

**Does the financial sector cause an appreciation of the real
exchange rate?**

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Abstract

In developed economies industry was once the backbone of the economy and was seen as the machinery behind economic growth. During the past decades, industry's importance has been diminishing in advanced economies. The trend has been stronger in some countries than in others but seems rather consistent over time. Furthermore the financial sector has enjoyed vast growth since the 1980's. In the countries where financial sector growth has been particularly strong it appears to have replaced industry as the largest sector. In this paper the real exchange rate is examined to investigate if growth in the financial sector has a tendency to crowd out industry through an appreciating exchange rate. The study is based on the framework first developed by Corden and Neary (1982) to investigate the Dutch disease. Here it is applied to a situation where the financial sector is booming instead of a natural resource sector which was the original set up of the model. United States, United Kingdom, Germany and Sweden are considered in the study. Of these countries the two former ones have large financial sectors and the later ones have rather strong industry sectors. An OLS regression is applied to investigate the relationship between the real exchange rate and relative productivity of the financial sector. However, the regression fails to prove any relationship, thereby no support for a crowding out effect could be found.

Keywords: Real exchange rate, Dutch disease, deindustrialization, financial sector.

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1. Introduction

Many advanced economies have during the past decades experienced structural changes in the composition of GDP. The industry sector, which once used to be the backbone of every advanced economy, has in many countries been shrinking significantly relative to the rest of the economy. Simultaneously the financial sector has been growing at a rapid pace and stands for more than 30 percent of total output in some economies. The economic structure is crucial to people as it has a significant impact on the breadwinning of the people who can only obey the predominant position of the economy.

The world economy has during the past decades gone through numerous changes in trade policies. The policies have conducted the economy towards a greater degree of openness between different economies. These changes have opened up new markets to the advanced economies. Consequently, new opportunities have opened for those who want to tap the new markets. Furthermore a greater degree of economic openness does not only open new market, it increases trade over all.

The exposure of advanced economies to competition from low-wage countries has changed the market conditions. The low real exchange rate can allow these countries to keep wages at a lower level than advanced economies can. In particular the industry sector is very sensitive to the real exchange rate changes. This is because it produces traded goods hence is exposed to exchange rate movements. Industry characterized by low skilled labor, which is something that easily can be provided at a low cost by emerging economies, is affected more severely by international competition than other industries.

Most of all, the last two to three decades' economic reforms towards economic openness and free trade have lead to a decline in transaction costs for traded goods. As a consequence of lower transaction costs which have previously worked as trade barriers, businesses in advanced economies are now more exposed to international competition. Countries with a lower wage level can therefore compete at a different scale as markets opens up and transaction cost decreases. Many of these economies have a competitive advantage in low-skilled labor over the high-income countries. But apart from competition from low-wage countries other factors may be even more important to explain the trend towards deindustrialization.

The financial sector has, at the same time, been steadily increasing its output share to GDP in many advanced economies. When markets opens up and trade increases new opportunities also opens up for this sector. Since the sector is traded it is able to take advantage of the international market. In addition it does not face the low-wage competition as industry does. Along with the trend of fewer

trade barriers, during the past two to three decades we have seen new advanced computer technology which has improved productivity. Furthermore financial deregulations have enabled the sector to grow. In some particular countries the growth has been bigger than in others.

If we turn to Figure 1, we can observe how the trend has changed the composition of GDP in some advanced economies. If we examine the trend we can see that in the UK and the US the financial sector has been growing substantially since the mid 1980's. During the same period of time Industry has been decreasing in its size as a part of GDP.

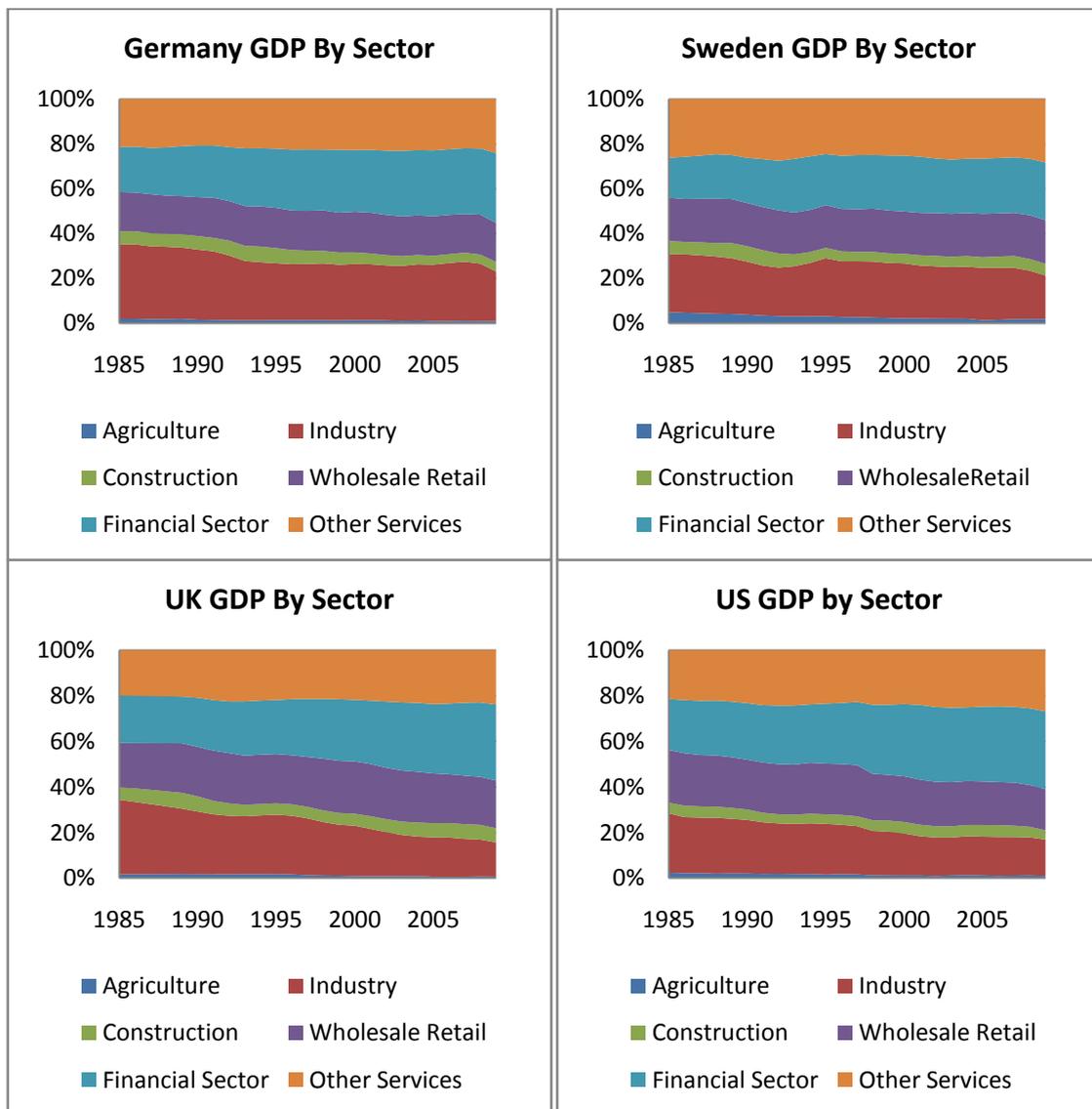


Figure 1: GDP by sector as gross value added
Source: OECD Database

Germany saw the financial sector increase during the early 1990's but the trend has thereafter been rather constant. If we now turn our focus to industry we can observe a decrease in industry output during the same time as the increase in financial sector output occurred. Just like the financial

sector, industry seems to have followed a fairly flat trend from the mid 1990's until recent years. Sweden has experienced the smallest increase in financial sector output of all four countries. Industry has remained rather strong during the whole time period. What is interesting in the case of Sweden is that the economy experienced a phase of reindustrialization in terms of output to GDP during the mid 1990's. An interesting fact which should be added to the discussion above is that Germany and Sweden have been experiencing a depreciation real exchange rate from the early to 1990's (see Figure 4). The exchange rate depreciation suggests that the industry in these countries should have increased their ability to compete on the global market.

The course of events described above makes us to wondering about the puzzling matter of what might be the underlying factors behind deindustrialization. The real exchange rate is a crucial variable in international trade adding up that industry is heavily exposed to international competition it drags up the subject of investigating the exchange rate. Furthermore the real exchange rate can, at least in theory, be determined by productivity levels of the traded and non-traded sector. On the basis of this the question whether productivity in the financial sector might be an underlying factor of an exchange rate appreciation.

This leads us to the following question:

Does financial sector productivity growth have a tendency to appreciate the real exchange rate?

The study concerns Germany, Sweden the UK and the US. As was stated above these countries have been following rather different patterns in terms of industry and the financial sector. Where Germany and Sweden have not been going through such a high degree of deindustrialization as the UK and the US, at the same time as the financial sector has grown far more in the two later countries compared to the former ones.

The theoretical model is based on the theory developed by Corden and Neary (1982) to explain the Dutch disease. This phenomenon is closely linked exploitation of natural resources but is just as well applicable to other matters. The model assumes a small open economy with three sectors. Two traded sectors out of one booming and one lagging and one non-traded sector. Furthermore it defines the real exchange rate as the relative price of traded and non-traded goods. The boom, or rather productivity increase, in the booming sector, here the financial sector, brings about a move of the production possibility frontier. The move of the curve changes the relative prices and causes the price of non-traded goods to increase i.e. the real exchange rate appreciates.

In order to examine the effects of a boom in the financial sector an ordinary least square will be applied. The regression will be using the real effective exchange rate as dependent variable and a

productivity measure of the financial sector as independent variable. Furthermore two more variables are added to the regression to cover for other effects on the exchange rate than financial sector productivity. To extend the study the analysis includes a literature review on deindustrialization and the financial sector productivity. This is to state which underlying factors that have triggered financial growth and caused deindustrialization.

The duration of the study is chosen on the basis of the observed increase in the financial sectors output as percentage of GDP. This is to capture the important sequences in time when a possible productivity growth phase is likely to have occurred. The data is considering the years between 1985 and 2009 for Sweden the UK and the US. However data the data for Germany does only cover the span between 1991 and 2009. This is due to lack of availability of labor data before the reunification of Germany.

In chapter two a literature review which covers the deindustrialization in advanced economies and the productivity and growth of the financial sector. In chapter three the real exchange rate is defined and the model which will be used to investigate the effects of the financial sector productivity on the exchange rate is specified. Chapter four covers the specification of the data used in the econometric study. The method which is used and the various tests which are preformed are described in chapter five. In Chapter six the results are presented and chapter seven covers the conclusions.

2. Background

2.1 Deindustrialization

During several decades advanced economies have undergone structural changes in the composition of national output and employment. In Western Europe and the United States the manufacturing sector, has had problems to keep up with the rest of the economy in terms of growth. In the literature, when in relative terms, where the rate of employment and output in relation to the rest of the economy is decreasing it is referred to as relative deindustrialization.

On a thirty year basis the relative downward sloping trend of manufacturing output has unambiguously been playing a role in the economic development in the developed world. However, the course of event has been somewhat different with a varying degree of deindustrialization in different economies. In some cases absolute numbers output and employment have declined, this is referred to as absolute deindustrialization.

Especially labor intensive manufacturing has been subject to the decline in output. This part of production has largely move to middle- and low-wage countries. During the last two decades this trend has increased as the movements have been enabled through liberalization of trade and capital markets. Along with this turn away from industry the service sector has grown steadily during this period of time and is now clearly dominating both the share employment and output in high income countries. Competition from low-income countries and the growth of the service sector plays a significant role in the matter Debande (2006). Where the former is closely related to the real exchange rate and the later can be assumed to increase competition with the industrial sector in the demand for factors such as labor.

Rowthorn and Coutts points out consumer preferences, productivity, increased competition and specialization as the most important factors explaining deindustrialization in advanced economies.

When income increases consumers tend to change their consumption patterns. In developing countries consumption is expected to turn from agricultural goods to manufactures as a share of total spending. In more advanced economies where the fraction of income spent on manufactures is reasonably high an increase in income tends to change spending towards services. This will of course be at the expense of the fraction of income spent on other goods Rowthorn and Coutts (2004).

The income level of advanced economies explains why the demand for manufactures is decreasing as a part of total spending as income elasticity of demand for manufactures is negatively correlated

with income. In a typical developed economy with an income elasticity of demand at about 0.7 for manufactures would have an elasticity of around 1.1 for services. Because the service sector in these countries represents a larger part of consumption than in manufactured goods increasing expenditure on services makes up for the relative decrease of the budget spent on manufactures Rawthorn and Ramaswamy (1999, pp. 20-22). Furthermore demographical changes have an impact on demand, in most of the developed world the population is ageing which implies a further move towards services in consumption Debande (2006, p. 71).

The growth of productivity in manufacturing has been relatively high compared to the rest of the economy and has led to a decrease in demand for labor. This has in turn led to a greater supply of labor for the service sector which needs to increase its labor force to keep up with the greater demand for services when the productivity is not growing at the same pace as manufacturing. If the service sector grows fast enough the sectors demand for labor will increase at a level where the excess supply of labor released from manufacturing can be absorbed. In this way employment level in the economy as a whole can be maintained Rawthorn and Ramaswamy (1997, p. 5).

However, the trend in productivity in the service sector has been changed slightly during later years. Productivity in "IT using" service industries has increased significantly since the mid 1990's and did in the US exceed the productivity gains in the goods sector during this time. Although a significant raise in productivity in some parts of the service sector has occurred this is not true for the whole sector. The service sector is still lagging behind in terms of productivity growth, although it has during recent years in some occasions reached the level of the goods sector Bosworth and Triplett (2007). The productivity growth in manufacturing has been large in most advanced economies although it has taken different shapes in the national accounts and employment figures. For example in the UK and the US the rate of labor productivity growth has been increasing at a similar pace. In the US between 1960 and 2003 the number of workers within manufacturing has been more or less constant consequently the output has grown at approximately the same pace as productivity. In the UK on the other hand output has been rather stagnant with only a slight increase where the productivity gains have been compensating a shrinking manufacturing employment in absolute terms Rowthorn and Coutts (2004). Most studies point out the productivity growth as the major reason and most significant factor in explaining the deindustrialization. It represents as much as 60 % of the fall in manufacturing employment during the period between 1970 and 1994 according to the analysis in Rawthorn and Ramaswamy (1997).

Another factor which is important to consider when analyzing deindustrialization is specialization, which in part actually is not necessarily deindustrialization but a matter of classification. As an

economy is developing, much of the production is streamlined and some parts of the production which was previously done within the manufacturing sector have been outsourced. This regards activities such as transportation, design and sales. This part of the production, when it is not performed by the manufacturers themselves, appears as services in the statistics. This implies that the measure of industrialization may be biased towards deindustrialization. Some parts of the phenomenon could be explained by a reclassification of the activities and would thereby not exist under a different definition of manufacturing Rowthorn and Coutts (2004). However specialization does also lead to actual deindustrialization, where many multinationals relocate their low-skilled and labor intensive production in low-income countries. The high-tech production and product development which requires a higher skilled labor force is often kept in the advanced economies Boulhol and Fontagné (2006). This way the deindustrialization is due to offshore outsourcing and is not a matter of reclassification of production.

International trade induce competition from foreign countries, increased competition may have a positive effect on productivity. It could encourage firms to restructure production in order to reduce costs as well as reduce the amount of low value-added activities. For an economy to be able to import goods it also has to have incomes from overseas. In the long run the imports have to be paid for through exports or income from investments overseas, in the short run imports can be paid for through borrowing. When goods are imported or exported it affects the economic structure of the country.

When trade occurs between the home country and a foreign country the trade will also leave a trace in the production of the two countries. Let's say that low-tech goods are being imported, in this case jobs in this sector will be lost. But in order to pay for the imports the home country has to export something, let's say high-tech goods, in this case jobs will be created. Whether or not jobs will be lost depends on how labor intensive the imported and exported goods are. If it is the case of low and high-tech goods as in the example the home country will lose jobs in case the high-tech industry has higher labor productivity than the low-tech industry. In the case for most advanced economies trade with less developed economies will most likely lose jobs by trading with low wage countries since their production lies in high value-added sectors Rowthorn and Coutts (2004).

Rowthorn and Ramaswamy (1999) estimates that in the OECD countries on average for every job created through export of high-tech goods to low income countries 4.4 were lost through competition from imports. Although there is most certainly a correlation between trade with low-wage countries and deindustrialization in the advanced economies the effect of trade is generally regarded as limited compared to other factors. Most studies regards internal factors such as relative

prices and productivity as the most important factors explaining the decline in the manufacturing employment and output, however external trade have gained importance during recent years Debande (2006). Rowthorn and Ramaswamy (1999) also estimates, for the OECD countries, internal factors as the cause of deindustrialization in terms of manufacturing jobs to approximately four fifths of the whole phenomenon. This leaves about one fifth due to trade with low wage countries during the period between 1970 and 1994. The study was later updated and extended and it was found the north-south trade destroyed 5.7 times more jobs than it creates. This is an increase compared to the previous 4.4 and implies that trade with low-income has gained importance. The explanation the authors give is mostly increased trade, especially with China Rowthorn and Coutts (2004).

As well Boulhol and Fontagné (2006) find an increasing trend, however international trade still does not make up for nothing near the size of the importance of internal factors. In their study they have investigated the impact of international trade on reallocations of resources and deindustrialization during the period between 1970 and 2002. The year of 1986 divides the period into two sub-periods in order to highlight the changes of the phenomenon over the years. They find that trade with low income countries during the second sub-period contributed about twice as much to job loses within the manufacturing sector in the advanced economies. The increase of specialization of production and international trade between advanced and developing economies suggest that production will be in accordance with comparative advantages. This implies that trade does not necessarily have to be contributing to deindustrialization at a very high level, it rather boils down to comparative advantages. In such situation we would find that imports to a large extent would be complements to domestically produced goods rather than substitutes Boulhol and Fontagné (2006).

Demand for services is steadily increasing with income whereas the productivity is growing at a slower pace, when adding up that the opposite relationship between productivity and demand is true for manufacturing, the conclusion that the economy is turning towards deindustrialization at least in terms of employment does not seem to be so far away. If trade is not taken into account it is just a matter of an arithmetic relationship. Although since trade does play a role in the real economy the analysis of this relationship is not as straight forward. Due to foreign trade some advanced economies have maintained a strong manufacturing industry and are running a trade surplus in manufactures and a deficit in other traded goods, such countries are Germany and Japan. On the other hand countries like the UK and Australia have a trade deficit in manufactures and need therefore to have a surplus in other traded goods (or incomes from overseas) in order to cover for their deficit Rowthorn and Ramaswamy (1999, pp. 20-22).

2.2 Financial sector productivity growth

The presented framework in chapter 3 was first developed to explain the effects of a boom due to extraction of natural resources might have on the economy and which structural changes the boom will bring about. However, the model is also well suited for studies on other sources of the boom in different sectors as long as they are tradable. For example the boom might occur due to a price increase or technical improvements. Technical improvements and market liberalization are the most important factors in explaining why the asymmetric growth of the financial sector relative to the rest of the economy in the countries it has occurred. The financial sector has enjoyed vast growth in some advanced economies since the 1980's. The sector has been subject to technical change and increasing demand for its services due to increasing international trade and financial deregulation during this period of time.

Mörttinen (2002) provides productivity measures for the banking industry in different European countries. One measure which is presented in the study is the real assets per employee. The ratio has been increasing in all countries in the study. Most importantly the ratio started to accelerate in the early to mid 1990's which matches well the increasing share of GDP the financial sector has gain during the corresponding time in some economies. In the UK the asset to labor ratio increased on average by 4.4 percent on an annual basis between 1984 and 1999, the German growth of the ratio was 5.1 percent between 1989 and 1997, where as the corresponding Swedish growth rate was 3.1 percent between 1981 and 1999. During the time periods employment grew rather slow, in the UK employment growth was 1.4, in Germany 2.4 and in Sweden 1.3 percent.

The financial sector relies heavily on computer technology, a technology which has been under a massive improvement during the last 30 years. When the service industry is often said to be struggling with its productivity growth and is consequently lagging behind the goods sector it does not apply to IT using services. For example the US services sector experienced an overall multi factor productivity growth of an average annual percentage point change of 0.5 between 1987 and 1995, 1.3 between 1995 and 2000 and 1.5 for the period reaching from 2000 to 2005. During the same period of time the goods sectors multi factor productivity grew steadily at a rate of about 2 percent on annual bases. During the first period labor productivity in services grew at 1.1 percent at an annual basis and at 2.3 and 2.4 respectively for the two later periods.

IT using industries are pointed out as those which have enjoyed the largest growth rates in multi factor productivity. Furthermore IT usage is recognized as one large contributor behind the increasing labor productivity within the services industry. The IT usage in the financial sector has led

to increasing productivity compared to the rest of the service industry. For example securities and commodities brokerage multi factor productivity grow at around 11 percent during 1995 to 2005 making it the second fastest productivity growth during this time in the study of Bosworth and Triplett (2007).

There has been a substantial growth in the amount of financial products and as well as in the quality of the products. A quality improvement of any good is difficult to measure and even more so for a service. However, there are some measures to look for to find some support of the theory of quality improvement of financial services. During the 1990's in two different studies based on data from US Banks finds ambiguous on productivity growth. One finds that the cost productivity has decreased and the other one which suggest an increase, however in both of the studies the changes has been very small. This contradicts the presumption that technical improvements should reduce costs and raise productivity. Although when specifying the business condition variables in the same manner as the studies which points towards a productivity decline the same is not true for profits. Profit productivity, which also includes costs, seems to have increased substantially during the period. Higher costs followed by even higher revenues goes in line with the theory that financial services have undergone quality improvements during the 1990's. This is under the assumption that a higher quality service incur higher costs but also a higher willingness to pay by customers Berger (2003). Improvements in information technology in general should however have a negative effect on costs, if the products remain the same as before the technology improvement. This is due to its positive effect on financial institutions ability to screen customers. When the ability to process information increases it will improve the institutions ability to avoid bad loans and consequently avoid losses Mörntinen (2002, p. 10).

As the literature review reveals much of the technical improvement in the financial industry was due to computer technology. Different tasks can be divided into routine tasks and non-routine, in the routine tasks computers can often be used as substitute of labor. For non-routine tasks computers would rather be compliments for labor. As computers are introduced as a tool in an industry it may lead to higher labor productivity in non-routine tasks. In routine tasks however the substitution of technology for labor is most often labor-saving hence lead to decreasing demand for labor Philippon and Rechef (2007, p. 11).

IT usage may also have a positive effect on labor demand because it in particular creates labor demand for skilled labor. If it is labor saving or not depends on which one of these effects which is the stronger. Evangelista and Savona (2002) finds, in their study of Italian productivity, that in the heavy IT using sectors innovations had a negative effect on labor demand between 1993 and 1995.

Particularly in the banking and insurance industry these effects have been severe. The study divides the labor force into high-skilled and low-skilled labor. During the period of the study it is found that innovations had a positive impact on demand for high-skilled labor. Innovations had a labor saving impact on low-skilled labor. When adding the two subdivisions of labor, the labor increasing effect in high-skilled labor did not offset the negative effects on low-skilled labor thus the overall effect was negative.

Amel, Barnes, Panetta and Salleo (2003) emphasize new regulations and financial openness in excess of technology improvements as a source of structural change in the financial sector. The study investigates the growing amounts of and the efficiency gains due to mergers and acquisitions. It pronounces that there has been a large increase of mergers and acquisitions during the 1990's both at a national and international level in the advanced economies. However the study finds mixed results in efficiency in the financial sector due to mergers and acquisitions, although the results are leaning towards positive effects on the marginal efficiency.

3. Theoretical Framework

3.1 The real exchange rate

The real exchange rate is a crucial element when determining the competitiveness for export industries such as manufacturing. Thereby it is also the most essential variable in our analysis, which states it as the relative price between tradable and non-tradable goods. When investigating the real exchange rate one has to recognize that it is an estimate of relative prices between the home country and foreign countries, i.e. it measures the relationship between foreign and domestic price levels. The very definition of the real exchange rate as the relative price of traded and non-traded goods is essential to the analysis in this model of Corden and Neary (1982) and is very practical for theoretical reasoning.

When using statistical data and conducting a statistical study of the movement of the real exchange rate other definitions might be more practical. The problem with the definition in the model is that it is hard to define which goods are tradable and which are not and the supply of already existing data makes other definitions even more attractive. As a substitute of the relative price of traded and non-traded goods definition a consumer price index (CPI) deflated real exchange rate will be used in this study. The real exchange rate is by this definition defined as the nominal exchange rate deflated by CPI in the corresponding country. How these two definitions are related and under which assumptions will be explained in detail later in this paper.

The Nominal exchange rate can be defined as either the number of units of domestic currency per foreign or as the number of foreign currency units per domestic. If this is expressed between two different currencies it is quite straight forward how to denote the value of a currency. On the other hand when foreign is defined as more than one other country the process and the notations will be a little bit different. In this case the relative price of the exchange rate can no longer be denoted in a single currency. What is done to create a nominal exchange rate with more than one country as foreign is that the foreign currencies are being weighted in a currency basket according to their corresponding economy's importance as trading partner. The exchange rate is then weighted against several currencies denoted as an index with a base year, this weighted nominal exchange rate defines the nominal effective exchange rate Burda and Wyplosz (2009, pp. 145-147).

The CPI is a weighted basket of consumer goods and services weighted according to what amounts of this good or service are consumed, the weights are supposed to represent the consumption of the average individual Burda and Wyplosz (2009, p. 30). There are several problems one encounters

when estimating and using the data. Since the CPI consists of a consumption basket suppose to reflect the average consumer, when the consumer preferences changes over time so will the CPI.

When one is looking at CPI data over time the newer measures are not entirely comparable with the older ones. However the goods included in the index obviously have to follow the consumption pattern otherwise the index would be outdated and become irrelevant. A problem which occurs over time when new technology creates new consumption patterns is when the basket and weights are not updated at the same pace as consumption changes. It might take several years for new goods or services to be included in the index which could create a bias when the index cannot fully represent the consumption in the economy. Furthermore, the quality of a good or service may vary between different but similar products and over time which is another source of bias in the measurement Hausman (1997). Since the index is aiming at reflecting an average consumer the different kinds of goods and the weights differ between different countries as a consequent of different consumption patterns in different countries.

The real effective exchange rate is the nominal effective exchange rate adjusted for price differences using CPI in the different currency zones Burda and Wyplosz (2009, p. 147). This can be used as a measure of competitiveness and is the key variable in this analysis of deindustrialization.

In the following part the link between the relative price of traded and non-traded goods and real exchange rate using price levels and the nominal exchange rate will be explained. There are a lot of different definitions for the real exchange rate even when it is narrowed down to foreign and domestic price levels, but one definition which is commonly used is:

$$(1) q \equiv s - p + p^*$$

In this definition s is representing the log nominal exchange rate, p is the domestic log price level and p^* is the foreign log price level. In this equation prices can be specified further and be divided into traded and non-traded goods prices:

$$(2) p = \alpha p^N + (1 - \alpha)p^T$$

$$(3) p^* = \alpha^* p^{N^*} + (1 - \alpha^*)p^{T^*}$$

Here the $*$ denotes foreign, α represents a weigh between traded and non-traded goods, N non-traded and T traded goods price. If we substitute (2) and (3) into (1) and rearrange the components we get:

$$(4) q \equiv (s - p^T + p^{T^*}) - \alpha(p^N - p^T) + \alpha^*(p^{N^*} - p^{T^*})$$

This shows that that the real exchange rate can be expressed as a composition of relative prices of traded and non-traded goods. The first bracket gives the relative price of traded goods, the second represents the domestic relative price of traded and non-traded goods and the third gives the foreign relative price on traded and non-traded goods. Equation four can be broken down into relative price between tradables and non-tradables. This will be achieved if we first assume that the weights in the average price index of the non-traded goods are equal the second and third terms in (4) can be collapsed into a log intercountry price difference, namely:

$$(5) q \equiv (s - p^T + p^{T*}) - \alpha(p'^N - p'^T)$$

Here the prices marked with an apostrophe denote the intercountry log prices difference of traded and non traded goods. If we make a second assumption assuming that the law of one price holds for traded goods and all consumption baskets are identical the second term will be non zero. This leaves us with a definition of the real exchange rate which depends on the relative price of traded and non-traded goods:

$$(6) q \equiv -\alpha(p'^N - p'^T)$$

Here we can clearly see that under the assumptions stated above the real exchange rate can be determined by the intercountry relative price of non-tradables and tradables Chinn (2006, pp. 116-118). This is the case for the “dependent economy” stated by Salter (1959) and used in the framework of Corden and Neary (1982). Furthermore since the price of traded goods is set by the world market, the exchange rate can be assumed to be determined by the price of non-traded goods.

3.2 Theoretical model

The analysis in this study is based on the model used to analyze the Dutch disease phenomenon and developed by Corden and Neary (1982). The theory has its roots in the analysis of structural changes in resource abundant countries when the resources are exploited and the economy is experiencing a boom in this sector. However the analysis can be applied on circumstances where the booming sector is not extractive as long as it is traded. Since the boom concerns a traded sector it will lead to an increase of capital inflow which will lead to an appreciation of the real exchange rate. The appreciation has a tendency to bring about de-industrialization as it makes, in particular, the manufacturing sector less competitive.

The model does not take into account any monetary or nominal variables but considers only real variables and we can therefore use the standard international trade theories to analyze the asymmetric growth caused by the boom. The economy is assumed to be a small open economy, thus does not have an impact on the world prices of the traded goods hence prices can be assumed to be given exogenously. The international trade is assumed to be balanced so that a country cannot run a deficit in its balance of payments overall.

The economy consists of three different sectors out of two are traded. The two traded sectors will be labeled the booming sector and the manufacturing sector and the non-traded sector will simply be referred to as the non-traded sector. The prices of the goods produced in the later are flexible and are set by supply and demand on the domestic market. Each one of the sectors uses capital as a factor, which is defined as specific for each sector, and labor which is perfectly mobile between the sectors i.e. the model considers medium-run effects of the boom. Wages are assumed to be perfectly flexible which means that the economy is working with full employment at all time and all goods are used for final consumption. Furthermore the model considers the technical characteristics behind the boom and distinguishes between a Hicks-neutral and a non-Hicks-neutral technical improvement. The key variable in the analysis is as mentioned the real exchange rate which is defined as the relative price between traded and non-traded goods. The exchange rate is flexible as it is defined by a price ration where non-traded goods prices are flexible.

The effect of the boom can be divided in to resource effect and spending effect which will affect the real exchange rate and the composition of output and employment for the economy at large. The spending effect occurs due to a rise in national income which will lead to higher prices of non-traded goods thus an appreciation. Under the assumptions that have been made labor is the only mobile factor of production, the resource effect describes how the booming sector raises its marginal product and will through that attract resources from the other sectors if needed. Additionally the combination of the two effects increases output in the non-traded sector. Here the spending effect raises demand for non-traded goods which creates a disequilibrium which will be restored by a resource move in to the non-traded sector. The two effects will tend to crowd out manufacturing through an appreciating exchange rate and because resources are drawn out of the sector as demand for labor increases in the other industries.

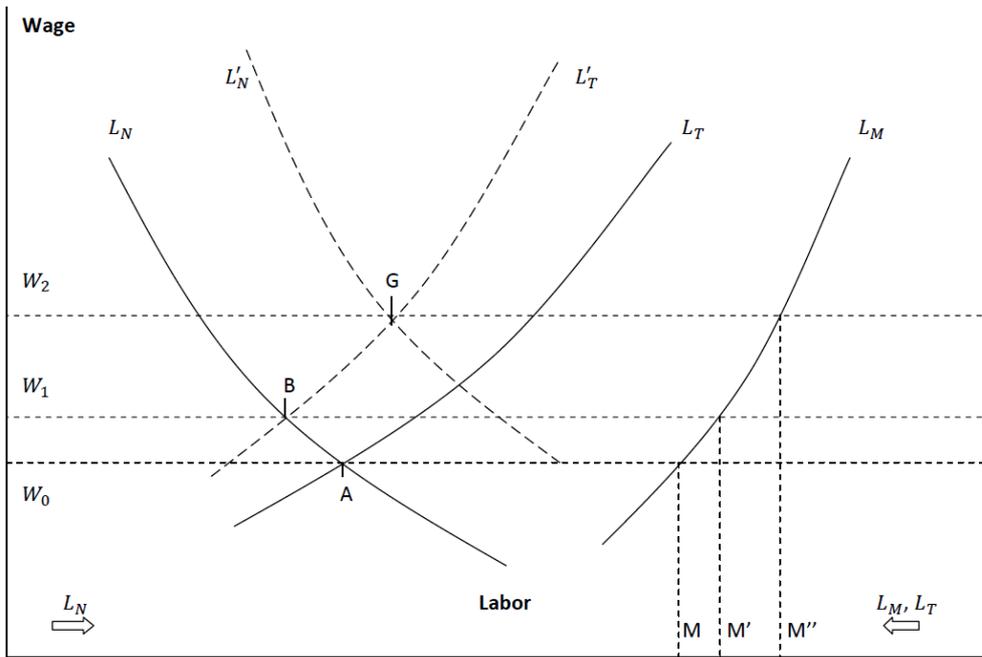


Figure 2: The effects on the labor market
 Constructed by author based on Corden and Neary (1982)

Figure 2 is describing the labor market where the vertical axis is represents the wage rate and the horizontal axis is measuring labor input in non-traded goods starting from the left-hand side, labor input for the two traded sectors is measured from the right-hand side. L_N is denoting labor demand for non-traded goods, L_M denotes labor demand for manufacturing and L_T denotes labor demand for all traded goods.

The pre-boom state in the model is at point A in Figure 2, when the boom is raising profitability in the booming sector the demand for labor in this sector shifts upwards and equilibrium is restored at point B and manufacturing sector share of labor is reduce from M to M', and the wage level has increased. In the first stage the real exchange rate is held constant, the effect of the boom raises profitability and raises demand for labor in the booming sector. The increased labor demand increases salaries in the booming sector in order to attract labor into the sector. This causes a resource movement from the manufacturing and the service sector into the booming sector, a further result is higher wages over all in the economy. This is referred to as direct-deindustrialization. Our analysis now moves on to consider the production-possibility curve illustrated in Figure 3.

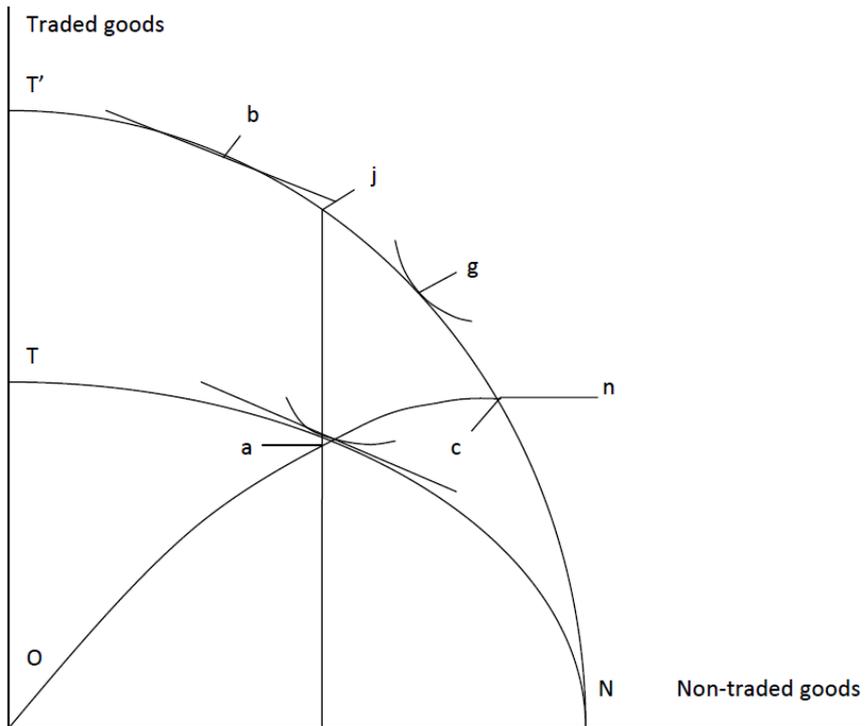


Figure 3: Effect through the production-possibility frontier
 Constructed by author based on Corden and Neary (1982)

Figure 3 explains the effect of the boom using the production-possibility frontier. The terms of trade are fixed hence the two traded sectors can be summarized in to one traded good in this analysis and is measured by the vertical axis, the non-traded sector is measured by the horizontal axis. In the initial state the economy has its equilibrium at point a in which we find the initially highest value indifference curve and the real exchange rate is given by the slope of the tangent.

The boom increases output of traded goods which shifts the production-possibility frontier in Figure 3 upwards to OT'. If the real exchange rate is held constant the effect caused by the resource movement gives, through the movement of labor from the non-traded into the traded sector as a whole, a new production point at b. The resource movement within the traded sector taps manufacturing on labor in favor of the booming sector. Point b is found to the left of the initial point a which demonstrates a reduction of production in the non-traded sector. Assuming that demand for non-traded goods have not diminished as a consequence of the boom the economy ends up in disequilibrium at this stage.

The first stage of the spending effect will be examined under the assumption that income-elasticity of demand for non-traded goods is zero. This assumption implies that the extra income only leads to increased consumption of tradables although does not decrease demand for non-traded goods. The income-consumption curve this could be illustrated by a vertical line through a and j in figure 3. The resource movement effect transferred resources from the non-traded sector thus decreased the output. Now if the income-elasticity of demand for non-traded goods is at least zero there must be

excess demand for these goods. To restore equilibrium there must be an appreciation of the exchange rate, in other words, the price of non-trade goods must increase. Equilibrium will be restored along the T'S line somewhere between point b and j, however output of non-traded goods will be lower than in the initial stage.

To further investigate the spending effect we consider a situation where the booming sector does not use any labor, thus the resource movement effect is omitted and does not give rise to any change in the labor market in Figure 2. Furthermore the assumption that the income-elasticity of demand of non-traded goods is zero is relaxed and the income-consumption curve is no longer vertical but increases with the level of income according to On in Figure 3. The raise in income from the boom brings about higher demand for non-traded goods at the initial real exchange rate demand ends up at point c. At this point disequilibrium will occur and an appreciation of the exchange rate is necessary for the equilibrium to be restored. This will happen somewhere between point c and j along the production-possibility frontier i.e. output of services has increased from the effect of the boom.

When combining the effects equilibrium will be found at point g on the production possibility frontier. This point is in the figure representing a situation where the spending effect is stronger than the resource movement effect, if the later is the stronger equilibrium will end up on the left side of point j. Throughout the analysis, apart from point b, a real appreciation of the real exchange rate will occur. This is illustrated by the slope of the tangent which is steeper at every point on the right hand side of point b. This concludes that the boom unambiguously will appreciate the real exchange rate, however the resource and spending effects have different effect on the output of non-traded goods.

Depending upon the characteristics of the technical improvement behind the boom the magnitude of the resources movement will vary. The spending effect on the other hand remains the same. If the technical change is Hicks-neutral the booming sector will increase its demand for labor and the resource movement effect will have a rather strong impact on the other sectors. If however the technical improvement is non-Hicks-neutral it might have labor saving effect on the sector and the resource movement will be weakened. The spending effect remains the same no matter if the technical improvement is Hicks-neutral or not. Consequently the spending effect will be dominating if the booming sector has been subject to a non-Hicks-neutral change.

Which one of the spending effect and the resource movement effect which is the strongest determines where on the production possibility frontier final equilibrium will be found. If the

spending effect is dominating equilibrium will end up to the right of point g in Figure 3 Corden and Neary (1982).

3.3 Modeling the effect on the exchange rate

In accordance with the reasoning above the real exchange rate is determined by the relative price of traded and non-traded goods. The relationship is described in the production possibility frontier where the relative productivity between the traded and non-traded sector changes the curve. According the model a relative increase in labor productivity has a tendency to appreciate the exchange rate. The reasoning goes in line with the Balassa-Samuelson effect which describes how a relative increase in the traded goods sector gives rise to a real exchange rate appreciation Flek and Marcová and Podpiera (2002).

In order to continue with the analysis the relationship between the productivity and the real exchange rate deserves to be examined more formally. Under the assumption that wages are closely linked to labor productivity the relationship between wages, labor productivity and prices can be described as follows:

$$(7) w^T - p^T = a^T$$

$$(8) w^N - p^N = a^N$$

Where w^T and w^N denotes wages in the traded and the non-traded sector a^T and a^N express labor productivity in the two sectors. As before p^T and P^N denotes prices and all variables are logged. If wages in the non-traded sector are not considered to be linked to labor productivity within the sector but instead are determined by wages equalization across sectors, wages in the non-traded sector will be determined by productivity in tradables. This means that the wages are assumed to be equal in the two sectors and equation 7 and 8 gives the relationship:

$$(9) p^N - p^T = a^T - a^N$$

By substituting equation 9 into equation 6, which explained the relationship between prices and the real exchange rate we get:

$$(10) \quad q \equiv -\alpha(a^T - a^N)$$

This gives us that the relative productivity of traded and non-traded goods can under certain assumptions determine the real exchange rate Egert (2002, pp. 2-3).

In order to investigate the resource curse in Russia Oomes and Kalcheva (2007) examines the real exchange rate on the basis of the same theoretical model as presented above. The study examines the impact of an increasing oil price on the rest of the economy. The real effective exchange rate is used as the dependent variable. Since the study concerns oil sector the price of the good is used as an explanatory variable. Furthermore since the exchange rate also is affected by other factors, more variables are added to the regression. In this study a regression is run which includes two other variables apart from the oil price. The added variables are government consumption and net international reserves, the former is expected to have a positive effect on the real exchange rate and the latter negative. Variables are found to have a statistically significant effect on the exchange rate with the expected signs.

In accordance with what is stated above, this study is considering the relationship between the inter-country ratio between the traded and the non-traded sector productivity and the real exchange rate. Furthermore on the basis of the presented theory we can conclude that the real exchange rate can be expressed as a function of the ratio labor productivity between traded and non-traded goods as follows:

$$(11) \quad RER = f(Prod)$$

Where *Prod* stands for the relative productivity of the traded and non-traded sector and *RER* denotes the real exchange rate. Furthermore since there are indeed other factors which affect the real exchange rate other variables will be added to the regression. To correct for other influences on the exchange rate i.e. to attempt to avoid an omitted variable bias more variables have to be added to the model. In line with Oomes and Kalcheva (2007), government expenditure (*G*) and total international reserves (*IR*) will be added to the function. *RER* is exchanged for the real effective exchange rate.

This gives us the following model:

$$(12) \quad REER = f(Prod, G, IR)$$

Prod is according to the presented theory expected to have a positive effect on the exchange rate. In line with Oomes and Kalcheva (2007) *G* is expected to have a positive impact on the exchange rate, *IR* is expected to have a negative impact.

4. Data

4.1 Specification of Data

The duration of the study stretches from 1985 for the US, the UK and Sweden and from 1991 for Germany until 2009 and considers annual data. The limitation of the German study is due to lack of data on labor for the period before the reunification of the country.

The data supporting the labor productivity measure is taken from the OECD National Accounts Statistics database. It consists of labor and output data by sector with which the productivity measures are calculated. The labor data differs for the different countries, this is due to data availability. Labor for Sweden and Germany is measured as number of hours worked, for the US it is defined as number of jobs and for the UK it is defined as number of persons employed in each sector. The difference in labor data should not cause any problems for the study. The output data based on gross value added at current prices. The productivity measure is calculated as described below.

The relative labor productivity of the financial sector is used as a proxy of the relative productivity of traded. The labor productivity of the financial sector is defined as:

$$(13) \quad Prod^F = Y^F / L^F$$

Where Y^F stands for gross value added in the financial sector and L^F denotes labor. The non-traded sector is defined as

$$(14) \quad Prod^N = (Y^{Total} - Y^F - Y^I) / (L^{Total} - L^F - L^I)$$

Where Y^{Total} denotes gross value added of total activity, Y^I the gross value added of Industry, L^{Total} total labor and L^I industry labor. This definition of the traded sector may be questioned but it is made for simplicity. There is no exact definition of what is a traded or non-traded sector but industry is often considered traded thus removed. Using the financial sector as the traded sector obviously serves the purpose of capturing the effect of a productivity gain in this sector. The productivity measures are expressed as indices with the starting year as base year and take the value 100 at this point.

The real exchange rate is taken from the World Bank data base WDI and GDF and is a consumer price index deflated real effective exchange rate. The data has been modified so that the base year is the first in each period for the sake of clarity and takes the value 100 at the base year. The

government expenditure data is for Germany, UK and US extracted from the OECD database. The corresponding Swedish data is extracted from IMF World Economic Outlook Data Base. For all the countries the data is defined as total expenditure of general government as percentage of GDP. The total international reserves data is provided by the World Bank data base WDI and GDF it is expressed in billions of US dollars.

4.2 Analysis of data

In this section we demonstrate the data on the real effective exchange rate and the productivity measure calculated as presented above. When we take a look at the data presented in Figure 4 we see how the exchange rate and productivity has developed for each country. By examine the data in this way we can get a hint on how the figures correspond to each other and detect potential currency shocks.

Taking a look at Germany we can see that the two variables seem to follow a similar pattern. The relative productivity has been declining a little more than 20 percent during the period. The exchange rate on the other hand has been appreciating during the first years. After the first the years of appreciation the exchange rate seem to have been following the productivity pretty well. At the last stage the trend seems to have been rather flat for both of the variables. In the Swedish data a very volatile period can be observed during the early 1990's.

This period represents the Swedish financial crisis and a steep fall in the exchange rate can be observed between 1992 and 1993. This fall corresponds to the change in exchange rate regime of the Swedish Krona. During this period the variables do not seem to follow a similar pattern which one can observe with the naked eye. Although the exchange rate has many determinants out of which the relative productivity of the traded sector is one hence it cannot be expected to fully describe its movements. During the time after the 1990's financial crisis the two variables has been decreasing at a similar pace.

When turning to the UK, the exchange rate appear a rather volatile. As well as Sweden the UK did go through a major financial crisis during the early 1990's which explains some of the volatility. The subsequent shows a steady appreciation of the exchange rate which came to an abrupt end in the end of the time period. The steep fall in the exchanged rate matches with the current financial crisis which did hit the UK particularly hard. After the fall in productivity at the early phase of the period productivity has been sloping upwards until the end of the study.

The American exchange rate starts with a steep fall. This fall was preceded by a very steep increase in the exchange rate in the early 1980's which is not displayed in this figure, trend remains rather flat to until the mid 1990's. It reaches its peak in 2002 and declines until the end of the period. Productivity experienced a fairly flat trend until the very end of the 1990's and had increased about 15 percent at the end of the period.

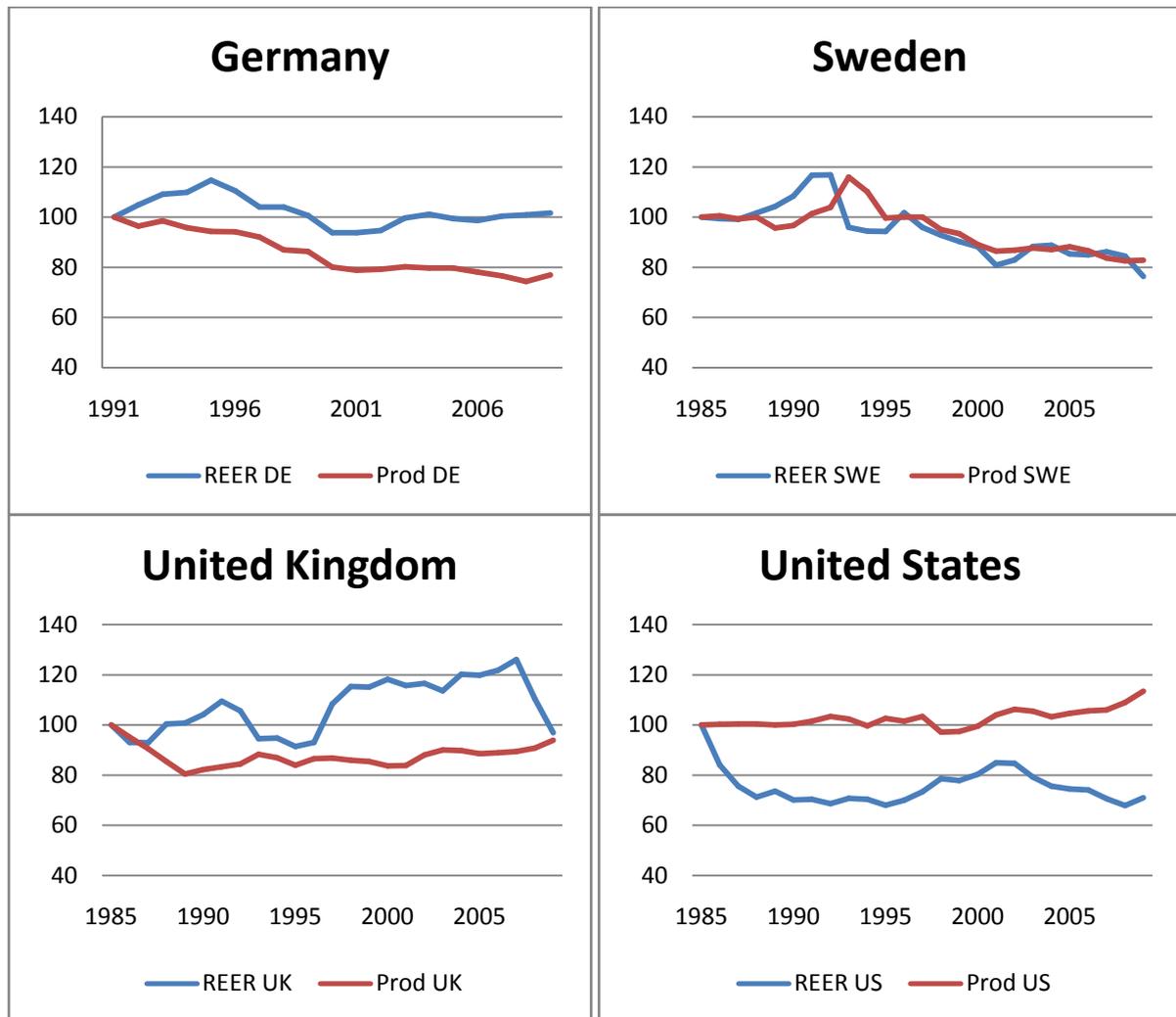


Figure 4: Relative labor productivity and the real effective exchange rate, base year=1
 Source: Prod is extracted from OECD database, REER is extracted from World Bank data base WDI and GDF

To sum up what can be observed in Figure 4 we can see that in both Germany and Sweden has seen a decline in both the real exchange rate and the relative productivity of the financial sector from the mid 1990's until 2009. For UK and US the productivity has followed a rather similar trend from the beginning of the 1990's. From this point in time the slope shows an increase until the end of the period. Worth noting is that the trend seems to have been rather flat during the 1990's and has thereafter increased during the last decade. It is hard to see if the exchange rates are following any specific pattern for either of the countries. Furthermore times of financial turmoil seem to bring

about volatility of the exchange rate. The extreme changes in the exchange rates which are observed in Figure 4 could possibly cause problems for the model. This is because such massive sudden changes are likely to be due to other factors not included in the model.

5. Method

The method which will be applied to investigate the relationship between the relative productivity of the financial sector and the exchange rate is a multiple ordinary least square regression. In order to avoid problems with non-stationary variables we estimate the regression with the log-difference of the variables. The ordinary least square estimator assumes that the error term u is normally distributed with zero mean and variance σ^2 . In addition the regression model assumes homoscedasticity i.e. whether the variance of u is constant, if this is not the case u is considered heteroscedastic. Furthermore the error terms u_i and u_j are assumed not to be autocorrelated, that is the $E(u_i, u_j) = 0$. To find out whether these assumptions are fulfilled or not various tests will be run. If autocorrelation and heteroscedasticity are found in the residuals Newey-West method will be applied to the OLS estimate to cope with the matter. The method provides heteroscedasticity and autocorrelation consistent standard errors of the coefficients. This means that although heteroscedasticity and autocorrelation is present in the residuals the regression will provide reliable standard errors and p-values. The regression and the tests are run using EViews.

The model is estimated accordingly:

$$(15) \quad \Delta \ln REER = \beta_1 + \beta_2 \Delta \ln Prod_t + \beta_3 \Delta \ln G_t + \beta_4 \Delta \ln IR_t + e_t$$

Here \ln denotes the natural logarithm and Δ represents the first difference. The results yielded from this regression will be used to investigate the relationship between the exchange rate and the relative labor productivity of the financial sector.

To test for normality the Jarque-Bera test of normality will be applied. The test is based on the skewness S and the kurtosis K of a random variable. The test statistics is defined as:

$$(16) \quad JB = \frac{n}{6} \left(S^2 + \frac{(K-3)^2}{4} \right)$$

Here n denotes the sample size. The test statistics is chi-square distributed with 2 d.f. asymptotically. If the variable which is subject to the test is not normally distributed the JB will take increasingly higher values. If the variable follows normal distribution the test statistics assumes zero. The null hypothesis of the test is that the variable is normally distributed. if:

$$(17) \quad JB > \chi^2_{(2)}$$

The null hypothesis can be rejected at chosen level of significance, a rather low p-value indicates rejection of the null hypothesis.

The test which will be performed to test for heteroscedasticity is White's heteroscedasticity test. The White's test runs an auxiliary regression on the squared residuals from the original OLS on the variables, on the squared variables and the cross-product of the variables from the original OLS. The R-squared value from the auxiliary regression multiplied by the number of observations follows the chi-square distribution. The number of explanatory variables from the auxiliary regression defines the degrees of freedom. With three independent variables as in our regression this adds up to nine degrees of freedom. The null hypothesis assumes no heteroscedasticity, if:

$$(18) \quad R^2 * n > \chi^2_{(d.f.)}$$

The null hypothesis can be rejected, this corresponds to a low p-value Gujarati (2006).

To test for autocorrelation the Breusch-Godfrey Serial Correlation LM test will be applied. The test runs an auxiliary regression using the residuals of the original OLS as dependent variable and the variables and lagged residuals of the original OLS as independent variables. The number of lags is chosen on basis of the number of observation not to lose too many degrees of freedom. In the case of this study two lags will be used since the number of observations is only 25 and 19 a larger number of lags would consume too many degrees of freedoms. The R-squared value multiplied by the number of observations follows the chi-square distribution with the number of lags as degrees of freedom. If:

$$(19) \quad R^2 * n > \chi^2_{(d.f.)}$$

The null hypothesis of no autocorrelation can be rejected, this corresponds to a low p-value.

If the Null hypothesis of normality is rejected thus we can conclude that the residuals are not normally distributed we have to find a cure in order to be able to attain reliable results of the regression. One possible solution for this problem is to transform the dependent variable.

6. Results

In this section the regression model is applied to the data is presented according to what is stated above. To find out whether we can find a relationship between the exchange rate and relative productivity growth in the financial sector the regression defined as equation 15 is examined. As previously stated other variables are expected to have an effect on the exchange rate. Therefore the relationship between the financial sector productivity and the exchange rate is examined when these exchange rate determinants are added. The results of the regression are presented in Table 1 along with the tests statistics of normality heteroscedasticity and autocorrelation.

Table 1: OLS Regression: dependent variable $\Delta \ln REER$

| | Germany | Sweden | UK | US |
|--------------------------------|------------|------------|------------|------------|
| Constant | -0.000542 | -0.017465 | 0.008814 | -0.009478 |
| S.E | (0.007759) | (0.013195) | (0.012192) | (0.013304) |
| P-value | (0.9453) | (0.2006) | (0.4781) | (0.4845) |
| $\Delta \ln Prod$ | 0.228652 | -0.446051 | 0.185612 | -0.036519 |
| S.E | (0.257584) | (0.320575) | (0.460736) | (0.698751) |
| P-value | (0.3897) | (0.1794) | (0.6913) | (0.9588) |
| $\Delta \ln G$ | 0.250748 | 0.016972 | -1.121873 | 0.156066 |
| S.E | (0.133411) | (0.486934) | (0.385636) | (0.669466) |
| P-value | (0.0811) | (0.9725) | (0.0087) | (0.8180) |
| $\Delta \ln IR$ | 0.127849 | 0.026054 | -0.083733 | -0.107718 |
| S.E | (0.060090) | (0.066950) | (0.065270) | (0.119549) |
| P-value | (0.0516) | (0.7013) | (0.2142) | (0.3783) |
| R-squared | 0.512887 | 0.116400 | 0.361401 | 0.044900 |
| Adj. R-squared | 0.408506 | -0.016140 | 0.265611 | -0.098364 |
| S.E of regression | 0.026810 | 0.059817 | 0.055966 | 0.058113 |
| Observations | 18 | 24 | 24 | 24 |
| Jarque-Bera | 0.678596 | 0.304769 | 0.287325 | 1.880807 |
| P-value | (0.71270) | (0.858658) | (0.866180) | (0.390470) |
| White Test | | | | |
| Obs*R-squared | 15.00537 | 12.73873 | 7.525210 | 4.976687 |
| P-value | (0.0908) | (0.1748) | (0.5826) | (0.8363) |
| LM Test for serial correlation | | | | |
| Obs*R-squared | 1.521446 | 3.350137 | 1.417530 | 1.475760 |
| P-value | (0.4673) | (0.1873) | (0.4923) | (0.4781) |

Starting with the test of normality the Jarque-Bera statistics p-values provided in Table 1 shows us JB values between 1 and 0 for all countries except for the US which attain a value around 1.88. The US has the lowest p-value which is as high as 0.39 thus the null hypothesis of normal distribution cannot be rejected, this is with a large margin.

Turning to the White test statistics the p-values gives us that the null hypothesis of no heteroscedasticity cannot be rejected for Sweden UK and the US. For Germany the test statistics provides the p- value 0.0908 which shows stronger significance than what was shown for the other regressions. Although we cannot reject the null hypothesis at a 5 percent level of significance.

The Breusch-Godfrey LM test of autocorrelation is now considered. The test statistics reveals high p-values, according to the decision rules the null hypothesis of no autocorrelation cannot be rejected. We have now stated that the residuals of the regressions are normally distributed, are homoscedastic and are non serial correlated.

Our next step is to discuss the estimates, we start with Germany. The productivity and government spending shows the expected signs, although international reserves seems to be positively related to the exchange rate when looking at the sign of the coefficient. However when turning to the p-values we can conclude that the productivity variable is far from significant i.e. we cannot conclude that a productivity increase in the financial sector has an effect on the exchange rate on the basis of the regression. Further the government spending variable has the p-value of 0.0811 which is not significant at a 5 percent level. Although the international reserves variable has the unexpected sign attains a p-value of 0.0516 in this case one should rely on existing theory and simply not consider it as significant. The Swedish coefficients for productivity and international reserves have attained different signs than expected and only government expenditure has the predicted sign. However none of the p-values indicate that the coefficients are significant and we cannot draw any conclusions based on the estimates. The UK regression yields coefficients for productivity and international reserves which has the signs which go in line with existing theory. But also in this regression we have one coefficient which does not follow what we had expected. It is also the only coefficient which is statistical significance i.e. we cannot draw any conclusions on the impact of any of the variables impact on the exchange rate based on this regression either. Again the regression which is run on the US data also provides the unexpected signs of the productivity measure, the other coefficients follows what is expected. However none of the coefficients comes out as significant.

As a consequence of p-values and misleading signs of many of the coefficients no conclusions can be drawn using the regression. Most of all the coefficients accounting for labor productivity showed far too high p-values to be considered significant. Furthermore some the coefficient even turned out to be negative which contradicts the hypothesis in this paper.

Although none of the coefficients in the regression showed signs of being significant the some of the R-squared values of some of them where not very low. The R-square values came out as 0.512887, 0.116400, 0.361401 and 0.044900 respectively. Even though the R-squared value is used as a measure of the how well regression explains of the relationship to the dependent variable and the explanatory variables the measure better not be used in this case. This is because we cannot draw any conclusions about the coefficients and most of all many of the variables showed unexpected signs. But what it does on the other hand is that it might give a hint about what have gone wrong in the regression. A high R-squared value and few significant variables is an ordinary sign of multicollinearity.

If the presence of multicollinearity is a fact there are no straight forward remedial measures to take to cope with. The measures that are available are to transform variables, a transformation might make the problem less severe, although it cannot solve the problem entirely. Another possible remedy for this model could for example have been to add dummy variables accounting for financial turmoil. As displayed in Figure 4 during times of financial turmoil the exchange rate appears to be volatile which might have caused problems for the regression.

7. Conclusions

In this study the effect of labor productivity growth on the real effective exchange rate has been investigated using the theoretical model of Corden and Neary (1982). The study has its roots in the structural changes of the advanced economies in the composition of the GDP. Many of these economies have undergone deindustrialization during the past decades and the real exchange rate is one out of many variables which are likely to have caused this trend. According to the theory presented relative productivity growth of a traded sector should have an appreciating effect on the exchange rate. In addition there are more variables than the productivity in the financial sector which affects the exchange rate. Consequently government expenditure and international reserves were added to the regression to correct for these effects.

Furthermore the duration of the study covers the episode when the largest productivity growth in the financial sector is suggested to have occurred. According section 2.2 the productivity gains in the financial sector should have started to increase the most in the mid 1990's to the early 21th century. Furthermore for the UK and the US which are the countries in this study which have seen the financial sector grow substantially during the time of the study. Figure 1 suggests that the output relative to the rest of the economy has seen the largest gains during this period for these countries.

A multiple ordinary least square regression was applied to investigate the matter, however not very successfully. The regression models did not yield any results which where possible to draw any conclusions on. The p-values indicated very low level of significance for most variables. Most of all none of the p-values of the productivity measure indicated significant results. Many of the coefficients in the regression had different signs than expected i.e. contradicted established theories of exchange rate determinants. Consequently no relationship between the relative labor productivity of the financial sector and the real effective exchange rate could be found.

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