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Regional Characteristics, Monetary Union and Regional Income Volatility

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Abstract

Relatively little attention has been paid to the issue of how individual regions will fare as a consequence of the national decision on whether or not to adopt the single European currency. Regional welfare is influenced by both mean income and volatility. The present paper focuses on volatility. We develop a model of a regionally-integrated macroeconomy to explore how the income variance implied by the national decision on EMU is distributed across a country's regions. The model suggests that weaker regions are likely to do better than stronger regions with respect to volatility if the national economy participates in EMU.

Keywords: Monetary Union, Regional Income, Volatility.

JEL Classification Numbers: E42, F33, R13

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1. Introduction

The costs and benefits of monetary union have been much debated in recent years, with the income and volatility elements of the welfare analysis generally being treated separately.

The early emphasis on the savings in currency transactions costs, for example, focuses on the income element, as does the debate over whether monetary union will stimulate further trade and investment; see e.g. Rose (2000). The debate between the European Commission (1990) and Krugman (1993), on the other hand - over whether national production structures would converge or diverge as integration proceeded - is concerned with the effects on volatility. If production structures diverge with increased integration, as Krugman argues, national shocks may become less symmetric, resulting in an increase in the relative variance of national incomes. This would represent a negative effect, to be balanced against possible positive effects arising elsewhere.

The present paper follows the literature in focussing on only one dimension of the welfare effect - in our case the volatility of incomes. Our point of departure is different however; here we are concerned with the variance of sub-regions of a national economy. This issue has largely been ignored so far. The chapter on "Spatial Aspects" in the EU Commission document, *One Market, One Money* (1990), that set the debate in motion does not even address the implications of a change in monetary regime for regional variance.

Why should it make a difference whether one discusses national economies or sub-regions? This paper argues that different issues arise in the case of sub-national regions because they cannot, even if the economy remains outside EMU, use monetary or exchange-rate policy to offset the effects of shocks to which they are subject.¹

We address the following question: for regions within a particular country, what structural differences determine how one region fares relative to another if the country maintains an

independent exchange rate, and what bearing do these differences have on relative performance if the country abandons its independent currency?² We take these regional structural differences - in the composition of industry and degree of labour market flexibility - as given. In holding the composition of industry constant, we are clearly in the realm of short-term macroeconomics: we have nothing to say about the longer-term economic geography issues that motivate the Krugman-Commission debate. Likewise in holding the degree of labour-market flexibility constant we avoid the issue of whether and how monetary union affects the incentive to engage in labour-market reform; Sibert (1999), Sibert and Sutherland (2000).

There are two components to the question we ask; one is concerned with the types of shocks that characterise each environment, and the other with differing regional responses to these shocks. The latter is dealt with in the context of the theoretical model developed in the next section of the paper. From the outset however we need to take a view on the types of shocks that are likely to be of most significance in each environment.

The first point to note is that the national decision on EMU (apart from the economic geography effects that do not form part of the present analysis) has no bearing on the virulence of, or response to, *region-specific shocks*, on the assumption that each region is small relative to the national economy. In this case region-specific shocks do not influence national policy either inside or outside monetary union.

The same holds true for *sector-specific shocks*, unless the national economy is highly specialised in particular sectors, in which case these become national shocks, to be dealt with below.

¹ It will be clear that regions are here assumed to be small relative to the size of the national economy.

² Another way to view the motivation of the paper is to note that abandoning a policy instrument may lead to increased instability but this may be required if benefits in terms of increased mean incomes are to be captured. If so, the cost is an increase in variance. We are concerned with how this potential cost is distributed across regions.

Now consider *exchange-rate shocks*, on the assumption that there are three currencies of importance: the national currency, the dollar and the euro. Clearly, movements in the euro-national exchange rate are possible only if the country remains outside EMU. If the economy participates in EMU on the other hand, dollar-euro exchange rate shocks will have more virulent effects, if the alternative would have been to follow a middle course between the euro and the dollar.

Which of these exchange-rate shocks is likely to be more important? Our guess is that the possibility of over- or under-valuation against the euro is likely to be more important than of over- or under-valuation against the dollar, as all EU countries trade more with the rest of the EU than with the rest of the world; European Economy (2000).³ Thus we view the national economy as being more vulnerable to exchange rate shocks while outside EMU (though this will not necessarily be the case for all regions, the implications of which can easily be determined from the model).

Our characterisation of the "National Economy outside EMU" scenario assumes that these exchange-rate shocks are the main types of shocks to which the economy is subject in that environment. The current strength of sterling, for example, provides a case in point.

The relative importance of *asymmetric demand shocks* inside and outside EMU is more ambiguous. Outside EMU the country can use monetary policy in response, so the significance of these shocks might be thought to be lessened in that scenario. Many such shocks appear to be policy driven, however, and with deeper policy harmonisation within EMU these should decline in importance.⁴ With the Krugman-Commission debate yet to

³ This does not prove the point of course. Further suggestive evidence is provided by the Irish case however, where US MNCs, many of which price in dollars, are of great significance. Attempts to construct a basket of "currencies of importance" to take account of this fact does not lead to the use of weights very different from standard trade weights; Bartolini (1993).

⁴ Helg et al. (1995) find that more variance of output innovations to a local industry is explained by country- rather than by industry principal components, suggesting that harmonisation of monetary and fiscal policies may be more important than possible concentration effects, while Artis and Zhang (1997) find EMS membership associated with more highly synchronised business cycles, suggesting that demand shocks overall become more highly correlated across countries.

reach a definitive conclusion, we must remain agnostic as to the implications of monetary union for the virulence of demand shocks.⁵

EMU participation is unlikely to synchronise *asymmetric supply or productivity shocks* to the same extent however.⁶ All the factors behind the current Irish boom for example represent asymmetric supply shocks; Barry (2000). These include convergence in educational throughput and infrastructure, changes in the systems of industrial relations and pay determination and an increase in the elasticity of FDI with respect to corporation-tax rates. Countries will obviously continue to differ in the pattern and extent of technology shocks, and these impulses are mediated differently via differences in the degree of product and labour-market regulation; Koedijk and Kremers (1996).

Since the real effects of supply-side shocks can be mitigated by exchange-rate movements if nominal wages are at all sticky, as Bruno and Sachs (1985) show, the effects of such shocks are projected to increase in intensity in our "National Economy in EMU" scenario.

To conclude, our outside-EMU scenario focuses on the regional effects of national over- or under-valuation relative to the euro, while our inside-EMU scenario focuses on economy-specific supply shocks where the possibility of an exchange-rate response has been removed .

The next section of the paper develops a model of a regionally-linked economy with regions differentiated in terms of industry mix and degree of labour-market flexibility. The following sections analyse the regional effects of the various shocks considered, and a final section concludes.

⁵ De Grauwe (2000) makes the point with respect to the Krugman–Commission debate that with increased integration industrial concentration will be more likely to straddle national borders. Thus sectoral demand shocks will remain distinct from economy-specific asymmetric demand shocks, reducing the relevance of the exchange rate instrument.

⁶ While Bayoumi and Eichengreen (1993, 1994) find that supply shocks are more symmetric than demand shocks they are not perfectly symmetric of course. Some increase in symmetry may arise however if technology spillovers increase in range and speed as integration proceeds.

2. A Two-Sector Model of a Regionally-Integrated Economy

2a. Preliminary discussion

The national economy has two industrial sectors; one produces a traditional good T, with recognisably-domestic characteristics, and the other a standard internationally-tradable modern good, M, produced by an internationally-mobile industry. There are two types of labour - skilled and unskilled - while capital is fixed and sector specific.

The traditional sector comprises non-traded elements as well as low-technology exportables. Writers in the macro tradition, such as Obstfeld and Rogoff (1995), frequently model non-tradable as monopolistically competitive, while the recognisably domestic characteristics we assume for the low-tech exportables allows us expand this assumption of product differentiation to the entire T sector. Thus the demand for this good is downward sloping, and price is determined endogenously.⁷

The modern good, M, on the other hand, is the product of a high-tech internationally-mobile industry, in which the domestic economy is only one of a number of international production locations. The domestic economy is a price-taker with respect to this good, whose price is set in euros on world markets.

The traditional good is produced using capital and *less-skilled* labour, while the modern good is produced using capital and *skilled* labour. The wages of skilled workers are assumed to be perfectly flexible so that the market for skilled labour always clears, while the wages of unskilled labour may be sticky, in which case employment of unskilled labour will fluctuate.

⁷ In order to focus on inter-regional linkages and avoid the distraction of inter-regional price differences we ignore *regional* non-traded goods, which one might think of as encompassing many services. .

Regions will be taken to differ across two dimensions: the mix of industries (T and M) that they exhibit, and the degree of flexibility of their markets for unskilled labour.

What is the justification for these various assumptions? Essentially we are equating the modern sector with internationally mobile industry. We do know that such industry is more export-oriented than domestic industry. For the 5 EU countries for which OECD (1999) reports data, the export-output ratio is higher for foreign-owned than for domestic firms in Ireland, the Netherlands, Finland and France. It is clear from Griffith (1999) and Gorg and Ruane (1999) that the same holds true for the UK. Only in the Swedish case are the shares equal.

We extrapolate from international tradability to price-taking behaviour. Again this is common in the macro literature. We do not need to assume competition in the sector however, simply that the price of modern-sector output is independent of conditions in any one of its markets or production locations.⁸

OECD (1999) shows that compensation per employee in foreign-owned manufacturing is everywhere greater than in domestic industry. Human-capital theory would read this as support for our assumption on the different skill intensities in the two sectors.

Alternatively, one can focus on the specific sectors in which foreign-owned industry is located: in seven of the eight EU countries for which data is provided, employment and value added in foreign-owned industry emerges disproportionately from high-tech and high-skill sectors; OECD (1999).⁹

⁸ Pavelin (2000) shows that the several hundred leading multinational firms in the EU produce on average in more than 2 EU locations other than their home base.

⁹ The seven countries are the UK, Ireland, Germany, France, Italy, Finland and Sweden. The Netherlands proves an exception because of the size of its domestic electronics sector. High-tech sectors are as defined in OECD (1994). High-skill sectors are so classified in terms of the proportion of administrative, technical and clerical (ATC) staff in the labour force, and are as defined in Midelfart-Knarvik et al. (2000). See Griffith (1999) on the wages and ATC ratios of foreign-owned and domestic industry in the UK.

The justification for the assumption that the wages of skilled workers are much more flexible than those of unskilled workers is that unemployment rates everywhere are much lower for the former; Nickell and Bell (1996).

2b. The Model

As mentioned above, the economy is a price taker in the market for good M, and the price is set in euros. Domestic and foreign currency prices are related via the exchange rate (defined as the price of foreign currency) as follows:

$$p_m = e p_m^*$$

With p_m^* exogenous we set it equal to unity, yielding:

$$(1) \quad p_m = e.$$

Good M is produced under constant returns to scale, with a technology parameter A which we will allow to vary later on. With the stock of sector-specific capital held fixed, employment (of skilled labour) is a function only of the productivity-adjusted real product wage of skilled labour, w_s/Ae . Thus

$$(2) \quad Y_{mi} = Af(w_s/Ae)$$

The skilled wage is completely flexible, so that full employment of skilled labour is guaranteed. Regional output of good M deviates from its initial level therefore only via a shock to the technology parameter A.¹⁰

The traditional T sector is modelled as monopolistically competitive, with its price determined endogenously. As we will see, this allows us easily take the regional dimension into account. The relationship between the domestic and foreign price of good T is also mediated via the exchange rate. However, since the T sector produces a differentiated product the foreign currency price p_t^* (unlike p_m^*) is endogenous.

$$(3) \quad p_t = e p_t^*$$

¹⁰ We want A to represent an equal shock to labour productivity in both sectors. Perfect wage flexibility for skilled labour leaves w_s/Ae constant; the elasticity of both Y_m and Y_m/L_m with respect to A is therefore unity. We will see below that the elasticity of labour productivity to A in the T sector is also unity.

World preferences over both goods can be described by a CES utility function:

(4)

$$U = \left[\mathbf{j}_1 C_m^{\frac{a-1}{a}} + \mathbf{j}_2 C_t^{\frac{a-1}{a}} \right]^{\frac{a}{a-1}}$$

where α is the elasticity of substitution and C_m and C_t represent consumption of each good.¹¹

Since the T good is only produced in the home country, world consumption must equal home country production. Therefore we can write:

$$(5) \quad Y_t = (p_t/e)^{-\alpha} (\phi_1/\phi_2)^{-\alpha} Y_m$$

Here we write world demand for the T good as a function of world output of M. In fact the only component of M production that matters for our analysis is home-country production since rest-of-world production will be held constant.¹² Accordingly we will henceforth let Y_m denote home-country production of M.

The consumer price index, P, associated with this utility function is:

(6)

$$P = \left[\mathbf{j}_1 p_m^{1-a} + \mathbf{j}_2 p_t^{1-a} \right]^{\frac{1}{1-a}}$$

Output, Y_t , of the traditional good is a CES composite of intermediates produced in the different regions of the national economy. Since firms will be fixed both in number and in location (due to the fixed capital stock, as seen below), we need not distinguish between regions and (T-sector) firms. Regions are subscripted i , and the output of the T sector in region i is denoted Y_{ti} .

$$(7) \quad Y_t = \left[\sum_{i=1} Y_{ti}^{\frac{s-1}{s}} \right]^{\frac{s}{s-1}}$$

¹¹ See Ferguson (1971) and Jehle and Reny (1998) on the manipulation of CES functional forms.

with

$$(8) \quad p_t = \left[\sum_{i=1} p_{ti}^{1-s} \right]^{\frac{1}{1-s}}$$

and

$$(9) \quad Y_{ti} = (p_{ti}/p_t)^{-\sigma} Y_t.$$

Thus regional intermediates are differentiated products whose prices can diverge somewhat from each other. We assume throughout that these regional components of the T good are closer substitutes for each other than are the T and M goods; i.e. $\sigma > \alpha$.

We follow Lawrence and Spiller (1983) in assuming that fixed costs of production arise from capital while variable costs stem from labour. The total cost of production of the T component produced in region i is:

$$(10) \quad TC_i = \gamma r_i + w(\beta/A)Y_{ti}$$

where γ is the amount of capital required to set up production, r_i is the (endogenous) rental rate on capital in region i, and A/β is the marginal and average product of labour in this sector.¹³ Note that here and henceforth an unsubscripted w refers to the wage of unskilled labour.

Each firm sets marginal cost equal to marginal revenue, to yield the mark-up pricing rule:

$$(11) \quad p_{ti} = [\sigma\beta/A(\sigma-1)]w_i.$$

With the number of firms fixed in the present short-run model, each firm's output level responds to market demand so that:

and

$$(12) \quad Y_{ti} = (p_{ti}/p_t)^{-\sigma} (p_t/e)^{-\alpha} Y_m^w$$

¹² While world consumption of T must equal home production, the country can run a trade surplus on this good, which can be offset by an equivalent gap between home production and consumption of M.

¹³ Monopolistic competition normally entails new firms entering until profits are bid down to zero. In the present model however, the number of firms in a region is constrained by the fixed stock of T-sector capital: $n_i = K_i/\gamma$ (which is set = 1). Excess profitability induces current and potential firms to bid against each other for the fixed stock of capital, however, which drives up the rental rate causing firms to expand

In contrast to the skilled labour used in the M sector, whose wage flexibility guarantees continuous full employment, the regional wages of the unskilled labour used in the T sector can be sticky, and with some degree of regional immobility differential regional unemployment rates can therefore appear.¹⁴

The degree of nominal wage stickiness among the unskilled is measured relative to that prevailing in the "average" region. Note firstly that if the real productivity-adjusted wage were constant everywhere, then employment would be constant with respect to our two shocks. We take this as our benchmark degree of flexibility. The closer to zero is the elasticity of the regional wage with respect to prices and productivity $\varepsilon(w_i;AP)$, the greater the degree of nominal wage stickiness in the region. This elasticity will generally in our analysis have a value of less than one.

3. Regional Effects of Exchange-Rate Shocks with the National Economy outside EMU

We are interested in the impact of changes in e on the variance of regional income Y_i where

$$(13) \quad Y_i = (p_{ti}/e) Y_{ti} + Y_{mi}$$

To compute variance we use the *delta method* which shows that for a function $Y = h(X)$, the variance of Y can be approximated by $\{h'(E[X])\}^2 \text{Var}(X)$; Johnson, Kotz and Kemp (1992). The variance of regional income in the present case is therefore:

$$\text{Var}(Y_i) \Big|_{\text{National economy outside EMU}} = (dY_i/de)^2 \text{Var}(e).$$

We therefore wish to compute the effect of a change in the exchange rate on regional income.

production to cover the increase in fixed costs. Formally Y_{ti} is as determined above and the zero-profit condition yields an implicit value for the rental rate on the fixed stock of capital: $Y_{ti} = (r_i/w_i)(\gamma/\beta)(\sigma-1)$.

An exchange-rate change affects the price of the M good directly. Because of wage flexibility in this sector however the full impact of the exchange rate feeds into skilled wages, and there are no output or employment effects. The change in the nominal value of M-output impacts on the T sector however.

Consider a region with an average degree of wage stickiness among unskilled workers; i.e. where the elasticity of the regional wage with respect to the exchange rate $\varepsilon(w_i;e)$ is the same as the average, $\varepsilon(w;e)$. By (11) this implies $\varepsilon(p_{ti};e) = \varepsilon(p_t;e) = \varepsilon(w;e)$. The impact on regional output of the T sector will in this case depend only on changes in p_t relative to e , by equation (12).

For such a region, the elasticity of output with respect to the exchange rate is

$$(14) \quad \varepsilon(Y_i;e) = - [(p_{ti}/e)Y_{ti}/Y_i] (\alpha-1) [\varepsilon(w_i;e)-1]$$

With perfect labour-market flexibility or real-wage rigidity throughout the entire economy this would of course be zero, since nominal shocks have no real effects under these circumstances.¹⁵ With some stickiness however, the elasticity of the wage with respect to the exchange rate (which is the elasticity with respect to the price level times the elasticity of the price level with respect to the exchange rate) will be less than one, as both of its components will be less than unity. Since the elasticity of substitution, α , in monopolistically-competitive models is greater than one, the elasticity of regional income to the exchange rate is therefore positive. There is no surprise in this. It simply says that a devaluation in the presence of unemployment and wage stickiness draws excess labour into production, and so output rises.¹⁶

¹⁴ It will be clear that my definition of a region is an entity which does not control its own exchange rate, rather than an entity characterised by perfect labour mobility. As is well known, interregional labour migration is quite slow in Europe.

¹⁵ If only one region has real-wage rigidity however, while others do not, the p_{ti} for that region will rise relative to p_t raising the possibility of a fall in that region's income. Many such interesting cases can be explored within the model.

¹⁶ Note that in the present context this is undesirable, as we are concerned with minimising the variance of regional output in the face of random shocks.

Taking this "average region" as our benchmark we now wish to ask how the vulnerability of regional income to exchange-rate shocks changes with the proportion of regional income stemming from traditional industry, and with the degree of labour-market stickiness.

To answer the first question we differentiate the elasticity, $\varepsilon(Y_i; e)$, with respect to the proportion of regional income that stems from the traditional sector, $(p_{ti}/e)Y_{ti}/Y_i$. From (14) this is easily seen to be positive. Since the modern sector is unaffected by this shock while the traditional sector is, a larger traditional sector will increase the impact of the shock and therefore raise the variance of regional income.¹⁷

The second question is as easily answered. Nominal wage stickiness implies that the elasticity of wages with respect to technology and the price level; i.e. $\varepsilon(w_i; AP)$, is close to zero. Again noting that $\varepsilon(w_i; e)$ in equation (14) is $\varepsilon(w_i; AP) \varepsilon(P; e)$, we find

$$(15) \quad d\varepsilon(Y_i; e)/d\varepsilon(w_i; AP) = [(p_{ti}/e)Y_{ti}/Y_i] (1-\alpha) [\varepsilon(P; e)] < 0$$

This result tells us a region with a marginally lower than average degree of wage stickiness will find its level of income less vulnerable to exchange-rate shocks. Again this is easy to understand since increased labour-market flexibility reduces the difference in response of the two sectors.

The conclusion from this section therefore is that if the country remains outside EMU the variance of regional output will be higher for weaker regions, i.e. for those with a greater share of the traditional sector in regional income and/or those with less flexible labour markets.

¹⁷ Note that Baker, Fitz Gerald and Honohan (1996) find for the Irish case that traditional industries are indeed more responsive to monetary shocks, whether of the exchange-rate or interest-rate variety.

4. Regional Effects of Aggregate Supply-Side Shocks with the National Economy in EMU

With the country in EMU exchange-rate shocks become less important. Aggregate supply shocks become more virulent however as they cannot now be compensated for by changes in the exchange rate. The *aggregate* nature of the supply-side shock imposed here is represented by the fact that the impact on labour-productivity in the two sectors is the same.¹⁸

The variance of regional output in this case, with the country in EMU, is given by:

$$\text{Var}(Y_i) \Big|_{\text{National economy inside EMU}} = (dY_i/dA)^2 \text{Var}(A).$$

Hence we want to evaluate the elasticity of regional output with respect to the shock parameter A.

The impact on the modern sector is straightforward. With perfect wage flexibility of skilled labour the skilled wage rises one-for-one with productivity, there is no change in employment in this sector, and the output of M rises one-for-one with A, as seen in equation (2). The impact on the T sector is more complicated, with the chain of effects running from productivity through wages to prices and demand.

The overall impact on the income of a region with average labour-market flexibility is:

$$(16) \quad \varepsilon(Y_i; A) = 1 - [(p_{ii}/e)Y_{ii}/Y_i] (\alpha-1) \varepsilon(p_{ii}; A)$$

The mark-up pricing equation shows that

$$\varepsilon(p_{ii}; A) = \varepsilon(w_i; A) - 1, \text{ where}$$

$$\varepsilon(w_i; A) = \varepsilon(w_i; AP) [\varepsilon(P; A) + 1]$$

From these last two equations and the definition of the price index, the elasticity of the latter with respect to productivity, $\varepsilon(P; A)$, is:

¹⁸ From the discussion following equation (2) it is clear that the elasticity of labour productivity in the M sector with respect to A is unity. From the specification of total costs of production in the T sector, equation (10), labour productivity there is A/β , so the elasticity of labour productivity with respect to A is again unity.

$$- \phi_2 p_t^{1-\alpha} [1-\varepsilon(w_i;AP)] / \{ \phi_1 p_m^{1-\alpha} + \phi_2 p_t^{1-\alpha} [1-\varepsilon(w_i;AP)] \}$$

whose value lies between zero and minus one.

Hence it is easily seen that the effect of a productivity shock on the regional wage w_i is positive but less than unity, and so the effect on the price of good T is negative. In other words, an adverse productivity shock reduces regional wages less than one-for-one, real unit labour costs rise and the price of good T is driven up.

M sector output changes one-for-one with productivity, while T sector output changes more than one-for-one. If there were perfect labour market flexibility across the entire national economy, on the other hand, productivity would pass one-for-one through to wages, leaving unit labour costs unchanged. There would then be no price effects, and the elasticity of regional output with respect to productivity would attain a value of unity.¹⁹

Again we are interested in how the value of this elasticity, and hence the variance of regional income, is influenced by the regional characteristics of interest; i.e. the share of the traditional sector in regional income, and the degree of regional labour-market flexibility. We explore the first issue by differentiating equation (16) with respect to the proportion of regional income that stems from the traditional sector, $(p_{ti}/e)Y_{ti}/Y_i$. This is easily seen to be positive, because the co-efficient on $[(p_{ti}/e)Y_{ti}/Y_i]$ in (16) is greater than unity while the co-efficient on $[Y_{mi}/Y_i]$ is one. Thus a stronger share of the traditional sector in regional income makes that region more vulnerable to supply-side shocks.

To find the impact of a marginally higher degree of labour market flexibility than average, we differentiate (16) with respect to the indicator of labour-market flexibility $\varepsilon(w_i;AP)$.

This is easily found as:

$$d\varepsilon(Y_i;A)/d\varepsilon(w_i;AP) = - [(p_{ti}/e)Y_{ti}/Y_i] (\alpha-1) [\varepsilon(P;A) + 1] < 0$$

¹⁹ Once again however, interesting possibilities arise for regions with labour-market flexibility, if the average is somewhat inflexible. For such a region, the price of its T intermediate rises relative to the average, raising the possibility that regional income will fall.

Regional income rises more than one-for-one with a productivity shock because wage stickiness allows more of the shock to be reflected in output and less in prices. A lower degree of wage stickiness (i.e. a higher value of the elasticity $\varepsilon(w_i;AP)$ or greater labour-market flexibility) will clearly reduce the output effects of the shock.

For the case of the national economy in EMU then, our results are qualitatively similar to the case where the country remains outside. The variance of regional output is higher for regions which are weaker in terms of the two dimensions of the analysis: those with a higher share of the traditional sector in regional income, and those with less labour-market flexibility.

5. The Relative Effects on Weaker Regions of the National Decision on EMU

In the last two sections we have seen that both characteristics of weakness in a region, the importance of the traditional sector in regional income and the degree of labour-market inflexibility, increase the output effects of the shocks we looked at. Thus weaker regions are more vulnerable than stronger ones both outside and inside EMU.

It will be clear that we can say nothing about the absolute volatility of regional incomes inside or outside EMU, as this will depend not just on the regional response elasticities but also on the absolute variance of the shocks to which the regions will be subjected in the two environments. This point seems to have been overlooked by Allsop, Davies and Vines (1995) for example, who argued that because the regional stabilisation performed by national governments within the EU is comparable to that which takes place in the US or Canadian fiscal systems, there does not appear to be a need for a federalist system for stabilisation within EMU. This fails to note that the pressures placed on the system within EMU could perhaps increase dramatically.

The main question which we are interested in addressing however still remains to be answered. This concerns the relative effects on stronger and weaker regions of the national decision on EMU. To answer this we need to look at the impact of regional

characteristics on a region's vulnerability outside EMU relative to its vulnerability inside EMU (where vulnerability is defined in terms of the response of regional output to the relevant exogenous shocks).

We are concerned therefore with the effects of the regional characteristics of interest on the quotient:

$$[\text{Var}(Y_i) \big|_{\text{outside EMU}}] / [\text{Var}(Y_i) \big|_{\text{inside EMU}}]$$

which we have argued is related to:

$$[(dY_i/de)^2 \text{Var}(e)] / [(dY_i/dA)^2 \text{Var}(A)]$$

From (16) and (14) it can easily be shown that for the benchmark case where all regions have the same degree of labour-market flexibility,

$$d [(dY_i/de)/(dY_i/dA)]/d [(p_{ii}/e)Y_{ii}/Y_i] > 0$$

and

$$d [(dY_i/de)/(dY_i/dA)]/d \epsilon(w_i; AP) < 0$$

The first result tells us that a higher proportion of traditional industries makes a region relatively more vulnerable to the type of shocks likely to dominate if the national economy remains outside EMU. The second result runs in the same direction, telling us that *less* labour market flexibility will have the same effect. Both results therefore imply that regions that are weaker in terms of either characteristic are more vulnerable than average if the national economy remains outside EMU.

As to why the effects of "regional weakness" are magnified for exchange-rate shocks relative to labour-productivity shocks, the basic answer is that remaining outside EMU (leaving the economy prone to exchange-rate shocks) raises the vulnerability of the weaker sector only (and so impacts more strongly on weaker regions) while joining EMU raises the vulnerability of both sectors (reducing the relative cost to weaker regions).

6. Conclusions

Membership of EMU will change the nature of the shocks to which an economy will be subjected. For a country that does most of its trade with EMU countries, remaining outside EMU will leave the economy vulnerable to under- or over-valuation against the euro. Joining EMU, on the other hand, will leave the economy more vulnerable to shocks for which an exchange-rate change may be an appropriate response. This paper explores how different regions will fare relative to each other, in terms of the variance of regional income, as a consequence of these changes.

According to the analysis, the type of shocks to which the economy will be subjected outside EMU will impact primarily on the traditional sector. A strong currency means wages, if inflexible, are set at uncompetitive rates. The effects will show up particularly strongly then in regions with less flexible labour markets. These regions suffer a double blow if traditional industry is of particular importance there, since the intermediates they produce will not be priced competitively and they will lose demand to other regions. Hence the effects of these shocks will show up particularly strongly in weaker regions. The aggregate shocks to which the national economy will become more vulnerable within EMU impact on both sectors, on the other hand, thereby diminishing the *relative* vulnerability of weaker regions if the country participates in EMU.

The present paper therefore offers a new perspective on the importance of fiscal federalism for monetary union. Sala-i-Martin and Sachs (1992) made the point that countries suffering asymmetric shocks will be better able to cope without the exchange rate if a fiscal federalist system is in place. Bayoumi and Masson (1995) and Allsop, Davies and Vines (1995) responded that the regional stabilisation performed by national governments within the EU is comparable to that which takes place in the US or Canadian fiscal systems, suggesting that the need for fiscal federalism within EMU may be overstated.

The present paper makes two further points: one fairly obvious and the other substantive. The first is that the variance of regional income may rise within EMU, if the variance of the shocks in the policy-constrained environment are greater than the shocks cum policy response outside EMU. Thus the stabilisation burden on the existing fiscal system in Europe may be increased. It suggests that the conventional analogy with US states - whereby fiscal federalism makes the option of running their own monetary policies less desirable - is misleading. A more appropriate analogy would be to ask whether monetary union with the US would increase the fiscal-federalist burden of the Canadian government with respect to the Canadian provinces or not.

The second point is the more substantive one. It says that the variance of the weaker regions, i.e. those with the higher variance to begin with, will fall relative to that of the stronger regions, and in this sense the burden of stabilisation will be reduced. It also suggests that from the viewpoint of volatility alone, monetary union should be more strongly supported in weaker than in stronger regions.

Finally we consider some issues that arise in thinking about empirically testing the present model. One difficulty is that a high share of output emanating from foreign multinationals is treated in the paper as an identifier of a strong region. However, it may not necessarily signal a structurally sound region, if extra incentives have been offered to foreign firms to locate in weaker regions.

A second set of issues arises in attempting to identify regional labour-market rigidities. In the model these are reflected in stronger employment swings amongst unskilled workers. Empirically however it is probably reasonable to suppose that there is much greater wage flexibility in the face of beneficial shocks than in the case of adverse ones.²⁰ If such behaviour is associated with labour-market hysteresis, it might be reasonable to view regional long-term unemployment as an indicator of this type of nominal stickiness; Barry (1998).

²⁰ This asymmetry is of course the basis of the assumed convexity of the short-run Phillips curve.

References

Allsop, C., G. Davies and D. Vines (1995) "Regional Macro Policy, Fiscal Federalism and European Integration", *Oxford Review of Economic Policy*, 11, 2, 126-144.

Artis, M. and W. Zhang (1997) "International Business Cycles and the ERM: Is There a European Business Cycle?", *International Journal of Finance and Economics*, 2 (1), 1-16.

Baker, T., J. Fitz Gerald and P. Honohan (1996) *Economic Implications for Ireland of EMU*, Policy Research Series Paper No. 28, Dublin: Economic and Social Research Institute.

Barry, F. (1998) "Exchange Rate Policy when the Labour Market exhibits Hysteresis", *Manchester School*, 66 (5), 532-549.

Barry, F. (2000) "Convergence is not Automatic: Lessons from Ireland for Central and Eastern Europe", *World Economy*.

Bartolini, L. (1993) "Devaluation and Competitiveness in a Small Open Economy: Ireland, 1987-1993", IMF Working Paper 93/82.

Bayoumi, T., and B. Eichengreen (1993) "Shocking Aspects of European Monetary Integration", in F. Torres and F. Giavazzi (eds.) *Adjustment and Growth in the European Monetary Union*, Cambridge: Cambridge University Press.

Bayoumi, T., and B. Eichengreen (1994) *One Money or Many? Analysing the Prospects for Monetary Unification in Various Parts of the World*, Princeton Studies in International Finance No. 76.

Bayoumi, T., and P. Masson (1995) "Fiscal Flows in the US and Canada: Lessons for Monetary Union in Europe", *European Economic Review*, 39.

Bruno, M., and J. Sachs (1985) *Economics of Worldwide Stagflation*, Harvard University Press.

De Grauwe, P. (1997) *The Economics of Monetary Integration*, 3rd edition, Oxford: Oxford University Press.

Commission of the European Communities (1990) *One Market, One Money: An Evaluation of the Potential Benefits and Costs of Forming an Economic and Monetary Union*, European Economy.

European Economy (2000) Statistical Annexe.

- Ferguson, C. (1971) *The Neo-Classical Theory of Production and Distribution*, 2nd edition, Cambridge: Cambridge University Press.
- Görg, Holger and Frances Ruane (1999), "US Investment in EU Member Countries: The Internal Market and Sectoral Specialisation", *Journal of Common Market Studies*, Vol. 37 (2), pp. 333-48.
- Griffith, Rachel (1999) "Using the ARD Establishment Level Data to Look at Foreign Ownership and Productivity in the United Kingdom", *Economic Journal*;109(456), F416-42.
- Helg, R., P. Manasse, T. Monacelli and R. Rovelli (1995) "How much (a)symmetry in Europe? Evidence from industrial sectors", *European Economic Review*, 39, 1017-1041.
- Jehle, G., and P. Reny (1998) *Advanced Microeconomic Theory*, Mass.: Addison-Wesley.
- Johnson, N., S. Kotz and A. Kemp (1992) *Univariate Discrete Distributions*, 2nd edition, New York: Wiley and Sons.
- Koedijk, K., and J. Kremers (1996) "Market Opening, Regulation and Growth in Europe", *Economic Policy*, 445-467.
- Krugman, P. (1993) "Lessons of Massachusetts for EMU", in F. Torres and F. Giavazzi (eds.) *Adjustment and Growth in the European Monetary Union*, Cambridge: Cambridge University Press.
- Lawrence, C., and P. Spiller (1983) "Product Diversity, Economies of Scale and International Trade", *Quarterly Journal of Economics*, 98, 63-83.
- Midelfart-Knarvik, K. H., H. Overman, S. Redding and A. Venables (2000) *The Location of European Industry*, Economic Papers No. 142, Brussels: European Commission.
- Nickell and Bell (1996) Changes in the Distribution of Wages and Unemployment in OECD Countries, *American Economic Review*, Papers and Proceedings, 86 (2), 302-308.
- Obstfeld, M. and Rogoff (1995) Exchange Rate Dynamics Redux, *Journal of Political Economy*.
- OECD (1994) *Manufacturing Performance: A Scoreboard of Indicators*, Paris.
- OECD (1999) *Measuring Globalisation*, Paris.
- Pavelin, Stephen (2000) "The Geographical Diversification of Leading Firms in the EU", Working Paper 00/15, Centre for Economic Research, University College Dublin.

Rose, A. (2000) "One Market, One Money: Estimating the Effect of Common Currencies on Trade", *Economic Policy*, April.

Sala-i-Martin and Sachs (1992) Fiscal Federalism and Optimum Currency Areas: Evidence for Europe from the United States, in Canzeroni, Grilli and Masson (eds) *Establishing A Central Bank: Issues in Europe and Lessons from the US*, CUP.

Sibert, A. (1999) "*Monetary Integration and Economic Reform*", *Economic Journal*, 109 (452), 78-92.

Sibert, A., and A. Sutherland (2000) "*Monetary Union and Labour Market Reform*", *Journal of International Economics*, 51 (2), 421-35.