP and the terms of trade during each exchange rate period. In accordance with these studies, the quantity of imports was, a priori, assumed to be endogenously determined by income and relative prices. However, it cannot be ruled out, that these three variables are also cointegrated in other directions121. Therefore, the purpose of this section is to analyze if real income and relative prices, in fact, "Granger cause" the volume of imports as specified by the cointegrating equations based on equation (3.2.1.). This issue has been neglected so far in the literature.

According to Engle and Granger (1987), the indication of cointegration among a set of variables allows to determine an error

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121 See Miller and Russek (pp. 18-19). In focusing on Thirlwall's Law, it is bejond the scope of this thesis, however, to estimate other possible cointegrating relationships among the three data series.

correction model in a least one direction122. Based on this finding, Miller and Russek (1990, 1991) have recently utilized a Granger causality test based on the cointegration approach to test the existence of causality.

Miller and Russek (1991, p.14) point out that their procedure allows to analyze channels of causality ignored by standard Granger causality tests. Standard Granger causality tests examine, if past changes in one or more variables predict current changes of another variable. The Granger causality test, however, based on cointegration also takes account of the effects emanating from the common trend reflected by the error term of the level regression of the cointegrated time series. Therefore, lagged levels of one or more series may contribute to explaining current changes of another series (p. 15), in addition to the standard Granger causality effects described above. Therefore, for the Granger causality test based on cointegration, the lagged levels of the time series may explain current changes of another time series even if past changes of one or more variables do not account for current changes in another variable123. This is because the cointegration properties resulting from the level cointegrating regression, which imply that the estimated level series move along a common trend, can be incorporated into the error correction model. Miller and Russek

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122 See Charemza and Deadman, (1992, p.154), and Miller and Russek (1991, p. 15 and p. 22)

123 The latter condition, however, must apply to the standard Granger causality test (Miller and Russek, p. 16).

point out (p. 16) that, therefore, one or more series can Granger causes another series, even if the coefficients on the lagged changes of the explanatory series are not jointly significant[124].

To test for Granger causality based on cointegration, the error correction model[125] for the three variable case of the import demand function (2.3.1.), can, in accordance with Miller and Russek (p. 15 and p. 21) be stated as

(3.5.1.) $dlnM_t=a_0+\sum a_1 dlnM_{t-i}+\sum a_2 dlnY_{t-i}+\sum a_3 dlnTOT_{t-i}+a_4 ECM_{t-1}+u_t$

where dlnM, dlnY, dlnTOT are the first differences of the cointegrated time series, respectively. Therefore, all of these series are stationary[126]. Four lags for the r.h.s. variables of dMt, dY, dTOT are applied, respectively, in accordance with Miller and Russek are utilized for testing the joint significance of the changes of these series. ECM_{t-1} is the first lag of the stationary[127] error term, representing the residuals from the cointegrated OLS level regression.

Based on the procedure suggested by Miller and Russek, the regression results of equation (3.5.1.) for the 1950-1971 period are presented in the three l.h.s. data-columns of Table 3.5. indicate that the error correction term (ECM-1) is significantly

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124 The latter condition reflects the standard Granger causality test based on F-test statistics (Miller and Russek, p. 16).
125 According to Miller and Russek (1991, p. 15).
126 See Table 3.1., supra.
127This is the requirement for a set of series to be cointegrated, as outlined in section 2.8., supra.

negative128. I.e., the terms of trade and domestic income both have a causal impact on the volume of imports during the Bretton Woods era129 through their effect on the error correction term130. The Durbin Watson statistic is 1.99.

The individual t-values of the lags of the first differences of lnM, lnY, and lnTOT are not significant. Miller and Russek, however, focus on the joint significance of these lags in their analysis (p.21) based on F-statistics. These F-tests for the hypothesized exogenous variables, TOT and Y, as shown in the third column, indicate that domestic income, in addition to its impact through the error correction term, also directly Granger causes imports.

As shown in the l.h.s. data column of Table 3.5., all individual time lags are insignificant, and this may represent an over-parametization of the error correction process (3.5.1.), applied in accordance with Miller and Russek.

We, therefore, apply an additional test procedure and respecify the error correction model of equation (3.5.1.) in accordance with suggestions by Engle and Granger (1987)131, eliminating the non-

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128 Standard t-values apply for testing the signifcance of ECM_{t-1}. However, the error correction term must have a significantly negative value!

129 For a similar argument, see Miller and Russek (1991, p.21-22).

130 See Miller and Russek's desciption of the impact of the error correction term on a endogenous variable (p. 19)

131 See the r.h.s. column in Table IV of Engle and Granger (p. 272). See also Cohen and Wyplosz for a similar suggestion (1991, pp.180-182). Due to the nature of their data series, Cohen and Wyplosz do not eliminate all insignificant variables.

Table 3.5. Causality Test; Income and the Terms of Trade Cause Imports, 1950-1971

	dlnM	t-value	F-value132	dlnM	t-value
dlnM(-1)	-.17002	-1.266			
dlnM(-2)	-.013714	-.099			
dlnM(-3)	.067629	.517			
dlnM(-4)	-.11935	-1.034			
dlnY(-1)	.97183	1.601			
dlnY(-2)	.77417	1.354			
dlnY(-3)	-.94531	-1.712			
dlnY(-4)	-.46048	-.808			
			2.496**		
dlnTOT(-1)	.0299161	.061			
dlnTOT(-2)	.24366	-.498			
dlnTOT(-3)	-.046841	-.094			
dlnTOT(-4)	-.13237	-.263			
			.085		
ECM(-1)	-.24026	-2.195**		-.31624	-4.095**
CONSTANT	.019848	2.16**		.019143	4.113**
SE	.0428676			.043663	
DW	1.99			1.98	

** Significant at the 5 percent level.

significant lagged values of the time series, retaining, however, ECM(-1), irrespective of its statistical significance resulting from regression (3.5.1.)133.

These reestimation result are given at the two r.h.s. colums of Table 3.5. Because all individual lags of the differenced time

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132 The F-statistics are derived as follows:
$F=(N-k)[(ESS_R-ESS_{UR})]/[q(ESS_{UR})]$, where ESS_R and ESS_{UR} are the sums of squared residuals of the restricted and unrestricted regressions, and N, k, q is the number of observations, the number of estimated parameters of the unrestricted regression, and the number of parameter restrictions, respectively. See Pindyck and Rubinfeld (1991, p.216)

133 In some cases ECM_{t-1} could also become insignificant simply due to the over-parametization of equation (3.5.1.).

series are insignificant, only the error correction term, lagged by one quarter, was included.

The results indicate that the error term now becomes highly significant. The Durbin Watson statistic is hardly lower than in the analysis above, indicating the validity of eliminating the insignificant variables from equation (3.5.1). Compared to the results based on Miller and Russek, the full impact of the Granger causality is now emanating from the error correction term. This finding is consistent with the findings from the Miller and Russek test procedure. It demonstrates that income and relative prices in fact Granger cause imports during the Bretton Woods era. Therefore, the cointegration regression of Table 3.2., above, based on this causal hypothesis appears to be correctly specified.

The same causality test procedures are applied for the 1972-1992 period and the results of these tests are provided in Table 3.6.

According to the Miller and Russek procedure, the error correction (ECM-1) is not significant. However, the F-test statistic, measuring the joint significance of both past changes in income and the terms of trade on current changes in import are significant134. Therefore, past changes of relative prices and past changes of U.S. income Granger cause changes in the current volume of U.S. imports.

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134 Therefore, the findings are similar to the standard Granger causality test analysis (Miller and Russek, 1991, p. 15).

Table 3.6. Causality Test; Income and the Terms of Trade
Cause Imports, 1972-1992

	dlnM	t-value	F-value135	dlnM	t-value
dlnM(-1)	.040509	.305			
dlnM(-2)	-.046826	-.374			
dlnM(-3)	-.03115	-.247			
dlnM(-4)	.017972	.168			
dlnY(-1)	1.2743	3.184**		1.267	4.258**
dlnY(-2)	-.25532	-.596			
dlnY(-3)	.17672	.402			
dlnY(-4)	.037376	.089			
			2.6677**		
dlnTOT(-1)	.23542	1.426			
dlnTOT(-2)	-.024507	-.139			
dlnTOT(-3)	.12674	.749			
dlnTOT(-4)	.50118	2.841**		.52616	3.725**
			2.8**		
ECM(-1)	-.19593	-1.49		-.25891	-3.388**
CONSTANT	.0067994	1.604		.0057407	1.697
SE	.026589			.0255123	
DW	1.71			1.58	

** Significant at the 5 percent level.

The t- value of the error correction parameter, however, is insignificant. This result could be due to the over-parametization of the error correction process. As Table 3.6. indicates, most of the individual t-values of the lags of the terms of trade and income variable are not statistically significant. Therefore, as for the Bretton Woods period, we also apply Engle and Granger's

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135 The F-statistics are derived as follows:
$F=(N-k)[(ESS_R-ESS_{UR})]/[q(ESS_{UR})]$, where ESS_R and ESS_{UR} are the sums of squared residuals of the restricted and unrestricted regressions, and N, k, q is the number of observations, the number of estimated parameters of the unrestricted regression, and the number of parameter restrictions, respectively. See Pindyck and Rubinfeld (1991, p.216)

alternative error correction procedure for the post Bretton Woods era, keeping only the error correction term and the significant lags. The results, provided in the two r.h.s. columns of Table 3.6. demonstrate that the change of the first lag of income and the change of the forth lag of the terms of trade are clearly significant. Also, the error correction (ECM-1) now significantly enters the error correction process136.

This result demonstrates that past levels, as well as changes of income and relative prices impact on changes in current imports; i.e., these effects Granger cause imports during the 1972-1992 time period.

In essense, the results of this section of the study indicate that the elasticity parameters of the import demand functions derived in section 3.2., above, are not only based on a stable long term function, but, that equation (3.2.1.), according to the findings of this section has also been appropriately specified137.

3.6. THE BALANCE OF PAYMENTS CONDITION

Thirlwall's Law, as outlined in section 2.2. above, and explicitly expressed by equation (2.2.1.) is based on continuous nominal balance of payments equilibrium. Unfortunately, Thirlwall's Law does not provide a clear definition of what Thirlwall considers as a long term violation of this balance of payment constraint for

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136 The Durbin Watson statistics are somewhat lower for the post Bretton Woods era as compared to the Bretton Woods era.

137 The findings in this section, however, must, ceteris paribus, not lead to the conclusion that the implications of Thirlwall's Law are valid. See the discussion of chapter five, infra.

nations, which are plaqued by unemployment and underutilization of productive resources138. Previous empirical studies on Thirlwall's Law taking capital flow effects into account have not explicitly tested whether Thirlwall's long term balance of payments constraint may in fact be violated.139

According to Thirlwall's standard assumptions, the rate of growth of exports should equal the rate of growth of imports. In less strict terms this should imply that nominal exports and imports move along a common trend, so that one could at least be confident that any imbalances ranged within certain limits and did not explode. This in turn implies stationarity of the nominal trade balance.

Similar to the tests performed in sections 3.2., supra, the concept of cointegration provides a procedure for the evaluating the validity of these claims, although it needs to be emphasized that possible cointegration of exports and imports is a minimum requirement, and that the condition does not necessarily imply the non-existence of a sustained trade deficit or surplus.

In order to establish evidence, if the U.S. was in a balance of payments equilibrium situation, or, more accurately, if any potential nominal trade imbalances have been kept within a limited range, a level regression cointegration to test for a stable

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138 The constraint would be violated for supply constraint economies.

139 E.g. Atesoglu's (1993/4) study on Canada, which takes capital flows into accoùnt.

relationship between nominal exports and impo can to be applied. In addition, one would expect net nominal capital inflows to be stationary140, i.e., net nominal capital inflows to show at least relatively stable behaviour, if Thirlwall's balance of payments constraint is satisfied.

In accordance with the analyses of the previous sections of this study, the Bretton Woods era are ranges from 1950(1) through 1971(4); the post Bretton Woods era ranges from 1972(1) through 1992(2).

All quarterly data, seasonally adjusted at source, are taken from the Survey of Current Business. Nominal imports and exports of goods and services, are expressed as IM and EX; net nominal capital inflows (CIN), are defined as IM minus EX.

All variables were utilized in levels, and both the levels of nominal exports and imports were expressed in logarithm to obtain the unit roots test results presented in Table 3.7.

The DF/ADF results from Table 3.7. demonstrate that nominal exports (EX) and imports (IM) are both integrated of order one, i.e. they are I(1) in levels, but I(0) when first differenced. It is, therefore, appropriate to apply the cointegration technique to test, if the long term balance of payments process hypothesized by Thirlwall's Law is consistent with the data.

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140 In terms of the cointegration approach, capital flows should be trend reverting and not move too far off, if "shocked" in a certain direction.

Table 3.7. Unit Roots Test: The Balance of Payments, 1950-1971, 1972-1992

Variable	Level	First differenced
1950(1)-1971(4)		
CIN	-2.089(3)	-4.497(3)*
lnEX	-.9649(0)	-5.33(4)*
lnIM	-.5737(1)	-6.069(3)*
1972(1)-1992(2)		
CIN	-1.463(3)	-7.933(0)*
lnEX	-1.799(3)	-3.855(1)*
lnIM	-2.485(4)	-7.197(0)*

* Significant at the 1 percent level.
** Significant at the 5 percent level.
*** Significant at the 10 percent level.
Critical values are taken from Engle and Yoo (1987). Numbers in parentheses correspond to lags required to adjust for serial correlation.

Furthermore, net nomial capital inflows (CIN) are also found not to be stationary in levels, but I(0) when first differenced. This result indicates already that the balance of payments constraint may not apply for the U.S. economy during both exchange rate regimes.

The procedure to test the hypothesis of non cointegration between lnEX and lnIM is similar to the previous cointegration test performed above. Firstly, based on the result that the variables are integrated of order one, an OLS regression including a constant is run on both series in levels and the DF/ADF test is applied to test for possible stationarity of the estimated residuals u_t. If the two non-stationary variables are cointegrated, the residuals u_t of the level regression are stationary. The test is run both ways, because we make no specific assumption about causality between the

Table 3.8. Cointegration Test: The Balance of Payments, 1950-1971, 1972-1992

Cointegrating equation	slope coefficients lnIM	lnEX	D-W	R2	DF/ADF
1950(1)-1971(4)					
lnEX	.94656		.365	.961203	-2.449(4)
lnIM		1.0155	.360	.961203	-2.231(4)
1972(1)-1992(2)					
lnEX	.90425		.118	.968397	-1.923(1)
lnIM		1.0709	.118	.968397	-1.868(1)

* Significant at the 1 percent level.
** Significant at the 5 percent level.
*** Significant at the 10 percent level.
Critical values are taken from Engle and Yoo (1987). Numbers in parentheses correspond to lags required to adjust for serial correlation.

two series141. The results of the two cointegration regressions are provided in Table 3.8.

For the 1950-1971 period, as well as the 1972-1992 period, the values of the ADF test are clearly below the critical values (Engle and Yoo, 1987), so that the series of nominal imports and nominal exports do not move along a common trend. Put differently, the hypothesis of no cointegration between lnEM and lnIM cannot be rejected, irrespective of which way the regression is run, and regardless of the chosen time period142.

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141 A bivariate system requires the cointegration level regression results to either indicate no cointegration between the series, or cointegration in both directions.

142 The slope coefficients of the OLS level regressions given in Table 3.8. are close to unity. This appears to contradict with the claim that the series don't move along a common trend. However, since the series are not cointegrated, the slope coefficients should not be taken too seriously. Furthermore, although the cointegration procedure cannot test for this claim, a common trend between the series could still imply a persistent trade imbalance, as already mentioned above.

As described earlier, the unit roots test for net nomial capital inflows (CIN) were also found not to be stationary, which confirms the finding of nominal imports and exports not moving along a common trend.

In essense, according to the findings of the cointegration tests obtained in this chapter, the critical long run assumption of Thirlwall's Law, that the U.S. has been balance of payments constrained under either one of the two exchange rate regimes appears to be invalid. Consequently, it appears appropriate to integrate capital flows into the analysis.

3.7. THE IMPACT OF CAPITAL FLOWS

The purpose of this section is to provide evidence about the role of capital flows, while still relying on the elasticity estimates derived from the import demand function in section 3.4. In case of substantial capital flows, Thirlwall and Hussain (1982) claim that the equilibrium rate of growth may be extended to account for those flows143. With respect to capital flows, these initial suggestions have recently been further clarified for empirical purposes by McCombie and Thirlwall144.

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143 See section 2.6. Their article clearly focused on developing countries. More recently, Atesoglu indicated, that capital flows may be of significance for the U.S. economy.

144 In private conversation, refering to the rate of growth of capital flows, Thirlwall suggests to "take the change in capital flows over the whole period and divide by the number of years" (Fax from Thirlwall, November 1994.)

Refering to the extended Thirlwall's Law outlined in chapter two of this study, McCombie145 points out that the weighted growth of real financial flows, i.e. real net capital inflows (ci), can be expressed as:

(3.7.1.) $a*ci = a[(ci_{t1}-ci_{t0})]/ci_{t0}]$

where ci_{t1} and ci_{t0} are the average real rates of growth of capital inflows at the beginning and the end of a chosen time period and

(3.7.2.) $a = ci_{t0}/(x_{t0}+ci_{t0})$

is the share of inital real capital inflows, relative to the total real import bill. The total import bill is equal to the sum of the rate of growth of exports, x, and ci. As McCombie points out, equation (3.7.1) is formally identical to

(3.7.3.) $a*ci = (ci_{t1}-ci_{t0})/(x_{t0}+ci_{t0})$

The purpose of this study is to analyze Thirlwall's Law as proposed by its advocates, and we, therefore, adopt McCombie's approach of integrating capital inflows into the empircial analysis of this study146.

In accordance with our analyses of the last two sections, we integrate McCombie's procedure. Accordingly, if terms of trade changes and capital flows are now accounted for, the following two

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145 As expressed in private conversation (Fax from McCombie, November 1994)

146 As it is shown in section Table 5.6., infra, real net capital inflows are not stationary for the years 1950-1971 and 1972-1992, respectively. This indicates that the balance of payments constraint, expressed in real terms may not have been valid during these time periods.

equilibrium rates of growth can be derived in conjunction with the analysis by Thirlwall and Hussain147:

(3.7.4.) ybbb = [(1-a)x+(a)ci]/h

(3.7.5.) ybbbb = {[-g(1-a)](tot)+(tot)+(1-a)x+a(ci)} / h148

Equation (3.7.4.) integrates only the capital flows effects; equation (3.7.5.) accounts for both the impacts arising from capital flows and the terms of trade. The respective equilibrium growth rates are shown in Table 3.9.

The results demonstrate that incorporating ci into the analysis changes the findings significantly, as compared to the

Table 3.9. Equilibrium Growth Rates; Capital Flows, 1950-1971, 1972-1992

Variable	Actual Average Rate of growth (quarterly data annualized)	Equilibrium Rate of growth	
1950(1)-1971(4)		ybbbb	ybbb
y	.037404	.042848	.037776
x	.049192		
tot	.005344		
[-g(1-a)(tot)]/h	-.003046766		
(tot)/h	.00321663		
[(1-a)x]/h	.031331834		
[a(ci)]/h	.006444741		
1972(1)-1992(2)			
y	.024076	.027211	.024969
x	.0641		
tot	-.008492		
[-g(1-a)](tot)]/h	.002333223		
(tot)/h	-.0038768		
[(1-a)x]/h	.02485		
[a(ci)]/h	.00011930		

147 See chapter two, supra.
148 Thirlwall and Hussain (1982) do not derive such an equation. It does, however, follow from $y_b=[1-g](tot)+x]/h$ in section 3.4., above.

results derived in the previous sections of this chapter. Particularly the equilibrium rate, y_{bbb}, is now very close to the actual U.S. rate of growth of income for the Bretton Woods era. However, capital inflows appear not to have played a decisive role during the post Bretton Woods era as [a(ci)], the share of real net capital inflows times the rate of growth of real net capital inflows is almost negligible149.

3.8. INTERPRETATION

Contrary to previous studies in this area, the results of this chapter demonstrate that empirical tests of the long term hypotheses of Thirlwall's Law with respect to the U.S. economy, if based on the income elasticity of demand for imports, should be approached with the concept of cointegration. This is because the time series utilized for the import demand function were found to be I(1). This issue, however, has not been addressed in the previous literature.

In addition, the fact that no cointegration can be found for a specific chosen time period must not lead to the conclusion that the data series, being I(1) in levels, should, therefore, be differenced, as suggested by Bairam (1993a), because Thirlwall's Law refers to longer run hypotheses. The appropriate conclusion to be drawn, if the series are not cointegrated for a specific time period - as found in this chapter of this study with respect to

149 Although the share of capital inflows, a, has been positive, the rate of growth of capital inflows, ci, has been relatively insignificant during the years 1972 to 1992.

the whole post WW II era - is that that there is no evidence of a longer term secular relationship among the volume of U.S. imports, real domestic income and the terms of trade, i.e., no reliable stable elasticity parameters can be found for this time period. Differencing the data in such a case is questionable, because the variables are I(1), so that any results based on differenced data must be interpreted within a short term, transitory perspective. Such an approach, however, would violate the longer term focus of Thirlwall's Law. The Law does not emphasize on transitory effects; rather its hypotheses propose longer run, secular relationships. Therefore, the analyses of this chapter has refrained from reestimating non cointegrated level data series by utilizing first differenced data.

Atesoglu's (1993a) study on the validity of Thirlwall's Law for the U.S. economy has assumed a single, stable income elasticity of demand thoughout the 1955-1990 period. According to the evidence provided in this chapter, such a conclusion, however, may be questioned and is not supported by the findings of this thesis. The result by Atesoglu (p.511) may be due to his approach of utilizing first differenced data for estimating the import demand function.

According to the results presented in this chapter, the income demand elasticity has clearly not been stable throughout the post WW II period. Whereas the value of the income demand elasticity during the Bretton Woods era has been relatively low, its value rose significantly during the post Bretton Woods era.

This result, ceteris paribus, interpreted according to Thirlwall's Law expressed by the standard equation (2.2.9.), implies that the U.S., supposedly, had to lower its rate of growth of income during the 1972-1992 period, because of the long term requirement of the balance of payments constraint, although the impact of the declining income elasticity may have been partly offset by the relatively high rate of growth of export volume during the post Bretton Woods era. However, as the findings of section 3.3. have demonstrated, Thirlwall's equilibrium rates according to equation (2.2.9.) are at some variance with the actual U.S. growth experience particularly for the Bretton Woods era, so that the decline of the U.S. rate of growth of income during the post 1970's can hardly be explained by solely relying on Thirlwall's basic Law as expressed by equation (2.2.9.).

Integrating the terms of trade into the analysis is important for cointegration, and, therefore, for deriving stable parameter estimates of the import demand functions. However, the impact on the equilibrium growth rates appear rather limited.

Finally, incorporating capital flows improves the findings considerably for the Bretton Woods era. Consequently, it appears that the results of previous studies (Thirlwall 1979) which often underestimated the actual U.S. rate of income growth for the Bretton Woods era, may be due to the fact that this factor was previously neglected.

However, relative insignificance of net capital inflows on the equilibrium growth rate during the 1972-1992 period is somewhat surprising, given the fact that it was shown that the U.S. may not have been faced by a balance of payments constraint during this era, but ran relatively high trade deficits both in nominal and real terms, particularly during the 1980s. It appears, therefore, that the findings of this chapter based on Thirlwall's Law do not account for the considerable increase of net capital inflows during the early 1980's.

3.9. CONCLUSION

The analytical results of this chapter have been based upon the income demand elasticities derived from the long term import demand function. Although this procedure has been considered as the most reliable and, therefore, has been most widely used for empirical studies by Thirlwall's advocates, the empirical procedure pursued in previous studies of utilizing differenced data may have led to findings which are based on inappropriate estimation procedures.

According to the findings of this chapter, Thirlwall's Law, including its extended versions provides only a partial explanation for the long term rate of growth of income of the U.S. during the post WW II era.

4. THIRLWALL'S LAW BASED ON THE EXPORT DEMAND FUNCTION

4.1. INTRODUCTION

The purpose of this chapter is to comprehesively analyze the empirical validity of Thirlwall's Law based on the income elasticities derived from the export demand function for the post Bretton Woods era[149]. In doing so, the analyses of this chapter, as in the previous chapter, is strictly based on the indirect approach of estimating the validity of Thirlwall's Law. By utilizing the econometric technique of cointegration[150], this chapter, in contrast to previous studies in this area dealing with the U.S. economy, is based on an alternative econometric procedure, emphasizing on the long term propositions[151] expressed by Thirlwall's Law.

In the next section, the U.S. export demand functions for the flexible exchange rate period are estimated and the significance of the price term in deriving the income elasticities of demand is discussed. Based on these results, it is argued in section 4.3. that it appears appropriate to reestimate the export demand function for the 1972-1986 time period. The long term export and import demand functions[152], and Thirlwall's equilibrium growth rates for the 1972-1986 time period are determined in section four

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149 Due to data limitations. See section 4.2., infra.
150 The concept of cointegration is summarized in chapter two.
151 See, e.g., McCombie (1985, p.68), a major proponent of the model.
152 For comparison of the quantitative estimates, the U.S. import demand function is also reestimated for the years 1972 to 1986.

and section five of this chapter. The impact of the terms of trade on these equilibrium rates of growth is further analyzed in section six. The seventh section focuses on whether domestic income and relative prices in fact determine the volume of exports and the volume of imports, as it is implicitly assumed by Thirlwall Law. Section eight analyses the validity of the balance of payments assumption and the impact of capital flows on Thirlwall's equilibrium growth rates. Some interpretations of the results and conclusions are drawn in sections nine and ten of this chapter.

4.2. THE EXPORT DEMAND FUNCTION

It has been argued in the literature that estimates based on the export demand function may provide a more accurate estimate for testing the appropriateness of Thirlwall's Law (Williamson, 1994)153.

To estimate the U.S. export demand function, the first task is to derive a proxy for real foreign income. Because no foreign income estimate is available on a quarterly basis for the Bretton Woods period, our analysis is restricted to the 1972(1)-1992(2) post Bretton Woods era.

An index of the level of foreign income (Y^*) is derived from data of the six major industrialized countries, Japan, Italy, United Kingdom, Canada, France, and Germany. It represents a weighted average of the six GDP volume indices, the weights representing the 1985 export shares of the six countries. The

153 See chapter two, section 2.4.

volume data are taken from OECD Quarterly National Accounts; trade weights are taken from Monthly Statistics of Trade. Choosing this proxy account for the relative importance of a country as a U.S. trading partner. Previous studies in this area have relied on similar data sets[154].

The volumes of U.S exports of goods and services (X), and the terms of trade (TOT)[155] are obtained from the Survey of Current Business. All data, except relative prices, are seasonally adjusted at source.

The cointegration technique is again utilized for determining the long term export demand function. To determine the level of integration of the three data series, unit roots tests are performed on the levels of each series, expressed in logarithms. The results of these tests are provided in Table 4.1.

In essense, the findings demonstrate that the levels of U.S. export volume, the foreign income proxy, and the terms of trade[156] are all integrated of order one in levels, but all stationary when first differenced.

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154 Rose and Yellen (1986, p. 58), and Borkakoti (1992) also utilized data from the Group of Seven. Weights based on export shares have also been applied in the previous literature; e.g., (Borkakoti, 1992).

155 As stated in chapter three, supra, in the case of Thirlwall's Law, we need to utilize identical data for both the export and import demand function. Therefore, the terms of trade are defined in the same way and taken from the same data source, as outlined in section 3.2.

156 The ADF-test value for the terms of trade is identical to the one derived shown in Table 3.1. For a discussion of the implications of this finding, see section 3.2., supra.

Table 4.1. Unit Roots Test: The Export Function, 1972-1992

Variable	Level	First differenced
1972(1)-1992		
lnX	-.9622(1)	-7.938(0)*
lnY*	-.2831(4)	-5.183(3)*
lnTOT	-2.783(1)***	-6.673(0)*

* Significant at the 1 percent level.
** Significant at the 5 percent level.
*** Significant at the 10 percent level.
Critical values are taken from Engle and Yoo (1987). Numbers in parentheses correspond to lags required to adjust for serial correlation.

As the next step, it needs to be established if the series are cointegrated, i.e., if a secular relationship among the variables in form of an export demand function can be established. Hereby, similar to the approach taken in section 3.2., above, two export demand functions are estimated; the first one incorporating all three data series the second excluding relative prices157.

The first export demand function in levels and using natural logarithms158, may be expressed as:

(4.2.1.) $\ln X = a + v \ln(TOT) + w \ln Y^*$

where X, Y^*, and ToT are real U.S. exports of goods and services, real foreign income, and the real terms of trade, respectively. v is the price elasticity for exports, and w is the income demand elasticity for exports.

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157 In order to assess the claim that relative prices may be excluded from the export equation. See McGregor and Swales (1991), and the discussion in section 2.4, above.
158 See Bairam (1993a) for the only example of cointegration.

Table 4.2. Cointegration Test: The Export Function, 1972-1992

Cointegrating equation	slope coefficients lnY*	lnTOT	D-W	R2	DF/ADF
1972(1)-1992(2)					
lnX	1.6436		.0876	.919492	-1.669(3)
lnX	1.5979	-.61047	.111	.937911	-.8814(3)

* Significant at the 1 percent level.
** Significant at the 5 percent level.
*** Significant at the 10 percent level.
Critical values are taken from Engle and Yoo (1987). Numbers in parentheses correspond to lags required to adjust for serial correlation.

In order to evaluate the impact of relative prices, the second level export demand function is alternatively stated, in terms of logarithms as:

(4.2.2.) $\ln X = a + w \ln Y^*$

where the variables are defined as in equation (4.2.1.).

Because all the data series are integrated of order one, OLS level regressions are performed on equation (4.2.1.) and equation (4.2.2.), and the DF/ADF test is applied to test for possible stationarity of the residuals of each estimated regression. If the I(1) variables utilized in each regression are cointegrated, the residuals of the level regression are stationary.

The results of the cointegration tests, presented in Table 4.2. show that, although the estimated parameters for the two regression equations appear to have plausible values, the t-statistics of the ADF tests are clearly below the critical values. In other words, for the flexible exchange rate era, irrespective of

whether the U.S. export demand function is estimated according to equation (4.2.1.) or equation (4.2.2.), there is no tendency for the data series to move along a common trend. Therefore, the hypothesis of no cointegration cannot be rejected for either one of the two function. Consequently, no evidence for a stable long term U.S. export demand function for the 1972-1992 post Bretton Woods era can be found.

Due to these findings, the equilibrium growth rate according to equation (2.2.8) cannot be derived; neither is it possible to analyze the impact of potential relative price changes on the equilibrium growth rate159.

One possible procedure to derive some conclusions with respect to these issues would be to difference all data series and reestimate some export demand functions based on these revised series160. However, doing so may lead to a loss of long run information which are critical to Thirlwall's hypotheses, and utilizing first differenced data would emphasize the short term effects of the export demand function. This issue appears to be particularly important in the context of this study, because short

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159 I.e., none of the tests similar to the one performed in sections 3.3 and 3.4. with respect to the import demand function can be performed. Furthermore, because the export demand function for the post Bretton Woods era is not cointegrated, we are also not in a position to assess Thirlwall's hypothesis, that the Marshall-Lerner condition might just be fulfilled, i.e., that the sum of the respective price elasticities are not significantly larger or smaller than one for this period.

160 This has been the suggestion by Bairam (1993a).

term relative price effects are generally considered as being significantly lower than long term price elasticities[161].

Although there is no indication that the export demand function has been stable over the whole range of the flexible exchange rate era, it can not be concluded, necessarily, that no stable long run export demand function could be found by restricting the time period under consideration. This appears reasonable, taking into account that Krugman and Baldwin (1987) have pointed out that, particularly during the earlier 1980s, export demand elasticities have been considerably unstable.

Therefore we reassess the data in order to determine, if structural breaks occured during the post Bretton Woods era. If so, these breaks destroy the long run nexus among foreign income, relative prices and the volume of exports. This will be the task of the following section.

4.3. TEST FOR STABILITY OF THE EXPORT DEMAND FUNCTION

The analysis concerning the export demand function, so far, has shown inconclusive results regarding Thirlwall's Law. The year 1987, however, was one with substantial structural changes for the U.S. economy. Capital inflows into the U.S. declined considerably. Furthermore, the 1986 tax reform act came into effect (Sinn, 1988). In addition, the U.S. budget deficits, as a per cent of GDP

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161 See Goldstein and Khan (1985, p. 1077). This phenomenon may be a reason why previous studies on Thirlwall's Law utilizing first differenced data have found relative prices to be relatively insignificant.

declined significantly[162]. Therefore, taking all these aspects into account, it does not appear unreasonable to expect possible parameter shifts around the year 1987.

Kennedy (1992, p. 108) suggests utilizing a Chow-test to evaluate the stability of the parameter estimates of any single regression. One of the procedures of doing so would be to subdivide the time series (Kennedy, 1992, p. 108). However, in the present context, there are no sufficient observations for doing so within the framework of cointegration[163]. Therefore, an alternative test, suggested by Kennedy (p. 98), is applied[164] by evaluating the parameter stability of the export demand function with recursive parameter estimations, using a one-step forecast procedure. The sample size is 1972(1)-1986(4), less 12 forecasts.

According to the procedure, the regression is fitted with the initial sample values of the time series and it is subsequently tested, if the estimated parameters also explain the data in the forecast period. This procedure is repeatedly applied for each forecast period. The hypothesis is that there exists no structural change for the parameters between the sample period and the

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162 Furthermore, this chosen time period would also allow a closer comparison with previous studies considering the validity of Thirlwall's Law; e.g., Bairam (1988).

163 Only 22 quarterly data points are potentially available for estimation purposes concerning the 1987(1)-1992(2) period. This amount is clearly insufficient for deriving an OLS level regression and testing for stationary residuals in the context of cointegration analysis.

164 A similar procedure is suggested by Goldstein and Khan (1985, p. 1074).

Table 4.3. Chow Test for Parameter Stability, 1972-1986

Date	Actual	Forecast	Forecast SE	t-value
1984(1)	5.69709	5.70760	.0414336	-.253580
1984(2)	5.71670	5.71496	.0420931	.041235
1984(3)	5.73075	5.71369	.0429028	.397675
1984(4)	5.74556	5.72459	.0433263	.484129
1985(1)	5.73947	5.71530	.0447782	.539816
1985(2)	5.73593	5.73319	.0448680	.060953
1985(3)	5.71801	5.74783	.0450555	-.661841
1985(4)	5.74300	5.78345	.0448036	-.902682
1986(1)	5.77113	5.79288	.0445120	-.488556
1986(2)	5.78043	5.78556	.0457718	-.112038
1986(3)	5.80091	5.79732	.0457829	.078292
1986(4)	5.83744	5.80370	.0458841	.735380

Chow F(12,45) = .32494 [.9807]

forecast period; i.e., the parameters derived for the sample period can explain the data of the forecast periods. According to the hypothesis, therefore, a high Chow-F-test value leads to a refutation of the hypothesis.

The test is performed for the export demand function which includes the terms of trade165 and the results are given in Table 4.3.

The Chow test result demonstrates that the hypothesis of parameter constancy cannot be rejected. Therefore, the forecast values of the logarithm of exports are well within the acceptable range so that no parameter break has occured within this chosen time period. In other words, the parameters of the export demand function (4.2.1.) derived from the sample period are also

165 Most studies on Thirlwall's Law integrate an income and a price variable into the function. See also McCombie's argument (1992) discussed in section 2.4.

appropriate for explaining the movement of the data series during the forecast period.

In comparison, the same export demand function is again estimated from 1972(1) to 1989(4), less 12 forecasts and the results are given in Table 4.4.

The Chow-test statistic now clearly shows that the parameter constancy breaks down. I.e., the parameter values of real foreign income and the terms of trade of the sample period are inappropriate for explaining the export data series during the forecast period.

Therefore, we may conclude that there was, in fact, a significant change in the parameters associated with U.S. exports in the year 1987.

Table 4.4. Chow Test for Parameter Stability, 1972-1989

Date	Actual	Forecast	Forecast SE	t-value
1987(1)	5.83510	5.83159	.0365575	.096184
1987(2)	5.87633	5.85392	.0365870	.612572
1987(3)	5.91755	5.88117	.0367214	.990787
1987(4)	5.95610	5.89808	.0368632	1.57382
1988(1)	6.00906	5.91292	.0369915	2.59907
1988(2)	6.03357	5.92234	.0371432	2.99451
1988(3)	6.04997	5.91615	.0373826	3.57959
1988(4)	6.08268	5.93560	.0374250	4.45641
1989(1)	6.11920	5.95205	.0375072	5.28410
1989(2)	6.15698	5.95882	.0375010	5.36174
1989(3)	6.15888	5.95676	.0376974	5.79695
1989(4)	6.18970	5.97111	.0377072	5.79695

Chow F(12, 57) = 7.7.881[.00000]

4.4. THE 1972-1986 ERA: THE EXPORT DEMAND FUNCTION AND A COMPARISON WITH THE IMPORT DEMAND FUNCTION

The cointegration technique is applied to determine if in fact a long term structurally stable export demand function for the 1972-1986 period may be derived. In addition, we also reestimate the import demand function for the same chosen time period, to provide quantitative measures for comparisons and interpretations of the findings with respect to Thirlwall's Law.

As the first step, unit roots tests for the 1972-1986 period are performed on the levels of each data series[166], expressed in logarithms. The results of these tests are provided in Table 4.5.

Table 4.5. Unit Roots Test: The Export and Import Functions, 1972-1986

Variable	Level	First differenced
1972(1)-1986(4)		
lnY	-.3894(1)	-5.368(0)*
lnY*	+.3805(4)	-5(3)*
lnX	-.9622(0)	-6.839(0)*
lnM	-.1308(1)	-6.176(0)*
lnTOT	-2.325(1)	-5.264(0)*

* Significant at the 1 percent level.
** Significant at the 5 percent level.
*** Significant at the 10 percent level.
Critical values are taken from Engle and Yoo (1987). Numbers in parentheses correspond to lags required to adjust for serial correlation.

166 Data for the unit roots tests are taken from the same sources and are defined in the same way as discussed in sections 3.2. and 4.2. of this study.

The findings demonstrate that the series of the levels of U.S. export and import volumes, the foreign income proxy, domestic income, and the terms of trade are all integrated of order one; futhermore, all series are stationary, i.e. I(0), when first differenced.

Because all the data series are integrated of order one, OLS level regressions are performed on two export demand functions and two import demand functions, according to equations (4.2.1.) and (4.2.2.), and equations (3.2.1.) and (3.2.2.), respectively[167]. Subsequently, DF/ADF tests are applied to test for possible stationarity of the estimated residuals of each of the four level regressions.

Table 4.6. Cointegration Test: The Export and Import Functions, 1972-1986

Cointegrating equation	slope coefficients lnY	lnY*	lnTOT	D-W	R2	DF/ADF
1972(1)-1986(4)						
lnM=	2.2391			.207	.920629	-2.36(0)
lnM=	2.3868		.73839	.806	.97352	-4.721(2)**
lnX=		1.3384		.139	.839254	-2.606(3)
lnX=		1.1551	-.8555	.682	.963799	-4.091(4)***

* Significant at the 1 percent level.
** Significant at the 5 percent level.
*** Significant at the 10 percent level.
Critical values are taken from Engle and Yoo (1987). Numbers in parentheses correspond to lags required to adjust for serial correlation.

167 The bivariate demand functions excluding the terms of trade are again incorporated into the analysis for comparative purposes.

The results of the tests provided in Table 4.6. show that the terms of trade are significant and need to be integrated into each of the cointegration equations in order to achieve stationarity of the residuals of the OLS level regressions. The stationarity of the residuals is reflected by the DF/ADF statistics which demonstrate that including the terms of trade according to equation (3.2.1.) and (4.2.1.) improves these values significantly. In other words, for these two level equations ranging from 1972 to 1986 period, the DF/ADF statistics reject the null hypothesis of no cointegration at the 10% level for the export demand function and at the 5% level for the import demand function. As an additional indicator for the validity of this result, Table 4.6. shows that the Durbin-Watson statistics also rises considerably when the term of trade are included, as compared to the two OLS estimates based on equation (3.2.2.) and (4.2.2.), respectively[168].

Including the terms of trade variable into the cointegrating regression according to equation (3.2.1.) leads to an increase of the income demand elasticity, compared to the non cointegrated bivariate import function estimate. In the case of the export demand function, the opposite effect occurs[169].

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168 The overall fit for the two regressions based on the trivariate data series also improves significantly and R^2 reaches values clearly above .95.

169 As indicated previously, these comparisons should not be overemphasized, because the null hypothesis of no cointegration cannot be rejected for the bivariate demand equations. Nevertheless, it indicates the importance of specifying the long term structural relationships correctly.

Consequently, according to our cointegration results, not including the price term into the respective demand equations as suggested in previous studies (Bairam, 1988, 1993a; Atesoglu 1993a) may lead to considerable bias of the actual parameter values, and more important, it also implies an incorrect, unstable model specification.

The absolute values of the import and export price elasticities for the 1972-1986 time period are .73839 and .8555, respectively. The sum of these elasticities, stated in absolute terms, is 1.59389. Therefore, the Marshall-Lerner condition appears not to conform with the strict hypothesis implied by Thirlwall's Law (1979). Consequently, terms of trade changes may not only affect the volumes of exports and imports, but also the trade balance as a whole. On the other hand, it appears that relative prices would need to change dramatically, in order to achieve significant effects on the U.S. balance of payments.

In essense, although we cannot deny that terms of trade effects have some impact on the U.S. balance of payments, their effect appears to be relatively limited on the balance of payments during the 1972-1986 period.

Table 4.6. also provides evidence that the U.S. income demand elasticity for imports was about twice as high during the years 1972-1986 as the income demand elasticity for U.S. exports. According to Thirlwall's Law (McCombie 1989, Davidson, 1990/1), this finding, ceteris paribus, would indicate the inability on part

of the U.S. to grow at a rate as high as its trading partners without negatively affecting its balance of payments performance.

4.5. THIRLWALL'S EQUILIBIRUM GROWTH RATES

The results in Table 4.6. have demonstrated that both the import and export demand functions are cointegrated over the 1972-1986 period when the terms of trade are included in the regression equations. Table 4.7. gives the respective annual U.S. equilibrium growth rates which can now be derived according to equations (2.2.8.) and (2.2.9.)[170].

In Table 4.7., the two r.h.s. colums give the U.S. equilibrium rate of growth while the data column to the left gives the value of the actual average growth rate of U.S. (y) and foreign income (y^*), and the actual average rate of growth of real exports of goods and services (x).

Table 4.7. Equilibrium Growth Rates; The Export and Import Functions, 1972-1986

Variable	Actual Average Rate of growth (quarterly data annualized)	Equilibrium Rates of growth (y_b)	
1972(1)-1986(4)		x/h	wy^*/h
y	.02624	.02283392	.015056759
y^*	.031112		
x	.0545		

170 Hereby, the equilibrium rates of growth (y_b), utilize the values for h and w from Table 4.6., based on the two cointegrated demand functions.

The results show that during the 1972-1986 time period, y lies considerably above the equilibrium growth rate x/h171. With respect to the equilibrium rate derived from the export demand function, the difference between y and wy^*/h is even more striking, and the U.S. income actually rose considerably more than suggested by Thirlwall's equilibrium rate.

Based on the results of Table 4.7., it appears that with respect to Thirlwall's Law, the actual U.S. rate of growth forced the U.S. into a balance of payments constraint position.

Based on the estimates of the cointegrated import and export demand functions derived in the previous section, we now apply Atesoglu's approach172 to the 1972-1986 era. The data is provided in Appendix 4.1 and 4.2., respectively. The regression results are as follows:

(4.5.1.) $y = .026822 - .23499\ y_b$

$(10.342)\quad (-1.457)\qquad R^2 = .100442$

(4.5.2.) $y = -.0084321 + 2.3497\ y_b$

$(-1.07)\quad (4.04)\qquad R^2 = .462117$

where the first regression reflect the results derived from equation (2.2.9.), and the latter the findings from equation (2.2.8.).

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171 This result does not confirm the finding derived in section 3.3. of the previous chapter of this study concerning the years 1972-1992.

172 See section 3.3., supra. The data series for the equilibrium rates of growth of the export function are based on equation (2.2.8.)

The results from the import demand function are not supportive of Thirlwall's Law since the slope coefficient indicates a negative relationship between U.S. actual income growth and the estimated U.S. equilibrium growth rate. The findings based on the export demand function are considerably better, however. The constant is close to zero, although not statistically significant, and the slope coefficient is positive and highly significant. In addition, R^2 is equal to .46, a value of considerable magnitute[173]. Nevertheless, a one to one relationship between U.S. income and the equilibrium growth rate cannot be confirmed.

4.6. THE IMPACT OF THE TERMS OF TRADE

Similar to the analysis in chapter three, we now integrate the terms of trade effects in deriving estimates for the equilibrium growth rates based on the export and import demand functions for the years 1972-1986. The two respective equations[174] can be stated as

(4.6.1.) $y_{bb} = [(1-g)tot + x] / h$

(4.6.2.) $y_{bb} = [(v-g)tot + tot + wy^*] / h$

The annual rate of growth of the terms of trade during the 1972-1986 period[175] showed a decline of .010368. The absolute

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173 The fit is better than the previous result in chapter three.

174 Concerning the derivation of equation (4.6.1.) and equation (4.6.2.), see comments section 3.4., supra.

175 It may surprise that the average decline has been higher during the 1972-1986 period as compared to the 1972-1992 period. However, although nominal exchange rates declined considerably after 1986, the terms of trade remained relatively stable, so that on average the overall annual decline during the 1972-1992 era are lower.

Table 4.8. Equilibrium Growth Rates; The Terms of Trade, 1972-1986

Variable	Actual Average Rate of growth (quarterly data annualized)	Equilibrium Rates of growth (y_{bb})
1972(1)-1986(4)	[(1-g)tot+x]/h	[(1+v-g)tot+wy*]/h
y	.02624	.022220649	.017579024
y*	.031112		
x	.0545		
tot	-.0101368		

values for the respective price elasticities for imports and exports during this period are .8555 and .73839, respectively. The results are provided in Table 4.8.

Compared to the findings of the previous section, the results demonstrate an improvement in that the gap between the equilibrium rate of growth and the actual growth rate derived from the export demand function narrows. Still, however, the U.S. rate of growth based on both equation (4.6.1.) and (4.6.2.) was considerable above the one predicted by Thirlwall's Law.

Applying Atesoglu's approach for the 1972-1986 era, the regression results are as follows:

(4.6.3.) $y = .026165 - .19577\ y_{bb}$

(9.264) (-1.08) $R^2 = .0578017$

(4.6.4.) $y = .03387 - .70923\ y_{bb}$

(7.0923) (-2.49) $R^2 = .246049$

where the first regression reflects the results derived from the import demand function, and the latter the findings from the export demand function. The data is provided in Appendix 4.1. and 4.2.

In both cases these findings do not support Thirlwall's Law. Furthermore, the findings indicate a negative, although in one case not significant relationship between y and y_{bb}. In essense, including the terms of trade effect and applying Atesoglu's procedure does not provide evidence of the validity of Thirlwall's Law.

4.7. CAUSALITY TEST: THE EXPORT AND IMPORT FUNCTION

As in section 3.5., supra, two Granger causality tests are performed on the cointegrated import and export equations. The results for the import demand function during the 1972-1986 time period are given in Table 4.9.

Based on the Miller and Russek approach, the error correction term shown in Table 4.9. is negative, but statistically insignificant. In addition, the joint significance tests based on the F-statistics for changes of income and changes the terms of trade provide no evidence of Granger causality.

Deleting the insignificant lag entries, due to potential overparametization in accordance with the Engle and Granger test procedure, the results given in the two r.h.s. colums of Table 4.9. now indicate that both the error term and the first lag of the change of income impact on the current change of the volume of imports. Accordingly, income and relative prices Granger cause imports over the years 1972-1986.

Table 4.9. Causality Test; Income and the Terms of Trade Cause Imports, 1972-1986

	dlnM	t-value	F-value176	dlnM	t-value
dlnM(-1)	.09449	.527			
dlnM(-2)	.0036944	.023			
dlnM(-3)	.012197	.077			
dlnM(-4)	.016542	.125			
dlnY(-1)	1.0785	2.063**		1.3912	3.829**
dlnY(-2)	-.34159	-.642			
dlnY(-3)	.21787	.402			
dlnY(-4)	.083021	.161			
			1.314		
dlnTOT(-1)	.10182	.471			
dlnTOT(-2)	-.10676	-.45			
dlnTOT(-3)	.085696	.385			
dlnTOT(-4)	.41124	1.722			
			1.051		
ECM(-1)	-.35779	-1.728		-.38903	-3.927**
CONSTANT	.0053211	.921		.0034993	.781
SE	.0300518			.0293838	
DW	1.7			1.58	

** Significant at the 5 percent level.

Based on these tests, although the overall results are somewhat ambiguous, there appears to be at least no strong evidence that imports may not be determined by income and relative prices.

The findings of the two Granger causality tests with respect to the export demand function177 for the 1972-1986 time period are provided in Table 4.10.

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176 The F-statistics are derived as follows:
$F=(N-k)[(ESS_R-ESS_{UR})]/[q(ESS_{UR})]$, where ESS_R and ESS_{UR} are the sums of squared residuals of the restricted and unrestricted regressions, and N, k, q is the number of observations, the number of estimated parameters of the unrestricted regression, and the number of parameter restrictions, respectively. See Pindyck and Rubinfeld (1991, p.216)

177 The test procedures are the same as above. Of course, the variables of the regression equation (3.5.1.) are altered. Instead

Table 4.10. Causality Test; Foreign Income and the Terms of Trade Cause Exports, 1972-1986

	dlnX	t-value	F-value178	dlnX	t-value
dlnX(-1)	.25722	1.433			
dlnX(-2)	.038724	.224			
dlnX(-3)	.21561	1.372			
dlnX(-4)	.30497	2.013*		.19234	1.829
dlnY*(-1)	.84443	1.2454			
dlnY*(-2)	.65953	.961			
dlnY*(-3)	-.92001	-1.441			
dlnY*(-4)	.63822	1.071			
			1.769		
dlnTOT(-1)	.021311	.13			
dlnTOT(-2)	.043024	.234			
dlnTOT(-3)	.12178	.694			
dlnTOT(-4)	.0393	.225			
			.147		
ECM(-1)	-.44891	-2.775**		-.32645	-2.952**
CONSTANT	-.0072518	-1.04		.0095228	2.567**
SE	.0224106			.0272064	
DW	2.1			1.26	

** Significant at the 5 percent level.

The causality test results based on the dynamic model specification of Miller and Russek show that the error corrections terms significantly impacts on the current changes of exports. Consequently, the current change of the volume of exports is partly

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of the domestic income and imports variables, first differences of the logarithms of real foreign income (y^*) and the volume of U.S. exports are utilized.

178 The F-statistics are derived as follows:
$F=(N-k)[(ESS_R-ESS_{UR})]/[q(ESS_{UR})]$, where ESS_R and ESS_{UR} are the sums of squared residuals of the restricted and unrestricted regressions, and N, k, q is the number of observations, the number of estimated parameters of the unrestricted regression, and the number of parameter restrictions, respectively. See Pindyck and Rubinfeld (1991, p.216)

resulting from foreign income and the terms of trade matching the trend movement of the volume of exports, as reflected by the error correction term of the cointegrated variables[179]. The F-statistics are not significant, however, indicating no further causal link between lagged changes in relative prices or foreign income on current changes of exports.

Again deleting the insignificant lag entries according to Engle and Granger, the error term, ECM-1 becomes significantly negative. The Durbin-Watson statistic, however, declines considerably compared to the Miller and Russek approach, indicating that the latter approach might be the more appropriate procedure. Overall, there appears to be evidence of a causal relationship, so that the hypothesized export demand function is correctly specified.

4.8. THE BALANCE OF PAYMENTS, AND THE IMPACT OF CAPITAL FLOWS

As outlined in section 3.6., supra, the integration of capital flows into the analysis should be preceded by a test which indicates the validity of the balance of payments constraint, as stated in its simple form by equation (2.2.1.). If no evidence for the balance of payments constraint can be found, net capital inflows may significantly impact on the equilibrium growth rate and should, therefore, be integrated into the empirical analysis[180].

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179 For interpretations of the impact of the ECM term within a dynamic specification, see Miller and Russek (1991, p. 15).
180 As outlined in section 3.6., with respect to the U.S., no study related to Thirlwall's Law has taken this issue into account.

Table 4.11. Unit Roots Test: The Balance of Payments, 1972-1986

Variable	Level	First differenced
1972(1)-1986(4)		
CIN	+.4764(0)	-5.109(0)*
lnEX	-2.396(3)	-5.184(0)*
lnIM	-1.962(1)	-6.082(0)*

* Significant at the 1 percent level.
** Significant at the 5 percent level.
*** Significant at the 10 percent level.
Critical values are taken from Engle and Yoo (1987). Numbers in parentheses correspond to lags required to adjust for serial correlation.

In order to establish evidence, if the U.S. was in a balance of payments equilibrium situation during the 1972-1986 period, or, more accurately, if potential trade imbalances were kept within a limited range, the same test procedure as outlined in section 3.6., above, is applied.

All quarterly data, seasonally adjusted at source, are taken from the Survey of Current Business and are defined as in section 3.6., supra.

The results of the unit roots tests presented in Table 4.11. demonstrate that net nominal capital inflows (CIN) are integrated of order one, but stationary when first differenced. This finding indicates that the balance of payments constraint may not be valid for the U.S. economy during the years of 1972 to 1986.

Table 4.11 also shows nominal imports and exports of goods and services, (IM) and (EX), both to be integrated of order one, i.e. I(1) in levels, but I(0) when first differenced. It is, therefore, appropriate to apply to technique of cointegration to establish

Table 4.12. Cointegration Test: The Balance of Payments, 1972-1986

Cointegrating equation	slope coefficients lnIM	lnEX	D-W	R2	DF/ADF
1972(1)-1986(4)					
lnEX	.84902		.158	.960735	-2.309(3)
lnIM		1.1316	.158	.960735	-1.977(1)

* Significant at the 1 percent level.
** Significant at the 5 percent level.
*** Significant at the 10 percent level.
Critical values are taken from Engle and Yoo (1987). Numbers in parentheses correspond to lags required to adjust for serial correlation.

further evidence whether the long term balance of payments process hypothesized by Thirlwall's Law is consistent with the data.

The results shown in Table 4.12. demonstrate that, irrespective of which way the OLS level regression is run, the DF/ADF test results are significantly below the critical values. Accordingly the two series, lnIM and lnEX, may in fact not have moved along a common trend during the 1972-1986 time period. Consequently, Thirlwall's balance of payments constraint may not be applicable to the U.S. during these years.

It is, therefore, appropriate to integrate capital flow effects into the analysis. Based on McCombie's and Thirlwall's suggestions, outlined in section 3.6., supra, and in conjunction with Thirlwall and Hussain (1982), we derive four alternative equilibrium growth rates

(4.8.1.) $y_{bbb1} = [(1-a)x + a(ci)] / h$

(4.8.2.) $y_{bbb2} = \{[-g(1-a)](tot)+(tot)+(1-a)x+a(ci)\} / h$

Table 4.13. Equilibrium Growth Rates; Capital Flows, 1972-1986

Variable	Actual Average Rate of growth (quarterly data annualized)	Equilibrium Rates of growth	
1972(1)-1986(4)		y_{bbb1}	y_{bbb2}
y	.02624	.03030	.28409
x	.0545		
tot	-.0101368		
[-g(1-a)(tot)]/h	.00235		
(tot)/h	-.004247		
[(1-a)x]/h	.0171345		
[a(ci)]/h	.013172		
1972(1)-1986(4)		y_{bbb3}	y_{bbb4}
y	.02624	.026152	.025303
y^*	.031112		
x	.0545		
tot	-.0101368		
{[(1-a)v-g](tot)/h	-.0050796		
(tot)/h	-.004247		
[(1-a)wy^*]/h	.011298		
[a(ci)]/h	.013172		

(4.8.3.) $y_{bbb3} = [(1-a)wy^* + a(ci)] / h$

(4.8.4.) $y_{bbb4} = \{[(1-a)(v-g)](tot)+(tot)+(1-a)wy^*+a(ci)]\}/h$

Equations (4.8.1) and (4.8.2.) are based on estimates from the import demand function of section 4.4., and equations (4.8.3.) and (4.8.4.) are based on the export demand function derived in section 4.4.

The empirical results are presented in Table 4.13.

The results clearly show that when capital inflows are integrated into the analysis, the actual U.S. rate of growth during the 1972-1986 period is well approximated by these four equilibrium growth rates. Obviously, according to Thirlwall's extended Law,

real net capital inflows allowed the U.S. to grow faster than approximated by the basic Thirlwall Law which does not take capital flows into account. The findings of Table 4.13. also appear to indicate that the equilibrium growth rates derived from equation (4.8.2.) and equation (4.8.4.), i.e., the equations which account for both the terms of trade and capital inflow effect give somewhat closer approximations of the actual U.S. rate of growth, y, as compared to the equilibrium growth estimates derived from equation (4.8.1.) and equation (4.8.3.).

4.9. INTERPRETATION

This chapter has focused on the post Bretton Woods era. As in chapter three, the empirical findings, contrary to previous studies demonstrate that the long term hypotheses of Thirlwall's Law when based on estimates of the U.S. export demand function should also be approached with the concept of cointegration. This is because the time series utilized for estimating the elasticity parameters of the export demand function were found to be I(1).

However, no evidence was found that would indicate that the data series utilized to measure an export demand function are cointegrated for the 1972-1992 post Bretton Woods era. This result, however, must not lead to the conclusion that the data, being I(1) in levels[182], should, therefore, be differenced, as it has been suggested by Bairam (1993a).

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182 As outlined in the last chapter, as well as in section 2.8., differencing the data in such a case is questionable, and any results based on differenced data must be interpreted within a

The appropriate conclusion drawn in this chapter is that if the series are not cointegrated for a specific time period then there is no evidence of a longer term secular relationship among the volume of U.S. exports, real foreign income and the terms of trade. Therefore, no reliable long term demand elasticity parameters may be estimated.

Consequently, the export demand function was tested for possible break points, and it was found that a stable export demand function can be derived for the 1972-1986 period. Subsequently, the import demand function was also found to be cointegrated for the 1972-1986 time period.

Based on these estimates, the Marshall-Lerner condition appears to be above unity so that terms of trade changes may not only affect the volumes of exports and imports, but also the trade balance as a whole. This finding appears at variance with the results of McCombie's (1989) study. The finding is also in contrast to previous research by Bairam (1988) and Atesoglu (1993a) who found relative prices to be relatively significant. However, Bairam and Atesoglu utilized first differenced data which accounts primarily for short run effects.

With regard to the relative income demand elasticities during the 1972-1986 period, dividing 2.3868 by 1.1551, the ratio is equal to 2.0663. Therefore, ceteris paribus[183], to prevent the U.S.

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short term, transitory perspective. Such an approach, however, would violate the longer term focus of Thirlwall's Law.

183 Excluding substitution effects.

balance of payments on goods and services from moving into a secular deficit position, the rate of growth of income of the U.S. trading partners had to be approximately twice as high as the U.S. rate of growth of income. However, as shown in Table 4.13, this has not been the case for the 1972-1986 era.

Contrary to the somewhat preliminary and ambiguous results of the previous chapter of this study, the findings of this chapter now appear to provide an explanation for the secular decline of the U.S. trade balance, particularly during the 1972-1986 period, taking into account that the U.S. has not been balance of payments constraint during the post Bretton Woods era.

As stated in the previous chapter, net real capital inflows (CI) appear not to have played a significant role significant during the 1972-1992 time period. However, because Thirlwall's model is based on average rates, the average rate of real net capital inflows for the years 1972-1992 may not capture the significant U.S. trade deficit position which occured particularly in the early 1980's. Real net capital inflows during the post Bretton Woods era starting from $ 61.2 billion in 1972 declined to $ 52.7 billion in 1992, the last year considered in this study. Within that time period, however, U.S. net real capital inflows reached record highs184. In 1986, the U.S. real net trade deficit of goods and services reached $ 151.2 billion in 1987 dollars.

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184 See, e.g., Helkie (1987, Chart 10, p. 37), who discusses the the development of the U.S. real net export balance of goods and services over the 1970-1986 period. in 1982 dollars.

Obviously, the high rate of growth of income of the U.S. relative to its trading partners may have partly contributed to this unprecedented external U.S. trade position. In the later part of the 1980's, the U.S. rate of growth of income started to level off, which may provide an explanation for the relative decline of the U.S. trade deficit during the years 1986-1992.

4.10. CONCLUSION

The findings of chapter four appear to provide some insights into the causes of the U.S. trade deficit during the 1972-1986 era. The U.S. income demand elasticity for imports during the years 1972-1986 was considerably higher than during the Bretton Woods era. This implies a relative decline in the ability to achieve a relatively high rate of income growth without causing a secular decline in the balance of payments on current account.

Whenever the U.S. has grown above the relative equilibrium rate of growth suggested by Thirlwall's basic Law, and assuming 1) no significant long term changes in the real terms of trade, 2) the ability on part of the U.S. to potentially run persistent balance of payments deficits, and 3) stable income elasticity parameters, the U.S. rate of growth of income has led to a secular decline of its external balance on current account. Stated differently, the U.S. had to build up an external balance deficit during these years.

Furthermore, given the U.S. position as a lender of last resort, foreign nations may have deliberately pursued relatively

export driven growth strategies during parts of the post Bretton Woods era (Davidson, 1992) leading to trade surpluses on part of some of the U.S. trading partners. Had foreign countries stimulated their own economies, world output would possible have grown faster than it was actually the case during the post 1972 era, and international trade imbalances may not have occured to the extent experienced during the post Bretton Woods era.

5. EXPORT LED GROWTH

5.1. INTRODUCTION

The empirical analyses of the previous two chapters have been based on elasticity estimates derived from the import and export demand functions. As suggested in chapter two of this study, advocates of Thirlwall's Law have also proposed an alternative, direct link for analyzing the long term causal relationship between exports and income, based on the so-called Hicks supermultiplier. This chapter focuses on the empirical validity of this hypothesis put forward by advocates of the Law. Unlike previous studies, however, the concept of cointegration is applied for this task.

In the following section, the potential existence of long term relationships between exports and income are tested without imposing an a priori causal restriction on the two variables. Based on these results, Thirlwall's equilibrium rate of growth of income is determined, and the empirical relationship between this rate and the actual rate of growth of income is assessed. Section three deals with the causality issue. What is tested is whether exports "Granger-cause" the long term level of income, as hypothesized by Thirlwall's Law. Sections four and five analyze the possible long run impact of terms of trade changes and capital flow changes on domestic income in the way hypothesized by Thirlwall's advocates. In section six, the results are interpreted; some conclusions are drawn in section seven.

5.2. THE EXPORT LED GROWTH HYPOTHESIS

As pointed out in chapter two, assuming that capital flows and the terms of trade do not significantly affect the secular relationship between exports and domestic income, the export led growth strategy can be expressed in rates of growth as

(5.2.1.) $y = a_0 + a_1 x \qquad 0<a_1<1$

where y and x are the rates of growth of income and exports, a_0 is a constant, and a_1 approximates the reciprocal of the income elasticity of demand for imports, respectively (McCombie, 1985).

We have discussed in chapters three and four, supra, why it is pertinent not to utilize differenced data in applying empirical test for longer term hypotheses such as Thirlwall's Law without previously testing the data series for their respective degree of integration (Bairam, 1993a). The same rational applies to the export led growth strategy analyzed in this chapter.

All data for real U.S. GDP (Y) and real U.S. exports of goods and services (X) are taken from the Survey of Current Business and are seasonally adjusted at source. For comparison of the findings with previous studies as well as with the results stated in chapters three and four of this study, cointegration tests are performed over four time ranges, 1950-1992, 1950-1971, 1972-1992, and 1972-1986.

Similar to the procedure applied in the previous two chapters, the first step is to perform unit roots tests on both income and exports. The findings are summarized184 in Table 5.1.

The DF/ADF test results provided in Table 5.1 demonstrate that irrespective of the time period, real exports and real GDP, both expressed in logarithms, are integrated of order one, i.e. they are I(1) in levels, but I(0) when first differenced. Therefore, it is appropriate to apply the technique of cointegration on both variables in log levels for determining if evidence of a secular long term relationship between real exports and real income for each of the respective four time periods can be found.

In order to establish such evidence, which is equivalent to the export led growth hypothesis described in its standard form by equation (5.2.1.), cointegration tests in the form of OLS level regressions are run for each of the four time periods. Because some studies have questioned the one-directional relationship hypothesized by export led growth strategies, OLS level regressions are also performed in the reverse direction.

As in the previous two chapters, DF/ADF tests are applied to test for possible stationarity of the estimated residuals. If the residuals from the OLS level regression are stationary, the two

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184 Most of these tests have already been performed in chapters three and four, supra. The only new results are derived for the levels of exports of goods and services for the 1950-1992 period and 1950-1971 period.

Table 5.1. Unit Roots Test: Export Led Growth, 1950-1992, 1950-1971, 1972-1992, 1972-1986

Variable	Level	First differenced
1950(1)-1992(2)		
lnX	-.07921(3)	-15.3(0)*
lnY	-1.63(1)	-8.428(0)*
1950(1)-1971(4)		
lnX	-.9217(1)	-11.15(0)*
lnY	-.8808(1)	-5.965(0)*
1972(1)-1992(2)		
lnX	-.9622(1)	-7.938(0)*
lnY	-.7741(1)	-6.076(0)*
1972(1)-1986(4)		
lnX	-.9622(0)	-6.839(0)*
lnY	-.3894(1)	-5.368(0)*

* Significant at the 1 percent level.
** Significant at the 5 percent level.
*** Significant at the 10 percent level.
Critical values are taken from Engle and Yoo (1987). Numbers in parentheses correspond to lags required to adjust for serial correlation.

non-stationary variables X and Y, expressed in logarithms, are cointegrated, i.e. they follow a common trend.

The results provided in Table 5.2. suggest only a structural long term relationship between the level of exports and the level of income for the Bretton Woods era. The residuals from the OLS regressions, as indicated by the ADF values for the 1950-1971 time period, are stationary at the 5% level, regardless of which direction the level regression is run. Neither over the whole post WW II era, nor for the later two post Bretton Woods periods, however, do the two variables exhibit a common trend. For these latter three periods, the respective ADF statistics as well as the respective Durbin-Watson statistics are clearly below the critical

Table 5.2. Cointegration Test: Export Led Growth, 1950-1992, 1950-1971, 1972-1992, 1972-1986

Cointegrating equation	slope coefficients lnX	lnY	D-W	R^2	DF/ADF
1950(1)-1992(2)					
lnY	.52764		.178	.978616	-3.239(3)
lnX		1.8547	.181	.978616	-3.136(3)
1950(1)-1971(4)					
lnY	.62213		.579	.961180	-4.03(3)**
lnX		1.5450	.600	.961180	-4.127(3)**
1972(1)-1992(2)					
lnY	.46201		.0661	.887626	-2.267(3)
lnX		1.9212	.0703	.887626	-2.357(3)
1972(1)-1986(4)					
lnY	.51151		.0875	.775738	-2.412(3)
lnX		1.5166	.103	.775738	-3.071(3)

* Significant at the 1 percent level.
** Significant at the 5 percent level.
*** Significant at the 10 percent level.
Critical values are taken from Engle and Yoo (1987). Numbers in parentheses correspond to lags required to adjust for serial correlation.

values. Therefore, support for the export-led growth hypothesis based on the Hick's supermultiplier effect can only be found for the Bretton Woods era.

In essence, according to the results of the cointegration tests above, the critical long run assumption of Thirlwall's Law, appears only valid for the fixed exchange rate regime.

Expressed in terms of a level regression (McCombie, 1985), the slope coefficient of .62213, derived from the cointegrated level regression of regressing lnY on lnX, supposedly, represents the reciprocal of the income elasticity of demand for imports, which is equivalent to the long term Hicks supermultiplier. The long term

Table 5.3. Equilibrium Growth Rates; Export Led Growth, 1950-1971

Variable	Actual Average Rate of growth (quarterly data annualized)	Equilibrium Rate of growth (y_b)
1950(1)-1971(4)		
y	.037404	.0306038
x	.049192	

equilibrium rate of growth of income (y_b) can, therefore, be derived by multiplying the actual rate of growth of exports (x) with the slope coefficient. This result is shown in Table 5.3.

According to this finding, the U.S. economy actually grew at a rate above the balance of payments constraint growth rate during the Bretton Woods era. This result is consistent with the one discussed in section 3.3. In fact, the equilibrium rate of growth shown in Table 5.3. is only insignificantly higher than the result shown in Tables 3.3., supra. Therefore, the results derived in chapter three are confirmed by the finding of this section.

As in the previous two chapters, we again follow Atesoglu's (1993a) lead and derive a simple statistical test for the relationship between the actual rate of growth of income (y) and the equilibrium rate of growth (y_b). The data is presented in Appendix 5.1.

The regression for the Bretton Woods era gives the following result:

(3.3.1.) $y = .019321 + .44864\ y_b$

$(5.753) \quad (4.517) \qquad R^2 = .302711$

This result is almost identical with the one derived for the Bretton Woods era in section 3.3., above, lending support for the accuracy of these previous findings. The constant is zero, and the slope coefficient indicates a positive relationship between y_b and y.

5.3. CAUSALITY BETWEEN EXPORTS AND INCOME

The debate between advocates and critics of the export-led growth concept has been discussed in chapter two, supra. The cointegration results provided in the previous section appear to lend some support to McCombie's arguments of a long term secular relationship between the rate of growth of U.S. exports and the rate of growth of U.S. income for the Bretton Woods era. Nevertheless, the results of Table 5.2. do not provide evidence for distinguishing whether the rate of growth of income during the Bretton Woods era has resulted from the rate of growth of the quantity of exports, as hypothesized by the export led growth theory, or vice versa. Regardless of which way the cointegrating regression is run, the ADF tests provided in Table 5.2. indicate a secular relationship between the two variables185. The purpose of the causality test below, therefore, is to provide further insights with respect to the nature of causality between U.S. exports and U.S. income.

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185 This is consistent with the argument of Engle and Granger (1987) that for a bivariate system, the possible existence of cointegration cannot be valid in only one direction.

Table 5.4. Causality Test; Exports Cause Income, 1950-1971

	dlnY	t-value	F-value[186]	dlnY	t-value
dlnY(-1)	.35569	3.434**		.40719	4.509**
dlnY(-2)	.19408	1.788			
dlnY(-3)	-.13425	-1.281			
dlnY(-4)	.0035752	.035			
dlnX(-1)	-.024302	-1.168			
dlnX(-2)	-.031956	-1.602			
dlnX(-3)	-.030323	-1.528			
dlnX(-4)	-.046001	-2.3***		-.048374	-2.569**
			2.363**		
ECM(-1)	-.044596	-1.756		-.027036	-1.152
CONSTANT	.0066781	4.283**		.0057971	4.384**
SE	.0088414			.00905127	
DW	1.95			2.07	

** Significant at the 5 percent level.

As in sections 3.5. and 4.7., supra, we apply two methods for testing potential "Granger causality" based on the cointegration results derived in the previous section. The first procedure has been suggested by Miller and Russek (1990, 1991), the second is associated with Engle and Granger (1987).

Clearly, the D-W statistics for each of the two test procedures are acceptable as shown in Table 5.4. The ECM(-1), on the other hand, is not significant in either case. Although some causal link between the change of lagged exports on the change in current income exists in case of the Miller and Russek procedure,

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186 The F-statistics are derived as follows:
$F=(N-k)[(ESS_R-ESS_{UR})]/[q(ESS_{UR})]$, where ESS_R and ESS_{UR} are the sums of squared residuals of the restricted and unrestricted regressions, and N, k, q is the number of observations, the number of estimated parameters of the unrestricted regression, and the number of parameter restrictions, respectively. See Pindyck and Rubinfeld (1991, p.216)

Table 5.5. Causality Test; Income Causes Exports, 1950-1971

	dlnX	t-value	F-value187	dlnX	t-value
dlnX(-1)	-.14707	-1.3			
dlnX(-2)	.15271	1.405			
dlnX(-3)	.27285	2.519**		.22479	2.314**
dlnX(-4)	-.017185	-.157			
dlnY(-1)	1.6969	3.038**		1.1794	2.47**
dlnY(-2)	-.18041	-.308			
dlnY(-3)	-.87261	-1.54			
dlnY(-4)	.44062	.8			
			2.513**		
ECM(-1)	-.30757	-3.433**		-.33231	-4.312**
CONSTANT	.0007844	.0938		.00031551	.045
SE	.0477278			.0480572	
DW	2.02			2.2	

** Significant at the 5 percent level.

the overall evidence indicates that exports may not Granger cause income, even though it appears from the cointegration test provided in the last section that lnX and lnY are cointegrated.

The same two tests are applied based on the reverse OLS regression results to test if income may have Granger caused exports during the Bretton Woods era. The results are given in Table 5.5.

The Miller and Russek procedure provides evidence that income may have Granger caused exports. In particular, exports,

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187 The F-statistics are derived as follows: $F=(N-k)[(ESS_R-ESS_{UR})]/[q(ESS_{UR})]$, where ESS_R and ESS_{UR} are the sums of squared residuals of the restricted and unrestricted regressions, and N, k, q is the number of observations, the number of estimated parameters of the unrestricted regression, and the number of parameter restrictions, respectively. See Pindyck and Rubinfeld (1991, p.216)

through their impact on the error correction term (ECM-1) Granger causes the volume of exports[188].

The Engle and Granger procedure supports Miller and Russek's findings, indicated by the high significance of the error correction term. Deleting the insignificant lag values to prevent a possible overparametization of the model appears appropriate according to the almost stable Durbin Watson statistic.

The results of this section support the view that the long term secular relationship between the volume of U.S. exports and real U.S. GDP during the Bretton Woods era does not appear to conform with the Hick's supermultiplier hypothesis that exports were the decisive factor in determining the long term trend of the level of income. Rather, the causal relationship between the two variables tested within a dynamic framework in this section indicates that real income changes appear to lead to changes in the quantity of exports, so that, contrary to the long term Hick's supermultiplier hypothesis suggested by McCombie (1985), income may be the weakly exogenous variable[189]. Consequently, McCombie's export led growth hypothesis appears not to be supported by the evidence of this study for the Bretton Woods[190] era with respect to the U.S. economy.

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188 Furthermore, as indicated by the significant F-statistic of the joint impact of the lags of the changes of income, income Granger causes exports also through this additional channel.

189 See Engle and Granger (1987, p. 273).

190 It has already been demonstrated in the previous section of this study that no long term stable relationship between exports

5.4. THE IMPACT OF THE TERMS OF TRADE

The purpose of this section as well as section 5.5. is to determine if the integration of the terms of trade and/or real net capital inflows into the analysis allows to derive a structural longer term relationship between U.S. exports and U.S. domestic income[191].

In essense, according to the unit roots test results for the four chosen time periods provided in Table 5.6., the terms of trade and real net capital inflows are I(1) in levels, but stationary when first differenced[192]. Consequently, it is appropriate to apply the technique of cointegration in the following empirical analyses.

In a first step, we incorporate the terms of trade into the analysis and test for cointegration among exports, the terms of trade and U.S. income. More specifically, it is tested whether real exports and the terms of trade can explain the secular movement of real domestic income of the U.S. economy.

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and income can be established for any of the other chosen time periods.

191 Irrespective of the result of the last section, domestic income is hereby assumed to be the endogenous variable, since, in the present context, the purpose is to evaluate the validity of Thirlwall's extended Law which explicitly makes this assumption.

192 Possible stationarity for the TOT for the 1972-1992 era was discussed in section 3.2., supra. As far as real net capital inflows (CI) are concerned, it appears that for the 1950-1992 period, CI may have been stationary, i.e., integrated of order zero. However, other studies have also applied cointegration, even though not all of the series are found to be integrated of the same order; see Kraeger (1992).

Table 5.6. Unit Roots Test: The Terms of Trade and Capital Flows, 1950-1992, 1950-1971, 1972-1992, 1972-1986

Variable	Level	First differenced
1950(1)-1992(2)		
CI	-3.039(4)**	-4.528(2)*
lnTOT	-1.541(1)	-9.544(0)*
1950(1)-1971(4)		
CI	-.4265(4)	-5.043(4)*
lnTOT	-1.663(1)	-6.854(0)*
1972(1)-1992(2)		
CI	-2.509(4)	-2.93(2)**
lntTOT	-2.783(1)***	-6.673(0)*
1972(1)-1986(4)		
CI	-1.082(3)	-2.473(2)
lnTOT	-2.325(1)	5.264(0)*

* Significant at the 1 percent level.
** Significant at the 5 percent level.
*** Significant at the 10 percent level.
Critical values are taken from Engle and Yoo (1987). Numbers in parentheses correspond to lags required to adjust for serial correlation.

The results presented in Table 5.7. show no cointegration among the variables irrespective of the chosen time period, although the slope coefficients have the correct signs and, in particular, the terms of trade have a positive impact on GDP in all cases193.

In essense, adding the terms of trade effect to the cointegration regression, therefore, appears not to enhance the findings. Rather, compared to the results derived in section 5.2., supra, the incorporation of relative prices into the OLS level regression does not allow to refute the hypothesis that exports and

193 These results, however, must be interpreted with caution, because the hypothesis of no cointegration among the series cannot be refuted.

Table 5.7. Cointegration Test: The Terms of Trade, 1950-1992, 1950-1971, 1972-1992, 1972-1986

Cointegrating equation	slope coefficients lnX	lnTOT	D-W	R^2	DF/ADF
1950(1)-1992(2)					
lnY	.5517	.34197	.266	.984841	-3.207(3)
1950(1)-1971(4)					
lnY	.58453	.2232	.543	.96347	-3.606(3)
1972(1)-1992(2)					
lnY	.48749	.35332	.0895	.911578	-1.366(3)
1972(1)-1986(4)					
lnY	.69854	.66821	.492	.92576	-3.266(3)

* Significant at the 1 percent level.
** Significant at the 5 percent level.
*** Significant at the 10 percent level.
Critical values are taken from Engle and Yoo (1987). Numbers in parentheses correspond to lags required to adjust for serial correlation.

relative prices are cointegrated with income during the Bretton Woods era.

5.5. THE IMPACT OF CAPITAL FLOWS

In addition, we analyze if net real capital inflows (CI) help to establish a secular relationship, i.e., if the series of exports and capital inflows are cointegrated with U.S. income194.

194 The unit roots tests for real net capital inflows (CI) are given in Table 5.6., supra. As outlined in section 5.4., above, the levels of CI for the respective four time periods can generally be considered as being I(1), but (0) when first differenced. Furthermore, it has been shown in chapter three and chapter four of this study, that the balance of payments restriction does not apply to the U.S. economy. Incorporating CI in the analysis is, therefore, appropriate.

Table 5.8. Cointegration Test: Capital Flows, 1950-1992, 1950-1971, 1972-1992, 1972-1986

Cointegrating equation	slope coefficients lnX	lnTOT	CI	D-W	R^2	DF/ADF
1950(1)-1992(2)						
lnY	.52086	.22859	.00072975	.327	.990272	-2.858(3)
lnY	.49961		.00089437	.241	.987802	-2.822(3)
1950(1)-1971(4)						
lnY	.54355		.0023333	.547	.975006	-2.584(1)
lnY	.53140	.091594	.0022357	.534	.975368	-2.565(1)
1972(1)-1992(2)						
lnY	.41715	-.095417	.00090932	.506	.989746	-3.036(0)
lnY	.4267		.00084537	.411	.988577	-2.412(0)
1972(1)-1986(4)						
lnY	.45908		.0008244	.499	.977049	-2.671(0)
lnY	.4652	.010175	.00081508	.499	.977058	-2.669(0)

* Significant at the 1 percent level.
** Significant at the 5 percent level.
*** Significant at the 10 percent level.
Critical values are taken from Engle and Yoo (1987). Numbers in parentheses correspond to lags required to adjust for serial correlation.

According to the results presented in Table 5.8., real net capital inflows, in conjunction with exports appear to impact positively on the level of income, but the hypothesis of no cointegration cannot be rejected for any of the four chosen time periods. Furthermore, the findings given in Table 5.8. appear to provide no evidence that exports, the terms of trade, and net capital inflows explain the long term movement of the level of U.S.income.

5.6. INTERPRETATION

The empirical results of this chapter demonstrate that tests of the long term export led growth hypothesis with respect to the

U.S. economy should be approached with the concept of cointegration, because all the time series utilized in the regression analysis were found to be I(1) in levels, but I(0) when first differenced.

In essence, the analyses of this chapter demonstrate that capital flows and terms of trade do not significantly impact on the rate of growth of U.S. income, even though the parameter coefficients of the series have the correct signs. Nevertheless, these two data series do not contribute to establishing a long term structurally stable relationship between the rate of growth of exports and the rate of growth of income.

Consequently, Atesoglu's (1994) suggestion that due to considerable capital inflows in recent years, an empirical analysis with respect to the U.S. economy based on the expanded Harrod foreign trade multiplier may provide important insights for the export led growth hypothesis is not supported by the findings of this study (p.482).

In fact, only the bivariate estimate between real income and real exports appears to provide some evidence in support for the export led growth hypothesis during the Bretton Woods period. Nevertheless, the results of section 5.3. also indicate that U.S. exports, even though they are cointegrated with U.S. income during the 1950-1971 time period may not Granger cause the U.S. income. In fact, the empirical findings of this study indicate a secular

causal relationship of the rate of growth of income on the rate of growth of exports.

With respect to the Bretton Woods era, the findings of this study, therefore, do not support the export led growth hypothesis.

The findings of this chapter appear to support the results of previous studies by Kugler (1991) and, Afxentiou and Serletis (1991). These two studies were also based on cointegration analyses and found no evidence for cointegration between U.S. exports and U.S. income.

McCombie and Thirlwall stress, that "[c]ertainly, a failure to find a statistically significant relationship between the growth of GDP and the growth of exports could be taken as a refutation of the hypothesis that the growth of exports play a crucial role in determining the growth of output." (1994, p. 396). In the long run, according to McCombie and Thirlwall (1994, p. 406-407), the supermultiplier operates, inducing a higher level of domestic activity until the balance of payments is restored. However, according to our findings, this claim appears not to be supported by the empirical evidence, and the U.S. rate of income growth may not be assessed by some version of the Hicks supermultiplier.

Therefore, McCombie and Thirlwall's (1994, p. 403) claim "...that growth of exports is the only element that simultaneously relaxes the balance of payments constraint while increasing the growth of income..." may not be an appropiate proposition with respect to the U.S. post WW II era.

5.7. CONCLUSION

The findings of this chapter refute the simple bivariate export led growth hypthesis with respect to the U.S. economy during the post WW II era. Furthermore, the extended export led growth hypotheses, incorporating net capital inflows and/or the terms of trade do not support the proposition that the U.S. external sector has causally determined the long term rate of growth of income of the United States during the post WW II era.

6. SUMMARY AND CONCLUSION

6.1. INTRODUCTION

This study has focused on the validity of Thirlwall's Law with respect to the U.S. post WW II economy. The next section sumarizes some important findings derived from these analyzes. Section three focuses on the limitations of the study and potential suggestions for future research with respect to the U.S. economy and other industrialized and developing countries. Some final conclusions are contained in the forth section of this chapter.

6.2. THIRLWALL'S LAW AND THE U.S. ECONOMY

This study has shown that the concept of cointegration provides an appropriate econometric procedure for analyzing the long term hypotheses of Thirlwall's Law and the export led growth concept with respect to the U.S. economy.

Based on the analyses of chapters three and four of this thesis, it has been shown that the inclusion of the terms of trade effects into the export and import demand functions are necessary, and that their respective impact on U.S. export and import volumes may not be as negligible, as previously indicated in other studies. In fact, contrary to McCombie's claim, relative prices may also have had some, although probably a limited impact on the overall trade balance, as it was shown for the 1972-1986 period[197].

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197 Due to data restrictions, no comparable conclusion can be drawn for the Bretton Woods period.

In addition, also based on the cointegration technique, it has been shown, that the U.S. may not have been exposed to a long term balance of payments constrained during the Bretton Woods or the post Bretton Woods era. McCombie's suggestion that the U.S. had to comply with the balance of payments constraint during the post Bretton Woods era may, therefore, be questionable.

Similarly, Thirlwall and Hussain's (1982, p. 498) statement refering to the basic Thirlwall Law that "...so many advanced countries seemed to approximate this simple rule suggested that for most countries capital flows are relatively unimportant...and that relative price changes...play only a minor role..." may not be an adequate description of with respect to the U.S. economy, according to our findings.

Capital flows effects have been integrated in chapter three and four of this study, and the results appear to indicate that the extended equilibrium rates of growth of Thirlwall's Law provide relatively close estimates of the actual rate of growth of income of the U.S. for both the Bretton Woods and post Bretton Woods era.

Nevertheless, although previous studies appear to interprete good approximations of Thirlwall's equilibrium rates of growth as an indication of the validity of the Law (Bairam, 1990), it should not be overlooked that such conclusions based on equilibrium growth estimates derived from import and export demand functions are questionable. The tests performed in chapter three and chapter four of this study, can not provide an indication for a causal

relationship between the rate of growth of exports and domestic income.

Consequently, to provide some insights about potential causal effects between exports and income, the export led growth strategy was analyzed in chapter five. Hereby, it has been shown that the cointegration procedure provides an appropriate empirical method to study this long term hypothesis. The empirical findings of chapter five appear to indicate that the Hick's supermultiplier may not be a valid description for the actual U.S. income growth experience during the post WW II era. Furthermore, incorporating relative prices and capital flows into the long term analysis does not alter the essential results of these findings. Therefore, the U.S. post WW II economy may not only have been unconstrained by its balance of payments, but its long term rates of growth of income may not have been primarily determined by its external sector and the rate of growth of exports.

The recent suggestion by Atesoglu (1993) to study Thirlwall's Law from a single country perspective appears to be valuable, and this study has followed this idea with respect to the U.S. economy. Particularly, as it has been argued in this thesis, there is no reason to suspect that parameter stability can be assumed to hold over predetermined time periods for different countries, as the analyses particularly in chapter four with respect to the export demand function indicates.

However, the findings of this study based on Atesoglu's statistical approach are generally not supportive of Thirlwall's Law. This may indicate that Thirlwall's Law is an inadequate model for descibing the U.S. economy[198].

6.3. LIMITATIONS AND SUGGESTIONS FOR FUTURE RESEARCH

This study has been limited to the U.S. economy. Therefore, the findings of this thesis cannot and must not be generalized as being valid for other industrialized or developing countries. Particularly, because the U.S. as a lender of last resort as had a unique position within the international economic and financial environment during the post WW II era[199].

Nevertheless, it seems pertinent to analyze the validity of the long term hypotheses of Thirlwall's Law with the concept of cointegration also with respect to other countries to determine if the peculiar international economic and financial position of the U.S. are the primary causes for the empirical findings of this study.

Furthermore, the hypotheses tested in this study are strictly based on the presumptions suggested by advocates of Thirlwall's Law. Therefore, the results of this study should not be interpreted

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198 However, he poor findings could also be due to the data restrictions imposed by Atesoglu; e.g., Atesoglu assumes fixed income demand elasticities and does not clearly define the chosen time ranges for the sample periods.

199 Some indications exist that the peculiar economic position of the U.S. may have already changed, particularly since the post Cold War era, but this issue is bejond the scope of the analysis of this thesis.

as a rejection of the hypothesis that the U.S. long term rate of growth of income can be described by a demand oriented approach. Even though Thirlwall's approach is demand oriented it focuses on the external sector of the economy. Consequently, it neglects any domestic components of demand. The latter, however, may crucially affect the long term rate of growth of the U.S. economy which appears not to be confined in its growth potential by Thirlwall's balance of payments constraint according to the findings of this study.

The era of flexible exchange rates, contrary to what most economists expected, might have brought increased international balance of payments instability, but this is not necessarily a reason to argue that this occasion itself led to changes of the income demand and/or price elasticity parameters. Nevertheless, this study has distinguished between the 1950-1972 and 1972-1992 time periods in accordance with previous studies.

However, the findings of this thesis indicate that future research should possibly focus on analyzing, whether, and when structural breaks may have occurred so that alterations of the chosen time periods may provide long term parameter stability. Furthermore, if in fact the data series are found to be I(1), however, not cointegrated, irrespective of any chosen time period, the conclusion derived should be that no secular relationship between the series exist, and that the long term hypotheses of

Thirlwall's Law, which require the assumption of a stable income demand elasticity may have to be reconsidered.

In this context, future research should also focus on the suggestions by export led growth strategists who have argued that the income elasticity parameters should be altered in order to relax a country's balance of payments constraint. Given the validity of Thirlwall's assumptions and if the export led growth strategy could successfully be implemented, the very success of such a policy would imply changes of the long term income elasticity parameters!

6.4. CONCLUSIONS

Based on the findings in chapter three and four of this study, Thirlwall's extended Law appears to provide some explanation for the secular decline of the U.S. external trade balance during the post WW II era, but not necessarily an explanation for the actual long term rate of growth of U.S. income.

Due to the rise of the income demand elasticity for imports during the Bretton Woods era, the U.S. growth of income led to high net capital inflows, which, according to Thirlwall's Law would, ceteris paribus, have been lower, had the U.S. experienced lower income demand elasticities for imports, or higher imcome demand elasticities for exports.

This general argument is clearly not rejected by this study. However, acccording to the findings of this study, it is not possible to determine, if net capital inflows into the U.S. were a

requirement for, or the result of, the relatively high actual rate of growth of income. The only conclusion that appears to be supported by the findings of this study, is that the U.S. was not restricted by the balance of payments in achieving a certain long term rate of growth of income.

In essense, Thirlwall's Law, with respect to the U.S. economy, cannot not provide evidence about its ability and possible external restrictions to achieve a certain rate of growth; however, it provides some indication about the relationship between the actual rate of growth of income and the resulting impact on the U.S. balance of payments.

Therefore, Bairam's general claim (1990, p.712) that the policy implications of Thirlwall's Law "...are quite clear. In an open economy relevant economic management is the one that manipulates the income elasticities of exports and imports. A successful economic policy that increases the value of [v] and /or reduces the value of [h], relaxes the balance of payments constraints and, eventually accelerates economic growth.200" may be questionable with respect to the U.S. post WW II economy. Obviously, lower income elasticities of demand for imports and higher income elasticities of demand for exports would, ceteris paribus, reduce the U.S. trade deficit. However, according to the findings of this study, there is no evidence suggesting that the

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200 v and h refer to equations (2.2.8.) and (2.2.9.) of this thesis.

U.S. was restricted in achieving a certain higher rate of growth, due to Thirlwall's Law.

The causal direct link between exports and income suggested by advocates of Thirlwall's Law and tested in this study with respect to the U.S. economy appears not to valid during the post WW II era. Therefore, the growth of U.S. income may in fact have been more domestically driven. If this has been the case, international trade agreement recently negotiated by the U.S., can not necessarily be perceived as a tool to enhance the long term U.S. rate of growth of income201.

Additional research, and possibly a revised and expanded theoretical concept may eventually provide a more accurate view of what have been the most decisive factors impacting on the long term rate of growth of income of the United States during the 1950-1992 era.

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201 Clearly such agreements, of course, may serve a variety of other purposes, however.

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APPENDIXES

APPENDIX 3.1.

Variable	Actual Average Rates of growth (quarterly data annualized)			Equilibrium Rates of growth	
	x	y	tot	y_b	y_{bb}
1950(1)-1959(4)	.03758	.039284	.008904	.022599	.023161
1950(2)-1960(1)	.051556	.037084	.013788	.031004	.031873
1950(3)-1960(2)	.054112	.034048	.013288	.035407	.033379
1950(4)-1960(3)	.053884	.030508	.018792	.032404	.033589
1951(1)-1960(4)	.045724	.027136	.021176	.027497	.028832
1951(2)-1961(1)	.04216	.0258	.023052	.025353	.026807
1951(3)-1961(2)	.02842	.024664	.025308	.017091	.018687
1951(4)-1961(3)	.031036	.023828	.021536	.018664	.020022
1952(1)-1961(4)	.03256	.025364	.02068	.019580	.020886
1952(2)-1962(1)	.026632	.025752	.019408	.016015	.017239
1952(3)-1962(2)	.044264	.027016	.01788	.026619	.027746
1952(4)-1962(3)	.05194	.026982	.01662	.031235	.032283
1953(1)-1962(4)	.0473	.024752	.01494	.028444	.029387
1953(2)-1963(1)	.048024	.024472	.012436	.028880	.029664
1953(3)-1963(2)	.055012	.024888	.012788	.033082	.033889
1953(4)-1963(3)	.05212	.026972	.010404	.031343	.032
1954(1)-1963(4)	.059132	.028548	.010012	.035560	.036191
1954(2)-1964(1)	.069668	.032516	.010392	.041895	.042551
1954(3)-1964(2)	.055924	.033692	.010152	.033630	.034271
1954(4)-1964(3)	.062688	.03364	.00994	.037698	.038325
1955(1)-1964(4)	.06022	.032404	.009592	.036214	.036819
1955(2)-1965(1)	.045116	.032184	.009248	.027131	.027714
1955(3)-1965(2)	.06168	.032476	.008332	.037092	.037617
1955(4)-1965(3)	.054068	.032948	.00662	.032514	.032932
1956(1)-1965(4)	.060508	.034588	.005524	.036387	.036735
1956(2)-1966(1)	.054908	.036736	.006972	.033019	.033459
1956(3)-1966(2)	.047888	.036472	.005336	.028798	.029134
1956(4)-1966(3)	.045656	.037468	.00492	.027456	.027766
1957(1)-1966(4)	.043	.036796	.006036	.025858	.026239
1957(2)-1967(1)	.038992	.036576	.00556	.023448	.023799
1957(3)-1967(2)	.040584	.037072	.005628	.024406	.024761
1957(4)-1967(3)	.04356	.037648	.003824	.026195	.026436
1958(1)-1967(4)	.048304	.039784	.00284	.029048	.029227
1958(2)-1968(1)	.0613	.0432	.00074	.036863	.03691
1958(3)-1968(2)	.063116	.044256	.000328	.037955	.037976
1958(4)-1968(3)	.068092	.04252	.000332	.040948	.040969

Variable	Actual Average Rates of growth (quarterly data annualized)			Equilibrium Rates of growth	
	x	y	tot	y_b	y_{bb}
1959(1)-1968(4)	.065	.040384	.002504	.039088	.039246
1959(2)-1969(1)	.059388	.040644	.004244	.035714	.035981
1959(3)-1969(2)	.076352	.039188	.003832	.045915	.046157
1959(4)-1969(3)	.06808	.040212	.004072	.040941	.041197
1960(1)-1969(4)	.072996	.039392	.004824	.043897	.044201
1960(2)-1970(1)	.061668	.037308	.004068	.037085	.037341
1960(3)-1970(2)	.061484	.03708	.004724	.036974	.037272
1960(4)-1970(3)	.057792	.038232	.002676	.034754	.034923
1961(1)-1970(4)	.059296	.03806	.002844	.035658	.035838
1961(2)-1971(1)	.058312	.039788	.0015	.035066	.035161
1961(3)-1971(2)	.063176	.038556	.000332	.037991	.038012
1961(4)-1971(3)	.063412	.037828	.001596	.038134	.03866
1962(1)-1971(4)	.050468	.0363	.000748	.030349	.030397

APPENDIX 3.2.

Variable	Actual Average Rates of growth (quarterly data annualized)			Equilibrium Rates of growth	
	x	y	tot	y_b	y_{bb}
1972(1)-1981(4)	.075184	.024168	-.0268	.032674	.029282
1972(2)-1982(1)	.059104	.021148	-.023564	.025686	.022703
1972(3)-1982(2)	.061024	.019920	-.019192	.026521	.024091
1972(4)-1982(3)	.052476	.018364	-.01934	.022806	.020358
1973(1)-1982(4)	.041588	.016944	-.019164	.018074	.015648
1973(2)-1983(1)	.034288	.015128	-.015344	.014901	.012959
1973(3)-1983(2)	.030464	.017348	-.014184	.013295	.011444
1973(4)-1983(3)	.029788	.018908	-.013832	.012946	.011195
1974(1)-1983(4)	.028596	.019852	-.011272	.012428	.011001
1974(2)-1984(1)	.026336	.022688	-.002528	.011445	.011125
1974(3)-1984(2)	.023524	.02376	-.00604	.010223	.009459
1974(4)-1984(3)	.029092	.025176	.007916	.012643	.013645
1975(1)-1984(4)	.027412	.026232	.007492	.011913	.012862
1975(2)-1985(1)	.028456	.02916	.007608	.012366	.01333
1975(3)-1985(2)	.030788	.028792	.007972	.013380	.01439
1975(4)-1985(3)	.028124	.028208	.005068	.012225	.012864
1976(1)-1985(4)	.026152	.027472	.00226	.011365	.011652
1976(2)-1986(1)	.029508	.026848	.00148	.012824	.013011
1976(3)-1986(2)	.03002	.026412	.003516	.013047	.013492
1976(4)-1986(3)	.029396	.026628	.00444	.012775	.013337
1977(1)-1986(4)	.03224	.02592	.003744	.019388	.014485
1977(2)-1987(1)	.033792	.025204	.004648	.014686	.015274
1977(3)-1987(2)	.035168	.02596	.00408	.015284	.0158
1977(4)-1987(3)	.039408	.024336	.003796	.017126	.017607
1978(1)-1987(4)	.046676	.02598	.003904	.020285	.020779
1978(2)-1988(1)	.04928	.025936	.00412	.021417	.021938
1978(3)-1988(2)	.042924	.023836	.002648	.018654	.01899
1978(4)-1988(3)	.0435	.023696	.004848	.018905	.019519
1979(1)-1988(4)	.042668	.023476	.003032	.018543	.018927
1979(2)-1989(1)	.046144	.024236	.003568	.020054	.020506
1979(3)-1989(2)	.050484	.024584	.003692	.021940	.022407
1979(4)-1989(3)	.047904	.023972	.008936	.020819	.02195
1980(1)-1989(4)	.045344	.024152	.011352	.019706	.021143
1980(2)-1990(1)	.044792	.024428	.01334	.019663	.021155
1980(3)-1990(2)	.04542	.027268	.015032	.019739	.021642
1980(4)-1990(3)	.046264	.026832	.012388	.020106	.021674

Variable	Actual Average Rates of growth (quarterly data annualized)			Equilibrium Rates of growth	
	x	y	tot	y_b	y_{bb}
1981(1)-1990(4)	.049204	.02384	.00666	.021384	.022227
1981(2)-1991(1)	.04526	.021712	.015004	.019670	.021569
1981(3)-1991(2)	.04792	.022556	.012816	.020826	.022448
1981(4)-1991(3)	.052072	.02234	.009976	.022630	.023893
1982(1)-1991(4)	.055868	.02408	.0088	.024280	.025394
1982(2)-1992(1)	.061364	.026048	.008684	.026668	.027768
1982(3)-1992(2)	.060876	.026032	.004636	.026456	.027043

APPENDIX 4.1.

Variable	Actual Average Rates of growth (quarterly data annualized)			Equilibrium Rates of growth	
	x	y	tot	y_b	y_{bb}
1972(1)-1981(4)	.075184	.024168	-.0268	.0315	.029879
1972(2)-1982(1)	.059104	.021148	-.023564	.024763	.023337
1972(3)-1982(2)	.061024	.019920	-.019192	.025567	.024406
1972(4)-1982(3)	.052476	.018364	-.01934	.021986	.020816
1973(1)-1982(4)	.041588	.016944	-.019164	.017424	.016265
1973(2)-1983(1)	.034288	.015128	-.015344	.014366	.013437
1973(3)-1983(2)	.030464	.017348	-.014184	.012764	.011905
1973(4)-1983(3)	.029788	.018908	-.013832	.01248	.011644
1974(1)-1983(4)	.028596	.019852	-.011272	.011981	.011299
1974(2)-1984(1)	.026336	.022688	-.002528	.011034	.010881
1974(3)-1984(2)	.023524	.02376	-.00604	.009856	.009495
1974(4)-1984(3)	.029092	.025176	.007916	.012189	.012668
1975(1)-1984(4)	.027412	.026232	.007492	.011485	.011938
1975(2)-1985(1)	.028456	.02916	.007608	.011922	.012383
1975(3)-1985(2)	.030788	.028792	.007972	.0129	.013382
1975(4)-1985(3)	.028124	.028208	.005068	.011783	.01209
1976(1)-1985(4)	.026152	.027472	.00226	.010957	.011094
1976(2)-1986(1)	.029508	.026848	.00148	.012363	.012453
1976(3)-1986(2)	.03002	.026412	.003516	.012578	.01279
1976(4)-1986(3)	.029396	.026628	.00444	.012316	.012585
1977(1)-1986(4)	.03224	.02592	.003744	.013508	.013734

APPENDIX 4.2.

Variable	Actual Average Rates of growth (quarterly data annualized)			Equilibrium Rates of growth	
	wy^*	y	tot	y_b	y_{bb}
1972(1)-1981(4)	.038155	.024168	-.0268	.015986	.022654
1972(2)-1982(1)	.035767	.021148	-.023564	.014985	.020848
1972(3)-1982(2)	.033461	.019920	-.019192	.014019	.018795
1972(4)-1982(3)	.032103	.018364	-.01934	.01345	.018262
1973(1)-1982(4)	.029575	.016944	-.019164	.012391	.01716
1973(2)-1983(1)	.02714	.015128	-.015344	.011137	.015189
1973(3)-1983(2)	.028014	.017348	-.014184	.011737	.015266
1973(4)-1983(3)	.028379	.018908	-.013832	.01189	.015332
1974(1)-1983(4)	.028111	.019852	-.011272	.011778	.014582
1974(2)-1984(1)	.029552	.022688	-.002528	.012382	.013011
1974(3)-1984(2)	.030735	.02376	-.00604	.012878	.01438
1974(4)-1984(3)	.031211	.025176	.007916	.013076	.011107
1975(1)-1984(4)	.033091	.026232	.007492	.013864	.012
1975(2)-1985(1)	.034921	.02916	.007608	.014631	.012738
1975(3)-1985(2)	.035027	.028792	.007972	.014675	.012692
1975(4)-1985(3)	.035263	.028208	.005068	.014774	.013513
1976(1)-1985(4)	.035406	.027472	.00226	.014834	.014272
1976(2)-1986(1)	.032883	.026848	.00148	.013777	.013409
1976(3)-1986(2)	.032403	.026412	.003516	.013576	.0127
1976(4)-1986(3)	.032934	.026628	.00444	.013799	.012694
1977(1)-1986(4)	.032528	.02592	.003744	.013628	.012697

APPENDIX 5.1.

Variable	Actual Average Rates of growth (quarterly data annualized) x	y	Equilibrium Rates of growth yb
1950(1)-1959(4)	.03758	.039284	.0233796
1950(2)-1960(1)	.051556	.037084	.0320745
1950(3)-1960(2)	.054112	.034048	.0336647
1950(4)-1960(3)	.053884	.030508	.0335229
1951(1)-1960(4)	.045724	.027136	.0284463
1951(2)-1961(1)	.04216	.0258	.026229
1951(3)-1961(2)	.02842	.024664	.0176809
1951(4)-1961(3)	.031036	.023828	.0193084
1952(1)-1961(4)	.03256	.025364	.0202566
1952(2)-1962(1)	.026632	.025752	.0165686
1952(3)-1962(2)	.044264	.027016	.027538
1952(4)-1962(3)	.05194	.026982	.0323134
1953(1)-1962(4)	.0473	.024752	.0294267
1953(2)-1963(1)	.048024	.024472	.0298772
1953(3)-1963(2)	.055012	.024888	.0342246
1953(4)-1963(3)	.05212	.026972	.0324254
1954(1)-1963(4)	.059132	.028548	.0367878
1954(2)-1964(1)	.069668	.032516	.0433426
1954(3)-1964(2)	.055924	.033692	.034792
1954(4)-1964(3)	.062688	.03364	.0390001
1955(1)-1964(4)	.06022	.032404	.0374647
1955(2)-1965(1)	.045116	.032184	.028068
1955(3)-1965(2)	.06168	.032476	.038373
1955(4)-1965(3)	.054068	.032948	.0336373
1956(1)-1965(4)	.060508	.034588	.0376438
1956(2)-1966(1)	.054908	.036736	.0341599
1956(3)-1966(2)	.047888	.036472	.0297926
1956(4)-1966(3)	.045656	.037468	.028404
1957(1)-1966(4)	.043	.036796	.0267516
1957(2)-1967(1)	.038992	.036576	.0242581
1957(3)-1967(2)	.040584	.037072	.0252485
1957(4)-1967(3)	.04356	.037648	.0271
1958(1)-1967(4)	.048304	.039784	.0300514
1958(2)-1968(1)	.0613	.0432	.0381366
1958(3)-1968(2)	.063116	.044256	.0392664
1958(4)-1968(3)	.068092	.04252	.0423621

Variable	Actual Average Rates of growth (quarterly data annualized) x	y	Equilibrium Rates of growth yb
1959(1)-1968(4)	.065	.040384	.0404385
1959(2)-1969(1)	.059388	.040644	.0369471
1959(3)-1969(2)	.076352	.039188	.0475009
1959(4)-1969(3)	.06808	.040212	.0423546
1960(1)-1969(4)	.072996	.039392	.045413
1960(2)-1970(1)	.061668	.037308	.0383655
1960(3)-1970(2)	.061484	.03708	.038251
1960(4)-1970(3)	.057792	.038232	.0359541
1961(1)-1970(4)	.059296	.03806	.0368898
1961(2)-1971(1)	.058312	.039788	.0362776
1961(3)-1971(2)	.063176	.038556	.0393037
1961(4)-1971(3)	.063412	.037828	.039891
1962(1)-1971(4)	.050468	.0363	.0313977

VITA

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