UNIVERSITY OF WUPPERTAL
BERGISCHE UNIVERSITÄT WUPPERTAL

EUROPÄISCHE WIRTSCHAFT
UND
INTERNATIONALE MAKROÖKONOMIK

Paul J.J. Welfens

Interdependency of Real Exchange Rate, Trade, Innovation, Structural Change and Growth

Diskussionsbeitrag 139
Discussion Paper 139

Europäische Wirtschaft und Internationale Wirtschaftsbeziehungen
European Economy and International Economic Relations

ISSN 1430-5445

Paul J.J. Welfens

Interdependency of Real Exchange Rate, Trade, Innovation, Structural Change and Growth

December 2005

Herausgeber/Editor: Prof. Dr. Paul J.J. Welfens, Jean Monnet Chair in European Economic Integration

EUROPÄISCHES INSTITUT FÜR INTERNATIONALE WIRTSCHAFTSBEZIEHUNGEN (EIIW)/
EUROPEAN INSTITUTE FOR INTERNATIONAL ECONOMIC RELATIONS
Bergische Universität Wuppertal, Campus Freudenberg, Rainer-Gruenter-Straße 21, D-42119 Wuppertal, Germany
Tel.: (0)202 – 439 13 71
Fax: (0)202 – 439 13 77
E-mail: welfens@uni-wuppertal.de
www.euroeiiw.de

JEL classification: O30, E13, E50
Key words: real exchange rate, monetary growth policy, economic growth, innovation

Summary: This paper analyzes the impact of the real exchange rate on trade, structural change and growth. We point out a new approach to monetary growth policy in an open economy with trade and foreign direct investment. Moreover, the analysis presents a paradox effect with respect to the link between process innovations and the price level: The latter can rise if there are process innovations provided that the income elasticity of the demand for money is between zero and unity. We also look into the more traditional Balassa-Samuelson effects and consider the major impact of real exchange rate changes on structural change and on economic growth, the latter including a modified neoclassical model with endogenous growth. In addition, we consider aspects of optimum growth. Main policy conclusions are that one should avoid massive overshooting. Poor countries willing to catch up with partner countries in an integration area would be well advised to promote foreign direct investment inflows and to stimulate upgrading of human capital. Supporting R&D is also crucial for economic catching up.

Zusammenfassung: Vorliegender Beitrag analysiert den Einfluss von realen Wechselkursen auf Handel, Strukturwandel und Wachstum. Wir zeigen einen neuen Ansatz der wachstumsfördernden Geldpolitik in offenen Volkswirtschaften mit Außenhandel und ausländischen Direktinvestitionen auf. Ferner weisen wir auf ein Paradoxon in Bezug auf Prozessinnovation und Preisniveau hin: Letzteres kann bei Prozessinnovation ansteigen gegeben dass die Einkommenselastizität der Geldnachfrage zwischen Null und eins liegt. In diesem Beitrag schauen wir uns auch den traditionellen Balassa-Samuelson Effekt an, und prüfen den Einfluss von realen Wechselkursen auf Strukturwandel und Wachstum, wobei ein modifiziertes neoklassisches endogenes Wachstumsmodell verwendet wird. Zudem werden Aspekte von optimalem Wachstum betrachtet. Eine der wichtigsten Politikimplikationen ist die Vermeidung von übermäßigem overshooting. Aufholende Länder sind gut beraten, ausländische Direktinvestitionen und Humankapitalbildung zu fördern. Auch die Förderung von Forschung und Entwicklung sind für aufholende Länder von großer Bedeutung.

Paper (revised) presented at project meeting "Changes in Industrial Competitiveness as a Factor of Integration: Identifying Challenges of the Enlarged Single Market" CEPS, Brussels, November 25-26, 2005 (EIIW Working paper No. 139)
[File Casewelfensbruss05short]

Paul J.J. Welfens, Chair in Macroeconomics and Jean Monnet Chair for European Economic Integration; President of the European Institute for International Economic Relations (EIIW) at the University of Wuppertal www.euroeiiw.de; www.econ-international.net, welfens@eiiw.uni-wuppertal.de

Determinants of Trade Specialization in the New EU Member States

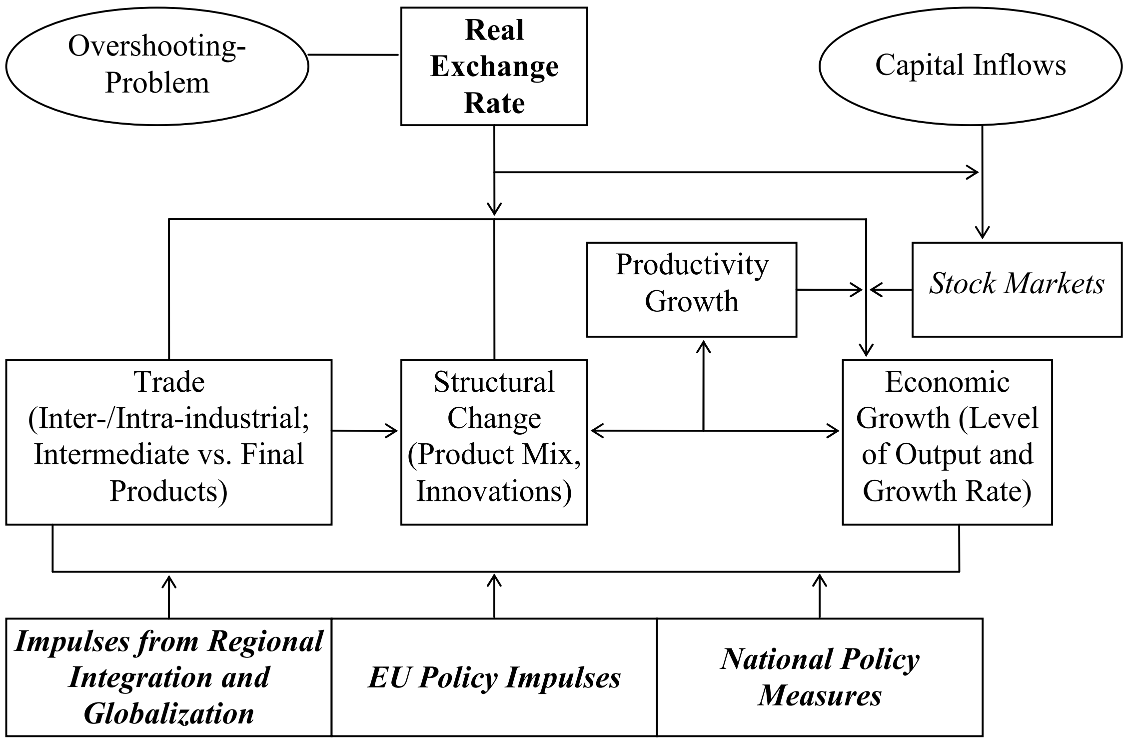
Contens

1. Introduction

As regards economic transition countries as well as EU accession countries, one can observe that they have recorded a long term real appreciation vis-à-vis the Euro and other currencies. Long term appreciation does not exclude considerable short term real exchange rate dynamics where stages of temporary nominal and real currency depreciation can be an element of a long term real appreciation process. On the one hand, one must therefore ask which role volatility – including potential overshooting – plays. On the other hand, the focus is on the impact of the real exchange rate trend on economic development.

The real exchange rate q* is defined here as eP*/P (e is the nominal exchange rate in price notation, P the price level, * denotes foreign variables) while the relative price of nontradables (N goods; T is tradables) is denoted as $\varphi=P^N/P^T$. It is clear that the international law of one price will not hold strictly for tradables if we take into account transportation costs, tariffs and other trade impediments. However, even without these physical and political impediments, the law of one price does not hold universally across countries – at least not in a Schumpeterian world with product innovations and process innovations. Subsequently, we will take a closer look at potential explanations and the implications. Competitiveness of EU15 and of eastern European accession countries as well as of EU25 will be affected by dynamic structural change and the newly emerging regional division of labor and innovation.From a theoretical perspective, the real exchange rate affects trade, structural change and economic growth in an interdependent way. In the short run a change of the real exchange rate will influence portfolio capital flows since the interest parity says that the domestic interest rate i= i*+ dlne/dt (i* is the interest rate; note that within a medium term perspective i=r+π and i*=r*+π* - π is the inflation rate and r the real interest rate – so that we get the equation r= r*+dlnq*/dt). Overshooting in this respect could be a problem, that is the medium depreciation rate could diverge from the short term depreciation rate. In the medium term the real exchange rate also will affect the trade volume, the product mix of exports and imports plus the current account position. Moreover, the structure of output will be affected. This will partly be linked to sectoral productivity growth. In the medium term and in the long run, there will be direct and indirect effects on national income and per capita income. These changes will in turn affect structural change and trade. In an open economy, the picture would be incomplete if one did not consider the effects of exchange rate dynamics on capital inflows as well as the stock market. To the extent that there is an increase of capital inflows and in particular foreign direct investment inflows, there will be effects on the production potential and productivity growth (see Fig. 1). From a policy perspective, one must ask which impulses arise from regional integration and economic globalization. Moreover, the questions as to which EU policy impulses are relevant and which national policy measures could spur growth must be asked. As regards structural change in Eastern Europe, it is clear that one should expect considerable structural change in the initial transition stage and possibly also once high foreign direct investment inflows occur. This occurred early on in Hungary, and the Slovak Republic, but only with a considerable delay in Poland. The various subsequent indicators show different intensities of structural change, and the intensity of change is not equal across the various indices. On theoretical grounds (see appendix) one should focus mainly on the Lilien index and the modified Lilien index. As the feature of those two indicators consider the sectors' relative weights, and also meet other standard requirements. As we can see in the subsequent table, the various indicators which summarize the intensity of structural change in the period from 1993 to 2001/02, the statistics point to rather strong structural change in several accession countries. Ideally, workers move out of sectors with low productivity growth towards sectors with high productivity growth, the latter often being found in sectors with high foreign direct investment inflows (FDI). FDI and investment of domestic firms will increase capital intensity and this, along with improved technology, will raise productivity. A positive gap between the growth rate of the wage rate and sectoral productivity growth will reinforce sectoral profit rates which in turn should stimulate sectoral FDI inflows. To the extent that economic catching-up and modernization is associated with high cumulated FDI inflows, one should expect that a considerable part of trade is shaped by FDI. Intra-company trade accounts for roughly 1/3 of trade in OECD countries.

Figure 1: Exchange Rate Dynamics, Trade, Structural Change and Growth



By contrast, the degree of structural change in Germany was rather low, though this might be an artefact related to rather rough sectoral decomposition. For example, if international outsourcing to Eastern Europe takes place this can be associated with considerable structural change although at the two-digital level one would not note that less automotive parts are produced in Germany in the early 21st century than a decade ago.

Table1: Various Indicators Measuring Structural Change based on Production Data at the NACE 2-digit level (LI=Lilien Index; MLI= modified LI)

		NaV	EuN	SRD	IG	GRP	LI	MLI
Germany	93-02	0.1727	0.0760	4.0043	0.0434	0.0731	0.1097	0.0327
Greece	95-02	0.2181	0.0737	5.7420	0.0529	0.0912	0.1222	0.0318
Hungary	93-01	0.5903	0.1967	20.7673	0.4593	0.2248	0.4124	0.0814
Poland	93-01	0.2601	0.0656	9.5737	0.0756	0.1146	0.1427	0.0282
Portugal	95-01	0.1503	0.0409	4.5519	0.0246	0.0640	0.0820	0.0177
Slovak Rep.	93-99	0.2749	0.1119	8.7107	0.1933	0.0994	0.2766	0.0442
USA	93-98	0.0825	0.0222	2.6044	0.0097	0.0364	0.0497	0.0096

Source: OECD STAN Database, own calculations

As regards structural change this is partly related to technologies, while also partly to other factors – including real exchange rate changes. There are two alternative definitions of the real exchange rate $q=P/(eP^*)$ – with * denoting a foreign variable and P and e representing the price level and the nominal exchange rate, respectively; P represents a basket of goods which is composed of tradables and nontradables. An alternative for defining the real exchange rate is $\lambda' = P^T/(eP^{T*})$ where T stands for tradables. A rise in q or a rise in λ' can be identified with a real appreciation.Subsequently, we take a closer look at alternative explanations for real exchange rate changes which must include an analysis of the links between nominal exchange rate dynamics and the real exchange rate (section 2). We demonstrate within a monetary growth model that the real money demand does not depend on the real interest rate unless the savings rate is a function of the real interest rate. Section 3 is on the real exchange rate and economic development, trade, structural change and growth where we also focus on a new structural model with product and process innovations but also on some aspects of the more complex HANSEN-RÖGER model. Our analysis also takes a look at the links between the real exchange rate and economic growth. In the final section, we present some basic policy conclusions. The appendix presents some innovative modelling related to the topic of exchange rate dynamics and macroeconomic analysis (including smooth linking of supply-side effects and demand-side impulses). At the bottom line, there is strong emphasis on the fact that the dynamics of exchange rate development and growth should simultaneously consider trade and foreign direct investment (FDI). With reference to both the OECD countries in general as well as to Eastern Europe and Asian countries in specific, a considerable share of trade is intra-company trade. The perspective adopted here is a mixture of Schumpter and Dunning, namely in the sense that innovation and FDI are emphasized.Both trade and FDI depend on the real exchange rate, however, as the FDI stock contributes to the overall capital stock in the host country the net trade position – more precisely the current account – depends on cumulated FDI: The difference between output produced and domestic absorption (sum of consumption, government consumption and investment, including FDI inflows) is equal to net exports. There also is a geographical coincidence in the sense that the gravity equation for FDI and trade typically shows similar patterns. This applies to Eastern Europe for which Western Europe represents the main export markets and also the main source of FDI inflows. Such inflows contribute to product upgrading over time. The analytical focus has various time horizons and brings some new insights, including the fact that in a non-inflationary economy the demand for money does not depend on the (long term) real interest rate. Indeed ambiguous results from empirical analysis in this field are well known. We also develop a rather convenient graphical model to focus on the issues of structural change and competitiveness and we propose new ways of how to include the optimum growth literature in the analysis of Schumpeterian economic dynamics. From a policy perspective, it becomes clear that analyzing macroeconomic topics can hardly be done adequately without taking into account structural change and innovation dynamics. While innovation and structural adjustment are a natural element of EU eastern enlargement both in western Europe and eastern Europe (or in a North-South perspective), not much is known about the adjustment costs of firms and countries when moving up the technology ladder.

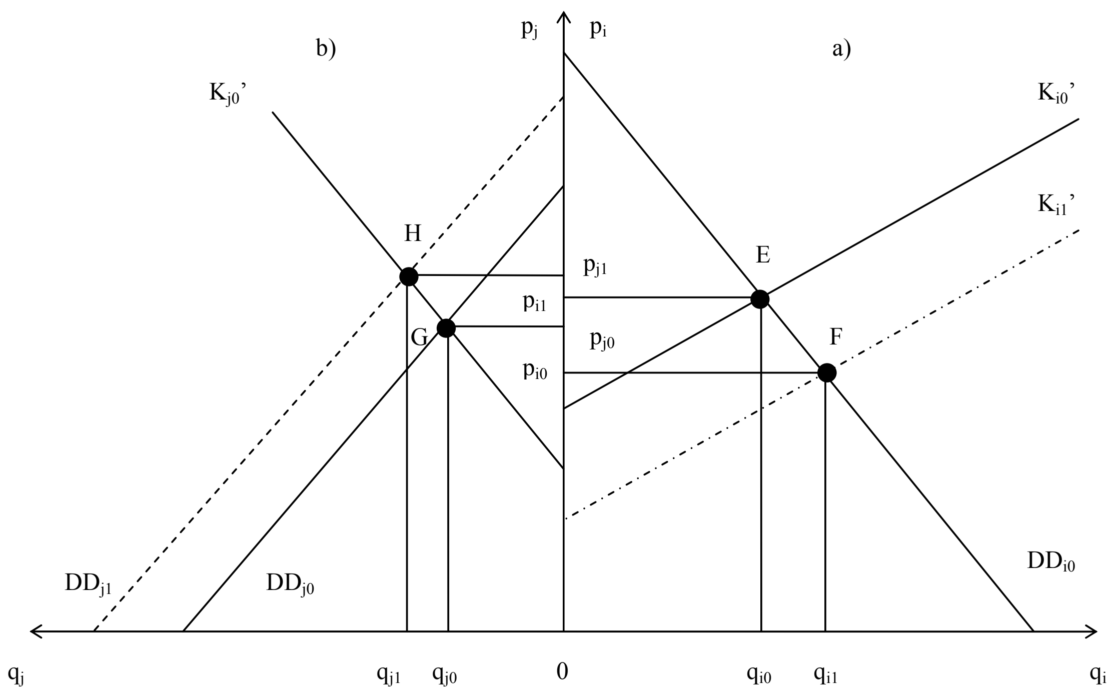
2. Exchange Rate Dynamics, Relative Prices, Employment and Growth

2.1. Technological Progress and the Long Run Price Level

2.1.1. Process Innovations and the Price Level

In modern economies process innovations are an important element of economic development. It is surprising that the role of process innovations have not been considered much in medium term macro models. Only in long run growth models have process innovations played a role. However, the dominant neoclassical growth models are non-monetary models in the sense that money market equilibrium is not considered. Subsequently we will show that combining a growth model with a money market equilibrium condition is quite useful. The following analysis is not only relevant for Schumpeterian innovation dynamics in a monetary economy (and every modern economic system is a monetary economy), we also can state that the role of monetary policy cannot be fully assessed if we do not include the role of technology.As regards the role of monetary policy it has been emphasized (BALL, 2001) that an income elasticity of the demand for money of less than unity has crucial implications for monetary policy, e.g. that the Friedman rule of monetary policy is not optimal and the growth rate of money should be below the growth rate of output in order to achieve price stability. Moreover, monetary aggregates are still important in the new era of inflation targeting (HAYO, 1999). Recent empirical work – based on co-integration analysis and error correction models - for broad money in Australia (VALANDKHANI, 2005), Germany (BEYER, 1998), the Euro zone (COENEN/VEGA, 2001) and the UK (ERICSSON), namely for narrow money, all have shown that the long-run income elasticity is rather close to unity which is consistent with the quantity theory of money (if the elasticity were 0.5 the implication is that the Baumol-Tobin transaction approach is applicable, if the elasticity is above unity money is a luxury good). As regards the growth of the demand for money relative to income LAMBSDORFF (2005) has presented empirical evidence for a cross-country approach. We will show that the income elasticity of the demand for money points to important long run implications in the context of technological progress.Process innovations which amount to the cutting of costs typically are expected to lead to a fall of the price level. The expansion of the digital economy often is considered as a case where process innovations have played a strong role (AUDRETSCH/WELFENS, 2002; WELFENS, 2002). This is a typical perspective one might have in an economy in which all sectors are subject to process innovations. However, this apparently convincing insight from microeconomics has a pitfall, as we will show in a simple long run approach to the quantity theory of money. We will combine the money market equilibrium with the condition of profit maximization; namely that the real interest rate r should be equal to the marginal product of capital. We will prove that, in the case of the income elasticity of the demand for money being between 0 and 1, there will be an increase in the equilibrium price level. Let us start the analysis with a standard microeconomic perspective of process innovations. Assume that there is a process innovation in market i (see in the following graph the downward shift of the marginal cost curve K'_i where i could represent the tradable sector) and an unchanged supply condition in market j. At first sight this will lead to a fall of price pi and hence (with b denoting the share of income spent on good i) a decline of the aggregate price level $P = (p_i)^b p_j^{(1-b)}$. One may introduce some refinement in the argument, namely that a real income effect associated with the higher output in the i-market and the (potentially transitory) fall of pi will shift the demand curve in the j-market upwards so that the price pj will rise as a consequence of technological progress in sector i; thus the effect on the price level is ambiguous (see the following graph). However, we can prove within a macroeconomic approach that there is no ambiguity at all if the income elasticity of the demand for money is in the range between 0 and unity. If the income elasticity is above unity then the long run equilibrium price level will fall as a consequence of process innovations. The relevant mechanism partly includes the macroeconomic money market: the demand for money is affected by a rise of the technology level in two offsetting ways as we will see. In a consistent macro model with goods markets and a money market, the relevant mechanism is related to the demand for money and this in turn suggests that there must be a real balance effect in goods markets (or in the aggregate goods market).

Figure 2: Ambiguous Effect of Technological Progress on Price Level



2.1.2. True Long Run Equilibrium in the Money Market

Let us consider the long run money market equilibrium, namely, real money balances M/P equals the real demand for money m^d (Y,i) where M is the nominal money stock, Y aggregate output and i the nominal interest rate. As we will assume an expected inflation of zero, we will set i=r (real interest rate). Moreover, we will consider a Cobb-Douglas production function with a Harrod factor A

(1) $Y=K^{ß}(AL)^{1-ß}$

and impose the condition of profit maximization so that

(2) $r=Y_K=ßY/K$

Here ß is the output elasticity of capital and Y_K the marginal product of K. In this approach the marginal product of capital determines the real interest rate. Thus we are not following the optimum growth model which leads to $f'(k') = \theta + n$ where k' is modified capital intensity K/[AL], f' the marginal product of capital, θ is the time preference and n the growth rate of the population (modified golden rule; alternatively the golden rule could be used $f'(k')=n$; see BLANCHARD/FISCHER, 1989). For an optimum growth approach one would rather consider n to be endogenous here; one also could argue that the golden rule approach assumes that utility maximizing consumers dominate the capital market while our approach assumes that investors dominate capital markets (in reality both groups will have an influence so that $r= b'\theta + (1-b')f'(k')$; b' represents that relative impact of consumers – we have a similar problem as with exchange rate determination in the presence of fundamentalist actors and speculators betting on present trends). Next we follow the standard assumption that the real money demand m is a positive function of Y and a negative function of the nominal interest rate i. Money market equilibrium is defined by

(3) $M/P = m(Y,i)$

Taking a look at the long run money market equilibrium condition (defined by M/P=m and the equality of the real interest rate and the marginal product of capital) brings an important and surprising insight. It is convenient to define real money demand as

(4) $m= Y^{\sigma} \sigma'/i$

Let us point out that with a real money demand function $m= Y^{\sigma} \sigma'/i$ (or a similar specification; $\sigma>0$; $\sigma'>0$) and zero expected inflation (hence the nominal interest rate i=r), we get in an economy with profit maximization and a Cobb-Douglas production function $Y=K^{ß}(AL)^{1-ß}$ the somewhat surprising result that a once-and-for-all rise of the level of technology A could raise the price level P. This can be seen from the money market equilibrium condition $M/P= m^d(Y,i)$ which is solved here for the steady state price level P#:

$$(5)\ P\#= M\, Y^{-\sigma}\, ß[Y/K]/\sigma' =[ß\, M\, Y^{1-\sigma}/K]/\sigma'$$

It is obvious that a rise of M will raise the equilibrium price level while for a given real interest rate and hence a constant ratio Y/K a rise of output will reduce the price level. If the international law of one price is holding, namely P=eP*, the nominal exchange rate is given (assuming an exogenous P*) by P#/P. Now let us consider the equation for the price level (true monetary long run equilibrium condition) in more detail:

$$(6)\ P= (ß/\sigma')M(AL)^{(1-ß)(1-\sigma)}\, K^{ß(1-\sigma)-1}$$

We can see that a rise in the capital stock will reduce the price level which corresponds to standard results from a model with two markets (or one aggregate goods market) in which there has been an increase in production capacity.

$$(7)\ \partial P/\partial K<0$$

Indeed, this condition obviously is fulfilled since $ß(1-\sigma) -1<0$ and $s(1-\sigma)<1$; and $1-(1/ß)<\sigma$. Since the expression $1-(1/ß)$ is negative and σ is positive, the multiplier for K is always positive. As regards the impact of process innovations (dA>0) (and similarly for dL) we find a rather paradoxical result (one should recall that the monetary approach to the balance of payments is also paradoxical as the Mundell-Johnson argument emphasizes that in a small open economy with a fixed exchange rate a rise of the foreign price level will raise through arbitrage the domestic price level and hence raise the demand for money; The excess demand for money translates into a current account surplus which leads to a rise of the money supply which is consistent with the initial rise of P). We indeed can see:

$$(8)\ \partial P/\partial A>0 \text{ if } 0<\sigma<1$$

If the income elasticity of the demand for money is slightly below unity, a rise of the technology level (A) will raise the price level. If this elasticity were above unity, process innovations will lead to a lower price level. As is well known from the literature, there has been (at least since Milton Friedman's argument that money is a luxury good: hence the income elasticity should be above unity) a long debate about the income elasticity of money and the empirical evidence is not always conclusive as to whether the elasticity is below unity or above unity. Returning to the true long run equilibrium condition in the money market, one may want to describe labor market equilibrium in a very simple way, namely labor supply $L^s=L^d$. We assume labor supply as exogenous, while labor demand is determined by the real wage equation (profit maximization) $W/P=ßY/L = ßk^ß =ßA^{-ß}k'^ß$ where k is capital intensity and k'=: K/(AL) and W the nominal wage rate (w=:W/P is the real wage rate). Thus $P=W/[ßk^{ß}]$, which determines the nominal wage rate W. In an open economy one additionally would have to consider real interest rate parity, namely $r=r^{*}+d\ln q^{E*}/dt$; here q^{E} is the expected real exchange rate. In our long run approach the level of technology has an impact both on real income and on the real interest rate: The reason for the interesting paradox presented is the role which the level of technology has on the marginal product of capital and hence on the interest rate; a rise of A amounts to raising the marginal product of capital and hence the interest rate so that the demand for money is reduced. Therefore money market equilibrium (at a given nominal money supply and a given capital stock) can only be restored if the price level is rising (this might be interpreted in a way that the real income effects of technological progress can overcompensate the direct price effect of falling marginal costs). If σ=1, the price level would remain stable and the positive real output effect associated with the rise of A would generate exactly sufficient additional demand for money to restore the equilibrium. If σ>1, the income-induced rise of the real demand for money would be so large that it would require a fall of the price level for equilibrium in the money market to be restored. Whatever the specification of the demand for money, there will always be a critical value of the income elasticity below which a rise of A has to be accompanied by a rise of the price level if a new equilibrium is to be achieved in the money market.Basically, we have an interesting empirical question on the one hand and on the other hand the idea presented reinforces the natural skepticism one has when simple analogies from microeconomics are drawn to derive macroeconomic conclusions. Even parallel process innovation in both markets could ultimately lead to a rise of the price level, namely if the real income effect in both markets is strong enough to outweigh the productivity/cost effect related to process innovations.

2.1.3. Long Run Growth Perspective

Next we recall that k'=: K/[AL]. Let us rewrite the true long run monetary equilibrium condition in the following way, where we observe that in the following equation the elasticity of P with respect to AL apparently is negative (this seems to contradict the initial equation for true long run monetary equilibrium, however, one must take into account that the variable k' contains AL in the denominator!):

(9) $P= (ß/\sigma')M(AL)^{-\sigma}k'^{\,ß(1-\sigma)-1}$

Assume that savings S=sY, reinvestment is proportionate to K (parameter δ) and that overall investment I=dK/dt+δK = S. From the standard neoclassical growth model we know that the equilibrium value k'# is expressed for the case of a given L and a given A by $k'\#=(s/\delta)^{1/1-ß}$. Thus we get:

(10) $P= (ß/\sigma')M(AL)^{-\sigma}[s/\delta]^{[ß(1-\sigma)-1]/[1-ß]}$

One should note, however, that the assumption that there is profit maximization imposes a restriction on the parameter sets since we have ßk'$^{ß-1}$=r and hence k'#= (ß/r) $^{1/1-ß}$; and we have k'#= [s/δ] $^{1/[1-ß]}$. This requires a specific savings rate, namely s=(ß/r)δ which could be fulfilled by choice of a specific ß. We can state that a rise of M raises the long run equilibrium price level while a rise of the savings rate will reduce it. An increase in the depreciation rate δ will raise the price level. In a stationary, non-growing economy inflation is always a monetary phenomenon.Next we consider an economy with population growth and sustained progress so that (with e' denoting the Euler number, n the growth rate of population and a the growth rate of the technology level A) L= L_oe'^{nt} and A=A_oe'^{at}. We therefore get the following equation which offers some non-monetarist insights about inflation:

$$(11)\ P(t) = (ß/\sigma')\ M\ [s/(a+n+\delta)]^{[ß(1-\sigma)-1]/[1-ß]}\ (L_oA_oe'^{(a+n)t})^{-\sigma}$$

Obviously in a growing economy there could be a sustained deflation, namely to the extent that a+n exceeds zero. A rise of the progress rate a will lead to both a rise of the level of P and of the deflation rate respectively (the expression ß(1-σ)-1 is always negative, so that the impact for the level of P is unambiguous). We now return to the true long run monetary equilibrium condition. Let us briefly focus on the case of an open economy which suggests an additional potential paradox. A paradox in an open economy in which there is parallel technological progress in country I and country II (dA>0, dA*>0; and dA=dA*) will occur if the income elasticity of the demand for money is below unity (in the interval 0,1) in the home country and above unity in country II. The consequence of global technological progress is that the price level in country I will rise, while it will fall in country II; implicitly one has to assume downward wage flexibility if unemployment is to be avoided. If the nominal exchange rate is constant the effect is a real appreciation of the home country's currency and this has to be taken into account in the context of the interest parity which reads in the absence of inflation r=r* +dlnq*/dt where q* is defined as eP*/P (e is the nominal exchange rate); hence technological progress will affect capital flows through the logic of the interest parity. While some observers analyzing country I might argue that process innovations (or rises in labor productivity) lead to a real appreciation, the true story is that process innovations per se do not lead to this appreciation, rather it is a mechanism which is related to the money market. Our approach suggests that analyzing long run price level dynamics in open economies with technological progress should be done in a careful way and must include an analysis of the money market. The common analytical split between pure trade theory (never looking at the money market) and monetary theory of international economic relations is not adequate in certain cases.

If one considers the case of flexible nominal exchange rates and process innovations (again with σ in the interval 0,1 in country I and above unity in country II) one may assume that the nominal exchange rate is rising, so that there is a nominal depreciation of the currency. Speculators and scientists therefore should be interested in the size of the income elasticity of the demand for money. It seems likely that in poor countries the income elasticity of the demand for money is below unity while in countries with a high per capita income it is above unity as the demand for real balances and other wealth assets is rising more than proportionately as income is rising. Economic catching up of poor countries and thus international real income convergence could thus help to avoid the above paradox. To learn more about the role of this paradox from an empirical perspective, one should particularly study the link between progress and the price level in those countries where the income elasticity of the demand for money is below unity in a certain period and above unity in the following period.

Next we take a look at the real exchange rate eP*/P while assuming that the above equilibrium equation holds in a similar way abroad:

$$(12) \quad P^* = (\beta^*/\sigma'^*)M^*(L^*_o A^*_o e'^{(a^*+n^*)t})^{-\sigma^*}[s^*/(a^*+n^*+\delta^*)]^{[\beta^*(1-\sigma^*)-1]/[1-\beta^*]}$$

Now we get a much better understanding about the long run real exchange rate which is given (denoting $s/(a+n+\delta)=: s''$, $L_o A_o =:Z'$ and $[\beta(1-\sigma)-1]/[1-\beta]=: \beta'$) by the following expression

$$(13) \quad q^* = e(\beta^*/\beta)(\sigma'/\sigma'^*)(M^*/M)(Z'^* e'^{(a^*+n^*)t})^{-\sigma^*}[s''^*]^{\beta'^*}/(Z' e'^{(a+n)t})^{-\sigma}[s'']^{\beta'}$$

If $\beta'=\beta'^*$ we can state that a rise of the foreign savings rate relative to the domestic savings rate will raise the real long run equilibrium exchange rate; a relative rise of the domestic savings rate will bring about a real appreciation; as $-\sigma < 0$ we can add that a relative rise of the sum of the domestic progress rate and the population growth rate will also bring about a real appreciation (both a relative rise of the savings rate and a relative rise of the domestic progress rate are typical of economic-technological catching up (with Japan being a prominent example in the 1970s and 1980s). One should note that the world real income in terms of country I (home country) is $Y^W = Y + q^*Y^*$.

Process innovations are a standard phenomenon of the economic analysis. In a monetary economy one can, however, not neglect the impact of the money market on the price level. Since process innovations not only affect real output but also the marginal product of capital and therefore the real interest, one has a principal ambiguity with respect to the impact of technology on the price level. There is a critical size of the income elasticity below which a rise of the level of technology implies a rise of the price level; with an elasticity above the critical value, process innovations will bring about a fall of the price level. The impact of technology on the price level in turn will have an impact on capital flows since a change of the real interest rate is part of interest parity. Our analysis suggests that analyzing technological progress requires combining an analysis of the real sphere and of the monetary sphere of the economy. As we have shown, monetary policy could avoid inflation by an adequate choice of the growth rate of the money supply.

2.2. Nominal Exchange Rate, Real Exchange Rate and Long Run Equilibrium

Naturally, there is a link between the nominal exchange rate and the real exchange rate q*. It holds that E(lne) + E(lnP*) = E(lnP). As regards the variance VAR it holds that VAR(lne +

$\ln P^*) = VAR(\ln e) + VAR(\ln P^*) + 2cov\ \ln e, \ln P^* = VAR\ \ln P$. If one were to assume that $VAR\ \ln P = VAR\ \ln P^*$, it is clear that for any variance of lne and of $\ln P^*$, there must be negative cov lne, $\ln P^*$. It indeed is plausible that a depreciation of country I's currency will go along with a fall in country II's price level as goods imported from country I will become cheaper in country II.

From the perspective of a small open economy, the short term nominal exchange rate e is determined by the interest rate parity $i=i^* + a^E$ where a^E denotes the expected depreciation rate and i the nominal interest rate. In the long run the interest rate at home and abroad is given by $i= r+ \pi$ (sum of the real interest rate r and the inflation rate π) and $i^*=r^*+ \pi^*$ which implies with profit maximization $r= Y_K$ and $r^*= Y^*_K$, respectively: $(r-r^*)+ (\pi - \pi^*) = a^E$. If there is free capital mobility and domestic and foreign bonds are perfect substitutes – but no free movement of foreign direct investment – it holds that $r=r^*$ which makes the interest parity fully consistent with long run purchasing power parity $P=eP^*$ if there is no (systematic) difference between expected and actual devaluation rate. The real exchange rate $q^*=:eP^*/P$ is determined in the short run by nominal exchange rate dynamics, in the long run P and P* plays a role as well. Overshooting phenomena of the short term nominal exchange rate thus will affect the real exchange rate temporarily.

If domestic and foreign bonds are not perfect substitutes while we have full mobility of foreign direct investment, the marginal products at home and abroad will be equal in the long run: $Y_K= Y^*_K$. Hence profit maximization in both countries will indirectly bring about the condition $r=r^*$ in the long run. However, there is not really a long run in a strict sense if one does not consider a growth model and some other aspects. A specific aspect will refer to the fact that foreign direct investment flows will be a function of the real exchange rate as argued by FROOT/STEIN (1991). We will turn to this later and at first focus on the issue of a long run equilibrium real exchange rate.

If we are to make a prediction about the domestic price level we could use a model that predicts the nominal exchange rate (WELFENS/BORBELY, 2004) and combine this with a model which explains the foreign price level P*. As regards the latter one may consider a rather simple approach based on four elements:

- money market equilibrium: This must be considered in long run growth modelling of a monetary economy;
- profit maximization: In the long run the real rate of interest must be equal to the marginal product of capital (with a standard Cobb-Douglas production function $Y= K^{ß}(AL)^{1-ß}$ the marginal product of capital $Y_K=ßY/K$ where K is capital, L is labor and A the level of labor-saving technology);
- a simple growth model: In a neoclassical growth model – with a growth rate dlnA/dt=:a, a Cobb-Douglas production function (as above) and a savings function S=sY – the steady state solution for per capita output $y\#= A_o e'^{at} (s/n)^{ß/1-ß}$; here e' denotes the Euler number. Hence the level of the growth path of y is a positive function of the initial level of technology A_o and the savings rate s, and the growth rate a. We will show that in an open economy with trade and foreign direct investment – and monetary transactions – the equilibrium solution looks more complicated and suggests new empirical approaches;
- an assumption with respect to the strategy of monetary policy.

At first we are interested in the level of P* which is not really exogenous here. One can show – as an innovative feature of the model – that the long run demand for money is independent of the real interest rate unless the savings rate depends on the real interest rate.

Money market equilibrium requires that real supply (M/P; M is the nominal money stock) equals real money demand m*(…):

(14) $M^*/P^*=m^*(Y^*,i^*)$

The equilibrium condition for the money market is fairly general as we will see. Indeed, it is reasonable both for a narrow definition of the money supply (M_1) and for a broad money supply (M_3). If we consider M_1, cash balances plus deposits, one should expect a close medium term link with the price level. In an underemployed economy a rise in the money supply will raise output Y, and as the capacity utilization rate is increased, the price level P will increase with a certain delay. If one wants to express (A.1) in a kind of a quantity-theoretical framework we can simply write: $M_1= V'(i,Y)PY$, with V' denoting the inverse of the income velocity of money. While it often is claimed that M_3 (M_1 plus term deposits plus savings deposits) is linked with the price level, there are no serious arguments why a rise in broad money M_3 should raise the price level unless one argues that there is a strong real balance effect. A serious argument would look different: A rise in M'_2 – here defined as M_3 minus M_1 – would increase within a portfolio-theoretical approach with the demand for stocks as real capital being complementary to money balances. Combining a higher stock of M'_2 with a higher value of stocks P'K (P' is the stock market price level and K the capital stock) reduces the portfolio risk. To the extent that P' is positively correlated with P, one may expect that empirical investigations on the long term demand for money come up with positive evidence for a link between M_3 and P. This point is easily understood if we assume that the fundamental value of stocks reflects discounted future profits which are – in a very simple two-period perspective (with Ω denoting unit labor costs and E the expectations operator) – given by the straightforward expression: $(P_t-\Omega_t)Y_t + (E(P_{t+1})-E(\Omega_{t+1}))Y_{t+1}/(1+i)= P'$. Assuming for simplicity that market participants expect $E(Y_{t+1})=Y_t$, that unit labor costs are constant, that output Y= KlnL (we will, however, later switch to Cobb-Douglas) and that firms finance all investment through the stock market, we can state the following equation: $M'_2= V''(i,Y)P'K$ and – assuming that $\Omega=P\,\omega$ – thus $M'_2=V''(i,Y)\,(P(1-\omega))(1+ (1+i)^{-1})\,Y/\ln L$. We can then add M_1 and M'_2 and state – with $\omega'=:1-\omega$ – the long term money market condition:

(14′) $M_3=V'(i,Y)PY+V''(i,Y)(P\omega'(1+(1+i)^{-1})Y/\ln L=PY(V'(..)+V''(..)\omega'(1+ (1+i)^{-1})\,Y/\ln L.$

This now looks more or less like the quantity theory of money $MV(Y,i) = \psi PY$. We therefore can indeed return to (14) while specifying for country II a specific money demand function:

(14′′) $M^*/P^* = Y^{*\sigma^*}\,\sigma^{*\prime}/i^*$

Thus the real money demand m* is specified as $Y^{*\sigma^*}\ \sigma^{*'}/i^*$ where Y* is foreign real output and i* the foreign nominal interest rate which in turn is the sum of the expected inflation rate plus the real interest rate r. The parameters σ and σ' stand for the apparent income elasticity of the demand for money and the implicit interest responsiveness of the demand for money, respectively. However, we will show that in a long term perspective that σ* and σ*' are not really the income elasticity of the demand for money and the domestic real interest rate, respectively. Assuming (with K*, A*, and L* denoting capital, the level of technology and labor input) a Cobb-Douglas production function abroad, we have

(15) $Y^* = K^{*\beta^*}(A^*L^*)^{1-\beta^*}$

Moreover as we assume that factors are rewarded in accordance with the marginal product rule, it holds that:

(16) $r^* = \beta^* Y^*/K^*$

In the absence of inflation/deflation, we can thus write that the money market equilibrium for country II is as follows:

(17) $M^*/P^* = = Y^{*\sigma^*}\sigma^{*'}/(\beta^* Y^*/K^*) = K^* Y^{*\sigma^*-1}\sigma^{*'}/\beta^*$

Here we have taken into consideration that i=r and that under profit maximization r=ßY/K. Taking logarithms we get:

(18) $\ln P^* = \ln M^* - (\sigma^*-1)\ln Y^* + (\ln\beta^*/\sigma^{*'}) - \ln K^*.$

As is obvious that the long run income elasticity of the demand for money is not σ*, rather it is σ*-1. We can rewrite the equation in per capita terms (actually in efficiency labor units AL) on the right-hand side, and this will be dubbed true long run money market equilibrium:

(19) $\ln P^* = \ln(M^*/A^*L^*) - (\sigma^*-1)\ln(Y^*/A^*L^*) + (\ln\beta^*/\sigma^{*'}) - \ln(K^*/A^*L^*) - (\sigma^*-1)\ln(A^*L^*).$

Note that in the case of flexible exchange rates, the nominal money supply is exogenous, and this is the main case we want to consider subsequently. The problem looks different under fixed exchange rates (in the case of eastern European accession countries this largely corresponds to the situation of moving to the European Exchange Rate Mechanism II).

If we assume that savings S=sY, no population growth, a zero rate of capital depreciation and that technological progress rate (dA/dt)/A=a is exogenous, we get – with y'=:Y/(AL) and k'=:K/(AL) and # for steady state – the standard neoclassical steady state solution, namely $y'\# = (s/a)^{\beta/1-\beta}$ and $K/(AL) = k'\# = (s/a)^{1/1-\beta}$. Thus it is obvious that in the long run demand for money, the savings rate and the progress rate will enter into play. The interest elasticity of money should be zero. If empirical analysis on the long run money demand finds a significant impact of r, it effectively confuses r* and r, that is the condition r=r*! (In an inflationary world one may, of course, have to consider the inflation rate as an additional variable determining the demand for money). Only in the case that one assumes that the savings rate depends on the interest rate would the long run money market equilibrium depend on the interest rate.

For the case that monetary policy maintains a constant m”*#(with m”*=: M*/(A*L*)), we get:

(20) $\ln P^* = \ln m''^{*\#} - \{[1+ (\sigma^*-1)ß]/(1-ß)\}\ln(s^*/a^*) + (\ln ß^*/\sigma^{*\prime}) - (\sigma^*-1)\ln(A^*L^*)$.

The long run equilibrium therefore is a positive function of the central bank’s target money stock m’. Assuming that the apparent income elasticity of the demand for money (σ) is smaller than unity, the price level is a negative function of the level of technology and of the size of the labor force. Moreover, it is a negative function of the ratio of the savings rate to the progress rate provided that ((1+ (σ*-1)ß*)/(1-ß*)) is positive. Note that the price level is stationary only if labor input declines with the same growth rate as the level of technology rises or if the apparent income elasticity of the demand for money is unity. The long run expected price level depends only on exogenous parameters, in particular the savings rate and the progress rate.

In an open economy we may assume – now considering the world from a country I perspective – that savings S=s(Y+ q*r* F^{n}**/P*), where F^{n}* is nominal net claims on the rest of the world. Hence q*r* F^{n}**/P*is interest income accruing in terms of domestic goods. We assume that net real foreign assets q*F^{n}**/P*expressed in domestic goods - are proportionate to Y. Defining f**’=: q*F^{n}**/P*AL= q*F^{r}**/AL, assuming that f**’=νy’ and assuming a constant progress rate in country I, namely a, and a production function

(21) $Y=K^{ß}(AL)^{1-ß}$

we get a steady state value

(22) $y'^{\#} = (s(1+ r^*\nu)/a)^{ß/1-ß}$

If we define Fr**/AL=ν’ and assume that households consider ν’ as a target ratio we can write:

(22’) $y'^{\#} = (s(1+ r^*q^*\nu')/a)^{ß/1-ß}$

Per capita income therefore is – denoting with e’ the Euler number - given by

(22”) $y\# = A_o e^{'at} s(1+ r^*q^*\nu')/a)^{ß/1-ß}$

Hence the long run steady state value of y’# depends on the real exchange rate. Moreover, long run money market equilibrium will also depend on the real exchange rate as is obvious if we plug in (22) into (19’); equation (19’) is the corresponding equation for the domestic economy:

(19’) $\ln P= \ln m'' - (\sigma-1)\ln y' + \ln(ß/\sigma') – \ln k' - (\sigma-1)\ln(AL)$

(19”) $\ln P=\ln m''- \{[1+(\sigma-1)ß]/(1-ß)\}\ln(s(1+ r^*q^*\nu')/a)+(\ln ß/\sigma')- (\sigma-1)\ln(AL)$.

If we assume for simplicity that $r^*q^*\nu'/a$ is close to zero, we may use the approximation that $\ln (1+ r^*q^*\nu')/a) \approx r^*q^*\nu'/a$. A rise in the real exchange rate – hence a real depreciation – will increase the price level if $(1+(\sigma-1)ß) <0$. This now points to an empirical issue.

2.3. Real Exchange Rate, Growth Path and Steady State

Let us get back to (22’). A real depreciation will raise the level of the growth path. This implication is, however, not robust if we assume that the progress rate depends negatively on q*, for example, if we assume that imported licences or technology intensive intermediate products play an important role for the country considered. Then we may state the hypothesis (with a_1 denoting the progress rate in a closed economy).

(23) $a= a_1– B''q^*$; assumption: $a_1\neq B''q^*$ where B” is a positive parameter related to ν’

We now also get an ambiguous result with respect to the impact of q* on the price level (see 19”). It still holds that the level of the growth path is positively influenced by q* (see 22’). However, the growth rate is negatively influenced and the sum of both effects on real per capita income will become negative after some critical time t=t’. We have a quasi-endogenization of growth and the progress rate, respectively, since from a traditional small country perspective, the real exchange rate – in a world in which only tradables exist – is exogenous. This, however, is no longer true if there are nontradables and differentiated tradables. For every product variety sold in the world market, increasing exports will correspond to a fall in the price of the respective product; this problem will be neglected for now. Rather we turn to the accumulation dynamics of foreign assets where an important aspect to consider is that $dF^{n**}/dt = r^* F^{n**} + PX/e - P^*J$ so that

(24) $(dF^{n}**/dt)/P* = r* F^{r}** + X/q* - J = r* F^{r}** +xY/q* - jY$

(25) $(dF^{r}**/dt)/F^{r}**= r* + x(Y/q*)/F^{r}** - jY/F^{r}** = r + x/v - jq*/v$

In the next section we take a closer look at the real exchange rate from a medium term perspective, where the link between the real exchange rate and investment will be considered. Before we turn to this aspect let us briefly consider the case of an open economy with foreign direct investment inflows and a production function where real money balances and the ratio of per capita imports j'=J/(AL) and export intensity x'=X/(AL) enter the production function

(26) $Y=K^{ß}(AL)^{1-ß}(J/AL)^{ß'} (X/AL)^{ß''} (m/AL)^{ß'''}$

The specific assumption here is that the output effect of imported intermediates/imported machinery and equipment – only those should be included in J here – is diluted if there are more workers in efficiency units. This mechanism could be associated with learning-by-doing in the sense that importing, say machinery, brings a one-off productivity increase for workers dealing with the sophisticated imports. If one assumes that imported machinery and equipment is employed with a lag of one period, the current import J would also show up in a higher K. A similar reasoning holds with respect to X/(AL) to the extent that one assumes that X/AL is a measure of the exposure of workers to world market dynamics. It is debatable whether or not m or m'=:m/(AL) – or m/L – should enter the production function; only empirical analysis can solve the issue. Here we use m', as one may argue that liquidity on a per capita basis is relevant for saving transaction costs and actually contributing to labor productivity. Finally, note that in a model with both inward and outward foreign direct investment, one might also have to include the stock of outward FDI, namely to the extent that there is considerable asset-seeking investment which implies international transfer of technology from the subsidiaries to the parent company. Firms in technology-intensive industries which invest abroad – namely in technologically-leading countries so that new technologies can be picked up rather easily – will benefit from a company wide technology transfer which is not just from the company headquarters to the subsidiary but also from the subsidiary back to the parent company.

Instead of using J/AL=:j' and X/AL=x' in the production function, one might chose a production function with 1+j' and 1+x' in the production function so that zero imports and zero exports imply a consistent output for the case of the closed economy. However, we use j' in the production function on the basis of the assumption that the country considered has become so specialized that it requires indispensable foreign inputs (in empirical investigations only the import of intermediate products and capital goods should be considered). For the sake of simplicity, we also use x' and not (1+x').

One may assume that real money balances enter the production function through a positive external effect of households using money in all transactions in the goods market. Therefore

(27) $y' = k'^{ß} j'^{ß'} x'^{ß''} m'^{ß'''}$

The accumulation dynamics is given by

(28) $dk'/dt = s(1-bß)k'^{ß} j'^{ß'} x'^{ß''} m'^{ß'''} - ak'$

Here we have assumed that foreign investors have a share b of the capital stock; and as capital income is ßY, the national income is GDP minus bßY. Savings S is proportionate to national income and therefore we have S=sY(1-bß)=s'Y. As we assume J/AL = j(q*)Y/AL and X/AL=x'(q*)Y*/AL or more conveniently X/AL=x'(q*)y'* A*L*/AL so that we get

(29) $y'\# = s(1-bß)\, j'^{\,ß'}\, y'^{ß} x'^{ß''} y'^{*\,ß''} (A^*L^*/AL)^{ß''} m'^{\,ß'''}/(n+\delta+a))^{ß/1-ß}$

If one were to impose a strict long run trade balance requirement one might want to impose in (28) the long term equilibrium condition that X=q*J so that x'=q*j' which, however, is not done here.

Taking into account the money market equilibrium condition (19') in an appropriate way, namely $m' = y'^{\,1/ß+(\sigma-1)} (AL)^{\,\sigma-1}\, \sigma/ß$ we obtain with $\Omega' =: (A^*L^*/AL)$:

(30) $y'\# = s(1-bß)\, j'^{\,ß'} y'^{ß} x'^{ß''} y'^{*\,ß''}\, \Omega'^{\,ß''} y'^{(1/ß+(\sigma-1))ß'''} (AL)^{(\sigma-1)ß'''} (\sigma/ß)^{ß'''} /(n+\delta+a))^{ß/1-ß}$

The implicit solution for the steady state output therefore is:

(31) $y\#'^{\,1-(1/ß+(\sigma-1))ß'''-ß''} = s(1-bß) j'^{ß'} x'^{ß''} y'^{*ß''} \Omega'^{ß''} (AL)^{(\sigma-1)ß'''} (\sigma/ß)^{ß'''} /(n+\delta+a))^{ß/1-ß}$

(32) $y\#' = \{s(1-bß) j'^{ß'} x'^{ß''} y'^{*ß''} \Omega'^{ß''} (AL)^{(\sigma-1)ß'''} (\sigma/ß)^{ß'''} /(n+\delta+a))^{ß/1-ß}\}^{1/1-(1/ß+(\sigma-1))ß'''-ß''}$

We will assume that bß is close to zero so that ln (1-bß)≈bß. If we take logarithms and define ß#:= 1/(ß/(1-ß))(1-(1/ß)+(σ-1))ß'''-ß'') we have a testable production function, namely for per capita income y=:Y/L

(33) $\ln y = ß\#\ln s - ß\# bß + ß\#ß'\ln j + ß\#ß''\ln x + ß\#ß''\ln y'^* + ß\#ß''\ln(A^*L^*) +$

$+ß\#((\sigma-1)ß'''-ß'')\ln(AL) + ß\#ß'''\ln(\sigma/ß) - ß\#(n+\delta+a) + at$

Taking a look at (32) we can see that the level of the growth path positively depends on the effective savings rate s', x', y'* and the relative technology level (A*L*/AL); note that the y'* variable effectively reflects the impact of exports. The steady state equilibrium output per capita – in efficiency units – therefore is a positive function of the income elasticity of the demand for money provided that $\sigma<0$. As regards the impact of q* one has to consider b(q*), x'(q*) and j'(q*), which is not unambiguous. Only empirical research can give a clear answer. The growth rate of per capita income y=Y/L is a, and one could consider how foreign direct investment, government expenditures (consumption vs. R&D promotion) and trade will affect the progress rate which raises many new interesting issues. We will pick up the issue of government expenditures and discuss the impact on the level of growth and growth itself.

An interesting refinement is to assume that S=sY(1-bß)(1-u)(1-τ) where u is the structural unemployment rate and τ the income tax rate. The we get for y' in the steady state:

$$(34)\ y\#' = \{s(1-b\beta)(1-u)(1-\tau)j'^{\beta'}x'^{\beta''}y'^{*\beta''}\Omega'^{\beta''}(AL)^{(\sigma-1)\beta'''}(\sigma/\beta)^{\beta'''}/(n+\delta+a))^{\beta/1-\beta}\}^{1/1-(1/\beta+(\sigma-1))\beta'''-\beta''}$$

We thus could consider the impact of unemployment and the income tax rate – both a higher tax rate and a higher unemployment rate will reduce the level of the growth path - as well as that of j' and x' on the level of the growth path. Moreover, we can also discuss the effects of the unemployment rate and the tax rate – making specific assumptions how tax revenues are used (public consumption vs. R&D financing) – on the growth rate.

Finally, we should take into account the requirement that in the long run the current account must be balanced. For the simple case of no foreign direct investment we have

$$(35)\ XP = eP^*J$$

We will assume that

$$(36)\ X=j^*(q^*)Y^*$$

$$(37)\ J=j(q^*)Y$$

Therefore we get – while multiplying the left hand side of (35) by A*L*/[A*L*] and the right hand side by AL/[AL] – the equation XP=eP*J or

$$(35')\ j^*Y^*P = eP^*jY$$

Thus we obtain:

$$(35'')\ [A^*L^*]j^*Y^*P/[A^*L^*] = ALeP^*jY/[AL]$$

$$(37)\ [A^*L^*]/[AL]= q^*jy'/j^*y^*$$

Note that there is a relation between j’ and j since J/(AL) =:j’= jy’; this applies in a similar way to the foreign country, namely j’*=:x’=j*y’*.

Replacing in (A.17) the expression Ω’=: A*L*/AL from (A.23) we get

$$(´30') \quad y'\# = s(1-b\beta)\, j^{\beta'} y'^{2\beta'} x'^{\beta''} y'^{*\,\beta''} [q^* j y'/j^* y^*]^{\beta''} y'^{(1/\beta+(\sigma-1))\beta'''} (AL)^{(\sigma-1)\beta'''}\, e'^{\beta'''\sigma/\beta} /(n+\delta+a))^{\beta/1-\beta}$$

Therefore we can write

$$(30'') \quad y'\#= s(1-b\beta)\, j'^{\beta'} y'^{\beta'+\beta''} x'^{\beta''} y'^{*\,2\beta''} [q^* j/j^*]^{\beta''} y'^{(1/\beta+(\sigma-1))\beta'''} (AL)^{(\sigma-1)\beta'''}\, e'^{\beta'''\sigma/\beta} /(n+\delta+a))^{\beta/1-\beta}$$

We thus could derive a similar equation to (A.21) where the elasticity ψ’ of y’ with respect to the modified expression {…} is higher than in (A.21); note that we make the assumption that y’* actually is foreign steady state per capita income in efficiency units. Moreover, one can see that the elasticity of y’# with respect to the real exchange rate also will have to consider the expression $[q^*j(q^*)/j^*(q^*)]^{\beta''}$ which reflects a modified Marshall Lerner impact. The overall effect of q* on y’ can, however, not be assessed without considering that b, j’ and j’ also are a function of q*. At the bottom line one may consider to allow a permanent trade balance surplus in our model with asymmetric foreign direct investment and this leads to a minor modification:

$$(35') \quad j^*Y^*P = eP^*jY + b\beta YP$$

On the right hand side we have nominal imports plus nominal dividends accruing to the foreign parent companies. Obviously we can write:

$$(38) \quad j^*Y^* = [q^*j + b\beta]Y$$

It also is debatable whether or not an adequate import function should not read J=jZ (with national income Z= :Y- bßY); and an adequate export function X=jZ* = jY*+bßY/q*.

2.4. Investment, Real Exchange Rate and Employment

As is well known the real exchange rate (q*=eP*/P) has an impact upon the trade balance, however, the real exchange rate also will affect foreign direct investment as was emphasized for the case of imperfect capital market by FROOT/STEIN (1991). Foreign investment inflows in the recipient country – say an EU accession country or a newly industrializing economy – can be expressed as a share ψ in overall investment where ψ(q*); the partial derivative of ψ with respect to q* is positive since a depreciation of the host country currency effectively makes it easier for foreign investors to be successful in mergers and acquisitions.

We thus assume that the overall investment output ratio I/Y is a positive function of the real exchange rate (in empirical analysis a positive correlation between I/Y also will catch the impact of improving net export expectations on the side of investors). Assuming profit maximization in an open economy in the form that the marginal product of capital Y_K is equal to the foreign real interest rate r* we can write for the growth rate of real output

(I) $g_Y = (I/Y)r^*$

Denoting the investment output ratio as z=z(q*) and recalling Verdoorn's Law, namely that the growth rate (g) of labor productivity Y/L is a positive function of the growth rate of output (V and V' are positive parameters) we have:

(II) $g_{Y/L} = Q' + Q'' g_Y$;

According to Verdoorn's Law the growth rate of employment will be a positive function of output growth

(III) $g_L = - Q' + [1-Q'']g_Y$; hence

(IV) $g_L = - Q' + [1-Q'']z(q^*)\ r^*$

If we assume that the parameter Q' is a positive function of the productivity-wage lag – meaning the time it takes for the real wage to fully catch up with marginal labor productivity Y_L (the long run equilibrium values are denoted by #) – we have in the case that the marginal product is proportionate (1-ß is a parameter in the interval 0,1) to the average labor productivity (Y_L=(1-ß)y; ß is the output elasticity of capital):

(V) $g_L = - Q' + Q''([y\#/w\#]/[y/w])\ z(q^*)\ r^*$

The parameter Q'''=:1-Q'' thus depends positively on the steady state productivity-wage ratio relative to the current productivity wage ratio. Hence outside the steady state – according to which (1-ß)y would be equal to the real wage rate w – the growth rate of labor demand will be a negative function of the current real wage rate and a positive function of per capita income y. An interesting case is to assume that Q''' – we have assumed Q'' to be smaller than unity – follows an inverted logistical adjustment path as y/w approaches y#/w#.

The following figures show the growth rate of employment and the annual change of investment/ GDP ratio for the EU 15 countries, Germany, Hungary, Poland, and the Czech Republic.

Figure 3: EU 15: Growth Rate of Employment and Annual Change of Investment/ GDP Ratio

Figure 4: Germany: Growth Rate of Employment and Annual Change of Investment/ GDP Ratio

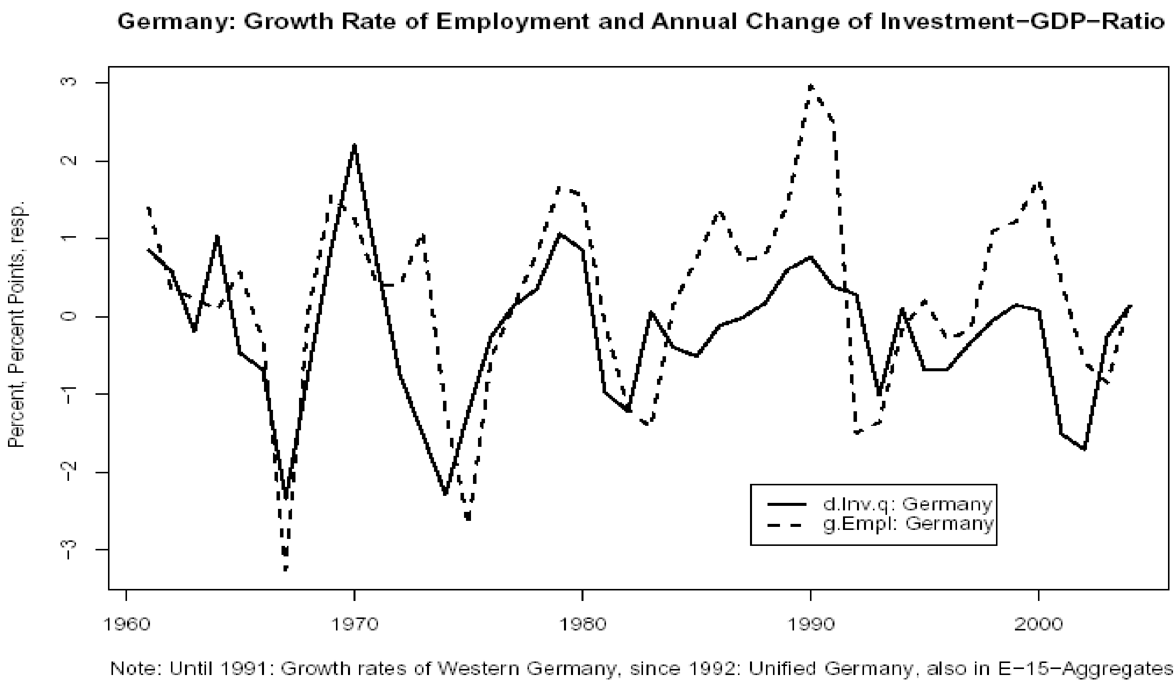
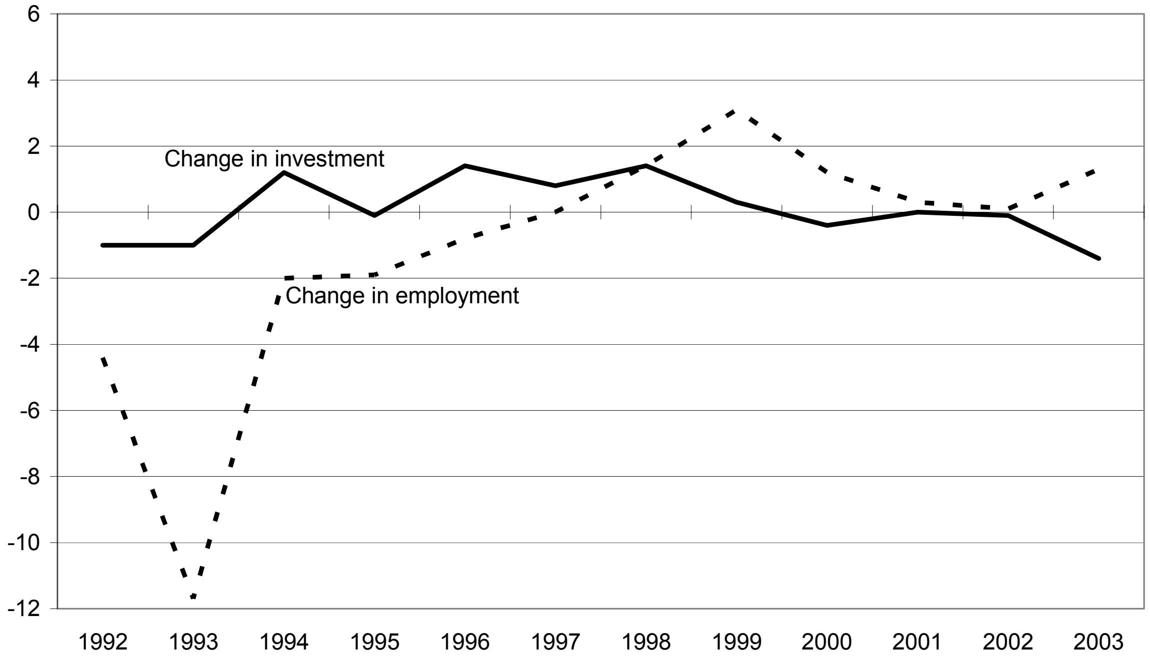
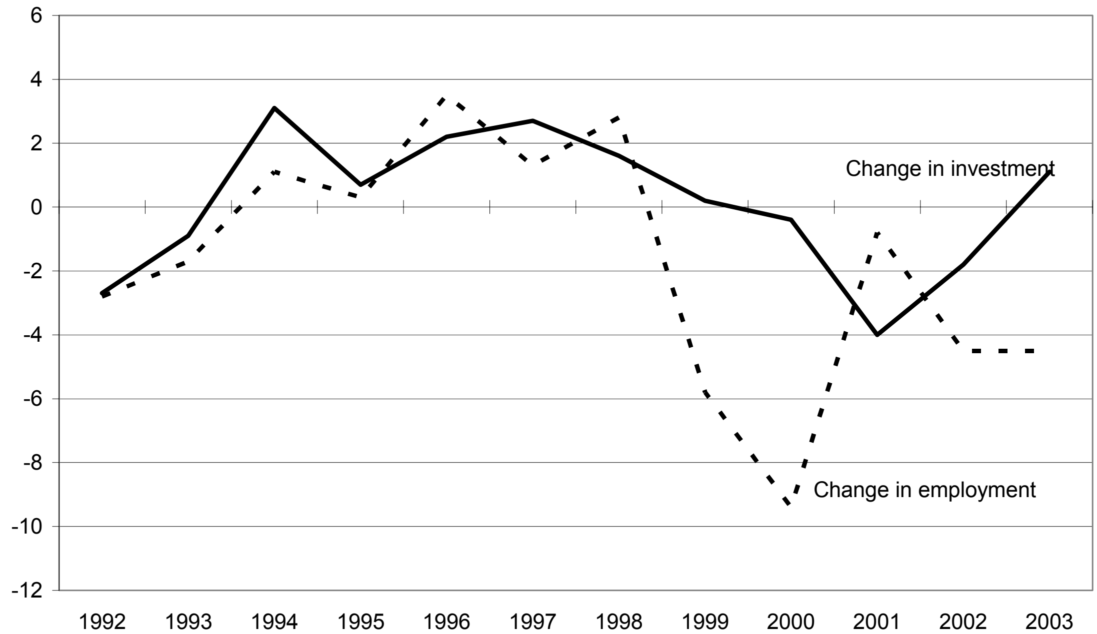


Figure 5: Hungary: Growth Rate of Employment and Annual Change of Investment/ GDP Ratio



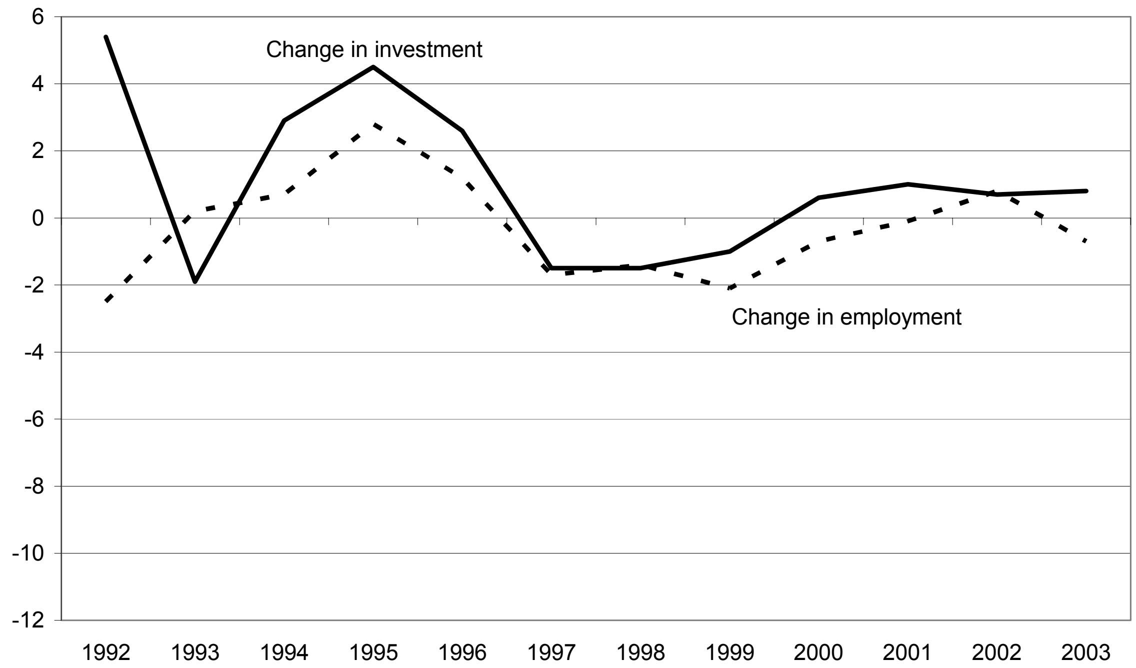
Source: Transition Report, EBRD, various issues

Figure 6: Poland: Growth Rate of Employment and Annual Change of Investment/ GDP Ratio



Source: Transition Report, EBRD, various issues

Figure 7: Czech Republic: Growth Rate of Employment and Annual Change of Investment/ GDP Ratio



Source: Transition Report, EBRD, various issues

2.5 Technology, Exchange Rate Changes and the Relative Tradable Price

In the following analysis, we will take a closer look at the role of technological progress - while sectoral capital stocks are assumed to be given in the short run - which for simplicity we assume to only occur in the tradables sector (T). Tradables and nontradables are gross substitutes on the demand side and the supply side. There is a technology shift parameter in the tradables market, namely A. In addition, the demand for tradables is assumed to negatively depend on the relative price of nontradables ($P^N/P^T=:\varphi$) and positively on the real money balances M/P – a proxy for wealth. M denotes the nominal money supply and P the price level. We assume that the quality of N-goods is given and does not change, but the quality index Q of tradables could change through product innovations in the tradables sector. Hence the hedonic price index is given by $P=P^{N\ \alpha}\ P^{T\ 1-\alpha}/Q=\ \varphi^{1-\alpha}\ P^T/Q$; the parameter α is in the interval 0,1. Due to arbitrage, we have $P^T=e\lambda' P^{T*}$ where e is the nominal exchange rate, λ' is a parameter reflecting trading costs (before full regional integration $\lambda'>1$, full integration $\lambda'=1$). Supply in both sectors depends on φ and labor as well as on capital stocks.

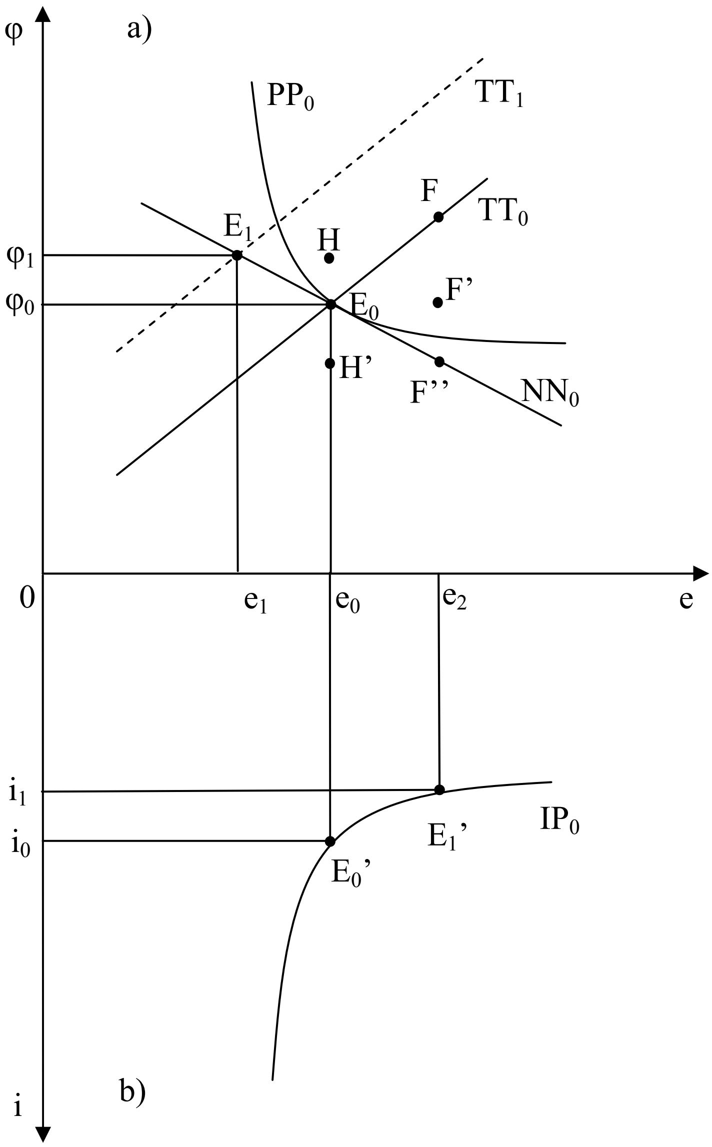
We can state a straightforward equilibrium condition for the tradables sector, namely tradables supply T=T' where T' denotes tradables demand. Any excess supply in the tradables sector is equivalent to a current account surplus since we are considering a small open economy. Equilibrium in the nontradables market is given by the equality of nontrables supply N' and nontradables demand N'= N"(…) +G where N"(φ, τ, M/P) is the private sector demand for nontradables and G government consumption of nontradables; τ denotes the tax rate. Note that the nominal exchange rate e enters the demand for both goods since M/P can be written as $M/(\varphi^{1-\alpha}e\lambda' P^{T*}/Q)$. The initial equilibrium is determined by the intersection of the NN curve - which portrays equilibrium in the nontradables markets - and the TT curve which portrays equilibrium in the tradables sector – as well as a balanced current account. Technological progress in the tradables sector, that is a rise in the supply parameter A, will shift the TT-curve upwards (TT_1) so that there is a rise in the relative nontradables price and a nominal depreciation. The price level remains constant if the nominal appreciation rate $-g_e = (1-\alpha)g_\varphi$ where g denotes growth rates. A given price level P_o is here indicated simply by the curve $\varphi=(QP_o/P^T*e)^{1/(1-a)}$.; the PP_o line indicates a given price level in φ-e space. Thus it depends on the slope of the NN curve whether or not technological progress in the T-sector brings about a fall in the price level or a rise in the price level. If the nominal wage is inflexible, a falling price level will bring about classical unemployment which in the context of empirical analysis should not be misinterpreted as technological unemployment! If there is no downward wage flexibility points below the PP line, an excess supply in the labor market is indicated. If the composition of tradables is increasingly characterized by product innovations, the tradables supply will become less price elastic as a higher share of product innovations typically will require more specialization and indeed higher sunk costs on the tradables supply side. Moreover, the demand for tradables becomes less price elastic; that is $\partial T'/\partial\varphi$ will fall and the slope of the TT curve will rise. Hence a depreciation will bring about a higher current account than previously. This is somewhat surprising as one might think that a lower relative price elasticity makes the trade balance (or the current account) less price sensitive. However, one has to take into account that a rise in the relative price level of nontradables will cause less supply-switching on the supply side of the economy.

An expansionary fiscal policy in the sense of raising G would shift the NN curve to the right and hence bring about a higher relative nontradables price and a depreciation of the currency. A fall in trading costs will shift the NN curve upwards and the TT curve downwards which in any case will bring about a nominal depreciation while the effect on the relative price of nontradables is unclear. An expansionary fiscal policy in the form of a cut in the tax rate τ will bring about a rightward shift of TT and an upward shift of NN. In the lower part (b) of the following graph we have drawn – for an exogenous expected exchange rate $E(e_1)$ - the interest parity line according to $i=i^*+E(e_1)-e/e$. The short term impact of an expansionary monetary policy would be a fall in the nominal interest rate and hence a nominal and real depreciation. As prices are assumed to be sticky, there would be a price reaction only in the medium term. An expansionary monetary policy therefore moves the economy (see panel a)) from point E_o to point F' so that we have an excess supply in the tradables market – with a temporary current account improvement - and an excess supply in the N market. The rise in the real money stock shifts the NN curve and the TT curve to the right and finally also will raise the price level (which implies that the long run rightward shift of NN and TT will be smaller than in the medium term). Hence we will get a new real equilibrium point which might be between E_o and F'. Assuming that money market equilibrium can be written as $M= V'(i)PK$, a rise in M will shift the PP-line upwards; a rise in i dampens the shift.

The approach is more complex if we consider the HANSEN/RÖGER (2000) model. In the HANSEN/RÖGER model, the real exchange rate is determined through the intersection point of the domestic equilibrium line and the foreign equilibrium line. In that model, consumption is assumed to depend positively on real income Y and negatively on the gap between the desired stock of wealth (F) and actual real financial wealth f. It also depends negatively on the real interest rate r relative to the long run equilibrium level r# (in a small open economy equal to r*). Interest parity together with the domestic equilibrium condition gives a differential equation in q. Setting dq/dt=0 and df/dt=0 gives two equilibrium lines which jointly determine the equilibrium solution.

Figure 8: Equilibrium in the (a) Tradables Market (TT) and Nontradables Market (NN) and Interest Parity (b); Model Can Track Fiscal and Monetary Policy & Supply Shocks

Tradables supply is T, demand T'; $T(\varphi, A, K^T) = T'(\varphi, \tau, M/P)$; with $P^N/P^T =: \varphi$; $M=PV(i)K$; $P=\varphi^{1-\alpha}P^T/Q$; nontradables equilibrium : $N(\varphi, K^N)=N''(\varphi, \tau, M/P)+ G$; arbitrage: $P^T=e\lambda P^{T*}$; interest parity $i= i^* +E_1(e)-e/e$



There is one particular instability area in part a) of the figure, namely between the PP curve and the NN curve (starting in point E_o: the area where NN_o is written). We observe in this area both an excess supply in both goods market and an upward real wage pressure – at a given nominal wage – so that the risk of unemployment is quite high unless workers who lost their job in the N-sector easily find a new job in the T-sector which in turn would have to generate a rather high trade balance surplus. If there is product innovation in the tradables sector both the TT curve and the NN curve will become steeper.

3. Real Exchange Rate Dynamics and Economic Effects

3.1 Real Exchange Rate and Trade

The rise in the real exchange rate has effects in transition countries. It affects

- the volume of imports whose growth is reinforced as import goods become cheaper;
- the volume of exports whose dynamics are dampened – this does not exclude high export growth to the extent that domestic firms show a rising export orientation or that subsidiaries of foreign multinationals increase exports;
- with standard price elasticity assumptions there will be a deterioration of the trade balance which could be reinforced by relatively high growth over time; as one can write net exports (X') of goods and services as a function of the real exchange rate (with $\partial X'/\partial q<0$), domestic demand Y (with $\partial X'/\partial Y<0$), foreign demand Y* (with $\partial X'/\partial Y^*>0$), the domestic production potential Y' (with $\partial X'/\partial Y'>0$) and the foreign production potential Y*' (with $\partial X'/\partial Y^{*\prime}<0$), it is clear that demand side effects as well as supply side effects have to be taken into account;
- there is an incentive to upgrade export products in terms of quality and technological sophistication which is a strategy to offset the upward price pressure from the appreciation of the currency.

A real appreciation – according to the argument of FROOT/STEIN (1991) - will reduce the influx of foreign direct investment which implies a long term deterioration of the current account since the increase of the production potential will slow down. This holds at least if one assumes that foreign direct inflows mainly affect the tradables sector; typically FDI inflows will transitorily lead to a current account deficit since there will be major imports of machinery and intermediate produces; often the subsidiary will use the same equipment as the parent company. In long run FDI inflows in the tradables sector should raise net exports of goods and services as firms will increasingly sell products not only in the host country market but in world markets as well.

3.2 Real Exchange Rate and Growth

3.2.1 Standard and New Growth Theory

In all industrialized countries, achieving sustained economic growth in the sense of a long run increase in output or output per capita is a crucial goal. From a neoclassical perspective, the basic growth models of SOLOW (1970) emphasize the role of the production function – and the respective input factors capital and labor – as well as the savings rate. Growth is modeled as a steady state equilibrium phenomenon characterized by accumulation dynamics for capital and certain parameters of the utility function (DIXIT, 1976). Modern growth theory to some extent has added emphasis on the role of human capital formation (LUCAS, 1988), but the mechanics of the basic neoclassical growth model can be retained if one interprets capital as human capital or skilled labor.

Technological progress

If one assumes that savings S = sY, a stationary population and that savings S equals investment I = dK/dt while there is labor-augmenting Harrod-neutral progress in the production function so that output $Y = K^{ß}[AL]^{(1-ß)}$, we obtain – with a denoting the exogenous growth rate of A(t) – a slightly modified equation for the accumulation dynamics of k'=: K/[AL] where k' is dubbed capital per efficiency unit of labor:

(1a) $dk'/dt = sk'^{ß} - ak'$

We might further refine this equation by introducing population growth (growth rate n) which leads to [a+n]k' as the second right-hand side term in the equation for the accumulation dynamics;

(1b) $dk'/dt = sk'^{ß} - [a+n]k'$

The solution of this Bernoullian differential equation is (with C_o to be determined from the initial conditions and e' denoting the Euler number; see appendix):

(1c) $k'(t) = \{C_o e'^{-[a+n](1-ß)t} + [s/[a+n]]\}^{1/1-ß}$

Clearly, there is a convergence for k' as long as ß<1. Here, it should be added that this applies as long as the growth rate n is not critically negative, that is the shrinkage speed of the population must not exceed a – obviously a problem which a priori cannot be dismissed for the case of ageing societies with declining population.

The steady state value for k' is

(1d) $k'\# = [s/[a+n]]\}^{1/1-ß}$.

Per capita consumption in the steady state is given by the difference of per capita output and investment per capita (I/L), that is C/[AL]= f(k') – [I/L]#; as [I/L]# is equal to (n+a)k maximizing per capita consumption requires – with c'=: C/[AL] as a necessary condition:

(1e) $dc'/dk' = f'(k') - (n+a) = 0$;

(1f) $f'(k'\#) = n+a$

Let us point out one important aspect: In the case of a Cobb-Douglas production function, the marginal product of capital is given by $f'(k') = ßk'^{ß-1}$. If one assumes that firms also maximize profits and hence f'(k')=r, the optimum growth policy is defined by the condition:

(1g) $r = ßk'^{ß-1} = a+n$

Therefore

(1g') $k'^{opt} = \{ß/[a+n]\}^{1/1-ß}$

Obviously this coincides with (1d) only if s=ß. Since ß in industrialized countries roughly is 1/3 and since savings ratios in most OECD countries are only around 20%, it seems that the major challenge for a government interested in maximizing long run per capita consumption is to indeed raise the national savings rate. From an empirical perspective it is, however, unclear to which extent ß is changing in the course of technological development. As regards the expansion of the digital "New Economy," one may anticipate that the ß, the production elasticity of capital, will increase.

We also could add capital depreciation at rate δ so that the second right-hand term in the above equation becomes [a+n+δ]k'. This will not affect the mechanics of the model in a critical way. All this is in the framework of standard textbook growth analysis (see e.g. JONES, 1998), and it is indeed a good starting point for some theoretical progress and certain refinements and theoretical innovations. Before we take a look at those, it is useful to briefly recall some key insights from the optimum growth theory in the traditional sense, namely of neoclassical growth models that have been used to derive optimum growth policies (PHELPS, 1961; WEIZSÄCKER, 1962). In those models, government can achieve maximum per capita consumption if the savings rate is manipulated in a certain way. In an economy with a constant growth rate of the population (n), profit-maximizing firms, no technological progress and zero capital depreciation, the optimum growth policy is characterized by the equality of n and the real interest rate r. Since output growth in the steady state is equal to n, the implication is that the growth rate of output is equal to r. GROSSMAN/HELPMAN (1991) have presented broad analytical progress in growth modeling, however, the issue of optimum growth was not picked up. AGHION/HOWITT (1998) presented new ideas about endogenous (new) growth, emphasizing in particular the role of innovation.

The result in a model in which consumers discount utility – thus going beyond the traditional approach – is not much different since maximizing the welfare function F (with U denoting Utility relevant for an integral from 0 to infinity, per capita consumption c', e' the Euler number and ρ the rate of time preference) to be maximized is

(1h) $F = \int U(c'_t)\, e'^{-\rho t}\, dt$

subject to dk'/dt= f(k') – c' – (n+a)k' which gives – with denoting the current-value shadow price – the Hamiltonian

(1i) $H = \int U(c'_t)\, e'^{-\rho t}\, dt + \lambda[f(k') - c' - (n+a)k']$

The optimality conditions ($\partial H/\partial c'=0$ and $\partial H/\partial k' = - d\lambda/dt$) give the Ramsey rule

(1j) $r = - d\ln U'(c')/dt + \rho + n + a$

In the steady state – were c' is constant and hence the growth rate of the marginal utility U' is zero – we thus get

(1k) $r = \rho + n + a.$

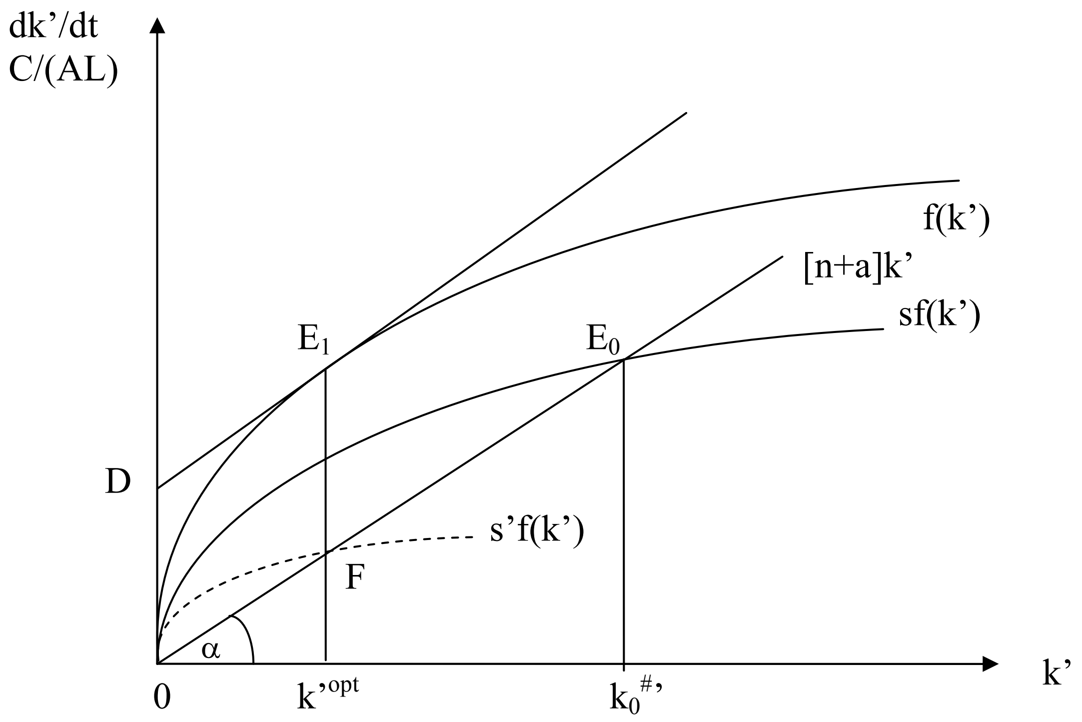
As we are not so much interested in the role of the time preference, we will not rely on the complex Hamiltonian approach. Rather, a simple graphical model is sufficient for bringing out the main critical results. The reader interested in the role of time preference can replace n in the relevant steady state condition through n+ρ if he wants to highlight the role of ρ. One may also note that adjusting the utility function in a way which contains both c' and k' – or more generally wealth – gives only a minor modification. The optimum steady state k# rises in comparison with traditional optimum growth approaches.

In the subsequent analysis, we at first are interested in endogeneizing technological progress. The following section takes a closer look at some key issues of endogenous growth and proceeds with combining optimum growth approaches and endogenous growth modeling. We will also consider the role of long-run relative price changes in the context of technological progress. The analysis presented then leads to several interesting policy conclusions related to both growth and innovation policy. The main conclusions clearly go beyond the standard analysis in the literature and basically suggest considerable changes in economic policy in both advanced and catching-up countries.

3.2.2 Optimum Endogenous Growth

The standard optimum growth literature of PHELPS (1961) and WEIZSÄCKER (1962) has established for the case of a closed economy that within a neoclassical growth model, the optimum growth – defined by maximization of steady state per capita consumption C/L – is determined by the condition that in the absence of technological progress, the growth rate of the population n is equal to the marginal product of capital Y_K. Moreover, in a world of implicit profit maximization and zero capital depreciation, this also implies that the real interest rate r=F'(k)=n, where F'(k) is the marginal product of capital (alternatively we denote the marginal product of capital as Y_K); the function y=F(k) is linear homogenous, y=Y/L is per capita output and k=: K/L capital intensity. From an optimum growth perspective, a government's growth policy should aim to manipulate the savings rate s - establishing indeed a new adequate savings rate s' - in such a way that the intersection point of the curve nk with sF(k) is such that for the respective k# the slope of the F(k) curve is equal to n. Similarly, if there is Harrod-neutral technological progress, we have a production function Y/[AL] = f(k') where k'=K/[AL].

Figure 9: Optimum Growth in the Standard Model



Graphically, the steady state value k'# is determined by the intersection of [n+a]k' and the curve sf(k') as shown in point E_0. In the steady state output, Y will grow at the rate n+a. Again, government could consider the topic of optimum growth, namely maximizing consumption per capita in the steady state. As y=C/[AL] + I/[AL], it is clear that point k'^{opt} is the optimum (DE_1 is parallel to the curve $[n+a]k'$), and it will be achieved - see the subsequent figure - if government reduces the savings rate to s'. In the implicit case of profit maximization, the optimum is characterized by the equality of r and the marginal product of capital $f'(k')$ and hence by $r=f'(k')=a+n$. Note that in the model, profit maximization is introduced here in an ex post fashion with no endogenous mechanism driving the economy towards k'^{opt}.

The standard optimum growth approach takes the population growth rate n as given and suggests that government should adjust the aggregate savings rate s. Indeed government could do so by adjusting the government budget deficit-GDP ratio in an appropriate way.

Role of Government Consumption

In the case of a constant Harrod neutral progress rate a, the mechanics of the neoclassical growth model remain the same as in the basic model. An interesting refinement suggested here is to analyze the role of government consumption G under the simple assumption that $G=\gamma Y$ and that private consumption as well as government consumption are full substitutes while γ negatively affects the progress rate, as we assume

(1l) $a=a_1(1-b'\gamma)$

where a_1 is the progress rate which would hold without government consumption and b' is a positive parameter in the interval 0,1. Progress is still exogenous here as γ is exogenous. Ruling out government deficits and therefore taking into account that $\gamma=\tau$ (where τ is the income tax rate), the accumulation dynamics are now given by:

(1m) $dk'/dt = s[1-\gamma]k'^{ß} - [a_1(1-b'\gamma)]k'$

The effect of government consumption on long run growth and technological progress is negative. However, the effect of γ on the level of the growth path is ambiguous since the steady state solution is given by

(1n) $k'\#=\{s[1-\gamma]/ [a_1(1-b'\gamma)] \}^{1/1-ß}$

The numerator in the above expression is reduced by rising government consumption so that the $s[1-\gamma]k'^{ß}$ curve – in dk'/dt-k' space – bends all the more downward the higher γ is. However, the ray OF (for $\gamma=0$) showing $[a_1(1-b'\gamma)]k'$ also rotates downward (see OF' for a certain γ in the interval 0,1), so that k'# could rise or fall as the consequence of relatively higher government consumption. Our analysis thus raises some interesting questions about the role of government in a neoclassical growth model. For the sake of simplicity, we will assume that the optimum capital intensity is not affected. However, it is clear that the optimum capital stock has increased, as the curve ak' has become flatter (we assume zero population growth). The gap between the natural steady state capital intensity and optimum capital intensity has narrowed. If narrowing this gap is considered an element of optimal policy, one has an interesting avenue of research. From a political economy perspective, the final outcome will depend on the use of tax revenues. If government spends those revenues in a way which helps to attract more foreign direct investment, in turn leading to a rise in the long run progress rate, one could not simply argue that introducing taxes has negative economic effects.

Politically optimal growth obviously can diverge considerably from what is optimal in a situation in which perfectly informed rational economic agents are interacting. If government in an economy with profit maximization wants to maximize long run per capita consumption while ignoring the link between γ and the progress rate, the optimum k' is given by the condition:

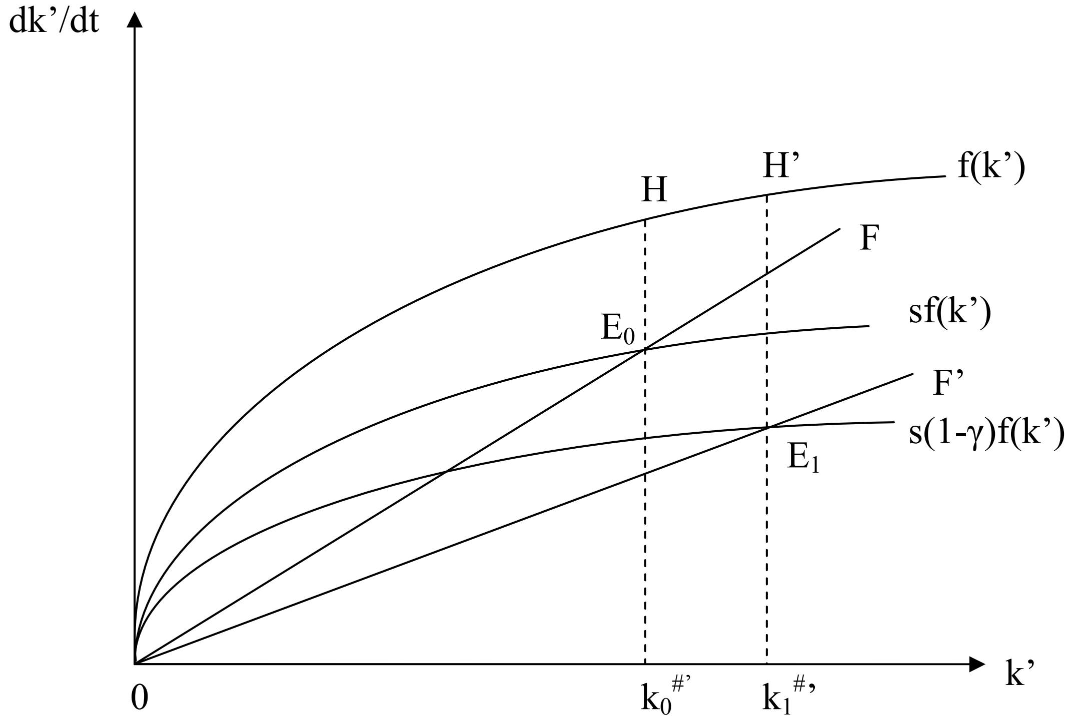
$$(1n') \quad r = [a_1(1-b'\gamma)]$$

If government expenditures represented pure R&D promotion expenditures, the impact of γ on the progress rate would not be negative, rather a positive impact would be expected, which leads (here b'' is the parameter indicating the impact of R&D promotion on the progress rate, and b" in turn will be linked with FDI, and FDI is a function of the real exchange rate) to the following modified optimum growth condition:

$$(1n'') \quad r = [a_1(1+b''\gamma)]$$

The implication obviously is that the optimum steady state value of k' is reduced so that there is a stronger case for government intervention, namely in the following sense. The increased gap between the "natural" steady state capital intensity and the optimum capital intensity has widened – remember that it still holds that $\gamma = \tau$. Hence, there are good reasons that government intervenes in such a way as to reduce the long-term savings ratio. In a short-term Keynesian perspective, a transitory impact of such a measure would be a rise in output, provided that there is some unemployment in the initial situation. However, these short-term aspects are indeed of minor importance here. It must, however, be emphasized that both in EU accession countries and in EU 15, it would be important to focus the policy debate on the issue of optimum growth.

Figure 10: Government Consumption and the Steady State in a Neoclassical Growth Model



4. Conclusions

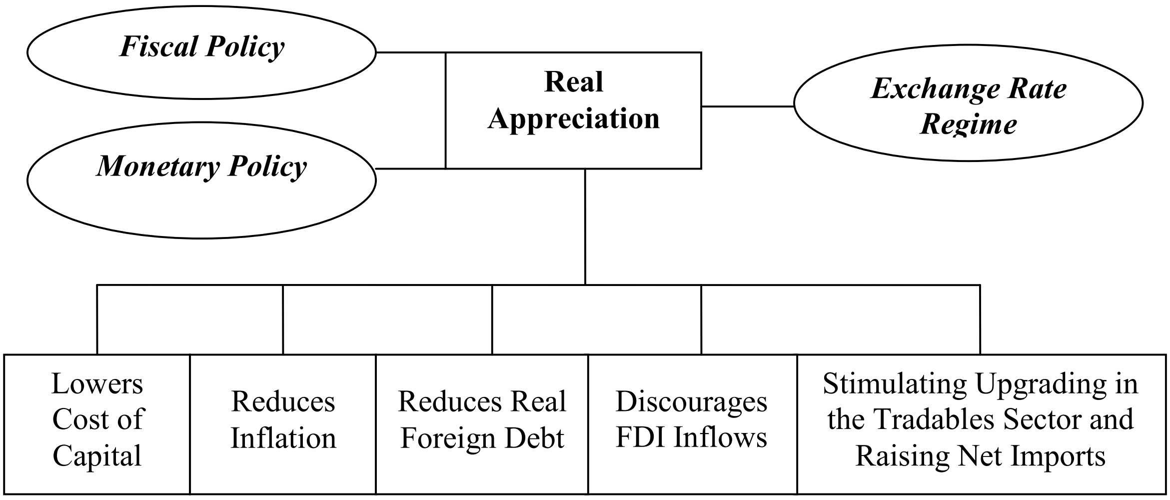
Theoretical analysis has shown that a real appreciation of the currency – in a country catching up economically – can have several major effects (see Fig. 11):

- it reduces the costs of capital;
- it reduces foreign direct investment inflows, but it has an ambiguous effect on output per capita;
- it stimulates product upgrading in the tradables sectors. However, it is unrealistic to assume that firms can quickly upgrade export products in terms of quality or product innovativeness. The adjustment time or learning phase required typically depends on the general ability of firms to adjust, the level of technological sophistication already acquired (and hence the presence of foreign investors) and the share of skilled workers available. A sudden strong real appreciation should be avoided, as the supply-side responsiveness of firms can cope only with limited exchange rate pressure. Moreover, as real appreciation tends to reduce foreign direct investment

inflows, phases of sudden and strong real appreciation could become a problem for an accession country (and this all the more the higher initial trade balance deficit is);

- it raises net imports of goods and services in the medium term – after the initial negative J-curve effect;.
- it could affect the price level and the inflation rate, respectively;
- it reduces net foreign debt.

Figure 11: Effects of a Real Appreciation

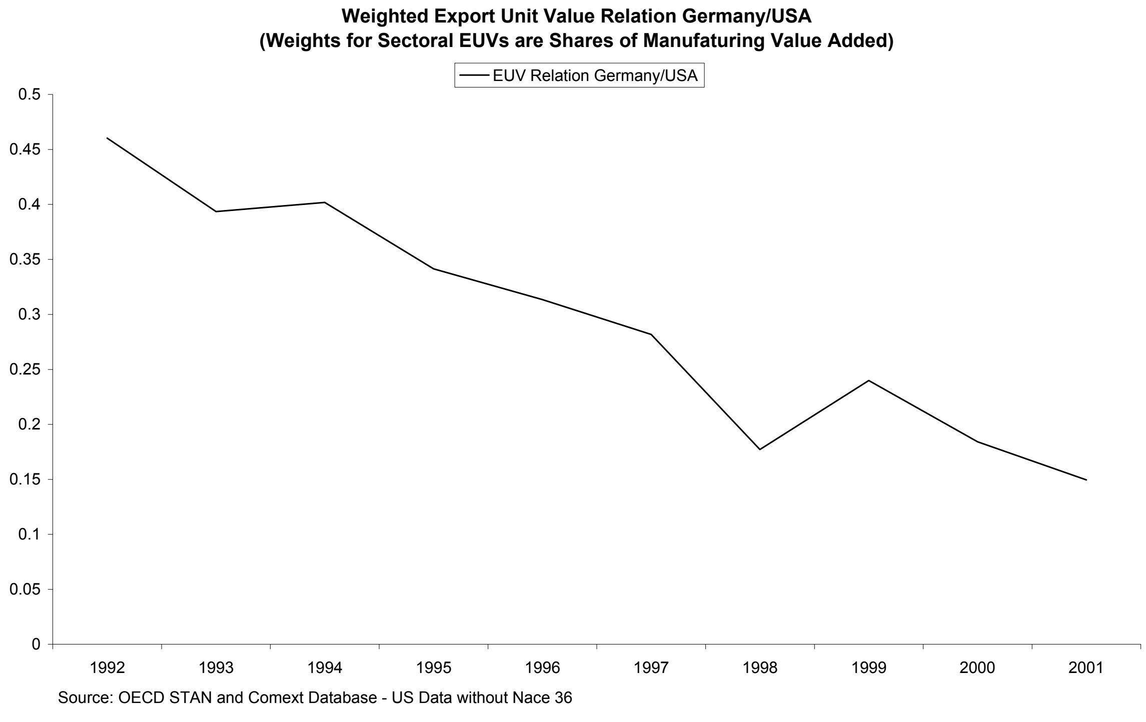


Among the policy implications, we find that government in poor countries – such as EU accession countries – should stimulate savings and encourage foreign direct investment. It also would be wise to avoid early fixing of the nominal exchange rate, since the normal rise in the relative price of nontadables can no longer be achieved through nominal and real appreciation but only through an increase of the nontradables price which must be stronger than the price increase of the tradables price. That is, combining low inflation rates and the long term increase of nontradables prices is difficult to achieve unless one has flexible exchange rates. There is, however, some risk that flexible exchange rate regimes could be associated with temporary overshooting. Since the exchange rate is an international relative price, the reason for overshooting dynamics could be internal or external. Strong and sudden real appreciations should be avoided. If the real appreciation comes not through a fall in the nominal exchange rate but through a very low inflation rate, this could create serious problems in an economy with insufficient downward wage flexibility. Moreover, the relative rise in the nontradables price to normally be expected along with a process of economic catching-up requires a fall in the nontradables price which could be difficult to achieve. While foreign direct investment inflows are basically a welcome ingredient for economic catching up, governments in host countries should be careful to avoid unnecessary concentration tendencies which could undermine the flexibility and innovativeness needed in an open economy exposed to temporary or permanent real appreciation of its currency.

The EU Eastern enlargement will bring a medium term real appreciation for the accession countries, which will affect foreign direct investment, trade and the current account. From a EU-15 perspective, Eastern Europe generates pressure for structural change and international outsourcing on the one hand, while driving high wage countries to increasingly specialize in technology-intensive goods on the other. For the governments of EU-15 countries, this could encourage promotion of technological progress through R&D subsidies. From an optimum growth perspective, both national governments and supranational EU policy should consider opportunities to bring about optimum growth. There clearly is a special challenge for the Euro zone due to uniform interest rates The long term dynamics of the current account, FDI growth and structural change require further analysis. It is not easy to design a consistent economic policy which stimulates the overall growth of EU-25 while maintaining economic stability.

The EU would be well advised to seriously consider the implications of endogenous growth theory and of the optimum growth theory. National governments in leading EU countries could indeed try to influence the progress rate, and in the Euro zone achieving optimum growth could be a challenge for the cooperation between national governments of the Euro zone's member countries – adjusting R&D promotion policy adequately – ad the ECB with its opportunities to adjust the interest rate. Eastern European accession countries also should carefully study the options of an optimum growth policy.

Figure 12: Relative Export Unit Value of German Industry (Germany relative to US)



A major challenge for EU25 is that an efficient modernization and innovation process requires that the adjustment in EU15 – especially in high wage countries – should be structural change towards skill-upgrading and product innovations which normally go along with a relative rise in export unit values ("relative" means in comparison to the USA, which is the leading OECD country). In a triangular economic perspective, rising EU15 outsourcing towards EU accession countries in eastern Europe should strengthen global competitiveness so that EU15 RCAs in the global market should improve in particular in sectors in which EU15 countries have rising imports from accession countries. Whether the overall development of EU25 terms of trade will be positive in the medium term is unclear. As regards Germany, it is remarkable that the weighted average export unit value for industrial products stayed flat in the 1990s while that of the US strongly increased. Hence, the relative German export unit value has fallen considerably.

The developments in Germany suggest that it is facing declining profit rates in world markets and might therefore face an intensified struggle for income (i.e., social conflicts between workers and capital owners). If Germany is forced by the interplay of domestic dynamics and global structure change to move more towards less profitable sectors, the German current account balance might improve if import demand is sufficiently elastic. It will in any case be important to conduct further research on European and global economic dynamics in the future.

References

AGHION, P.; HOWITT, P. (1998), Endogenous Growth Theory: Cambridge, MA, MIT Press.

AUDRETSCH, D., WELFENS, P.J.J. (2002) Economic Growth and the New Economy in the US and Europe, Heidelberg and New York: Springer 2002.

BALASSA, B. (1965). Trade Liberalization and Revealed Comparative Advantage. Manchester School 33, pp: 99-123.

BALL, L. (2001), Another Look at Long-Run Money Demand, Journal of Monetary Economics, Vol. 47, pp: 31-44.

BEYER, A. (1998), Modelling Money Demand in Germany, *Journal of Applied Econometrics*, Vol. 13, 57-76.

BLANCHARD, O.J.; FISCHER, S. (1989), Lectures on Macroeconomics, Cambridge: MIT Press.

COENEN, G.; VEGA, J.L. (2001), The Demand for M3 in the Euro Area, *Journal of Applied Econometrics*, Vol. 16, 727-748.

DIXIT, A.K: (1976), The Theory of Equilibrium Growth, Oxford: Oxford University Press.

ERICSSON, N.R. (1998), Empirical Modelling of Money Demand, *Empirical Economics*, Vol. 23, 295-315.

JONES, C.I. (1998), Introduction to Economic Growth, New York: Norton.

FROOT, K. A., and J. C. STEIN (1991). Exchange rates and foreign direct investment: An imperfect capital markets approach. Quarterly Journal of Economics 106:191-217.

GROSSMAN, G. M.; HELPMAN, E. (1991). Innovation and Growth in the Global Economy. MIT Press.

HANSEN, J.; ROEGER, W. (2000), Estimation of Real Equilibrium Exchange Rates, Economic Papers No. 144, European Commission, Brussels.

HAYO, B. (1999), Estimating a European Money Demand Function, *Scottish Journal of Political Economy*, Vol. 46, 221-244.

LAMBSDORFF, J. (2005), The Puzzle with Increasing Money Demand – Evidence from a Cross-Section of Countries, *Kredit und Kapital*, Vol. 38, 155-176.

LILIEN, D. M. (1982a): Sectoral Shifts and Cyclical Unemployment. *Journal of Political Economy,* 90, pp. 777–793.

LILIEN, D. M. (1982b): A Sectoral Model of the Business Cycle. Modelling Research Group

LUCAS, R.E. (1988). On the Mechanics of Economic Development. Journal of Monetary Economics, Vol. 22, I: 3-42.

PHELPS, E.S. (1961), The Golden Rule of Accumulation: A Fable for Growthmaen, *American Economic Review*, Vol. 51, 638-643.

SOLOW, R.M: (1970), Growth Theory: An Exposition, Oxford: Oxford University Press.

STAMER, M. (1999): Strukturwandel und Wirtschaftliche Entwicklung in Deutschland, den USA und Japan. Shaker, Aachen.

WEIZSÄCKER, C. VON (1962), Wachstum, Zins und optimale Investitionsquote, Tübingen: Mohr.

VALADKHANI, A. (2005), Modelling Demand for Broad Money in Australia, *Australian Economic Papers*, Vol. 44, 47-64.

WELFENS, P.J.J. (1997). Privatization, Structural Change and Productivity: Toward Convergence in Europe? in: BLACK, S., ed. (1997), Europe´s Economy Looks East, Cambridge: Cambridge University Press, 212-257.

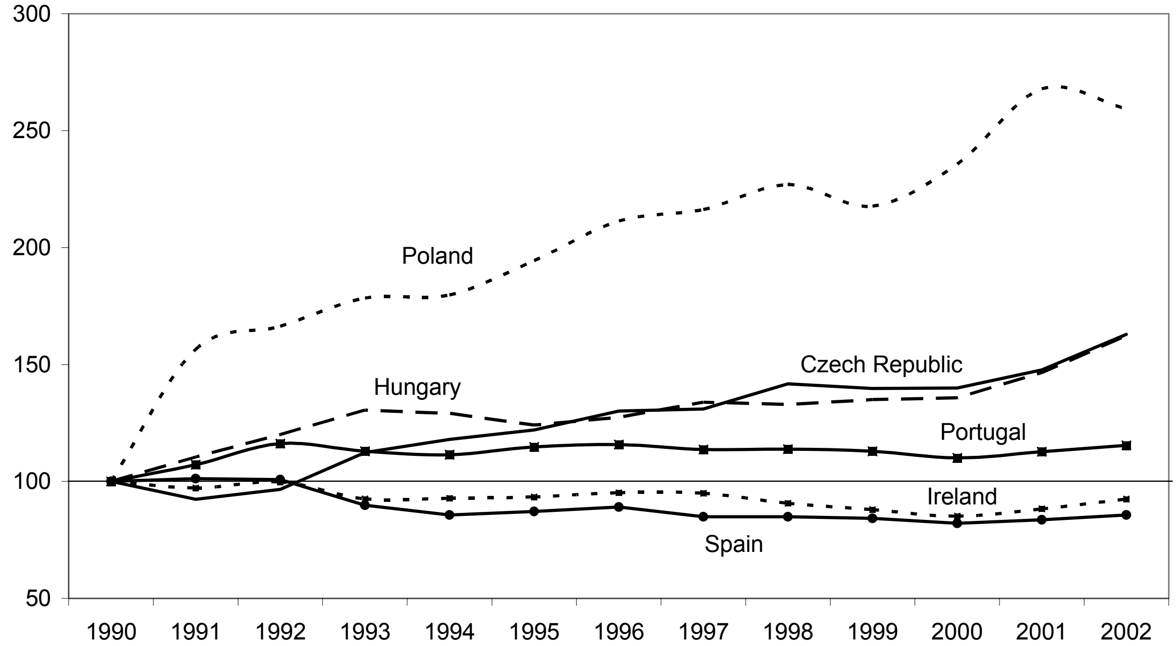
WELFENS, P.J.J. (2002), Interneteconomics.net, Heidelberg and New York: Springer, 2nd edition forthcoming 2006.

WELFENS, P.J.J.; BORBÈLY, D. (2004). Exchange Rate Developments and Stock Market Dynamics in Transition Countries: Theory and Empirical Analysis, Paper presented at CEPS, Brussels, November 18-20, 2004, EIIW Working Paper, No. 126.

WORLD BANK (2004). World Development Indicators, CD-Rom.

Annex 1

Figure Annex 1:Real Effective Exchange Rate (P/eP*) Dynamics in Selected EU Countries: Poland, Hungary, Czech Republic, Portugal, Spain, Ireland, 1990-2002



Source: World Development Indicators 2004.

Annex 2

Statistical Measures of Structural Change

According to STAMER (1999), the degree of structural change between the time points or time periods, 1 and 2, can be measured by several indicators, including the following indicators (for output X) if we distinguish sectors i = 1 ... n.

LILIEN Index (*L*I) (see LILIEN, 1982a, b):

(a1) $$LI_{1,2} = \sqrt{\sum_{I=1}^{n} x_{i2} \left(\ln \frac{x_{i2}}{x_{i1}} \right)^2}, \quad x_{i1} > 0, \quad x_{i2} > 0.$$

The modified LILIEN Index (*MLI*) (see STAMER, 1999, p. 42-44):

(a2) $$MLI_{1,2} = \sqrt{\sum_{I=1}^{n} x_{i1} x_{i2} \left(\ln \frac{x_{i2}}{x_{i1}} \right)^2}, \quad x_{i1} > 0, \quad x_{i2} > 0.$$

All indicators mentioned above have advantages and drawbacks. The choice of an indicator has to be made on the basis of the goals of the respective research. For many purposes, the norm of absolute values and/or the Euclidean norm are frequently used measures. A useful indicator as a measure of diversification is the index proposed by LILIEN (1982a). Some drawbacks of this indicator are remedied by the Modified LILIEN Index of STAMER (1999). This, however, comes at the cost of a more complex interpretation.

EIIW Discussion Papers

ISSN 1430-5445:
Standing orders (usually 13 issues or more p.a.): academic rate 95 Euro p.a.; normal rate 250 Euro p.a.
Single orders: academic rate10 Euro per copy; normal rate 20 Euro per copy.

Die Zusammenfassungen der Beiträge finden Sie im Internet unter:
The abstracts of the publications can be found in the internet under:

http://www.euroeiiw.de

No. 1 **Welfens, P.J.J.:** Telecommunications in Systemic Transformation, January 1995.

No. 2 **Welfens, P.J.J.; Graack, C.:** Telecommunications in Western Europe: Liberalization, Technological Dynamics and Regulatory Developments, January 1995.

No. 3 **Welfens, P.J.J.:** Achieving Competition in Europe's Telecommunications Sector, February 1995.

No. 4 **Addison, J.T.:** The Dunlop Report: European Links and Other Odd Connections, May 1995.

No. 5 **Addison, J.T.; Blackburn, McKinley L.:** A Puzzling Aspect of the Effect of Advance Notice on Unemployment, May 1995.

No. 6 **Welfens, P.J.J.; Graack, C.:** Deregulierungspolitik und Wettbewerb in Netzindustrien: Bedeutung und Optionen für osteuropäische Transformationsländer, May 1995.

No. 7 **Addison, J.T. Chilton, J.B.:** Models of Union Behavior, June 1995.

No. 8 **Graack, C.:** EU-Telecom Markets and International Network Alliances: Developments, Strategies and Policy Implications, August 1995.

No. 9 **Welfens, P.J.J.:** Koordinationserfordernisse der EU-Infrastrukturpolitik, November 1995.

No. 10 **Hillebrand, R.:** Umweltpolitik in föderalen Systemen - eine kritische Analyse der EU-Umweltpolitik, December 1995.

No. 11 **Addison, J.T.; Schnabel, C.; Wagner J.:** On the Determinants of "Mandatory" Works Councils in Germany, December 1995.

No. 12 **Welfens, P.J.J.:** Towards Full Employment and Growth in the European Union, December 1995.

No. 13 **Welfens, P.J.J.:** Wirtschaftspolitische Kompetenzverteilung in der Europäischen Union, December 1995.

No. 14 **Welfens, P.J.J.:** Privatization, Efficiency and Equity, January 1996.

No. 15 **Hartwig, K.-H.; Welfens P.J.J.:** EU and Eastern Europe: Western European Integration and Eastern European Transformation, May 1996.

No. 16 **Welfens, P.J.J.:** Konsequenzen einer Osterweiterung für die EU und deren Reformbedarf, May 1996.

No. 17 **Graack, C.:** Structure of the Telecoms Sector and Degree of Internationalization in Europe and Russia, July 1996.

No. 18 **Bogai, D.:** Werkstatt der Deutschen Einheit? Wirtschaft und Arbeitsmarkt in der Region Berlin-Brandenburg, October 1996.

No. 19 **Graack, C.:** Internationale Aspekte der Telekommunikationswirtschaft: Liberalisierung, internationale Tarifmechanismen und Wohlfahrtseffekte, October 1996.

No. 20 **Jungmittag, A.; Welfens P.J.J.:** Telekommunikation, Innovation und die langfristige Produktionsfunktion: Theoretische Aspekte und eine Kointegrationsanalyse für die Bundesrepublik Deutschland, October 1996.

No. 21 **Welfens, P.J.J.; Guth M.:** EU-Strukturpolitik in Deutschland: Entwicklung, Effizienzüberlegungen und Reformoptionen, October 1996.

No. 22 **Welfens, P.J.J.; Graack C.:** Telekommunikationsmärkte in Europa: Marktzutrittshemmnisse und Privatisierungsprobleme aus Sicht der Neuen Politischen Ökonomie, October 1996.

No. 23 **Welfens, P.J.J.:** Die Position Deutschlands im veränderten Europa: Wirtschaftliche und reformpolitische Perspektiven, November 1996.

No. 24 **Hartmann, P.:** Foreign Exchange Vehicles Before and After EMU: From Dollar/Mark to Dollar/Euro?, November 1996.

No. 25 **Jungmittag, A.; Welfens P.J.J.:** The Political Economy of EMU and Stabilization Policy, May 1997.

No. 26 **Hölzler, H.:** Privatisierung und Einführung von Wettbewerb in Rußland, January 1996.

No. 27 **Welfens, P.J.J.:** Small and Medium-sized Companies in Economic Growth: Theory and Policy Implications in Germany, May 1997.

No. 28 **Bogai, D.:** Europäische Arbeitsmarktpolitik und nationale beschäftigungspolitische Initiativen, May 1997.

No. 29 **Welfens, P.J.J.:** Research & Development Policy and Employment, June 1997.

No. 30 **Sinclair, A.:** Liberalising the Electricity Supply Industry in Western and Eastern Europe: Lessons for Russia, July 1997.

No. 31 **Graack, C.:** Infrastructure Investments and Regulation in Telecommunications, July 1997.

No. 32 **Welfens, P.J.J.; Schwarz A.:** Die Rolle des Staates in der Sozialen Marktwirtschaft bei Globalisierung der Wirtschaftsbeziehungen, August 1997.

No. 33 **Welfens, P.J.J.; Wiegert R.:** Transformation Policies, Regulation of Telecommunications and Foreign Direct Investment in Transforming Economies, July 1997.

No. 34 **Welfens, P.J.J.:** Internationalization of Telecoms, Deregulation, Foreign Investment and Pricing: Analysis and Conclusions for Transforming Economies, July 1997.

No. 35 **Schwarz, A.:** Subventionspolitik in den mittel- und osteuropäischen Transformationsländern: Gegenwärtige Strukturen, Probleme und Transparenzdefizite, September 1997.

No. 36 **Welfens, P.J.J.; Hillebrand R.:** Globalisierung der Wirtschaft: Wirtschaftspolitische Konsequenzen des internationalen Standortwettbewerbs, September 1997.

No. 37 **Stiller, H.:** Material Intensity of Transportation and Implications for Sustainable Mobility in Europe, September 1997.

No. 38 **Gerstberger, T.; Graack C.:** Competition and Deregulation in the Japanese Telecommunications Network Industry, September 1997.

No. 39 **Welfens, P.J.J.:** Wirtschaftspolitische Flankierungserfordernisse des Euro-Starts, November 1997.

No. 40 **Aslund, A.:** The Political Economy of Systemic Transformation and Institution-Bulding, November 1997.

No. 41 **Guth, M.:** Regionale Beschäftigungspakte im Rahmen der EU-Strukturpolitik: Hintergrund und Einordnung, November 1997.

No. 42 **Jungmittag, A.; Welfens P.J.J.:** Politische Ökonomie der Europäischen Währungsunion und Stabilitätspolitik, January 1998.

No. 43 **Welfens, P.J.J.:** Labor Costs, Unemployment and Innovation, February 1998.

No. 44 **Addison, J.T.; Audretsch, D.B.; Gries, T.; Grupp H.; Welfens, P.J.J.:** Economic Globalization, Innovation and Growth, April 1998.

No. 45 **Welfens, P.J.J.:** Euro, Währungsunion und EU-Binnenmarkt, April 1998.

No. 46 **Addison, J.T., Schnabel, C.; Wagner J.:** Works Councils in Germany: Their Effects on Firm Performance, March 1998.

No. 47 **Addison, J.T.; Portugal, P.:** Short- and Long-Term Unemployment, March 1998.

No. 48 **Welfens, P.J.J.:** Trade and Optimum Import Tariffs: A Note in the Context of Foreign Direct Investment, June 1998.

No. 49 **Bohn, F.:** Monetary Union and the Interest-Exchange Trade-off, July 1998.

No. 50 **Welfens, P.J.J.:** Exchange Rate Policy for the Euro: Theory, Strategic Issues and Policy Options, July 1998.

No. 51 **Addison, J.T.; Portugal P.:** Job Search Methods and Outcomes, July 1998.

No. 52 **Jungmittag, A.; Welfens P.J.J.:** Telecommunication, Innovation and the Long-Term Production Function: Theoretical Analysis and a Cointegration Analysis for West Germany 1960-1990, August 1998.

No. 53 **Welfens, P.J.J.:** Eastern EU Enlargement: Problems, Conflicts and Policy Options, September 1998.

No. 54 **Welfens, P.J.J.:** Die russische Transformationskrise: Monetäre und reale Aspekte sowie Politikoptionen, November 1998.

No. 55 **Graack, C.; Welfens, P.J.J.:** Internationaler Technologiewettlauf, Arbeitsmarktdynamik und Unternehmensgründungsdynamik bei Standortkonkurrenz, September 1998.

No. 56 **Welfens, P.J.J.:** Liberalisierung der Energiewirtschaft in Deutschland und EU-Partnerländern, Januar 1999

No. 57 **Welfens, P.J.J.:** The RussianTransformation Crisis: Origins, Analysis and NewPolicy Requirements, January 1999

No. 58 **Komulainen , Tuomas:** Currency Crisis Theories – Some Explanations for the Russian Case, May 1999

No. 59 **Welfens, P.J.J.:** Internet Market Dynamics in Germany: From a small Market towards a Strategic Sector of the Economy, May 1999

No. 60 **Wiegert, R.:** Der russische Bankensektor im Prozeß der Systemtransformation, Juni 1999

No. 61 **Vogelsang, M.:** How to rescue Japan: Proposal of a staggered VAT reform. Draft, May 1999

No. 62 **Welfens, P.J.J.:** The Start of the Euro, International Relations and Inflation, April 1999

No. 63 **Sutela, P.:** Overcoming the Russian Transformation Crisis: Selected Issues and Policy Options, June 1999

No. 64 **Bohn, F.:** The Italian Case: A Parable for the Eastern Enlargement of the EMU, July 1999

No. 65 **Meyer, B.; Welfens, P.J.J.:** Innovation – Augmented Ecological Tax Reform: Theory, Model Simulation and New Policy Implications, September 1999

No. 66 **Gavrilenkov, E.:** Crisis in Russia: Selected Problems of the Macroeconomic Performance, September 1999

No. 67 **Steinsdorff, S. v.:** Wie demokratisch ist Rußland? Dezember 1999

No. 68 **Pelzel, R.:** Internationalisierung der Telekommunikation, eine Vergleichsanalyse für USA, Großbritannien und Deutschland, Dezember 1999

No. 69 **Serebryakov, G.**: Structural Change and Econometric Prospective, January 2000

No. 70 **Bohn, F.:** Political Instability, Inflation, and International Loans, February 2000

No. 71 **Welfens, P.J.J.:** The EU and Russia: Strategic Aspects of Transformation and Integration, April 2000

No. 72 **Jungmittag, A.:** Techno-Globalismus: Mythos oder Realität?, Juli 2000

No. 73 **von Westernhagen, N.:** The Role of FDI in the Transition Process of Selected CIS and Eastern European Countries, September 2000

No. 74 **Welfens, P.J.J.; Hollants, J.; Kauffmann, A.:** Mittelständische Unternehmen und das Internet: Perspektiven in Deutschland, Oktober 2000

No. 75 **Jungmittag, A.; Welfens, P.J.J.:** Auswirkungen einer Internet Flatrate auf Wachstum und Beschäftigung in Deutschland, März 2000

No. 76 **Addison, J.T.:** Is Community Social Policy Beneficial, Irrelevant, or Harmful to the Labor Market Performance of the European Union?, September 2000

No. 77 **Welfens, P.J.J.:** Modern Exchange Rate Theory and Schumpetrian Economic Analysis: New Approach and Application to the Euro, June 2000

No. 78 **Guth, M.:** From technology policy for regions to regional technology policy towards a new policy strategy in the EU, December 2000

No. 79 **Welfens, P.J.J.; Kauffmann, A.; Vogelsang, M.:** Evaluationsbericht: Das Internet strategisch richtig nutzen, Februar 2001

No. 80 **Welfens, P.J.J.:** Transatlantische Wachstumsunterschiede, Euro-Schwäche und Finanzpolitik, Mai 2001

No. 81 **Jungmittag, A.; Welfens,P.J.J.:** Effects of an Internet Flat Rate on Growth and Employment in Germany, February 2001

No. 82 **Welfens, P.J.J.:** Transatlantic Growth Differentials, ICT Dynamics, Fiscal Policy and the Fall of the Euro, July 2001

No. 83 **Wiegert, R.:** Financial Sector and Human Capital in a Long-Term Growth Perspective: The Case of Russia, July 2001

No. 84 **Addison J.T.:** Principles of Market-Oriented Labor Market Policies; July 2001

No. 85 **Jungmittag, A.; Welfens, P.J.J.:** Europäische Telekomliberalisierung und Außenhandel: Theorie, Gravitationsansatz und Implikationen, Juni 2001

No. 86 **Ponder, J.K.:** Telekommunikationssektor in Polen: Entwicklungen, Investitionsperspektiven und Regulierung, Oktober 2001

No. 87 **Jungmittag, A.; Welfens P.J.J.:** Liberalization of EU Telecommunications and Trade: Theory, Gravity Equation Analysis and Policy Implications, October 2001

No. 88 **Bohn, F.:** Powerful Groups and Corruption, December 2000

No. 89 **Welfens, P.J.J.:** Aggregation in a Two-Sector Growth Model: A Modified Solow Approach with Cobb-Douglas Production Functions, September 2001

No. 90 **Welfens, P.J.J.:** Stabilization and Growth: A New Model, October 2001

No. 91 **Addison, J.T.:** Principles of Market-Oriented Labor Market Policies, March 2002

No. 92 **Jungmittag, A.:** Innovationsdynamik in der EU: Konvergenz oder Divergenz?, Eine Zeitreihen-Querschnittsanalyse, Februar 2002

No. 93 **Welfens, P.J.J.; Wiegert, R.:** Reform des Bankensektors und Stabilität in Rußland, November 2001

No. 94 **Welfens, P.J.J.:** Mittelfristige Herausforderungen für Euroland: Stabilität, EU-Osterweiterung, Wachstum; November 2001

No. 95 **Welfens, P.J.J.:** Constitutional Issues and the Quality of Political Competition: Analysis and Implications for a Future EU Constitution, April 2002

No. 96 **Jungmittag, A:** Innovation Dynamics in the EU: Convergence or Divergence?, A Cross-Country Panel Data Analysis, June 2002

No. 97 **Welfens, P.J.J.:** I&K-Technologie, Produktivität und Wachstum: Transatlantische Ananlyseperspektiven und wirtschaftspolitische Optionen, Juli 2002

No. 98 **Jungmittag, A.; Welfens, P.J.J.:** Telecommunication, Internet, Innovation and Growth in Europe and the US, August 2002

No. 99 **Welfens, P.J.J.:** Finanzpolitik zwischen Wachstumsschwäche und Maastrichter Vertrag / Stabilitätspakt: Ausgabenschwerpunkte neu setzen und kluge Steuerreform, September 2002

No. 100 **Gavrilenkov, E**: Macroeconomic Situation in Russia - Growth, Investment and Capital Flows, October 2002

No. 101 **Agata, K.**: Internet, Economic Growth and Globalization, November 2002

No. 102 **Blind, K.; Jungmittag, A.**: Ausländische Direktinvestitionen, Importe und Innovationen im Dienstleistungsgewerbe, February 2003

No. 103 **Welfens, P.J.J.; Kirn, T.:** Mittelstandsentwicklung, BASEL-II-Kreditmarktprobleme und Kapitalmarktperspektiven, Juli 2003

No. 104 **Standke, K.-H.**: The Impact of International Organisations on National Science and Technology Policy and on Good Governance, March 2003

No. 105 **Welfens, P.J.J.:** Exchange Rate Dynamics and Structural Adjustment in Europe, May 2003

No. 106 **Welfens, P.J.J.; Jungmittag, A.; Kauffmann, A.; Schumann, Ch.:** EU Eastern Enlargement and Structural Change: Specialization Patterns in Accession Countries and Economic Dynamics in the Single Market, May 2003

No. 107 **Welfens, P.J.J.:** Überwindung der Wirtschaftskrise in der Eurozone: Stabilitäts-, Wachstums- und Strukturpolitik, September 2003

No. 108 **Welfens, P.J.J.:** Risk Pricing, Investment and Prudential Supervision: A Critical Evaluation of Basel II Rules, September 2003

No. 109 **Welfens, P.J.J.; Ponder, J.K.:** Digital EU Eastern Enlargement, October 2003

No. 110 **Addison, J.T.; Teixeira, P.:** What Have We Learned About The Employment Effects of Severance Pay? Further Iterations of Lazear et al., October 2003

No. 111 **Gavrilenkov, E.:** Diversification of the Russian Economy and Growth, October 2003

No. 112 **Wiegert, R.:** Russia's Banking System, the Central Bank and the Exchange Rate Regime, November 2003

No. 113 **Shi, S.:** China's Accession to WTO and its Impacts on Foreign Direct Investment, November 2003

No. 114 **Welfens, P.J.J.:** The End of the Stability Pact: Arguments for a New Treaty, December 2003

No. 115 **Addison, J.T.; Teixeira, P.**: The effect of worker representation on employment behaviour in Germany: another case of -2.5%, January 2004

No. 116 **Borbèly, D.:** EU Export Specialization Patterns in Selected Accession Countries, March 2004

No. 117 **Welfens, P.J.J.:** Auf dem Weg in eine europäische Informations- und Wissensgesellschaft: Probleme, Weichenstellungen, Politikoptionen, Januar 2004

No. 118 **Markova, E.:** Liberalisation of Telecommunications in Russia, December 2003

No. 119 **Welfens, P.J.J.; Markova, E.:** Private and Public Financing of Infrastructure: Theory, International Experience and Policy Implications for Russia, February 2004

No. 120 **Welfens, P.J.J.:** EU Innovation Policy: Analysis and Critique, March 2004

No. 121 **Jungmittag, A.; Welfens, P.J.J.:** Politikberatung und empirische Wirtschaftsforschung: Entwicklungen, Probleme, Optionen für mehr Rationalität in der Wirtschaftspolitik, März 2004

No. 122 **Borbèly, D.:** Competition among Cohesion and Accession Countries: Comparative Analysis of Specialization Within the EU Market, June 2004

No. 123 **Welfens, P.J.J.:** Digitale Soziale Marktwirtschaft: Probleme und Reformoptionen im Kontext der Expansion der Informations- und Kommunikationstechnologie, Mai 2004

No. 124 **Welfens, P.J.J.; Kauffmann, A.; Keim, M.:** Liberalization of Electricity Markets in Selected European Countries, July 2004

No. 125 **Bartelmus, P.:** SEEA Revision: Accounting for Sustainability?, August 2004

No. 126 **Welfens, P.J.J.; Borbèly, D.:** Exchange Rate Developments and Stock Market Dynamics in Transition Countries: Theory and Empirical Analysis, November 2004

No. 127 **Welfens, P.J.J.:** Innovations in the Digital Economy: Promotion of R&D and Growth in Open Economies, January 2005

No. 128 **Welfens, P.J.J.:** Savings, Investment and Growth: New Approaches for Macroeconomic Modelling, February 2005

No. 129 **Pospiezna, P.:** The application of EU Common Trade Policy in new Memberstates after Enlargement – Consequences on Russia's Trade with Poland, March 2005

No. 130 **Pospiezna, P.; Welfens, P.J.J.:** Economic Opening up of Russia: Establishment of new EU-RF Trade Relations in View of EU Eastern Enlargement, April 2005

No. 131 **Welfens, P.J.J.:** Significant Market Power in Telecommunications: Theoretical and Practical Aspects, May 2005

No. 132 **Welfens, P.J.J.:** A Quasi-Cobb Douglas Production Function with Sectoral Progress: Theory and Application to the New Economy, May 2005.

No. 133 **Jungmittag, A.;Welfens, P.J.J:** Institutions, Telecommunications Dynamics and Policy Challenges: Theory and Empirical Analysis for Germany, May 2005

No. 134 **Feiguine, G.:** Beitritt Russlands zur WTO: Probleme und Perspektiven, June 2005

No. 135 **Libman, A.:** Russia's Integration into the World Economy: An Interjurisdictional Competition View, June 2005

No. 136 **Welfens, P.J.J.:** Rational Regulatory Policy for the Digital Economy: Theory and EU Policy Options, October 2005

No. 137 **Welfens, P.J.J.:** Schattenregulierung in der Telekommunikationswirtschaft, November 2005

No. 138 **Borbèly, D.:** Determinants of Trade Specialization in the New EU Member States, November 2005

EIIW Economic Policy Analysis:

No. 1 **Welfens, P.J.J.:** Globalisierung der Wirtschaft und Krise des Sozialstaats: Ist die Wirtschaftswissenschaft am Ende?, April 1997

No. 2 **Welfens, P.J.J.:** Nach der D-Mark kommt die E-Mark: Auf dem Weg zur EU-Währungsunion, Juli 1997

No. 3 **Welfens, P.J.J.:** Beschäftigungsförderliche Steuerreform in Deutschland zum Euro-Start: Für eine wachstumsorientierte Doppelsteuerreform, Oktober 1998

Fordern Sie den EIIW Newsletter an: www.euroeiiw.de

Please subscribe to EIIW Newsletter: www.euroeiiw.de

Weitere Beiträge von Interesse:
Titels of related interest:

WELFENS, P.J.J., WZIATEK-KUBIAK, (eds., 2005): Structural Change and Exchange Rate Dynamics – The Economics of EU Eastern Enlargement; Heidelberg: Springer.

WELFENS, P.J.J., ZOCHE, P., JUNGMITTAG, A. (et al. 2005): Internetwirtschaft 2010 (final Report for the German Federal Government; joint study EIIW and Fraunhofer Institute for System Dynamics and Innovation, Karlsruhe), Heidelberg: Physica.

GRAHAM, E., ODING, N., WELFENS, P.J.J., (2005): Internationalization and Economic Policy Reforms in Transition Countries, Heidelberg: Springer.

GAVRILENKOW, E., WELFENS, P.J.J., (2005): Инфрастуктура, Инвестиции и Экономическая Интеграция: Перспективы Восточной Европы и России (Infrastructure, Investments and Economic Integration: Perspectives for Eastern Europe and Russia), Moscow: HSE.

APOLTE, T.; CASPERS, R.; WELFENS, P.J.J. (2004), Ordnungsökonomische Grundlagen nationaler und internationaler Wirtschaftspolitik, Stuttgart: Lucius & Lucius.

GAVRILENKOV, E.; WELFENS, P.J.J.; WIEGERT, R. (2004), Economic Opening Up and Growth in Russia, Heidelberg and New York: Springer.

MC MORROW, K.; RÖGER, W. (2003), The Economic and Financial Market Consequences of Global Aging, Heidelberg and New York: Springer.

WIEGERT, R. (2003), Transformation, Wachstum und Wettbewerb in Rußland, Heidelberg und New York: Springer.

PETZOLD, L. (2003), Infrastrukturreform in Transformationsländern, Lohmar: EUL-Verlag.

LANE, T., ODING, N., WELFENS, P.J.J. (2003), Real and Financial Economic Dynamics in Russia and Eastern Europe, Heidelberg and New York: Springer.

BARFIELD, C.E., HEIDUK, G., WELFENS, P.J.J. (2003), Internet, Economic Growth and Globalization, Perspectives on the New Economy in Europe, Japan and the USA, Heidelberg and New York: Springer.

GRIES, T., JUNGMITTAG, A., WELFENS, P.J.J. (2003), Neue Wachstums- und Innovationspolitik in Deutschland und Europa, Heidelberg und New York: Springer.

D. CASSEL; P.J.J. WELFENS (Hrsg., 2003), Regionale Integration und Ostererweiterung der Europäischen Union, Stuttgart: Lucius & Lucius.

ADDISON, J.T., WELFENS, P.J.J. (2003), Labor Markets and Social Security, Heidelberg and New York: Springer.

WELFENS, P.J.J., WIEGERT, R. (2002), Transformationskrise und neue Wirtschaftsreformen in Russland, Heidelberg und New York: Springer.

WESTERNHAGEN, N. VON (2002), Systemic Transformation, Trade and Economic Growth, Heidelberg and New York: Springer.

AUDRETSCH, D.B., WELFENS, P.J.J. (2002), The New Economy and Economic Growth in Europe and the US, Heidelberg and New York: Springer.

WELFENS, P.J.J. (2002), Interneteconomics.net, Heidelberg and New York: Springer.

BUNTE, H.-J., WELFENS, P.J.J. (2002), Wettbewerbsdynamik und Marktabgrenzungen auf Telekommunikationsmärkten, Heidelberg und New York: Springer.

JUNGMITTAG, A., WELFENS, P.J.J. (2002) Internet, Telekomliberalisierung und Wirtschaftswachstum, Heidelberg und New York: Springer.

SCHWARZ, A. (2001), Subventionen in Mittel- und Osteuropa, Lohmar: EUL-Verlag.

PELZEL, R.F. (2001), Deregulierte Telekommunikationsmärkte, Heidelberg und New York: Springer.

WELFENS, P.J.J. (2001), Stabilizing and Integrating the Balkans, Heidelberg and New York: Springer.

WELFENS, P.J.J. (2001), Internationalization of the Economy and Environmental Policy Options, Heidelberg and New York: Springer.

WELFENS, P.J.J. (2001), European Monetary Union and Exchange Rate Dynamics, Heidelberg and New York: Springer.

GAVRILENKOV, E., WELFENS, P.J.J. (2000), Restructuring , Stabilizing and Modernizing the New Russia, Heidelberg and New York: Springer.

TILLY, R., WELFENS, P.J.J. (2000), Economic Globalization, International Organizations and Crisis Management, Heidelberg and New York: Springer.

JUNGMITTAG, A., REGER, G., REISS, T. (Eds., 2000), Changing Innovation in the Pharmaceutical Industry. Globalization and New Ways of Drug Development, Heidelberg and New York: Springer.

GRAACK, C., WELFENS, P.J.J. (1999), Technologieorientierte Unternehmensgründungen und Mittelstandspolitik in Europa, Heidelberg und New York: Springer.

GRAACK, C., GRINBERG, R., WELFENS, P.J.J., YARROW, G. (Eds., 1999), Towards Competition in Network Industries – Telecommunications, Energy and Transportation in Europe and Russia, Heidelberg and New York: Springer.

ADDISON, J.T., AUDRETSCH, D.B., GRIES, T., GRUPP, H., WELFENS, P.J.J. (1999), Globalization, Economic Growth and Innovation Dynamics, Heidelberg and New York: Springer.

WELFENS, P.J.J. (1999), EU Eastern Enlargement and the Russian Transformation Crisis, Heidelberg and New York: Springer.

WELFENS, P.J.J. (1999), Globalization of the Economy, Unemployment and Innovation, Heidelberg and New York: Springer.

TILLY, R., WELFENS, P.J.J. (1999), Economic Globalization, International Organizations and Crisis Management, Heidelberg and New York: Springer.

WELFENS, P.J.J. et al. (eds., 1998), Competition in Network Industries: Telecommunications, Energy and Transportation in Europe and Russia, Heidelberg and New York: Springer.

PALKINAS, P.; EICHHORN, B., WELFENS, P.J.J. (eds., 1998), Europäische Währungsunion: Argumente und Fakten zur Euro-Debatte, Frankfurt/Main.

GLOEDE, K., STROHE, H.B. WAGNER, D., WELFENS, P.J.J. (eds., 1998), Systemtransformation in Deutschland und Rußland: Erfahrungen, ökonomische Perspektiven und politische Optionen, Heidelberg und New York: Springer.

AUDETSCH, D.B., ADDISON, J.T. GRUPP, H., WELFENS, P.J.J. (1998), Technological Competition, Employment and Innovation Policy in OECD Countries, Heidelberg and New York: Springer.

ADDISON, J.T., WELFENS, P.J.J. (eds., 1998), European Labor Markets and Social Security, Heidelberg and New York: Springer.

GRAACK, C. (1997), Telekommunikationswirtschaft in der Europäischen Union: Innovationsdynamik, Regulierungspolitik und Internationalisierungsprozesse, Heidelberg: Physica (award-winning book).

WELFENS, P.J.J., WOLF, H. (ed., 1997), Banking, International Capital Flows and Growth in Europe, Heidelberg and New York: Springer.

BÖRSCH-SUPAN, A., VON HAGEN, J., WELFENS, P.J.J. (eds., 1996,1997), Springers Handbuch der Volkswirtschaftslehre, Band 1 und 2, Heidelberg und New York: Springer.

WELFENS, P.J.J., YARROW, G. (eds., 1996), Telecommunications and Energy in Systemic Transformation, Heidelberg and New York: Springer.

GRAACK, C., WELFENS, P.J.J. (1996), Telekommunikationswirtschaft: Deregulierung, Privatisierung und Internationalisierung, Heidelberg und New York: Springer: (award-winning book).

WELFENS, P.J.J. (ed., 1996), European Monetary Integration, 3rd edition, Heidelberg and New York: Springer.

WELFENS, P.J.J. (ed., 1996), Economic Aspects of German Unification, 2. rev. and enlarged edition, Heidelberg and New York: Springer.

TILLY, R., WELFENS, P.J.J. (eds., 1995), European Economic Integration as a Challenge to Industry and Government, Heidelberg and New York: Springer.

WELFENS, P.J.J. (1995), Grundlagen der Wirtschaftspolitik, Heidelberg und New York: Springer.

JASINSKI, P., WELFENS, P.J.J. (1994), Privatization and Foreign Direct Investment in Transforming Economies, Aldershot: Dartmouth/Gower.

WELFENS, P.J.J. (1992), Market-oriented Systemic Transformation in Eastern Europe. Problems, Theoretical Issues and Policy Options, Heidelberg and New York: Springer.

KLEIN, M., WELFENS, P.J.J. (eds., 1992), Multinationals in the New Europe and Global Trade, Heidelberg and New York: Springer.

WELFENS, P.J.J. (1990), Internationalisierung von Wirtschaft und Wirtschafspolitik, Heidelberg und New York: Springer.

BALCEROWICZ, L., WELFENS, P.J.J. (1988), Innovationsdynamik im Systemvergleich. Theorie und Praxis unternehmerischer, gesamtwirtschaftlicher und politischer Neuerung, Heidelberg: Physica