Modelling Polish Regional Economies:
A preliminary case study based on Dolnośląskie Voivodship (Lower Silesia)

Working paper

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[1] Introduction

Economic mechanisms that operate within a region are very similar to those that operate inside a national economy. On the output side, firms located inside the region produce output, using factor inputs such as labour, capital, energy and other raw materials. Just as in a national economy, prices are set by firms, in a manner that is influenced by the economic “openness” of the region as well as by national and international business strategies. Wage bargains are also struck, but here it is usual for national wage norms and institutions to influence – or even completely determine – the outcome of regional wage bargaining. And just as in a national economy where at least some firms are foreign owned, many of the firms inside a region are owned by “outsiders”, be they from other regions of the nation state, or from abroad. As a consequence, for a regional economy, not all added value that is produced inside a region will remain inside that region and become part of the incomes of the local inhabitants. In the case of company’s profits, a portion of these will flow out of the region, and may also flow abroad.

On the expenditure side, the similarity of the structure and basic mechanisms of regional and national economies is even stronger. Households consume out of their disposable income. Local governments also consume, and much of the national public consumption can be allocated to the regions (e.g., the wage bill for maintaining regional offices of national government ministries). Locally-based firms invest in fixed assets, and the structure of investment is determined by the structure of production in the region. Public sector investment activities, even if they are planned at the “centre”, are actually implemented in the regions. Inventories held in regions are accumulated or run down, depending of the business cycle. Perhaps the main distinction between a regional and a national economy is when one examines the remaining two categories of expenditure: namely, regional “exports” and “imports”.

How should one define regional exports and imports? The conventional definition says that one should count as exports only sales of regional output outside the national territory. If such sales are added up for all the regions of a nation state, then they sum to the conventional measure of “exports” recorded in the national accounts.

However, it makes more sense to include all sales of regional output (goods and services) that are made to destinations outside the region, even if extra-regional sales to other regions of the state are almost never recorded in the official regional statistics. In this way, one could study the regional analogue of “export-led” growth, where a region can grow and develop by winning a greater share of national as well as international markets.

Exactly the same issues arise for imports. These are measured in the national accounts as imports to the state, and are often published in disaggregated form: allocated to types of goods (e.g., raw materials, semi-processed goods, capital goods, consumer goods, etc.) and to country of origin. The allocation of imports from abroad to the different recipient regions is almost never published, since such data are seldom collected. A wider definition of regional imports would include both direct international imports and “imports” from other regions of the state. We shall see later that the more comprehensive definition of trade – to include international and inter-regional trade – is useful in regional modelling.

Finally, the treatment of the income side of GDP in a region is also very similar to that used in the National Accounts for the state. The main source of household income is wages and
salaries. The main source of income of companies is profits, and these profits can either be retained inside the company to fund investment, or can be distributed to shareholders in terms of dividends. If they are distributed, they can either be distributed to local inhabitants or to persons who reside outside the region. In that case, they have to be excluded from regional personal income. The tax and expenditure activities of the national and regional public authorities are overlaid on the above corporate sector and household activities. Taxes serve to reduce household and company purchasing power. Public expenditure in the form of social welfare income support serves to boost household income. Subsidies will affect firms’ profits. The main challenge in a region is to be able to identify and collect these data.

Exactly the same balances are of interest within a region as are of interest in a state. For example, unemployment captures the balance between regional labour supply and regional labour demand. The net regional trade balance, where trade is measured according to the wide definition introduced above, measures the balance between regional supply of, and regional demand for goods and services. A regional public sector deficit can usually be defined as the difference between total regional public expenditure and total revenue raised by taxing the inhabitants of the region. Of course, some of these “balances” have very different implications for states and for regions. Unemployment is partially a regional responsibility, although national governments will normally operate regional support policies. But the trade and public sector balances are not directly the responsibility of the regional authorities, in the sense that the national government must ensure that national policies ensure that any deficits can be financed. But they are, of course, useful measures of the “health” of the region. We will return to this issue later, when we examine how the role of the public sector should be handled in a regional model.

This Working paper is an exploratory one, and is designed to address some of the methodological and data issues that will arise later, when we will construct models of the 16 Polish regions (Voivodships). The rest of the paper is structured as follows. In section 2 we set out a simple analytical framework that we will seek to implement for the Polish regions. To ensure continuity with the previous work on the national Polish HERMIN model, we retain much of the notation and the structure of HERMIN, and attempt to “regionalize” it. This will permit us to infer the nature of the database that will be needed to construct such a model.

In Section 3 we set out the type of time series of regional data that would ideally be required to construct a model of a typical Polish Voivodship. In the case of the production and expenditure side of the regional accounts, it is quite straightforward to state these needs. But we refrain from examining how much of these data are actually available until the following section. In the case of the public finance aspects of the income side of the regional accounts, there is no lack of data, but the different levels of local self-government (Gminas, Powiats and Voivodships) complicate the matter. We set out a simple data notation in this section, and return to the actual data availability next.

In Section 4 we present a comprehensive descriptive overview of the present state of Polish regional data, insofar as they are relevant to the task of regional modelling that was identified in Section 3. At the time of writing, extensive revisions of pre-2000 regional data were in progress at the Polish Central Statistical Office, and the post-2000 regional data are now prepared according to new international methodology. So, we only have two years data

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1 See Section 4 for details of the new regional data methodology.
prepared on the new basis. But the coverage of the data is likely to remain largely the same, so the post-2000 observations that have been published according to the new ESA methodology will provide relevant guidelines for the pre-2000 “historical” data, when they become available later in the year.

Based on our schematic regional modelling framework, and drawing on the regional database, in Section 5 we attempt to set out some of the main characteristics of a proposed model for Lower Silesia. Obviously, we are not yet able to calibrate this model, and this step must await the publication of the revised historical regional data, due in the 2nd half of October. But we can anticipate some of the regional modelling challenges that are likely to arise, and we set out a preliminary modelling framework for the region of Lower Silesia.²

Finally, in Section 6 summarise the main points that will be important in the new task of constructing models of all 16 Polish Voivodships, and highlight some of the most important areas of regional data where special remedial work and approximations will need to be done to fill in gaps in the published sources.

² The Polish modelling framework draws on previous modelling research carried out for the German Land of Sachsen-Anhalt (see GEFRA, 2004 for full details).
2.1: Introduction

The new breed of national macroeconomic models of the late 1970s addressed the theoretical deficiencies of conventional Keynesian econometric models that had focused purely on the income-expenditure side of the economy (Klein, 1983; Helliwell et al, 1985). The Keynesian demand-driven view of the world that dominated macro modelling prior to the mid-1970s was exposed as being entirely inadequate when the economies of the OECD were hit by the supply-side shocks of the crisis-wracked 1970s (Blinder, 1979). From the mid-1970s onwards, attention came to be focused on issues of cost competitiveness as an important ingredient in output determination, at least in highly open national economies. More generally, the importance of the manner in which expectation formation was handled by modellers could no longer be ignored, and the reformulation of empirical macro models took place against the background of a radical renewal of macroeconomic theory in general (Blanchard and Fischer, 1990). These issues also affected regional models, although the reform of regional modelling was a more gradual process than for national models.

The HERMIN model is a typical product of the sea-change in modelling methodology, in that it pays particular attention to the output side of the economy, and integrates this with the more conventional Keynesian income-expenditure side. The origins of the HERMIN model lay in the multi-sectoral HERMES model that had been developed by the European Commission from the early 1980s (d’Alcantara and Italianer, 1982). HERMIN was initially designed to be a small-scale version of the HERMES model framework in order to take account of the very restricted data availability in the poorer, less-developed EU member states and regions on the Western and Southern periphery (i.e., Ireland, Northern Ireland, Portugal, Spain, the Italian Mezzogiorno, and Greece). A consequence of the lack of detailed macro-sectoral data, and the lack of sufficiently long time-series that had no structural breaks, was that the HERMIN modelling framework needed to be based on a fairly simple theoretical framework that not only permitted the models to be constructed (in situations where sophisticated econometric analysis was impossible), but also permitted inter-country and inter-region comparisons and that facilitated the calibration of key behavioural parameters.

HERMIN models, of national economies and regions, were mainly intended for use in the analysis of medium-term policy impacts. So, they had to satisfy three basic requirements:

(i) The model needed to be disaggregated into a small number of crucial sectors which allowed one to identify and analyse the key sectoral shifts in the economy as it grew and developed;

(ii) The model needed to specify the mechanisms through which a developing economy was connected to the external “world”. For example, the world economy is a very important direct and indirect factor influencing the economic growth and convergence of the lagging EU and CEE states, through trade of goods and services, inflation transmission, population emigration and inward foreign direct investment. The same applies to regional models, where the external “world” now must include the rest of the national economy as well as the relevant part of the rest of the global economy;

3 After German unification, the former East Germany was added to the list of “lagging” EU regions.
4 For a description of the theoretical underpinnings of the HERMIN modelling framework, see Zaleski et al, 2004a.
(iii) It had to be recognised that a possible conflict might exist between actual situation in the country or region, as captured in a HERMIN model calibrated with the use of historical data, and the desired situation towards which the economy was evolving in an economic environment dominated by EMU and the Single European Market. This point raised particularly difficult modelling challenges for the national and regional economies of the new EU member states.

The HERMIN model framework for states and regions focuses on key structural features of the economy:

a. The degree of economic openness, exposure to world trade, and response to external and internal shocks. For regional models, this includes openness to trade with other regions, as well as to international trade;

b. The relative sizes and structural features of the traded and non-traded sectors and their development, production technology and structural change. By “traded” sector we mean a sector where firms sell at least some of their production outside the region, and are subject to competition from other regions (who produce competing goods and services). By “non-traded” sector we mean a sector where firms supply the local market with goods and services that have some form of protection from competition from other regions.5

c. The mechanisms of wage and price determination, and the evolution of competitiveness;

d. The functioning and flexibility of labour markets, including the role of international and inter-regional labour migration;

e. The role of the public sector, both in terms of its expenditure and taxation activities. For states, attention must also be given to the possible consequences of public debt accumulation, as well as the interactions between the public and private sector trade-offs in public policies. These issues tend to be less direct concern to regional governments, but cannot be ignored.

2.2 The HERMIN modelling framework

To satisfy the requirements set out above, the basic HERMIN framework was developed with four production sectors: manufacturing (a mainly traded sector), market services (a mainly non-traded sector), agriculture and government (or non-market) services.6 Given the data restrictions that often face modellers in cohesion and transition economies, this is as close to an empirical representation of the theoretical traded/non-traded designation that one is likely to be able to implement in practice. Although agriculture also has important traded elements, its underlying characteristics demand special treatment. Similarly, the government (or non-market) sector is non-traded, but is best formulated in a way that recognises that it is mainly

5 Many personal services have to be both produced and consumed locally. Some goods – such as local newspapers, and certain kinds of food products – also tend to have only a local market. But most goods are subject to competitive imported substitutes.

6 The basic four-sector Polish HERMIN model was recently extended to include disaggregation of manufacturing into four sub-sectors, and the separate treatment of mining (see Zaleski et al, 2004b).
driven by policy instruments that are available – to some extent, at least – to policy makers, both at the national and at the regional levels.

The structure of both national and regional HERMIN model frameworks can be best thought as being composed of three main blocks: a supply block, an absorption block and an income distribution block. Obviously, the model functions as integrated systems of equations, with interrelationships both within and between all their sub-components. However, for expositional purposes we describe the HERMIN modelling framework in terms of the above three sub-components, which are schematically illustrated in Figures 2.1 and 2.2.

Conventional Keynesian mechanisms are at the core of any HERMIN national or regional model. Expenditure and income distribution sub-components generate the standard income-expenditure mechanisms. But the model also has neoclassical features (i.e., features that are influenced by shifts in relative prices). Thus, output in manufacturing is not simply driven by demand. It is also potentially influenced by price and cost competitiveness, where firms seek out minimum cost locations for production. In addition, factor demands in manufacturing and market services are derived using a production function constraint, where the capital/labour ratio is assumed to be sensitive to shifts in relative factor prices. Wage bargaining can also be influenced by the degree of slack or tension in the labour market and this feedback mechanism (referred to technically as a structural Phillips curve), introduces further relative price effects through wage-price interactions.

From Figure 2.2 we see that the model handles the three complementary ways of measuring GDP in the national/regional accounts, on the basis of output, expenditure and income definitions. On the output basis, HERMIN disaggregates production activities into four sectors: manufacturing (OT), market services (ON), agriculture (OA) and the public (or non-market) sector (OG). On the expenditure side, HERMIN disaggregates into the conventional five components: private consumption (CONS), public consumption (G), investment (I), stock changes (DS), and the net trade balance (NTS). National or regional income is determined on the output side, and disaggregated into private and public sector elements.

Since all elements of output are modelled, and must give identical results (up to any statistical discrepancy), the output-expenditure identity can be used to determine the net trade surplus or deficit residually. This is a crucial identity in the model, since it mediates between the ability of a state or region to produce output, and local absorption of that output. If a shock hits the economy – for example, public investment expenditures associated with Structural Funds – then there is a degree of local supply response, and a degree of local absorption, and depending on the relative magnitudes of these two responses, the shock will produce either a net trade deficit or a net trade surplus.

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7 For an analysis of international plant location mechanisms, see Bradley and Fitz Gerald, 1988. These processes of foreign direct investment by multinationals are very relevant to regions, as they seek to attract inward investment from other regions of the state, as well as from abroad.

8 The traded/non-traded disaggregation implies that only a net trade surplus is logically consistent. Separate equations for exports and imports could be appended to the model, but would function merely as conveniently calculated “memo” items that were not an essential part of the model’s behavioural logic.
Figure 2.1: The HERMIN Model Schema

Supply aspects

Manufacturing Sector (mainly tradable goods)

Output = \( f_1(\text{World Demand, Domestic or Regional Demand, Competitiveness, } t) \)

Employment = \( f_2(\text{Output, Relative Factor Price Ratio, } t) \)

Investment = \( f_3(\text{Output, Relative Factor Price Ratio, } t) \)

Capital Stock = Investment + (1-\(\delta\)) Capital Stock\(_{t-1}\)

Output Price = \( f_4(\text{World Price} \times \text{Exchange Rate, Unit Labour Costs}) \)

Wage Rate = \( f_5(\text{Output Price, Tax Wedge, Unemployment, Productivity}) \)

Competitiveness = National or Regional Prices / World Output Prices

Market Service Sector (mainly non-tradable)

Output = \( f_6(\text{Domestic or Regional Demand, World Demand}) \)

Employment = \( f_7(\text{Output, Relative Factor Price Ratio, } t) \)

Investment = \( f_8(\text{Output, Relative Factor Price Ratio, } t) \)

Capital Stock = Investment + (1-\(\delta\)) Capital Stock\(_{t-1}\)

Output Price = Mark-Up On Unit Labour Costs

Wage Inflation = Manufacturing Sector Wage Inflation

Agriculture and Non-Market Services: mainly exogenous and/or instrumental

Demographics and Labour Supply

Population Growth = \( f_9(\text{Natural Growth, Migration}) \)

Labour Force = \( f_{10}(\text{Population, Labour Force Participation Rate}) \)

Unemployment = Labour Force – Total Employment

Migration = \( f_{11}(\text{Relative expected wage}) \)

Demand (absorption) aspects

Consumption = \( f_{12}(\text{Personal Disposable Income}) \)

Domestic Demand = Private and Public Consumption + Investment + Stock changes

Net Trade Surplus = Total Output - Domestic Demand

Income distribution aspects

Expenditure prices = \( f_{13}(\text{Output prices, Import prices, Indirect tax rates}) \)

Income = Total Output

Personal Disposable Income = Income + Transfers - Direct Taxes

Current Account = Net Trade Surplus + Net Factor Income From Abroad

Public Sector Borrowing = Public Expenditure - Tax Rate * Tax Base

Public Sector Debt = (1 + Interest Rate) Debt\(_{t-1}\) + Public Sector Borrowing

Key Exogenous Variables

External: World output and prices; exchange rates; interest rates;

Domestic: Public expenditure; tax rates.
Figure 2.2: Schematic outline of the HERMIN modelling approach
The output-income identity can also be used to determine corporate profits residually. Thus, profits are what results when the wage bill is subtracted from total economy-wide output. Finally, the equations in the model can be classified as behavioural or identity. In the case of the former, economic theory and calibration to the data are used to define the relationships. In the case of identities, these follow from the logic of the national and regional accounts, but have important consequences for the behaviour of the model as well.

2.3 The supply side of the HERMIN model

2.3.1 Output determination

The theory underlying macroeconomic modelling in a small open national or regional economy requires that the equation for output in a mainly traded sector reflects both purely supply side factors (such as real unit labour costs and external price competitiveness), as well as the extent of response of output to the level of external demand, e.g. through operations of multinational enterprises, as described by Bradley and FitzGerald (1988). By contrast, domestic demand (or regional demand in the case of regional models) should play a more limited role in a mainly traded sector, for example in terms of its impact on the rate of capacity utilisation.

However, manufacturing in any but extreme cases includes a large number of partially sheltered subsectors producing items that are effectively (or partially) non-traded. Hence, we would expect domestic or local demand to play a more substantial role in this sector, possibly also influencing longer term output decisions of firms.

HERMIN uses a hybrid supply-demand equation of the form:

\[
\log(OT) = a_1 + a_2 \log(OW) + a_3 \log(ULCT / POT) + a_4 \log(FDOT) + a_5 \log(POT / PWORLD) + a_6 t
\]

where \(OW\) represents the important external (or world) demand, and \(FDOT\) represents the influence of domestic (or regional) absorption. We further expect \(OT\) to be negatively influenced by real unit labour costs (\(ULCT/POT\)) and the relative price of domestic versus external goods (\(POT/PWORLD\)).

In the case of market services, we can usually assume that local demand is the key driving force, and a fairly simple form of the market service sector output equation (\(ON\)) is usually specified:

\[
\log(ON) = a_1 + a_2 \log(FDON) + a_3 t
\]

where \(FDON\) is a measure of domestic demand.

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9 In what follows, for simplicity we will normally only refer to external variables as “world” variables. In the case of regional models, the region’s “world” or external environment will also include the rest of the nation state of which it is a component part.

10 Logically, world activity should have no role in determining non-traded output. However, in certain economies (such as Ireland, Estonia, Latvia and Greece), some service activities that are traded (e.g., transit trade, tourism, financial services, etc.). In the case of the Polish regions, in particular the western regions, this will have to be examined on a region by region basis.
In the simple four-sector versions of HERMIN, no effort is made to construct detailed sub-models of agricultural activities. In an economy like Poland, and particularly in the eastern Polish regions that have a large share of agricultural activity, it is very likely that the sector will decline in importance as the non-agricultural sectors grow and absorb resources, labour in particular. So, output in agriculture is initially modelled very simply as an inverted labour productivity equation, where we expect productivity to rise steadily as farm labour is shed and as investment in labour-saving equipment rises.

\[(2.3) \quad \log(OA/LA) = a_0 + a_1 t\]

In the public sector, output is determined by public sector employment, which is a policy instrument. This applies whether the national or regional economy is being modelled.

### 2.3.2 Factor demands

Macro models usually feature production functions of the general form:

\[(2.4) \quad Q = f(K,L)\]

(2.4) \(Q = f(K,L)\)

(where Q represents output, K capital stock and L employment). But output need not actually be determined directly by this relationship. We have seen above that manufacturing output is determined in HERMIN by a mixture of external and local demand, together with price and cost competitiveness terms. Having determined output in this way, the role of the production function is to constrain the determination of factor demands in the process of cost minimisation that is assumed. Hence, given \(Q\) (determined as in equations 2.1 and 2.2 in a hybrid supply-demand relationship), and given (exogenous) relative factor prices, the factor inputs, \(L\) and \(K\), are determined by assuming cost minimization subject to the production function constraint. Hence, the production function operates in the model as a technology constraint and is only indirectly involved in the determination of output. It is partially through these interrelated factor demands that the longer run efficiency enhancing effects of policy and other shocks like the EU Single Market and the Structural Funds are believed to operate.

Ideally, a macro model should allow for a production function with a fairly flexible functional form that permits a variable elasticity of substitution. When an economy opens and becomes progressively more influenced by activities of externally-owned national or multinational companies, the traditional substitution of capital for labour following an increase in the relative price of labour need no longer happen to the same extent. The internationally or inter-regionally mobile capital may choose to move to a different location than seek to replace costly domestic labour.

Since the Cobb-Douglas production function is too restrictive, we use the CES form of the added value production function and impose it on both manufacturing (T) and market service (N) sectors. Thus, in the case of manufacturing:

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11 The “elasticity of substitution” measures the sensitivity of the capital-labour ratio to the ratio of the cost of capital relative to the cost of labour.

12 In the technical terms of the neoclassical theory of firm, the isoquants get more curved as the technology moves away from a Cobb-Douglas towards a Leontief type.

13 In the Cobb-Douglas production function, the elasticity of substitution is constrained to take the value unity.
\[ OT = A \exp \left( \lambda t \left[ \delta LT^{-\rho} + \left( 1 - \delta \right) KT^{-\rho} \right]^{1/r} \right), \]

In this equation, OT, LT and KT are added value, employment and the capital stock, respectively, A is a scale parameter, \( \rho \) is related to the constant elasticity of substitution, \( \delta \) is a factor intensity parameter, and \( \lambda \) is the rate of Hicks neutral technical progress.

In both the manufacturing and market service sectors, factor demands are derived on the basis of cost minimisation subject to given output, yielding a joint factor demand equation system of the schematic form:

\[ K = g_1 \left( Q, \frac{r}{w} \right) \]
\[ L = g_2 \left( Q, \frac{r}{w} \right) \]

where \( w \) and \( r \) are the cost of labour and capital, respectively.\(^{14}\)

Although the central factor demand systems in the manufacturing (T) and market services (N) sectors are functionally identical, they will have different estimated parameter values and two further crucial differences.

(a) First, output in the traded sector (OT) is driven by external demand (OW) and local demand (FDOT), and is influenced by external price competitiveness (PCOMPT) and real unit labour costs (RULCT). In the non-traded sector, on the other hand, output (ON) is driven purely by local demand (FDON), with possibly a limited role for external demand (OW).\(^{15}\) This captures the essential difference between the neoclassical-like tradable sector and the sheltered Keynesian non-traded sector.

(b) Second, the output price in the manufacturing (T) sector is usually heavily influenced by the external price. Indeed, in a regional model, the local price is often identical to the external (national) price, simply because the Statistical Offices do not collect regionally differentiated prices.\(^{16}\) In the market services (N) sector, the producer price is a pure mark-up on costs. This puts another difference between the partially price taking tradable sector and the price making non-tradable sector.

The modelling of factor demands in the agriculture sector is treated very simply in HERMIN, but can always be extended in later versions as more sophisticated satellite models, where the institutional aspects of agriculture are fully included. GDP in agriculture is modelled as an inverted productivity relationship (see equation 2.3 above). Labour inputs into agriculture are modelled as a (usually declining) time trend, and not as part of a neo-classical optimising

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\(^{14}\) The above treatment of the capital input to production in HERMIN is influenced by the earlier work of d’Alcantara and Italianer, 1982 on the vintage production functions in the HERMES model. The implementation of a full vintage model was impossible, even for the four EU cohesion countries. A hybrid putty-clay model is adopted in HERMIN (Bradley, Modesto and Sosvilla-Rivero, 1995).

\(^{15}\) For regional models, external demand in both of these cases – as represented by OW – will include national and international aspects.

\(^{16}\) Some prices are collected on a regional basis, mainly retail consumer prices and farming marketplace prices (see Statistical Yearbook of the Dolnoslaskie Voivodship, Part I, 2002, pages 267-279)
system, as in manufacturing and market services. The capital stock in agriculture is modelled as a trended capital/output ratio.

In the non-market service sector, factor demands (i.e., numbers employed and fixed capital formation) are exogenous policy instruments and can be varied by policy makers, subject to fiscal solvency criteria at both the national and regional levels of public administration.

2.3.3 Sectoral wage determination

Modelling of wages and prices in HERMIN is influenced by the so-called Scandinavian model (Lindbeck, 1979). Thus, the behaviour of the manufacturing (T) sector is assumed to be dominant in relation to wage determination, both nationally and regionally. The wage inflation determined in the manufacturing sector is passed through to the down-stream “sheltered sectors, i.e., market services, agriculture and non-market services, in equations of the form:

\begin{align}
\text{(2.7a) } \text{WNDOT} &= \text{WTDOT} + \text{stochastic error} \\
\text{(2.7b) } \text{WADOT} &= \text{WTDOT} + \text{stochastic error} \\
\text{(2.7c) } \text{WGDOT} &= \text{WTDOT} + \text{stochastic error}
\end{align}

where WTDOT, WNDOT, WADOT and WGDOT are the wage inflation rates in manufacturing, market services, agriculture and non-market services, respectively. What these equations assert is that wage inflation will tend to be fairly uniform between all four sectors, but that wage levels may continue to differ. In the case of the government sector, the relationship usually only holds in the longer term, since public sector wages have a tendency to drift out of line with private sector wages, and are “corrected” periodically through special public sector wage deals. Obviously these assertions have to be tested empirically, but have been reasonably supported for the national data (Zaleski et al, 2004a).

In the important case of manufacturing, wage rates are modelled behaviourally as the outcome of a bargaining process that takes place between organised trades unions and employers, with the possible intervention of the government. This mainly takes place at the national level, but can be replicated to some extent in the regional economies, depending on the structure of production activities.

Formalised theory of wage bargaining points to four paramount explanatory variables (Layard, Nickell and Jackman (LNJ), 1990):

a) Output prices: The price that the producer can obtain for output clearly influences the price at which factor inputs, particularly labour, can be purchased profitably.

b) The tax wedge: This wedge is driven by total taxation between the wage denominated in output prices and the take home consumption wage actually enjoyed by workers. The tax wedge is mainly a national variable, but can take on regional aspects if the regional public authorities have fiscal autonomy and can levy local direct and indirect taxes at rates that differ from national rates.

c) The rate of unemployment: The unemployment or Phillips curve effect in the LNJ model is a proxy for bargaining power. For example, unemployment is usually inversely related to the bargaining power of trades unions. The higher the rate of
unemployment, the weaker the bargaining power of trade unions. The converse applies to employers organizations.

d) Labour productivity: The productivity effect comes from workers’ efforts to maintain their share of added value, i.e. to enjoy some of the gains from higher output per worker. A full pass-through of productivity will result in a constant share of added value going to labour.

A simple log-linear formulation of the LNJ-type wage equation might take the following form:

\[
\text{Log}(WT) = a_1 + a_2 \text{log}(POT) + a_3 \text{log}(WEDGE) + a_4 \text{log}(LPRT) + a_5 \text{UR}
\]

where WT represents the wage rate, POT the price of manufactured goods, WEDGE the tax “wedge”, LPRT labour productivity and UR the rate of unemployment. In some cases, one might substitute the consumption price (PCONS) for the GDP deflator (POT).

2.3.4 Demographics and labour supply

Population growth is modelled through a “natural” growth rate, corrected for net additions or subtractions due to migration. Net migration flows can be modelled using a standard Harris-Todaro approach that drives migration by the relative attractiveness of the local (or national) and international labour markets, where the latter can be proxied by an appropriate destination of migrants.\(^17\) The alternative labour market could be taken as Germany in the case of Poland for the national model, but other Polish regions are likely to be important alternative labour markets in the case of a Polish regional model. The present Polish national HERMIN model does not yet include an international migration mechanism. However, inter-regional migration is likely to be considerably more important in the case of regional models, and these mechanisms will have to be included.

Finally, the labour force participation rate (i.e., LFPR, or the fraction of the working-age population (NWORK) that participates in the labour force (LF)), can be modelled as a function of the unemployment rate (UR) and a time trend that is designed to capture slowly changing socio-economic and demographic conditions.

\[
\text{LFPR} = a_1 + a_2 \text{UR} + a_3 \text{t}
\]

For example, in some of the Polish regions the unemployment rate is considerably higher than in others.\(^18\) The rate of unemployment tends to influence the rate of participation in the labour force (i.e., the willingness to engage in an active search for work), through “discouraged” and “encouraged” worker effects. A decision to migrate from one region to another can be looked on as a decision to “participate” in an alternative labour market.

\(^{17}\) Attractiveness can be measured in terms of the relative expected wage, i.e., the product of the probability of being employed by the average wage in each region (Harris and Todaro, 1970)

\(^{18}\) For example, in the Warminsko-mazurskie voivodship, the registered unemployment rate in the year 2001 was 28.9 per cent. The lowest rate was 13.0 per cent, in the Mazowieckie voivodship.
2.4 Absorption in HERMIN

2.4.1 Private consumption

Household consumption represents by far the largest component of aggregate demand in most developed economies. The properties of the consumption function play a central role in transmitting the effects of changes in fiscal policy to aggregate demand via the Keynesian multiplier. The determination of household consumption is kept simple in the basic HERMIN model, and private consumption (CONS) is determined purely by real personal disposable income (YRPERD).

\[
(2.10) \quad \text{CONS} = a_1 + a_2 \text{YRPERD}
\]

In other words, households are assumed to be liquidity constrained, in the sense of having very limited access to savings or credit in order to smooth their consumption over time. However, as the Polish banking system continues to evolve increasingly sophisticated consumer credit mechanisms, the liquidity constraint is relaxed and a switch to a “permanent income” consumption function will be required. In later extensions of the HERMIN model, the more sophisticated approach can be adopted.\(^{19}\)

2.4.2 Other elements of absorption

As for the remaining elements of absorption, public consumption is determined primarily by public employment, which is a policy instrument. Private investment is determined within three of the four sectors as the investment part of the sectoral factor demand systems. Public investment is a policy instrument. Due to the absence of data on inventory changes, this element of absorption is often ignored, but when available is modelled using the standard stock-adjustment approach.

Finally, in keeping with the guiding spirit of the two-sector small-open-economy model, exports and imports are not modelled explicitly in HERMIN. Instead, the net trade surplus is residually determined from the balance between GDP on an output basis (GDPFC) and local absorption (GDA). Hence, to the extent that a policy shock drives up local absorption (i.e., consumption or investment) more than output, the net trade surplus deteriorates.

2.5 National income in HERMIN

2.5.1 The public sector

With a view to its future use for policy analysis, HERMIN includes a conventional degree of institutional detail in the public sector. Within total public expenditure, the following are distinguished: public consumption (mainly wages of public sector employees), transfers (social welfare, subsidies, and, at least in the case of the national model, debt interest payments), and capital expenditure (for public housing, infrastructure, investment grants to industry). Within a regional model, it is necessary to distinguish between the activities of public consumption and investment carried out by national and by regional authorities. This matter will be taken up in the section of regional data.

\(^{19}\) For an examination of the role of the consumption function in Irish development, see Bradley and Whelan, 1996.
Within the public sector of a national model, we would ideally like to distinguish debt interest payments to domestic residents from interest payments to foreigners, the latter representing a leakage out of national GDP through the balance of payments. In the case of regional models, the issue of public sector debt accumulation and debt interest is less relevant, particularly if the ability to raise finance by borrowing by the regional authorities is legally restricted.

2.5.2 The national and regional income identities

The income-output identity is used in HERMIN to derive corporate profits. In the actual model, there are various data refinements, but the identity is essentially of the form:

\[
YC = GDPFCV - YW
\]

where \(YC\) is profits, \(GDPFCV\) is GDP at factor cost, and \(YW\) is the wage bill for the entire national or regional economy. Income of the private sector (\(YP\)) is determined in a relationship of form:

\[
YP = GDPFCV + GTR
\]

where \(GTR\) is total public sector transfers to the private sector. Income of the household (or personal) sector (\(YPER\)) is defined essentially as:

\[
YPER = YP - YCU
\]

where \(YCU\) is that element of total profits (\(YC\)) that is retained within the corporate sector for reinvestment, as distinct from being distributed to households as dividends. Finally, personal disposable household income (\(YPERD\)) is defined as

\[
YPERD = YPER - GTY
\]

where \(GTY\) represents total direct taxes (income and employee social contributions) paid by the household sector. It is the constant price version of \(YPERD\) (i.e., \(YRPERD = YPERD / PCONS\)) which drives private consumption in the simple Keynesian consumption function used in the basic HERMIN model:

\[
CONS = a_1 + a_2 YRPERD
\]

2.5.3 The monetary sector

There is no explicit monetary sector in the basic version of the HERMIN model. Consequently, both the exchange rate and domestic interest rates are treated as exogenous policy instruments. The nominal “anchor” in the national model is the world price, denominated in foreign currency. The nominal “anchor” in any regional model is often the “national” price. Furthermore, the financing of any public sector borrowing in the national model is handled in a rudimentary fashion, with any net flow of annual public sector borrowing being simply accumulated into a stock of debt. The debt accumulation issue is usually less relevant for public authorities in the voivods. This lack of a monetary sector is not a very severe restriction in the case of EU member states who are in euro zone, or for CEE countries who operate a rigid currency board. In the case of Poland, specific modelling of the
monetary side of the economy can be included at the national level. The issue is not relevant at the regional level.

In the case of regional models, the main monetary policy instruments (e.g., interest rates and exchange rates) are taken as being exogenous, since regional authorities have no role in setting monetary policy. However, monetary policy may have asymmetric regional impacts, depending on regional economic structures. It will become possible to analyse these national-regional interactions at a later stage, when work on the Polish regional modelling system is completed.

2.6 The behavioural equations in a HERMIN model

A typical HERMIN model contains a total over 200 equations, many of which are included to increase the model’s transparency and facilitate simulation and policy analysis exercises. The essential core of the model consists of a smaller number of equations, of which less than twenty are behavioural in a strictly economic sense (i.e., empirical versions derived from an underlying theoretical specifications, containing parameters that must be assigned data-dependent numerical values).

There are fifteen main behavioural equations that have to be calibrated in a HERMIN model, determining the following variables:

- GDP arising in manufacturing (OT)
- The factor demand system in manufacturing (employment (LT) and investment (IT))
- The GDP deflator for manufacturing (POT)
- Average annual earnings in manufacturing (WT)
- GDP arising in marketed services (ON)
- The factor demand system in marketed services (employment (LLN) and investment (IN))
- The GDP deflator for market services (PON)
- GDP arising in agriculture, forestry and fishing (OA)
- Labour input in agriculture, forestry and fishing (LA)
- Fixed capital stock in agriculture, forestry and fishing (KA)
- Household consumption (CONS)
- Expenditure prices (investment (PI) and consumption (PCONS))

The above set of behavioural equations is embedded amongst a larger set of identities, which are of vital importance to the performance and properties of the model, but do not contain numerical parameters that need to be calibrated. Together, the behavioural equations and the identities form an integrated system, and cannot be considered in isolation from each other.

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20 For example, the wage in manufacturing (WT) is determined in a behavioural equation. But the inflation rate (WTDOT) is determined in an identity, merely to facilitate the examination of simulation output.
[3] The data requirements for a regional model

3.1 Introductory remarks

Before examining the data availability in the Polish regions, we summarise here the kind of data that will be required in order to construct regional models. In some cases, these data are published. In some cases, proxies can be used as substitutes. In some cases, the required data are missing, and their absence will place constraints on the ability to model regional processes.

Before setting out the data requirements for a regional model, we emphasise that most of the data is presented in the official statistical publications at the voivodship level of aggregation. This is the level at which modelling will take place. But in the case of the public finance data, two lower levels of local self-government are used in addition to voivodship self-government: Gmina self-government and Powiat self-government. We return to this issue in section 3.4 below. Unless otherwise specified, when we use the term “regional”, we are referring to the voivodship level.

3.2 Production-side data requirements

Data on regional GDP is required for at least four sectors: in terms of constant price series,\textsuperscript{21}

\begin{itemize}
  \item [OT]: GDP in manufacturing (constant base year prices)
  \item [ON]: GDP in market services (constant base year prices)
  \item [OA]: GDP in agriculture (constant base year prices)
  \item [OG]: GDP in public (or non-market) services (constant base year prices)
\end{itemize}

and current price series,

\begin{itemize}
  \item [OTV]: GDP in manufacturing (current prices)
  \item [ONV]: GDP in market services (current prices)
  \item [OAV]: GDP in agriculture (current prices)
  \item [OGV]: GDP in public (or non-market) services (current prices)
\end{itemize}

We describe these data requirements in terms of sectoral GDP in the regions. But, anticipating the material from Section 3, what is actually published is “gross value added”, or GVA. The relationship between the concepts of GDP and GVA is:

\[
\text{GDP} = \text{GVA} + \text{Taxes on production} - \text{Subsidies on production}
\]

To complete the modelling of the added-value production processes, we also need data on the two factor inputs: labour and capital. We usually measure labour in terms of employment,

\begin{itemize}
  \item [LT]: Numbers employed in manufacturing (thousands)
  \item [LLN]: Numbers employed in market services (thousands)
  \item [LA]: Numbers employed in agriculture (thousands)
\end{itemize}

\textsuperscript{21} We are aware that there are few, if any, regional price deflators (or, equivalently, regional constant base year series). However, the national price deflators – already contained in the national HERMIN model – can be used as proxies for the missing regional data. This would mean, of course, that price homogeneity was being assumed for all Polish regions.
**LG**: Numbers employed in public (non-market) services (thousands)

In the case of capital, what we usually have are time-series for fixed investment, both in constant prices,

**IT**: Gross fixed capital formation in manufacturing (constant base year prices)
**IN**: Gross fixed capital formation in market services (constant base year prices)
**IA**: Gross fixed capital formation in agriculture (constant base year prices)
**IG**: Gross fixed capital formation in public (non-market) services (constant base year prices)

and current prices,

**ITV**: Gross fixed capital formation in manufacturing (current prices)
**INV**: Gross fixed capital formation in market services (current prices)
**IAV**: Gross fixed capital formation in agriculture (current prices)
**IGV**: Gross fixed capital formation in public (non-market) services (current prices)

These data can be used to generate proxies for the missing capital stock data.

The last essential data item on the production side concerns wages, which are usually presented in terms of sectoral wage bills,

**YWT**: Total wage bill, manufacturing (current prices)
**YWN**: Total wage bill, market services (current prices)
**YWA**: Total wage bill, agriculture (current prices)
**YWG**: Total wage bill, public (non-market) services (current prices)

The other category of data that logically belongs to this category concerns population, labour force and migration:

**NPREW**: Pre-working population (thousands)
**NWORK**: Working population (thousands)
**NPOSW**: Post-working population (thousands)
**LF**: Total labour force (ILO measure) (thousands)
**NMIG**: Net out-migration from the region (outflows minus inflows) (thousands)

If one wishes to construct a regional model at a four-sector level of disaggregation, the above represents the minimum data requirement.

### 3.3 Expenditure-side data requirements

The data requirements here are easier to state, and consist of the standard expenditure-side classification, in constant prices,

**CONS**: Household consumption (constant base year prices)
**G**: Public sector consumption (constant base year prices)
**DS**: Changes in inventories (constant base year prices)

---

22 See previous note on missing regional price data.
and in current prices,

**CONSV**: Household consumption (current prices)
**GV**: Public sector consumption (current prices)
**DSV**: Changes in inventories (current prices)

Note that we do not specify investment data, since these have already been specified as part of the production-side data requirements.

Note also that we do not specify regional export or import data either. This is in recognition that these data are simply not available. But it will be possible to recover proxy estimates of the net trade surplus (exports minus imports) when the basic (or raw) data are processed, via the output-expenditure identity.

### 3.4 Income-side data requirements

The basic data requirements on the income side of a regional model concern the activities of the public authorities as they spend and tax. This breaks down into separate consideration of regional tax revenue and regional public expenditure. However, there are three levels of self-government that are relevant:

- a) Gmina self-government
- b) Powiat self-government (including cities with the status of Powiat)
- c) Voivodship self-government

In each case, the budget revenue of local self-government entities consist of:

- a) Own revenue;
- b) Appropriated allocations from the state budget for specific tasks;
- c) Allocations received from appropriate funds;
- d) Other allocations;
- e) General subsidies from the state budget (to supplement own revenue for education, etc.);
- f) Funds from non-budgetary sources (for additional financing of own tasks).

For expenditure, the following headings are used:

- a) Allocations (including for extra-budgetary economy and appropriated funds);
- b) Benefits paid to persons;
- c) Current expenditure of budgetary entities, further broken down into
  - i. Wages and salaries;
  - ii. Contributions for social security and the Labour Fund;
  - iii. Purchase of materials and services.
- d) Property expenditures, including investment expenditures.

At a later stage in the modelling project, when all 16 voivodships will be included, together with the national model, consideration will have to be given to the organizational-legal forms of entities operating in the budget of the state and budgets of local self-government entities. The following forms can be distinguished:
Budgetary entities: Here, the expenditure is fully covered from the state budget or the budgets of local self-government entities;

Budgetary establishments: These also include auxiliary units of budgetary entities, whose expenses are covered from own revenues arising from conducting activities, as well as from allocations from the state of local-government entities;

Special funds of budgetary entities: These are financial funds accumulated in separate bank accounts and designated for specifically defined purposes;

Appropriated funds: These funds are set up by special acts of parliament, and their revenues originate from public revenues. Their expenditures are designated for the realization of specific tasks. They can be “state” appropriated funds, or “Voivodship”, “Powiat” or “Gmina” appropriated funds.

3.4.1 Public sector expenditure in a region

In the following we define the types of public sector expenditure that can take place within any given region. As we shall see in Section 4 below, in some cases these expenditures can be immediately identified from the published regional data. But in some cases, the expenditure categories are not identified, or may be zero. We also take account of the possibility that some public expenditure in the region may be carried out directly by the central state authorities, and bypass the three levels of regional self-government.

In the following notation, we use “N” to denote expenditure carried out by the national authorities, and “R” to denote expenditure by the regional authorities. Within the levels of regional self-government, “G” denotes Gmina, “P” denotes Powiats and “V” denotes Voivodships. Note that the following aggregate “economic” categories are more relevant to modelling than the individual departmental allocations.

Public consumption:

GVN: Public consumption expenditure made in the region by the national authorities

GVRG: Public consumption expenditure made by Gminas

GVRP: Public consumption expenditure made by Powiats

GVRV: Public consumption expenditure made by Voivodships

Subsidies:

GSUBN: Expenditure in the region on subsidies paid for by the national authorities

GSUBRG: Expenditure on subsidies paid for by Gminas

GSUBRP: Expenditure on subsidies paid for by Powiats

GSUBRV: Expenditure on subsidies paid for by Voivodships
Unemployment income support:

**GTRUN**: Income support payments to the unemployed in the region, paid for by the national authorities

**GTRURG**: Income support payments to the unemployed, paid for by Gminas

**GTRURP**: Income support payments to the unemployed, paid for by Powiats

**GTRURV**: Income support payments to the unemployed, paid for by Voivodships

Social welfare payments:

**GTRSO CN**: Social welfare transfers to the region, paid by the national authorities

**GTRSOCRG**: Social welfare transfers paid for by the Gminas

**GTRSOCRP**: Social welfare transfers paid for by the Powiats

**GTRSOCRV**: Social welfare transfers paid for by the Voivodships

Capital expenditure (including investment):

**GEKN**: Total public capital expenditure in the region, paid for by the national authorities

**GEKRG**: Total public capital expenditure, paid for by Gminas

**GEKRP**: Total public capital expenditure, paid for by Powiats

**GEKRV**: Total public capital expenditure, paid for by Voivodships

Total purely regional public expenditure (GEXP*) is defined as that element of total public expenditure in the region that is paid for by the appropriate regional authorities, and forms part of the regional budgetary process. It is defined as follows:

\[
\begin{align*}
GEXPRG &= GVRG + GSUBRG + GTRURG + GTRSOCRG + GEKRG \\
GEXPRP &= GVRP + GSUBRP + GTRURP + GTRSOCRP + GEKRP \\
GEXPRV &= GVRV + GSUBRV + GTRURV + GTRSOCRV + GEKRV
\end{align*}
\]

Total regional public expenditure can then be defined as:

\[
GEXPR = GEXTRG + GEXPRP + GEXPRV
\]

Total purely national public expenditure (GEXPN) is defined as that element of total public expenditure in the region that is paid for by the national authorities, and which does not form part of the regional budgetary process. It is defined as follows:

\[
GEXPN = GVN + GSUBN + GTRUN + GTRSO CN + GEKN ;
\]

Total (regional plus national) public expenditure (GEXP) is defined as follows:

\[
GEXP = GEXPR + GEXPN
\]
3.4.2 Regional tax and other revenue

From the published sources, it is clear that revenue can be raised by, or at the very least, can be allocated to, the three levels of local self-government: Powiats, Gminas and Voivodships. From the modelling perspective, not all this details may be necessary. But in light of the fact that it is intended to model all 16 Voivodships, and integrate the regional models with the national Polish model, we include a high level of regional and sub-regional detail on the revenue side in the database, to be described in Section 4 below.

Regional “Own Revenue”:

Since the Voivodship is the unit which is to be modelled, we can aggregate the expenditure tax revenues from the lower levels of self-government into three generic types:

i. Value-added taxes (GTEVAT)
ii. Other taxes on expenditure (GTEXP)
iii. Other tax revenue (GTEO)

Income tax revenues are of two kinds:

i. Personal income tax (GTYP)
ii. Corporate income tax (GYYC)

The total of these tax revenues will constitute “own revenue”, i.e., revenue from purely local taxes (levied, collected and retained in the Voivodship).

We can aggregate these “own revenue” items as follows:

Total taxes on expenditure: $GTE = GTEVAT + GTEXP + GTEO$
Total taxes on income: $GTY = GTYP + GTYC$
Total “own revenue”: $GT = GTE + GTY$

Appropriated allocations from the state budget:

These are recorded under two headings:

Allocations for government administration: GAALG
Allocations for own (i.e., regional) tasks: GAALR

and

Total appropriated allocations: $GAAL = GAALG + GAALR$

General subsidies from the state budget:

To avoid confusion with the use of the term “subsidy” on the expenditure side of regional public finances, we will refer to these general subsidies from the state budget as “grants”.

Two main types of grant are recorded:
Grants for educational talks: GGREDU
Grants for roads infrastructure: GGRINF
Other grants: GGRO

Total grants: GGR = GGREDU + GGRINF + GGRO

Total regional revenue:
GREV = GT + GAAL + GGR

We can then define the regional public sector deficit (DEFREG) as follows:

$$\text{DEFREG} = \text{GEXP} - \text{GREV}$$

3.4.3 Summary on public sector issues

The above is merely intended to be a stylised treatment, designed to guide the gathering of regional data. In practice, not all the data categories will be relevant. In some other cases, our initial assumptions (e.g., concerning regional taxation arrangements) will have to be modified. The nature of the regional funding allocations and retained tax revenue will require careful consideration, since the Polish regions are not a fully federal system, along the lines of the German Lander. However, these and other related issues will be examined again, after we present the main features on the available Polish regional data.
The structure of available Polish regional data

4.1 Introduction

4.1.1 The purpose and structure of this section

In Section 3, the scope and type of data required for regional modelling are summarised. The description of the scope and type of data contained in this summary is based on certain ideal assumptions with regard to the availability of data which would enable the construction of a typical macroeconomic regional model for a voivodship.

In this section, in turn, the currently available aggregated data for selected voivodships (Dolnośląskie, Lubelskie, Małopolskie and Zachodniopomorskie) are reviewed, as compared to regional modelling requirements defined in Section 3. Available data and methodological comments are presented in the form of a descriptive review based on the same categories which were described in Section 3, i.e., based on a scheme enabling the construction of the regional model which includes the following categories: output, expenditure, income. Following the descriptive review, there is an appendix to this section which contains tabulated synthetic information regarding the availability of data on the production side, aggregated by statistics services, and based on the example of Dolnośląskie Voivodship (Lower Silesia) which is a case study for this report.

At the time of preparation of this report, in connection with the implementation of the European Commission’s recommendations 23, extensive revisions of regional accounts data were in progress at the Central Statistical Office (CSO), as the second stage 24 of data revisions associated with methodological changes in the National Accounts, and as at the date of completion of this report, these data have not been published yet. On the other hand, we know the scope of those revisions and data categories which will be published. As a result of that, although regional accounts data prepared according to the uniform methodology, applied as a result of the first stage of revisions, are currently available only for 2 years, i.e., 2000-2001, we can make certain assumptions with regard to the availability of data of longer time series in the nearest future, which would also incorporate the results of the second stage of revisions. In effect, a comparable series for the years 1995-2002, compliant with the ESA 1995 recommendations, will be available for data revised on a comprehensive basis during the two stages of revisions. As noted before, the detailed review of all data, together with the determination of time series availability is the subject of this section.

4.1.2 Sources of statistical data for regional modelling

23 It relates to the implementation of recommendations of the European System of National and Regional Accounts ESA 1995.
24 Methodological changes in national and regional accounts were implemented in two stages. The first stage of revisions covered data for the years 2000-2001. In the case of the regional accounts, the results of this revision, together with a description of the methodological changes, were published in the publication “Gross Domestic Product by Voivodship and Subregion in 2001” (Published by the CSO, the Statistical Office of Katowice, Katowice 2003). During the preparation of this report, the second stage of data revisions; which covered the revision of data for the years 1995-1999, was underway. The results of the second stage of revisions, together with a description of the methodological changes, will be published in the 2nd half of October in the publication “Gross Domestic Product by Voivodship and Subregion in 2002” (Published by the CSO, the Statistical Office of Katowice, Katowice 2004).
As indicated previously, an essential condition for the construction of the regional HERMIN model is to have an adequate database of statistical data aggregated at the voivodship (regional) level. Therefore, during the initial stage of the work, sources of regional statistical data were reviewed. The review showed that aggregated regional data which would potentially be useful for the creation of a regional database for the regional HERMIN model could be derived from the following (discussed in detail in the further Sections 4.2-4.4) types of sources:

i. generally available publications of the Central Statistical Office (CSO), prepared in accordance with the annual Statistical Surveys Programme, both in the book form, and on the CSO website (e.g., the Regional Data Bank);

ii. other data, aggregated both by the CSO, e.g., for the needs of EUROSTAT, and by other institutions, e.g., the Ministry of Finance, but which are not widely published.

The detailed review of statistical regional data, hitherto published and planned to be published, in the context of the need to construct a database for the regional HERMIN model, showed that, in the case of statistics kept by the CSO, the following publications should be considered to be the main sources:

Publication 1: *Gross Domestic Product by Voivodship*.
The CSO’s publication under this title is prepared by the Main Centre for Regional Accounts at the Statistical Office of Katowice. In this publication, results of the calculation of basic national account categories by region are presented. The hitherto published data are available for the years 1995-2001, but they are not wholly comparable in this time series, both due to the deep methodological changes which were made in the Polish public statistics with respect to the calculation of regional accounts in this period, and the implemented administrative reform. Data aggregated for 16 new voivodships are available in the following publications from this series: “*Gross Domestic Product by Voivodship in 1995-1998*” (data aggregated both for 49 and 16 voivodships, but according to the outdated methodology), “*Gross Domestic Product by Voivodship in 1999*” (data aggregated for 16 voivodships, but according to the outdated methodology), and “*Gross Domestic Product by Voivodship in 2000*” (data aggregated for 16 voivodships, but according to the outdated methodology), and “*Gross Domestic Product by Voivodship in 2001*”. The last mentioned publication contains data prepared already in line with a part of the recommendations (the first stage of revisions) of the European System of National and Regional Accounts ESA 1995. This publication also contains absolute data for 2000, which were recalculated according to revised methodological assumptions in order to ensure their comparability with the 2001 data. This publication contains the results of calculations of regional GDP and its components aggregated for 16 voivodships, which are level 2 units (NUTS 2), and 44 subregions – level 3 units (NUTS 3) of the Nomenclature of Territorial Units for Statistics.

The publication “*Gross Domestic Product by Voivodship and Subregion in 2002*” is under preparation, and it is scheduled to be out in the 2nd half of October 2004.

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25 The Nomenclature of Territorial Units for Statistics, NUTS – a uniform system of administrative division of EU countries introduced in 1988. The NUTS is a five-level hierarchical classification in which three regional levels (NUTS 1-3) and two local levels (NUTS 4-5) are distinguished. The NUTS classification is used for the needs of the EU regional policy. Regions which are beneficiaries of Structural Funds are classified according to NUTS 2 statistics.
The Main Centre for Regional Accounts at the Statistical Office of Katowice, which aggregates data related to the regional accounts, carries out its work in accordance with the Statistical Surveys Programme of Public Statistics. In the a.m. publication under preparation (“Gross Domestic Product by Voivodship and Subregion in 2002”), the following categories are the result statistical information aggregated at the voivodship level (NUTS 2) from the study “Gross Domestic Product and Its Components by Region” (symbol: 1.67.07):

i. categories of the production account and the income generation account: output, intermediate consumption, gross value added, gross domestic product, employment related costs, gross operating surplus.

ii. categories of the allocation of primary income account and the secondary distribution of income account for the household sector: gross primary income, gross disposable income.

In the a.m. publication, there are also revisions of data for the voivodships from the previous years (the second stage of revisions) for the basic categories, such as (available time series of data after the revisions according to the uniform methodology in parentheses): gross domestic product (1995-2002), gross value added (1995-2002), employment related costs  

Publication 2: Statistical yearbooks of the following voivodships: Dolnośląskie, Lubelskie, Małopolskie, Mazowieckie and Zachodniopomorskie. Published by the Statistical Offices of Wrocław, Lublin, Kraków, Warsaw and Szczecin, respectively. Statistical yearbooks for the new voivodships have been published by the respective Voivodship Statistical Offices since 2000, and there are currently available releases which contain data for 4 years: 1999, 2000, 2001 and 2002. The next editions of statistical yearbooks of particular voivodships with data for 2003 are scheduled to be out in December 2004.

Publication 3: “The Statistical Yearbook of Voivodships”. Published by the Central Statistical Office. Yearbooks with data aggregated for the new voivodships have been published by the CSO since 2000, and their releases for the years 2000-2003 are currently available, and they contain data for 4 years: 1999, 2000, 2001 and 2002. “The Statistical Yearbook of Voivodships 2004” (with data for 2003) is now under preparation, and its publication is scheduled for November 2004 according to the CSO’s publishing plan.

4.2 Production

4.2.1 Gross domestic product by voivodship

The regional production account is based on the regional accounts. The basic publication which presents in widest scope statistical data related to the regional accounts is the CSO’s cyclical publication “Gross Domestic Product by Voivodship and Subregion”.

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26 In 2004 the aggregation of data is carried out in accordance with the Council of Minister Decree on the Statistical Surveys Programme of Public Statistics for 2004 dated 22 July 2003 (Dz.U. (Official Journal) No. 159, item 1538, dated 12 September 2003).

27 During the work on this publication, the category “employment related costs” were recalculated back to 1998, and unpublished data for 1998-2000 are available at the Statistical Office of Katowice at request.
Gross domestic product (GDP) shows the end result of activities of all national economy entities. Gross domestic product is equal to the total of gross value added (GVA) of all ownership sectors or institutional sectors, or the total of gross value added of all sections, groups plus taxes on production and less subsidies on production. Gross value added is the difference between output and intermediate consumption.

In the regional accounts, the total value of GDP generated in particular voivodships is shown in current prices, but it is not aggregated in detail by types of activity. It results from the fact that there are no estimates of taxes on production and subsidies on production by voivodship in the regional accounts, and a simplified assumption is made that the national value of GDP is disaggregated based on the structure of gross value added (GVA) generated in voivodships and subregions (the regional GDP structure and the regional GVA structure do not differ from each other, however, absolute figures are different, of course, they are higher in the case of GDP). The above method of deriving regional GDP estimates complies with EUROSTAT requirements.

Regional data on gross value added disaggregated into types of economic activity in accordance with the Polish Classification of Economic Activities (the so-called PKD) are grouped by the method based on local units and types of economic activity, i.e., based on the registered office and the basic type of economic activity of the local unit of an enterprise.

GVA data in the regional accounts are grouped according to five types of economic activity. This aggregation of the PKD sections differs from the aggregation made for the modelling purposes in the HERMIN model, which is a four-sector model, what of course implies a different distribution of sections within aggregates. Table 4.1 shows a comparison of the aggregation of sections within the HERMIN model and the aggregation used in the regional accounts.

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28 The Polish Classification of Economic Activities (the so-called PKD classification) was prepared on the basis of the “Nomenclature des Activités de Communauté Européenne – NACE rev.1” of the Statistical Office of the European Communities EUROSTAT. The PKD classification came into effect on 1 January 1998 under the Council of Minister Decree on the Polish Classification of Economic Activities dated 7 October 1997 (Dz.U. (Official Journal) No. 128, item 829), as amended, and replaced the European Classification of Economic Activities (the so-called EKD).

29 The detailed aggregation of GVA data in the regional accounts into five types of economic activity is based on the following breakdown of sections in the PKD classification: 1) agriculture, hunting and forestry; fishing and operation of fish hatcheries and fish farms - sections: “Agriculture, hunting and forestry”, “Fishing and operation of fish hatcheries and fish farms”; 2) industry - sections: “Mining and quarrying”, “Manufacturing”, “Electricity, gas and water supply”; 3) construction - section: “Construction”; 4) market services - sections: “Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods”, “Hotels and restaurants”, “Transport, storage and communication”, “Financial intermediation”, “Real estate, renting, research and development, and business activities”, “Other community, social and personal activities”, “Private households with employed persons”; 5) non-market services - sections: “Public administration and defence; compulsory social security”, “Education”, “Health and social work”.

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Table 4.1. Aggregation of sections in the HERMIN model and in the Polish regional accounts.

<table>
<thead>
<tr>
<th>HERMIN MODEL</th>
<th>PKD CLASSIFICATION SECTIONS</th>
<th>REGIONAL ACCOUNTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGRICULTURE (A)</td>
<td>Agriculture, hunting</td>
<td>AGRICULTURE, HUNTING AND FORESTRY; FISHING AND OPERATION OF FISH HATCHERIES AND FISH FARMS</td>
</tr>
<tr>
<td></td>
<td>Fishing and operation of fish hatcheries and fish farms</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Forestry</td>
<td></td>
</tr>
<tr>
<td>MANUFACTURING (T)</td>
<td>Manufacturing</td>
<td>INDUSTRY</td>
</tr>
<tr>
<td></td>
<td>Mining and quarrying</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Electricity, gas and water supply</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Construction</td>
<td>CONSTRUCTION</td>
</tr>
<tr>
<td></td>
<td>Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hotels and restaurants</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Transport, storage and communication</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Real estate, renting, research and development, and business activities</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Financial intermediation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Other community, social and personal activities</td>
<td></td>
</tr>
<tr>
<td>MARKET SERVICES (N)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NON-MARKET SERVICES (G)</td>
<td>Public administration and defence; compulsory social security</td>
<td>NON-MARKET SERVICES</td>
</tr>
<tr>
<td></td>
<td>Education</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Health and social work</td>
<td></td>
</tr>
</tbody>
</table>

However, the presentation of value added data aggregated into five groups of types of economic activity in the regional accounts makes it possible to aggregate them for the modelling purposes in the application of the four-sector HERMIN model. In data published in the regional accounts, data on “Manufacturing” are disaggregated from the whole “Industry”, what allows the former to be separated and the other two sections remaining as the difference (“Electricity, gas and water supply” and “Mining and quarrying”) to be included in “Market services”, as it is in the HERMIN model. Similarly, “Construction” is separated in the regional accounts, and it should also be included in “Market services” for the regional modelling purposes.

To sum up, regional data on gross value added by type disaggregated into four sectors (T, N, A, G) of the HERMIN model are available. The time series now covers data aggregated according to the unfirm methodology only for the years 2000-2001, but following the publication of “Gross Domestic Product by Voivodship and Subregion in 2002”, which will contain revisions of GVA data back to 1995, the time series will eventually cover the years 1995-2002. It is assumed in this section that the 1995-2002 time series data will be available for the need to construct a database for the regional model. These data (OTV, ONV, OAV, OGV) are however aggregated only in current prices, thus, these data will be calculated in constant prices (AT, ON, OA, OG) by using the national deflators for these sections (POT, PON, POA, POG).

4.2.2 Employment

Employment data aggregated in the Polish HERMIN model were prepared on the basis of the CSO’s representative Labour Force Survey (LFS) conducted on a quarterly basis for the years 1995-2002 (Q4 data were incorporated into the HERMIN model database). The data results show numbers employed by section. Persons who, in the week surveyed;
i. performed work which generated income or earnings or who helped (without wages) run a family farm or a family business;

ii. did nor perform any work (e.g., due to illness, leave, stoppage of operations of the employer, difficult weather conditions), but formally had a job,

were included in the employed. Persons aged 15 years and more, being members of randomly drawn households, were covered by the survey, except for persons staying abroad. This survey does not cover households living in collective accommodation facilities. The LFS method has been changed since the 4th quarter of 1999; instead of the observation of a selected week of the quarter (in the months of February, May, August and November), the observation is carried out on a continuous basis, i.e., the economic activity of the population is surveyed each week throughout the whole quarter.

The data results of the LFS are also available by section for all 16 voivodships for the years 1995-2002, i.e., for the same period as in the case of the national model. In order to construct the regional model database, the sections should be aggregated into 4 sectors of the HERMIN model (T,N,A,G). However, in the case of the regional results with the detailed disaggregation by section, one should be aware of a possible significant statistical error resulting from a small number of households covered by the survey in particular voivodships (e.g., in 2002 18,800 households were surveyed in a given quarter across Poland, i.e., ca. 0.14% of the total number of households).

4.2.3 Gross fixed capital formation

Gross fixed capital formation is measured by expenditures which increase the value of fixed assets (also including the increase of basic herd livestock), without expenditures being the initial plant and equipment of an investment, as well as interest on investment loans and borrowings throughout the period of the investment implementation. In the gross fixed capital formation account, the following are also included:

i. expenditures on repair of fixed assets,

ii. intangible assets increases, which include:
   - costs of acquisition of property rights, in particular, the right of perpetual usufruct of land and the co-operative right to premises, copyrights, rights to designs, inventions, patents, trademarks, licences,
   - start-up costs, if a special provision allows such costs to be borne by the entity, goodwill,
   - computer software with the expected lifetime more than one year.

Regional data on gross fixed capital formation, contrary to the statistics for this category for the whole country, are not published in generally available publications. However, these data are aggregated by the CSO in current prices by voivodship and by section (ITV, INV, IAV, IGV) for the EUROSTAT needs, and they are currently available for the years 1995-2002. These data will be calculated in constant prices (IT,IN,IA,IG) by using the national deflators for these sections.

In order to construct the regional model database, the sections should be aggregated into 4 sectors of the HERMIN model (T, N, A, G).
4.2.4 Compensation of employees

Compensation of employees includes the total remuneration in cash and the value of benefits in kind or their equivalents which are due to employees for their work. Data on compensation of employees are presented in the CSO statistics on a gross basis, i.e., together with personal income tax advance payments, and since 1999, with social security contributions (pension, disability pension and sickness contributions) paid by the insured employee.

The components of compensation of employees are the following: wages and salaries, distributions of profit and balance-sheet surplus in cooperatives, additional annual wages and salaries for employees of budgetary entities, non-wage remuneration, commissions, agency remuneration, author’s remuneration.

The category “wages and salaries and other labour income”, which corresponds to the HERMIN model category called “Total wage bill”, is not aggregated for voivodships by section. The Statistical Offices in particular voivodships aggregate the “gross wages and salaries” category by section, which is a component of the above category.

Wages and salaries are comprised of the following, inter alia: basic wage or salary, bonuses and awards, extra payments (e.g., for work in harmful conditions, for the length of service, for the performance of managerial functions), compensation for overtime work, compensation for time when the employee does not perform work (paid downtime, leave, illness), allowances in kind and workers’ compensation benefits. Wages and salaries relate to persons employed under a contract of employment, persons engaged in outwork, or apprentices who have entered into contracts of employment with employers for the purpose of vocational training.

Regional data on wages and salaries by section are not published in generally available publications. These data are currently available for the years 1999-2002. In order to construct the regional model database, the sections should be aggregated into 4 sectors of the model HERMIN (T, N, A,G).

4.2.5 Population by working age

The CSO statistics published in the yearbooks for particular voivodships aggregates particular age groups in terms of working age differently than the breakdown used in the HERMIN model (age brackets in the HERMIN model are given in parentheses), and the figures are shown as at 12 December of each year (in the HERMIN model, these values are as at the end of the 2nd quarter). The working age population is understood as the population at the age of working ability. For males, this age is 18—64 (15-64) years, for females —18—59 (15-59) years. The non-working population is understood as the pre-working population, i.e., up to 17 (0-14) years, and the post-working population, i.e., males — 65 years and more (65 years and more), females — 60 years and more (60 years and more). In addition, the CSO statistics disaggregates the working population into the mobile population, i.e., aged 18—44 years, and the non-mobile population, i.e., males — 45—64 years, females — 45—59 years. Currently, regional data on the non-working, working and post-working population are available for the years 1998-2002. The use of the same age brackets as in the HERMIN model will require the number of population to be calculated by sex and age based on demographic data. Such data can be derived from the statistical yearbooks for particular voivodships, in which data have been published for the years 1998-2002, or from data published electronically on the CSO website - bookmark: “Voivodships in the years 1990, 1998-2002” (spreadsheets 47-55).
These data are published as at 12 December of each year. Regional data as at 30 June are available for the years 1990, 1995 and 1999-2003 in the Voivodship Statistical Offices.

4.2.6 Labour force

Data related to the work-force determination are prepared based on the CSO’s representative Labour Force Survey (LFS) conducted on a quarterly basis for the years 1995-2002 (Q4 data were incorporated into the HERMIN model database). The data results show the labour force participation by section. The labour force participation figures include employed persons (definition in 4.2.2) and unemployed persons, i.e., persons aged 15-74 years (until 2000 – 15 years and more) who met simultaneously three conditions:

i. they were not employed in the week surveyed,

ii. over a period of 4 weeks (including the week surveyed as the last one), they were engaged in an active search for work,

iii. they were willing to take up work.

Persons who have found work and are waiting to start it (within 30 days) are also included in the unemployed.

The data results for the labour force participation, according to the LFS methodology, are also available for all 16 voivodships for the years 1995-2002.

4.2.7 Net out-migration

The CSO statistics on regional migration aggregates data on population inflows to a voivodship and total outflows from a voivodship, what gives in effect net out-migration.

Data on migration also include foreign migrations of the population, which are defined as departures from the country of residence to abroad and arrivals to a given country, as well as interregional movements under internal migrations. The Regional Data Bank, where data are published in an electronic version on the CSO website, is the most useful source of data in the case of foreign migrations, due to the longest (1996-2003) time series. From the point of view of the regional model, interregional movements under internal migrations, that is, movements from one voivodship to another, are also of special importance. Data on interregional movements are published electronically on the CSO website - bookmark: “Voivodships in the years 1990, 1998-2002” (spreadsheets 98-106).

4.3 Expenditure

A part of the categories which are on the expenditure side in the Polish HERMIN model: household consumption (CONSV/CONS), public consumption (GV/G), changes in inventories (DSV/DS), exports (XV,X)/imports (MV,M), both in current and in constant prices, are not aggregated by voivodship. Below, we suggest the application of calculation techniques with respect to missing data.
4.3.1 Household consumption

Consumption is the value of products (goods and services) consumed to satisfy needs of the total population, and it includes: private consumption and public consumption.

Private consumption, i.e., consumption in the household sector is disaggregated into individual consumption (from personal income) and consumption in the sector of non-commercial institutions (related to goods and services provided to households as social transfers in kind).

Private consumption is comprised of:
1) consumption in the household sector — individual consumption (from personal income) which includes: expenditures made by the population on the purchase of products (goods and services) valued at prices paid by consumers, the value of natural consumption of agricultural produce from own production valued at prices of purchase of raw (unprocessed) products, and the value of housing services, together with revalued depreciation of residential housing of housing cooperatives and individual housing (of natural persons), as well as contractual rents in non-rented housing of natural persons;
2) consumption in the sector of non-commercial institutions assumed at the level of this sector’s output, less the population’s payments. It is assumed that the value of this consumption is transferred in whole to the population.

Due to the absence of regional data on household consumption, we suggest that available data related to “retail sales of consumer goods” should be used as proxies for “household consumption”. Such data are available in the statistical yearbooks of particular voivodships for the years 1999-2002.

The second technique can be to use data on nominal incomes in the household sector disaggregated into “gross disposable income”. Gross disposable income in the national economy is used for financing consumption and gross savings, therefore, the adoption of certain assumptions with regard to the savings rate may in effect allow us to recover estimates of household consumption.

In the case of this data category, revised data for the years covering the 1998-2002 time series will be published in the publication “Gross Domestic Product by Voivodship and Subregion”.

The third technique can be to use data on “average monthly expenditure per capita in households on consumer goods and services” for the years 1999-2002, published in the same statistical yearbooks of particular voivodships, and then to multiply these data by the average number of persons in a household and by the number of households (the Statistical Office of particular voivodships will be a direct source of data here). However, it should be noted that the latter data are derived based on a limited number of households surveyed. Data on the number of households are estimates, and they are available at the voivodship level of aggregation for the years 1995-2002.

4.3.2 Public consumption

Public consumption includes consumption in the sector of government and local self-government institutions assumed at the level of this sector’s output, less the population’s payments for non-market services, plus allocations to the housing economy and the value of
services purchased in non-public health care establishments. Consumption in this sector is comprised of individual consumption and general public consumption:
1) individual consumption is the value of non-market goods and services transferred free of charge to the household sector. This category encompasses: the value of services of education, culture and national heritage conservation, health care, social welfare, physical culture and sport, tourism, allocations to the housing economy designed to cover a part of costs of maintenance of housing stock, the value of services purchased in non-public health care establishments;
2) general public consumption includes consumption of non-market goods and services which do not have specific individual recipients. This category encompasses, among others, the value of expenditure on public administration, national defence, research and development. The category of public consumption is not aggregated in the public statistics at the voivodship level. Aggregated data for the a.m. categories comprising public consumption can be derived from the aggregation of the execution of budgets of local self-government units and the state budget. It is assumed that such data are available for all 16 voivodships since the first year of their formation, i.e., 1999.

4.3.3 Changes in inventories

Changes in inventories are defined as the value of changes in inventories of materials (including fuels), work in progress, finished products, goods and the material part of deferred costs. In individual farms in agriculture, the value of changes in inventories is comprised of changes in plant and animal production and livestock (young herd).

The category of changes in inventories is not aggregated at the voivodship level. Changes in inventories are a component of accumulation, along with gross fixed capital formation. Regional data on gross fixed capital formation are available (the availability of data for this category is discussed more widely in section 4.2.3).

4.3.4 Investments

We suggest that relevant data on investments, which are available on the production side, be totalled and the category “total investments” be aggregated for the years 1995-2002.

Investment expenditures are capital expenditures or fixed investment expenditures designed to create new fixed assets or make improvements in existing tangible assets - buildings and structures (conversion and redevelopment, extension, reconstruction, adaptation and modernization), as well as expenditures on the so-called initial plant and equipment of an investment.

4.3.5 Exports/Imports

Data on exports and imports are not aggregated by voivodship. However, it will be possible to recover proxy estimates of the net trade surplus (exports minus imports) when the basic data will be available via the output-expenditure identity.

4.4 Data on regional income

An assumption has been made that data on aggregated regional income will available for all 16 voivodships from the first year of their functioning, i.e., since 1999. Therefore, the available time series of data may now cover the years 1999-2003. But it may be possible to
aggregate the earlier pre-1999 data to the "virtual" voivodship level. Due to the nature of these data, they will be obtained from the Ministry of Finance. It is assumed that statistical data on public finance related to revenue and expenditure in budgets of local self-government units located within a given voivodship will be the main source of information. Local self-government units are understood as gminas, powiats and voivodships in accordance with the Act on Revenues of Local Self-Government dated 13 November 2003. Statistical data on budgets are published in the Statistical Yearbooks of Voivodships and in the Statistical Yearbook of each voivodship by the relevant local Statistical Office.

(a) Revenue
Revenue of local self-government units includes:
- own revenue
- general subsidies from the state budget
- appropriated allocations from the state budget.

Own revenue of local self-government units is comprised of:
- a) shares in retained tax revenue from personal income tax and corporate income tax,
- b) revenue from taxes levied and collected under separate laws: i.e., property tax, agricultural tax, motor vehicle tax, fixed amount tax revenue, inheritance and gift tax, forestry tax,
- c) revenue from levies fixed under separate laws, e.g., stamp duty, exploitation levies, marketplace fees, tax on civil and legal transactions,
- d) revenue from property of local self-government units, e.g., rent and lease revenue, and revenue under other similar agreements,
- e) other income of local self-government units, e.g., administration fees, local fees, interest on deposits in bank accounts, interest on overdue payments.

General subsidies from the state budget are transferred to all local self-government units in order to supplement their own revenue, and they are an essential tool of income redistribution from the central government level to the local self-government level. However, general subsidies are funds which are transferred without earmarking them for specifically defined purposes.

In turn, appropriated allocations consist of:
- a) allocations from the state budget for tasks related to government administration, own tasks and tasks carried out under agreements with government administration authorities,
- b) allocations received from appropriated funds,
- c) other allocations.
Appropriated allocations are funds transferred to finance specific tasks.

Revenue of local self-government may also comprise:
- non-returnable funds from foreign sources
- funds from the European Union budget
- other funds prescribed in relevant laws.

Sources of revenue in gminas

Sources of gminas’ own revenue are the following:
1. revenue from taxes (property tax, agricultural tax, motor vehicle tax, personal income tax paid as fixed amount tax, tax on dogs, inheritance and gift tax, tax on civil and legal transactions)
2. revenue from levies (stamp duty, marketplace fees, administration fees, exploitation levies, other levies paid under separate laws)
3. income generated by gmina budgetary entities and payments from gmina budgetary establishments and auxiliary units of gmina budgetary entities
4. revenue from gmina property
5. inheritance, bequests and donations given to gminas
6. revenue from cash penalties and fines
7. 5% of revenue gained by the state budget in connection with the performance of government administration tasks and other tasks prescribed under relevant laws
8. interest on loans extended by gminas
9. interest on overdue payments being gmina revenue
10. interest on deposits in bank accounts held by gminas
11. allocations from budgets of other local self-government units
12. other income prescribed under relevant laws.

The share in retained tax revenue from personal income tax, collected from taxpayers of this tax domiciled within a given gmina, is 39.34%. In the case of corporate income tax, the share in retained tax revenue from corporate income tax taxpayers, domiciled within a given gmina, is 6.71%.

Sources of gminas’ revenue also include funds from the state budget transferred in the form of general subsidies and appropriated allocations from the state budget. General subsidies for gminas consist of three parts - the equalization, balancing and education components.

Appropriated allocations for gminas are in turn funds transferred from the state budget for the implementation of specific tasks by gminas - own and commissioned tasks.

Sources of revenue in powiats

Sources of powiats’ own revenue are the following:
1. revenue from levies being powiat revenue paid under relevant laws
2. income generated by powiat budgetary entities and payments from powiat budgetary establishments and auxiliary units of powiat budgetary entities
3. revenue from powiat property
4. inheritance, bequests and donations given to powiats
5. revenue from cash penalties and fines
6. 5% of revenue gained by the state budget in connection with the performance of government administration tasks and other tasks prescribed under relevant laws
7. interest on loans extended by powiats
8. interest on overdue payments being powiat revenue
9. interest on deposits in bank accounts held by powiats
10. allocations from budgets of other local self-government units
11. other income prescribed under relevant laws.

The share in retained tax revenue from personal income tax, collected from taxpayers of this tax domiciled within a given powiat, is 10.25%. In the case of corporate income tax, the share
in retained tax revenue from corporate income tax taxpayers, domiciled within a given powiat, is 1.40%.

Sources of powiats’ revenue also include funds from the state budget transferred in the form of general subsidies and appropriated allocations from the state budget.

General subsidies for powiats consist of three parts - the equalization, balancing and education components.

Appropriated allocations for powiats are in turn funds transferred from the state budget for the implementation of specific tasks by powiats - own and commissioned tasks. In the case of powiats, appropriated allocations include funds from the state budget transferred for the implementation of tasks of municipal guards, inspection services and emergency services referred to in the Act on Powiat Local Self-Government dated 5 June 1998 (Dz.U. (Official Journal) of 2001, No. 142, item 1592, as amended).

Sources of revenue in voivodships (in budgets of voivodships)

Sources of voivodships’ own revenue are the following:
1. income generated by voivodship budgetary entities and payments from voivodship budgetary establishments and auxiliary units of voivodship budgetary entities
2. revenue from voivodship property
3. inheritance, bequests and donations given to voivodships
4. revenue from cash penalties and fines
5. 5% of revenue gained by the state budget in connection with the performance of government administration tasks and other tasks prescribed under relevant laws
6. interest on loans extended by voivodships
7. interest on overdue payments being voivodship revenue
8. interest on deposits in bank accounts held by voivodships
9. allocations from budgets of other local self-government units
10. other income prescribed under relevant laws

The share in retained tax revenue from personal income tax, collected from taxpayers of this tax domiciled within a given voivodship, is 1.60%. In the case of corporate income tax, the share in retained tax revenue from corporate income tax taxpayers, domiciled within a given voivodship, is 15.90%.

Sources of voivodships’ revenue also include funds from the state budget transferred in the form of general subsidies and appropriated allocations from the state budget.

General subsidies for voivodships consist of three parts - the equalization, balancing and education components.

Appropriated allocations for voivodships are in turn funds transferred from the state budget for the implementation of specific tasks by voivodships - own and commissioned tasks.
Table 4.2. Availability of data for regional modeling: production side.

<table>
<thead>
<tr>
<th>On.</th>
<th>Notation</th>
<th>Variable</th>
<th>Source of data</th>
<th>Time series available</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>OTV</td>
<td>GVA in manufacturing (current prices)</td>
<td>CSO: GDP by V&amp;S&lt;sup&gt;30&lt;/sup&gt;</td>
<td>1995-2002</td>
<td>data to be published after October 18, 2004</td>
</tr>
<tr>
<td>2</td>
<td>ONV</td>
<td>GVA in market services (current prices)</td>
<td>CSO: GDP by V&amp;S</td>
<td>1995-2002</td>
<td>data to be published after October 18, 2004</td>
</tr>
<tr>
<td>3</td>
<td>OAV</td>
<td>GVA in agriculture (current prices)</td>
<td>CSO: GDP by V&amp;S</td>
<td>1995-2002</td>
<td>data to be published after October 18, 2004</td>
</tr>
<tr>
<td>4</td>
<td>OGV</td>
<td>GVA in non-market services (current prices)</td>
<td>CSO: GDP by V&amp;S</td>
<td>1995-2002</td>
<td>data to be published after October 18, 2004</td>
</tr>
<tr>
<td>5</td>
<td>OT</td>
<td>GVA in manufacturing (constant prices)</td>
<td>to be calculated on the basis of current prices</td>
<td>1995-2002</td>
<td>use of national deflator POT required</td>
</tr>
<tr>
<td>6</td>
<td>ON</td>
<td>GVA in market services (constant prices)</td>
<td>to be calculated on the basis of current prices</td>
<td>1995-2002</td>
<td>use of national deflator PON required</td>
</tr>
<tr>
<td>7</td>
<td>OA</td>
<td>GVA in agriculture (constant prices)</td>
<td>to be calculated on the basis of current prices</td>
<td>1995-2002</td>
<td>use of national deflator POA required</td>
</tr>
<tr>
<td>8</td>
<td>OG</td>
<td>GVA in non-market services (constant prices)</td>
<td>to be calculated on the basis of current prices</td>
<td>1995-2002</td>
<td>use of national deflator POG required</td>
</tr>
<tr>
<td>9</td>
<td>LT</td>
<td>Employed persons in manufacturing</td>
<td>CSO: LFS</td>
<td>1995-2002</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>LLN</td>
<td>Employed persons in market services</td>
<td>CSO: LFS</td>
<td>1995-2002</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>LG</td>
<td>Employed persons in non-market services</td>
<td>CSO: LFS</td>
<td>1995-2002</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>ITV</td>
<td>Gross fixed capital formation in manufacturing (current prices)</td>
<td>CSO: DNA&amp;F</td>
<td>1995-2002</td>
<td>data non-published available on request</td>
</tr>
<tr>
<td>14</td>
<td>INV</td>
<td>Gross fixed capital formation in market services (current prices)</td>
<td>CSO: DNA&amp;F</td>
<td>1995-2002</td>
<td>data non-published available on request</td>
</tr>
<tr>
<td>15</td>
<td>IAV</td>
<td>Gross fixed capital formation in agriculture (current prices)</td>
<td>CSO: DNA&amp;F</td>
<td>1995-2002</td>
<td>data non-published available on request</td>
</tr>
<tr>
<td>16</td>
<td>IGV</td>
<td>Gross fixed capital formation in non-market services (current prices)</td>
<td>CSO: DNA&amp;F</td>
<td>1995-2002</td>
<td>data non-published available on request</td>
</tr>
</tbody>
</table>

<sup>30</sup> See legend after the table 4.2.
<p>| | | | | |</p>
<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>17</td>
<td>IT</td>
<td>Gross fixed capital formation in manufacturing (constant prices)</td>
<td>to be calculated on the basis of current prices</td>
<td>1995-2002</td>
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<tr>
<td>18</td>
<td>IN</td>
<td>Gross fixed capital formation in market services (constant prices)</td>
<td>to be calculated on the basis of current prices</td>
<td>1995-2002</td>
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<tr>
<td>19</td>
<td>IA</td>
<td>Gross fixed capital formation in agriculture (constant prices)</td>
<td>to be calculated on the basis of current prices</td>
<td>1995-2002</td>
</tr>
<tr>
<td>20</td>
<td>IG</td>
<td>Gross fixed capital formation in non-market services (constant prices)</td>
<td>to be calculated on the basis of current prices</td>
<td>1995-2002</td>
</tr>
<tr>
<td>21</td>
<td>YWT</td>
<td>Personal wages and salaries -manufacturing (current prices)</td>
<td>CSO-W</td>
<td>1999-2002</td>
</tr>
<tr>
<td>22</td>
<td>YWN</td>
<td>Personal wages and salaries -market services (current prices)</td>
<td>CSO-W</td>
<td>1999-2002</td>
</tr>
<tr>
<td>23</td>
<td>YWA</td>
<td>Personal wages and salaries -agriculture (current prices)</td>
<td>CSO-W</td>
<td>1999-2002</td>
</tr>
<tr>
<td>24</td>
<td>YWG</td>
<td>Personal wages and salaries -non-market services (current prices)</td>
<td>CSO-W</td>
<td>1999-2002</td>
</tr>
<tr>
<td>25</td>
<td>NPREW</td>
<td>Pre-working population (thousands)</td>
<td>CSO (www)</td>
<td>1995-2002</td>
</tr>
<tr>
<td>26</td>
<td>NWORK</td>
<td>Working population (thousands)</td>
<td>CSO (www)</td>
<td>1995-2002</td>
</tr>
<tr>
<td>27</td>
<td>NPOSW</td>
<td>Post-working population (thousands)</td>
<td>CSO (www)</td>
<td>1995-2002</td>
</tr>
<tr>
<td>28</td>
<td>LF</td>
<td>Total labour force (thousands)</td>
<td>CSO: LFS</td>
<td>1995-2002</td>
</tr>
<tr>
<td>29</td>
<td>NMIG</td>
<td>Net out migration from the region (thousands)</td>
<td>CSO (www)</td>
<td>1995(-96)-2002</td>
</tr>
</tbody>
</table>

Legend:
CSO: Central Statistical Office
CSO: LFS – Labour Force Survey
CSO (www): CSO website
CSO: DNA&F – The CSO Department of National Accounts and Finances
CSO-W - The CSO – Statistical Office of Wroclaw

5.1. Introduction

It must be stressed that adequate data for constructing the 16 voivodship sub-models of Poland are not yet available for use. The data problems – as noted in the previous section - are of two main kinds:

i. Data series for sufficient years to make the calibration of regional sub-models a feasible exercise will not become available until after October 18th. This is too late to meet the deadline of the present project.

ii. In some cases, data that would be required in order to replicate the modelling analysis at the voivodships level that is already possible at the national level (Zaleski et al, 2004a) are not, and will not, be available for the foreseeable future.

The data difficulties of type (i) will be relatively easy to overcome, and there is the prospect of soon having an adequate run of annual data for most of the relevant time-series, on the revised ESA-95 basis. However, data difficulties of type (ii) pose more serious challenges, and can be addressed in various ways.

In this section we make the assumption that the new data referred to in (i) above will be available for use in the near future. In other words, where data are already available on a regional basis for a short period (as examined in the previous section), a sufficiently long time-series will be shortly available for use in modelling. The term “sufficiently long” is used informally to indicate (approximately) the period 1995-2002.

In the rest of this section we address the modelling implications of the type (ii) data difficulties. In Section 5.2 we summarise the main problems that exist under this heading. In Section 5.3 we address the implications for the types of regional HERMIN-type models that can be constructed using available data, and we outline a proposal for the structure of a regional model that is likely to make best use of the available data.

5.2 Reviewing data availability for regional modelling

The desirable set of data for regional modelling using a HERMIN-type framework was set out in Section 3. Broadly speaking, a full HERMIN regional framework seeks to model regional GDP in terms of three measures: output, expenditure and income. The output side is initially disaggregated into four main sectors: manufacturing, market services, agriculture and public (or non-market) services. The disaggregation of the expenditure side is into the four standard categories: private consumption, public consumption, investment and the net trade surplus (exports less imports). Unlike the production side of GDP – where fairly detailed data are available – the expenditure side has some serious gaps, which we examine below.

31 Further disaggregation of the output side will be possible. For example, it will be possible to extract building and construction activities from market services. In addition, it will be possible to consider the further disaggregation of manufacturing, perhaps along the lines of the disaggregated national HERMIN model (Zaleski et al, 2004b).

32 We discount the possibility of having access to data on inventory changes. But since our focus is on the medium-term evolution of the regional and national economies, this is not a serious deficiency. The stock accumulation/decumulation cycle is more important in short-term analysis.
Finally, to treat the income side of GDP requires data of wage income and on public sector revenue and expenditure, most of which are available in the present Polish regional data publications.

5.2.1 The output side data

Here we are interested in more than output data. In the regional model we wish to model the behaviour of firms as the produce output in a process that uses two inputs: labour and fixed capital.

It will be seen from Table 4.2 in the previous section that it is possible to disaggregate gross value added in current prices on an output basis in terms of the four “standard” HERMIN sectors. However, regional price deflators are not available. The simplest assumption would be to use the corresponding national output deflators as applying to all regions. This assumption is not completely satisfactory, for the following reason. The composition of the subsectors within each of the four main HERMIN sectors is very likely to differ from region to region. If we had the regional disaggregation of (say) the subsectors of manufacturing (in current prices), we would be able to re-weight the national deflators to reflect the specific manufacturing structure of each region. But we do not have this level of regional sub-sector disaggregation. Hence, we are obliged to use the national deflators without any regional re-weighting. What this means is that we can derive an estimate of gross value added on a regional basis in constant prices. But it is not possible to investigate if there are regional price differentials. However, this is more an apparent than a real problem, since it is very likely that regional prices are fairly homogeneous, and that for sectors that are exposed to “external” competition, producers in regions are more likely to be price takers than producers in the nation taken as an aggregate. Hence, regional profitability differentials are more likely to derive from cost differentials, and wage costs in particular.

Data on sectoral employment numbers by region are also available. In addition, there is much information on the “quality” of the regional labour force, although we will not make use of these data until a later stage of the regional modelling project. However, it is more difficult to derive regional wage rates (or, more accurately, average annual earnings) by sector. In Table 4.2 we saw that “personal wages and salaries” data were not officially published, but could be made available by the CSO. Combining these data and the employment data permits us to derive an approximate measure of sectoral “average annual earnings” by region.

As an example, consider the manufacturing personal wages and salary bill for region “r”, defined as YWT_r, (see Table 4.2) Suppose we denote total employment in manufacturing for region “r” as LT_r. Then we can calculate average annual earnings as follows:

$$W_{Tr} = \frac{YWT_r}{LT_r}$$

Ideally we would like total employment separated into employees and the self-employed, particularly in the market services and agricultural sectors. But this is not essential in the basic version of the regional model.

The second factor input – investment and the associated stock of fixed capital – is available for the national model, but is not published for the regions. However, the Central Statistical

33 For example, when we come to analyse regionalised Structural Fund programmes, it will be necessary to have measures of the level of human capital embodied in the regional labour force.
Office have indicated that they will be in a position to supply the investment data, by broad sector and by voivodship. But once again, it is not possible to have regionally differentiated investment deflators. Here, we also make use of the national deflators, and make the assumption that there are no regional price differentials.

With the above assumptions concerning present or future regional data availability, it will be possible to model the supply side of the Polish regional economies at roughly the same level of detail as in the basic (four-sector) national HERMIN model. But the only “price” that we will be able to model on a regionally differentiated way is the “price” of labour, i.e., the wage rate, WT, mentioned above. All other prices (i.e., output and investment deflators, as well as the user cost of capital) will be taken to behave exactly as their national aggregates.

5.2.2 The expenditure side data

Two of the four regional expenditure variables are available in the published or unpublished data: i.e., expenditure on public consumption (GV_r) and sectoral fixed investment expenditures (IT_r, IN_r, IA_r, and IG_r). In the case of investment expenditure, these are likely to be reasonably compatible with the national aggregate (in the sense that the sixteen regional values will add up to the national aggregate). But public expenditure on goods and services (GV_r) will have to be derived on a regional Finance Accounting basis, and the aggregate of the regional values are unlikely to be fully compatible with the ESA 95 national aggregate, GV.

The most serious problem on the regional expenditure side is the absence of official data on regional household (or private) consumption (CONSV_r). Various suggestions are made in Section 4.3.1 (such as using regional data on retail sales or using annualised values of regional average monthly household on consumer goods and services). Once again, the data conventions at the regional level are unlikely to be compatible with the national accounting conventions used for the National Accounts.

This problem is more serious, because at the regional level we do not have trade data (i.e., regional “imports” and “exports”, and will be forced to derive the regional net trade surplus (NTSV_r) as a residual:

\[ NTSV_r = GDPMV_r - (CONSV_r + GV_r + IV_r) \]

where GDPMV is total regional GDP. To the extent that there are errors in the measure of regional private consumption (CONSV_r), there will be offsetting errors in the net trade surplus (NTSV_r).

5.2.3 The income side data

(a) Public sector expenditure

With a view to its future use for policy analysis, the regional HERMIN models will need to include a conventional degree of institutional detail in the public sector. Within total public expenditure, we need to distinguish the following data categories:

i. public consumption (mainly wages of public sector employees, plus expenditure on non-wage goods and services);
ii. transfers (unemployment income support, other social welfare transfers, interest on borrowing by the regional authorities);

iii. subsidies paid to firms;

iv. capital expenditure (public housing, infrastructure, investment grants to industry).

From Section 4.4, we see that all these data items are available, but only for the years 1999-2002. We note that the voivodships were formally established in the year 1999. However, it may be possible to have data from the earlier years aggregated so as to give an approximation to the pre-199 ‘virtual’ voivodship regions.

We also note that public sector expenditure data are available at the gmina, powiat and voivodship regional systems of governance. For the purpose of modelling at the voivodship level, all lower level data will be aggregated.

(b) Public sector revenue

From Section 4.4, it is seen that the data on public sector revenue are also only available from 1999. Once again, it may be possible to aggregate the earlier pre-1999 data to the "virtual" voivodship level.

(c) The regional income identities

The regional income-output identity will used in HERMIN to derive regional corporate profits. In the actual model, there are various data refinements, but the identity is essentially of the form:

\[ Y_{Cr} = GDPFCV_r - Y_{Wr} \]

where \( Y_{Cr} \) represents profits, \( GDPFCV_r \) is regional GDP at factor cost, and \( Y_{Wr} \) is the wage bill for the entire regional economy.\(^{34}\) Income of the regional private sector \((Y_{Pr})\) is determined in a relationship of form:

\[ Y_{Pr} = GDPFCV_r + GTR_r \]

where \( GTR_r \) is total regional public sector transfers to the private sector. Regional income of the household (or personal) sector \((Y_{PER_r})\) is defined essentially as:

\[ Y_{PER_r} = Y_{Pr} - Y_{CU_r} \]

where \( Y_{CU_r} \) is the element of total regional profits \((Y_C)\) that is retained within the regional corporate sector for reinvestment, as distinct from being distributed to households as dividends. Finally, regional personal disposable income \((Y_{PERD_r})\) is defined as

\[ Y_{PERD_r} = Y_{PER_r} - GTY_r \]

\(^{34}\) The distinction between GDP at factor cost \((GDPFCV)\) and GDP at current market prices \((GDPMV)\) is made clearly at the national level, but not at the regional level. But it will be possible to derive data on net indirect taxes at the regional level, so that the conversion from factor cost to market prices will be possible.
where \( GTY_r \) represents total direct taxes paid within the region (income and employee social contributions) by the household sector. It is the constant price version of \( YPERD_t \) (i.e., \( YPERD_r = YPERD_t / PCONS_r \)) which drives regional private consumption in the simple Keynesian consumption function:

\[
CONS_t = a_1 + a_2 YPERD_t
\]

5.3 Regional modelling: the way forward

We examined above the basic issue of data availability, and highlighted that the main difficulties lie in the expenditure side of the economy. Even if some crude approximations have to be made, it is very desirable to be able to examine the status and evolution of a regional economy using output, expenditure and income frameworks.

A further set of modelling and data challenges emerge when one considers how the regional economy relates to the other regional economies, the national economy, and the international economy. If one were modelling a single region of a nation state, and if that region was fairly small (i.e., its GDP was a small fraction of the total), then one could regard the region being modelled as being post-recursive to the rest of the (non-regional) world (i.e., nothing that happens inside the region is likely to have any effect on the rest of the nation, or the rest of the world).\(^{35}\)

But the challenge to be faced in modelling all 16 Polish voivodships is more serious. The totals for the voivodships needs to add up to the national total (e.g., for employment, investment, consumption, etc.). There are various ways in which this issue can be addressed.

One could model at the national level, using the national Polish HERMIN model, and treat the regions as being ‘shares’ of the national totals. Here the focus would be on having models of the regional shares that were sensitive to regional endowments, and to regional competitive advantages and disadvantages. For example, activity in the agriculture sector could be allocated by taking the initial size of regional activity into account. In manufacturing, the regional shares might reflect the state of regional infrastructure, human capital, as well as the initial state of the regional manufacturing sector.

It may be better to treat each region as a separate part of the national economy, and to model the regional economy as an economy with its own characteristics. The challenge is now two-fold:

i. To model the internal characteristics of each voivodship ‘as if’ it were a separate economy, and to construct a regionalised version of the national HERMIN model, with explicit modelling of the output, expenditure and income sides;

ii. To model the inter-relationships between each individual voivodship and its ‘external’ world. The external world can be modelled to any degree of complexity, but can initially be taken as the rest of the nation, as well as the rest of the non-Polish world.

\(^{35}\) See GEFRA, 2004 for an example of a HERMIN-type model of the German region of Sachsen-Anhalt. Bradley et al, 2004 is also an example of the Italian Mezzogiorno treated as being post-recursive to the rest of the Italian nation state.
The following are the most important areas of the model where the regional-national, as well as the regional-international channels must be studied carefully.

5.3.1 The determination of regional manufacturing output ($OT_r$).

The Polish national HERMIN model uses a hybrid supply-demand equation for manufacturing output of the form:

$$\log(OT) = a_1 + a_2 \log(OW) + a_3 \log(ULCT / POT) + a_4 \log(FDOT) + a_5 \log(POT / PWORLD) + a_6 t$$

where $OW$ represents the important external (or world) demand, and $FDOT$ represents the influence of domestic (or regional) absorption. We expect $OT$ to be negatively influenced by real unit labour costs ($ULCT/POT$) and the relative price of domestic versus external goods ($POT/PWORLD$).

A possible format for the regional manufacturing output equation would be as follows:

$$\log(OT_r) = b_1 + b_2 \log(OT) + b_3 \log(FDOT_r) + b_4 \log(ULCT_r/ULCT) + b_5 t$$

Here, regional output ($OT_r$) is driven by national output ($OT$), internal regional absorption ($FDOT_r$) and the relative cost competitiveness of region “r” with respect to the nation, as measured by unit labour costs ($ULCT$). We recall that relative prices can play no role, since the regional and national prices are identical. Also, the term $FDOT$ is constructed using the national input-output table, and reflects how much of any unit increase in regional absorption is actually produced within the region, and how much is imported from outside the region.

5.3.2 Regional wage determination ($WT_r$)

The simplest possible assumption would be that sectoral wage inflation in the manufacturing (or exposed) sector in each region reflects the national sectoral wage inflation. In other words:

$$WTDOTr = WTDOT$$

where $WTDOTr$ is the regional wage inflation rate in manufacturing, and $WTDOT$ is the national wage inflation rate. And we can invoke the Scandinavian model to justify the assumptions:

$$WNDOT = WTDOT + \text{stochastic error}$$
$$WADOT = WTDOT + \text{stochastic error}$$
$$WGDOT = WTDOT + \text{stochastic error}$$

where $WTDOT$, $WNDOT$, $WADOT$ and $WGDOT$ are the wage inflation rates in manufacturing, market services, agriculture and non-market services, respectively. What these equations assert is that wage inflation within the region will tend to be fairly uniform between all four sectors, but that wage levels may continue to differ. Obviously these assertions have to be tested empirically, but have been reasonably supported at the national level (Zaleski et al, 2004a).
It may be the case that wage bargaining institutions operate at a regional level. In that case, it will be necessary to model the manufacturing wage rate more closely. As indicated in Section 2 above, formalised theory of wage bargaining points to four paramount explanatory variables (Layard, Nickell and Jackman (LNJ), 1990):

e) Output prices:

f) The tax wedge:

g) The rate of unemployment:

h) Labour productivity:

At the regional level, a simple log-linear formulation of the LNJ-type wage equation might take the following form:

$$\log(WT_r) = a_1 + a_2 \log(PO_T) + a_3 \log(WEDGE_r) + a_4 \log(LPRT_r) + a_5 UR_r$$

where $WT_r$ represents the wage rate, $PO_T$ the price of manufactured goods, $WEDGE_r$ the tax “wedge”, $LPRT_r$ labour productivity and $UR_r$ the rate of unemployment. In some cases, one might substitute the consumption price ($PCONS_r$) for the GDP deflator ($PO_T$). The actual selection of the wage equation formulation will have to await the data availability.

5.3.3 Regional labour supply ($LF_r$)

This is the third and final mechanism where regional economies are likely to differ from each other. If the regional labour markets were ‘closed’, i.e., if there was no interregional or international migration, then the regional labour supply ($LF_r$) would be determined as follows:

$$LF_r = LFPR_r \times NWORK_r$$

where $LFPR_r$ is the labour force participation rate (i.e., the fraction of the working age population ($NWORK$) that plays an active role in the labour market. The participation rate, in turn, can be modelled as a time trend, or as a function of the state of the regional labour market.

But regional labour markets tend to be open, so we need to reflect this in an equation determining the working agepopulation:

$$\Delta NWORK_r = a_1 NWORK_{-1r} + a_2 \, RE_r$$

where $RE_r$ attempt to capture the relative attractiveness of the regional labour market.

Net migration flows can be modelled using a standard Harris-Todaro approach that drives migration by the relative attractiveness of the local (or national) and international labour markets, where the latter can be proxied by an appropriate destination of migrants. The

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36 Recall that all regional prices are identical to their national counterpart.

37 Attractiveness can be measured in terms of the relative expected wage, i.e., the product of the probability of being employed by the average wage in each region (Harris and Todaro, 1970)
alternative labour market could be taken as Germany in the case of Poland for the national model, but other Polish regions are likely to be important alternative labour markets in the case of a Polish regional model. The present Polish national HERMIN model does not yet include an international migration mechanism. However, inter-regional migration is likely to be considerably more important in the case of regional models, and these mechanisms will have to be included.

Finally, the labour force participation rate (i.e., LFPR, or the fraction of the working-age population (NWORK) that participates in the labour force (LF)), can be modelled as a function of the unemployment rate (UR) and a time trend that is designed to capture slowly changing socio-economic and demographic conditions.

\[
(2.10) \quad LFPR = a_1 + a_2 \text{ UR} + a_3 \text{ t}
\]

For example, in some of the Polish regions the unemployment rate is considerably higher than in others.\(^{38}\) The rate of unemployment tends to influence the rate of participation in the labour force (i.e., the willingness to engage in an active search for work), through “discouraged” and “encouraged” worker effects. A decision to migrate from one region to another can be looked on as a decision to “participate” in an alternative labour market.

\(^{38}\) For example, in the Warminsko-mazurskie voivodship, the registered unemployment rate in the year 2001 was 28.9 per cent. The lowest rate was 13.0 per cent, in the Mazowieckie voivodship.
6.1. Economic potential and development processes in Polish voivodships

The analysis of development processes in Poland at the level of the new voivodships has been carried out in a methodologically uniform way since 1995. Given the time lag in collection and publication, the most recent statistical data on GDP generation come from 2001. Data published for particular years are usually revised in the following year by the Central Statistical Office (GUS), a fact that suggests their limited use for policy analysis. However, the analysis made of the 1995 and 2001 data confirms that regional gaps have been systematically increasing in Poland over the last years.

Economic cohesion (in the EU context) is primarily being attained by the Mazowieckie region and the voivodships associated with urban agglomerations (Table 6.1). In the years 1995-2001, the rate of GDP per capita growth in all NUTS 2-type regions of the old and new EU member states was the highest in the Mazowieckie region. The Opolskie Voivodship, in which the GDP growth rate was close to the EU average, was at the other end of the scale. The situation of the voivodships in eastern Poland is improving to a very small degree and much more slowly than in other regions. The Śląskie and Opolskie Voivodships have the lowest GDP growth rates. The implication of this is that the structure of allocation of the European funds must be tailored to the peculiarities of a given region. An allocation and development model which is effective in the richest, highly urbanized, fast developing regions, will not necessarily prove to be effective in rural, poorly urbanized or peripheral regions.

Table 6.1: GDP per capita in Poland (UE 15 =100)

<table>
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<tr>
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<td>7.8</td>
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<tr>
<td>Poland</td>
<td>39.4</td>
<td>40.9</td>
<td>6.3</td>
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Another important observation concerns the economic potential of the Polish regions. Regions are highly diversified, as much as 9 to 1, when the Mazowieckie and Opolskie regions are compared. The economic potential of the Mazowieckie region itself is close to that of Cyprus, Estonia, Lithuania, Latvia and Malta taken together, or that of Slovakia. The economic potential of three average Polish regions is greater than that of Estonia, Lithuania and Latvia taken together. In each of these states, the macroeconomic HERMIN models have been prepared for the years 2004-2006. The magnitude of the economic potential of the Polish voivodships means that the need to regionalize the Polish HERMIN model is an urgent priority.

The assessment of social cohesion processes is currently made in the European Union by means of two measures: the unemployment rate and the employment rate (for persons aged 15-64 as a percentage of the population representing the age group). Reservations about the unemployment rate measure result from the differences in methodology of assessment of unemployment in particular member states.

Among the 25 member states of the European Union, Poland stands out as having both the highest unemployment rate and the lowest employment rate (Table 6.2). Regional differences in Poland are also huge: in the case of the unemployment rate, from 16.2 per cent in the Małopolska region to 26.3 per cent in Lubuskie Voivodship; in the case of the employment rate, from 57.1 per cent in Mazowieckie Voivodship to 45.8 per cent in Zachodniopomorskie Voivodship. However, even these Polish regions, which are in the most favourable situation in terms of the labour market, differ significantly, to their disadvantage, from the average level in the European Union. Therefore, the assessment of the impacts of the European funds on the situation on the regional labour markets, made by means of a regionalized HERMIN model, is of crucial significance.

Table 6.2: Employment and unemployment rate by voivodship in 2002

<table>
<thead>
<tr>
<th>voivodship</th>
<th>Unemployment rate</th>
<th>Employment rate</th>
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<td>16.6</td>
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<td>Pomorskie</td>
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<td>Poland</td>
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<tr>
<td>EU 25</td>
<td>9.0</td>
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</tr>
</tbody>
</table>

6.2 European Union cohesion policy in the period 2007-2013

A discussion on the new cohesion policy was undertaken much earlier than it had taken place in the case of the previous programming periods. In the second EU Cohesion Report, published in 2001, nine questions were asked regarding the future cohesion policy of the European Union after 2006. As a result of a broad-based discussion in which, among others, the governments of the member states, regions, local governments, social partners, the professional and academic community, participated, the first comprehensive proposal was put forward by the European Commission in February 2004. In July 2004 new draft regulations on the funds were presented.

The proposals contained in the above-mentioned documents define the framework for the European cohesion policy in the next programming period relating to the period 2007-2013. The experience hitherto shows that the modifications in the original proposals of the European Union were at the most cosmetic. Therefore, the current set of documents should be treated as the most likely basis for the future cohesion policy of the Community.

The most important reasons arising from these documents, which justify the construction of the regionalized HERMIN model in Poland, are the following:

i. A very strong lobby seeking to limit the scale of the European cohesion policy has emerged in the European Union. One of the arguments is the allegedly low effectiveness of this policy. Consequently, Poland’s experience, as the largest beneficiary of the Structural Funds and the Cohesion Fund, is being closely watched. Thus, the need to document the effectiveness of this policy at the level of state and region beneficiaries, making use of state-of-the-art analytic techniques, is becoming increasingly necessary and important.

ii. The character of the European cohesion policy is changing. Hitherto, it has been focused to a large extent on the implementation of different equalisation functions. This policy is currently linked to the so-called Lisbon Agenda and orientated towards the building of a knowledge-based society, competitive and learning regions. This situation makes it necessary to seek such a structure of expenditure from the Structural Funds, both sector-based and regional-based, so as to achieve their optimal composition. The macromodel work carried out at the regional level should further this goal, since even in regions with the lowest level of development, projects which guarantee a high effectiveness should be selected,

iii. The European Union has decided that the next EU-wide programming period will be a seven-year period (2007-13), as was the previous one (2000-06). Hence, Poland will be able to implement structural policy based on the European funds within a seven-year time horizon. This is a challenge which is basically different from the programming of funds in the period 2004-2006 - which covered barely two years and eight months. A long time horizon of the EU Structural Funds favours the regionalization of model-based analysis.

In the course of the existing discussion on the European Union budget in the years 2007-2013, there has been a very significant divergence of views between the European Commission and state beneficiaries of the funds, on the one part, and net payers to the Community budget, on the other part. In connection with the European Union’s enlargement, some net donors wish
that the cohesion policy budget of the Community be cut down. It is thought that, irrespective of the outcome of this discussion, the scale of the European funds potentially available to Poland will approximate equal to the applicable ceiling of the average annual transfers amounting to 4 per cent of the state beneficiary’s GDP. It means that in the years 2007-2013 Poland may count on approximately €9 billion in 2004 prices on an average annual basis (in 2007 about €8 billion, in 2013 about €10 billion).

An important modification proposed by the EU is to exclude the financing of fisheries from the cohesion policy and to implement all measures supporting the development of agriculture and rural areas under the Common Agricultural Policy (CAP), and not, as hitherto, partly under the CAP, and partly under the cohesion policy. However, the EU proposes to change the method of calculation of this ceiling, as it is to be related not only to the new cohesion policy, but also to all expenditure allocated for development measures in the sphere of agriculture and rural areas, as well as fisheries. Given the substantial scale of development measures necessary in agriculture, which are financed from the European funds under the new Agriculture Development Fund, it reduces the ceiling of average annual transfers under the new cohesion policy to about 3.2 per cent of Poland’s GDP.

Thus, the scale of the EU funds available to Poland under the structural funds and the Cohesion Fund in the period 2007-2013 should be close to €54 billion in 2004 prices, which is worth comparing to the amount of €12.8 billion in 2004 prices which is available under the structural funds and the Cohesion Fund for the years 2004-2006.

Given huge backlogs in the work on transport and environmental infrastructure existing in the new member states, it is anticipated that about one third of the cohesion policy funds will be released in those countries under the Cohesion Fund. The resources from the structural funds should be released in similar proportions under sectoral and regional operational programmes. Of course, the allocation to these two types of programmes will also result from the structure of the proposed priorities and measures; some should be financed under the regional segment, others under sectoral arrangements. Therefore, it can be only roughly assumed that in the regional segment of about €18 billion of the structural funds (in 2004 prices) will be released in the years 2007-2013, i.e., it will be about €1,125 million for each Polish statistical voivodship. The level of co-financing of the structural funds with public funds will also remain on the level of 25 per cent in the new programming period, increasing the scale of development measures undertaken in the voivodships accordingly.

In the years 2007-2013, Poland will be the largest beneficiary of the structural funds and the Cohesion Fund in the expanded EU. Therefore, the sheer scale of the European funds available in this period requires and justifies the development of macroeconomic analyses relating to funds not only at the national level, but also at the regional level.

6.3 Implementation of the EU funds in Poland for the period 2007-2013

On April 30th, 2004, the Council of Ministers adopted a document entitled *Assumptions of the Polish National Development Plan for the years 2007-2013*. In May-July 2004, regional consultation on the NDP assumptions took place, and in September-October 2004, horizontal (strategic and programme) consultation relating to the most important problem areas of the NDP assumptions was held. This document forms a basis for the work programme on the new edition of regional strategies in Poland. It is composed of the following parts:
i. information on the NDP 2004-2006

ii. organization of the work on the NDP 2007-2013

iii. a baseline diagnosis of the socio-economic situation

iv. objectives and priorities of the NDP

v. instruments designed to implement the NDP

The theses for the regional development strategy defining the key objectives in the preparation of the regional development strategy are as follows:

a) the need to enhance economic competitiveness of Polish regions

b) an effective utilisation of the endogenous potential of the voivodships

c) diversity

d) rational land use and environmental resources management

e) equalization of opportunities

These are of special significance for the regional development programming. It is stressed that one document - the *National Strategy of Regional Development* - will form the basis for measures undertaken by the state in the area of regional development.

The legal bases for the regional development programming in Poland, which will be applicable in the years 2007-2013, are not yet fully in place. On the one hand, in June 2004 the *Act on the National Development Plan* came into force, which replaced the *Act on Rules of Regional Development Support*. Its solutions are fully in line with those relating to the EU funds which are in effect in the years 2000-2006, but most probably they will have to be amended due to the modified European framework of the next programming period for the years 2007-2013. On the other hand, the following provision was included in the *Assumptions of the National Development Plan* for the years 2007-2013:

“A new act (law) - on the state regional policy and the development of regions - will form the regulatory framework for actions of the state and local governments in the area of regional development of the country. The conception of a new regulatory framework stems from the conviction about the need to implement coherent and modern methods of creating and implementing the state regional policy and stable principles of long-term development of regions, understood more widely than voivodships (these are functionally and spatially based areas composed of several voivodships – ‘macro regions’). The new act on the regional policy and the development of regions should address the following problems: it should define (1) what is the area of interest of the state regional policy is; (2) how the state creates its policy and what implementation instruments the state has at its disposal, and which instruments always require the interaction of the state and local governments of the voivodships; (3) what rules and criteria of regional development support should be followed; (4) what a regional contract is, what mutual obligations and the way of their enforcement are”.
It follows that the regulatory framework for the interregional and intraregional policy will be proposed by the Government in the near future, and if this does not take place, the regional development in Poland in the years 2007-2013 will be shaped by the provisional regulatory framework, as before.

The following provision was included in the NDP assumptions document:

“The financing of regional development (...) will be based on external funds support, in the first place, the EU funds, in line with the rules laid down for the next budget period, assuming that voivodships will prepare their own regional development operational programmes (16 programmes)”. p.79.

A more detailed provision was elaborated in the section concerning the development policy instruments for the years 2007-2013:

“It appears that it is necessary to reinforce the regional approach in the work on the programmes for the period 2007-2013, lessening the sectoral approach, and to better link it with spatial planning, multi-annual programmes and the so-called governmental tasks. It also concerns the question of a different approach to the regional development programme, which is now a national-level programme (the Integrated Regional Development Operational Programme), and for the next programming period, it is the voivodships which should independently formulate operational programmes maximally adapted to regional conditions. It is also necessary to define a different role of the existing voivodship Contract, to implement the possibility of multi-annual financial planning and to decentralize public finance (the introduction of adequate changes in the public finance system)”. (p. 94)

Those provisions unequivocally point out that, in keeping with the Government’s intention, the implementation of the structural funds in the regional segment will be carried out in the years 2007-2013 through sixteen voivodship-based operational programmes.

In the NDP assumptions, it is indicated that the focus in the regional development strategy should be on the development of rural areas. In this respect, priorities should be the following:

i. the economic development enhancing the attractiveness of rural areas for residents and entrepreneurs

ii. to strengthen economically sustainable development of the agricultural sector, simultaneously maintaining the natural environment balance

iii. to boost competitiveness of the agricultural processing sector thanks to the improvement of agricultural products and to adjust supply to market requirements

In the years 2007-2013, all development measures relating to agriculture and rural areas should be shifted to the Common Agricultural Policy, which means that it is necessary to coordinate on a territorial basis the new cohesion policy and measures relating to the development of agriculture and rural areas.

In the course of the work on the National Development Plan, a number of forecasts for the years 2007-2013 and beyond were prepared, such as: population, migration flows,
macroeconomic conditions, the labour market, social spending, the development of science and technology, the development of the information society, and the energy balance. Another important element is national strategies on regional development, transport development, rural areas development, culture and social integration. The Convergence Strategy for the years 2004-2007 and the document Knowledge-Computerisation-Competitiveness: Poland on the Way to a Knowledge-Based Economy will be utilised in the course of the work. These documents form a programme framework for the new edition of voivodship strategies, and they should be utilized in the process of their preparation. It is of essential significance that only a certain part of measures proposed in the national strategies will be implemented under sectoral operational programmes, and a substantial part of them should be incorporated into regional operational programmes. It requires negotiation on the sectoral and regional arrangements.

In the course of the work on the National Development Plan, an expert report entitled The Conditions for the Introduction of Sixteen Regional Operational Programmes in Poland in the Community Support Programming Period 2007-2013 was prepared by Professor J. Zaleski [Zaleski, 2003]. In this report, the following issues were presented, inter alia:

a) analysis of the current state of preparation for the implementation of the regional policy at the regional level as a baseline for the programming period 2007-2013, and

b) essential conditions for the introduction of 16 regional operational programmes.

This expert report defines actions required on the Polish side upon which the European Commission’s approval of the decentralized model of the implementation of the regional segment of the structural funds is conditional. The recommendations of the report are, first of all, of a systematic nature associated with the legislative regulatory framework, and therefore they are addressed, in the first place, to the Government and to the Parliament. However, an excellent knowledge, at the regional level, of structural solutions which will be in effect in the years 2007-2013 conditions and enables necessary preparatory and adjustment works in particular voivodships.

6.4 Expected effects of the Polish regionalized HERMIN model

As stated before, the scale of resources from the structural funds and the Cohesion Fund potentially available in the years 2007-2013 - close to an equivalent of 4 per cent of Poland’s GDP on an average annual basis - means that the macroeconomic effect of the European Union structural intervention should be even larger than that which resources from the European funds allocated in Poland in the years 2004-2006 are likely to bring. It follows from the Zaleski report why it is necessary to construct the voivodship-based HERMIN model:

i. over the recent years, regional differences have been systematically increasing in Poland, and it is difficult to talk about the convergence of the socio-economic structures, which means that we rather have to do with sixteen regional realities, and not with one unified macroeconomic situation at the Polish national level;

ii. the scale of the European resources available in the years 2007-2013 of close to 4 per cent of Polish GDP means that one can expect a significant impact of the structural funds and the Cohesion Fund on the GDP growth, much larger than in the
previous programming period 2000-2006, and the improvement of the situation on the labour market. The impact of the funds on the situation of particular regions of Poland can be expected to be very strongly diversified, and this will need to be evaluated, of course;

iii. the provisions contained in the assumptions of the National Development Plan for the years 2007-2013 confirm the intention to implement a larger part of the European funds than hitherto in the regional segment and to adopt a decentralised model of their implementation by means of sixteen regional operational programmes. This means that local government authorities of each of the Polish voivodships will have allocations at their disposal approximate to the resources of each of the Baltic states.

The construction of the voivodship-based HERMIN model will require the solution of a number of problems which, if not addressed effectively, may lower the general quality of analysis and conclusions. The following are some of these problems:

i. very short statistical data time series for the new voivodships. The change in Poland’s administrative division, which took effect in January 1999, has caused a break of the continuity of statistical data on the voivodship level. Although the Central Statistical Office (GUS) has recalculated data pertaining to the old division for the years 1995-1998, but there is no guarantee of comparability for the previous sets of statistical data;

ii. the absence of many necessary statistical data compiled in a voivodship-based breakdown. As a result of the low level of the closure of socio-economic structures of the voivodships, a number of data cannot be compiled on such a territorial basis. A lot of necessary information is only estimates (the voivodship structure of foreign trade can be an example of that), but objections are raised with regard to their full credibility and comparability;

iii. a very wide extent of the grey economy, what lowers the quality of conclusion based on the official sets of statistical information. Estimates on the global extent of the grey economy in Poland, from the point of view of job creation and GDP, are quite credible. However, from the point of view of regional research, a significant differentiation between the voivodships, due to the scale of the parallel economy, is essential,

iv. the shift in the new programming period of the whole intervention relating to the development of agriculture and rural areas to the Common Agricultural Policy. This means, on the one hand, that the ceiling of 4 per cent is calculated based the new cohesion policy and the new Agriculture Development Fund. On the other hand, given the scale of expenditure and the significance of agriculture and rural areas in Poland, it is also necessary to take into account the impact of this fund on basic macroeconomic indicators in Poland and in particular regions,

v. the financing of the development of particular voivodships under three different segments: the regional operational programme, the Cohesion Fund projects implemented in the voivodship, and projects implemented in the region under sectoral operational programmes. Only the first segment is precisely defined, the other require regional estimation,
vi. system distortions of statistical data relating to certain Polish regions. The two most serious ones concern, first of all, Mazowieckie Voivodship, owing to the fact that a number of business activities are included in the statistics for this voivodships, because a given company has its registered office in Warsaw, but its activities are actually conducted in different parts of Poland, and due to the fact that many persons who formally reside somewhere else are associated with Warsaw’s economy; it also concerns Opolskie Voivodship where a lot of citizens are dual passport holders, what leads to a distortion of levels of many regional statistical data;

vii. very strong differences within Polish voivodships. This is confirmed by statistical information complied by the Central Statistical Office broken down into NUTS 3-type regions. These gaps are incomparably larger than those recorded under the NUTS 2 classification. This is a problem which cannot be solved by the voivodship-based version of the HERMIN model, however, it requires certain methodological reservations to be made. At the same time, analyses designed to assess the socio-economic situation with a breakdown into poviats (counties) and gminas (municipalities) should be developed 40.

The methodology of constructing voivodship-based editions of the HERMIN model is such a complex matter that the construction of sixteen models should be preceded by a pilot phase during which solutions for 3-4 selected voivodships will need to be tested. The selection of voivodships taking part in the pilot project should take into account the following matters, among others:

i. the level of the socio-economic development of the region,

ii. its size, the character of the voivodship (voivodships associated with large urban agglomerations and less urbanised ones) and

iii. the geographic location.

Two voivodships - Mazowieckie and Opolskie Voivodships - should be excluded from the pilot project on account of their socio-economic peculiarities.

The expected effects of the HERMIN model disaggregated into voivodships are as follows:

i. the possibility to determine what impact the structure of the structural funds expenditure in a voivodship will have on the GDP growth and a fall in the unemployment rate in particular voivodships,

ii. the possibility to determine on-line effects of changes in the structure of allocation of the structural funds in the region, in order to seek a structure of allocation of the European funds which is optimal for the economic growth and the situation on the labour market,

40 A workshop example of such analysis, which is worth disseminating, can be a study carried out for Zachodniopomorskie Voivodship Czyszkiwicz R., Molenowicz M., Tałasiewicz M., (2004), Regionalne drogi rozwoju. [Regional Development Paths] Roczniki Samorządowe województwa zachodniopomorskiego 1997-2002, Oficyna In Plus, Szczecin.
iii. the possibility to identify more precisely barriers to the socio-economic development of particular voivodships and the possibility to utilise the European funds in order to overcome them,

iv. the possibility to define an optimal structure of regional allocation of the structural funds resources in Poland in the next programming period.

Thus, the regional HERMIN model will be an essential support instrument for the funds programming for local government authorities in particular voivodships. Such a model can also be of essential significance for the national-level programming of the intraregional policy, thanks to the possibility of better adjustment of the state policy towards regions to their socio-economic characteristics.

6.5 Conclusion

An essential policy question which must be addressed concerns the durability of effects attained due to the intervention of the Structural Funds and the Cohesion Fund. The situation after 2013 depends, among other things, on the importance and budget of the future cohesion policy. If the provision on economic, social and territorial cohesion is incorporated into the European Constitution, it means that it will be one of the essential areas of financing by the Community. The important thing is whether the measures related to the construction of a knowledge-based society, which would allow the European Union to become the most competitive global economy, will be carried out under the cohesion policy, or under internal policies. The other solution means that the cohesion policy would sooner or later become an ethnographic park of the traditional equalisation policy for the poorest.

The decision on what the next programming periods will look like will be an essential one. In accordance with the provisions of the draft European constitution, this period will be not shorter than five years. A clear tendency is to bring the next programming periods after 2013 in line with the term of office of the European Parliament, the European Commission and other most important European institutions, i.e., five years. Further enlargements of the European Union will have an essential impact on the cohesion policy. The accession of Turkey itself means that that in the European Union there will be 65 million of new citizens with the GDP level amounting to about one half of the Polish level. The level of development of the Balkans countries is also relatively low. It means that, as a result of the expansion of the European Union, Polish regions will be subjected to a strong so-called statistical effect which produces an automatic GDP growth relative to the average of the entire EU. It may deprive Poland’s several richest regions of structural funds support as Objective 1 areas after 2013.

It is also essential to document effects of the utilisation of the Community funds in Poland and its regions in the periods 2004-2006 and 2007-2013. The absence of macroeconomic effects of adequate scale may result in the curtailment of the amount of the European funds available to Poland for the next years. Since Poland’s richest regions will inevitably lose their status of Objective 1 areas after 2013 (Mazowieckie will be the first to lose it), it is even more necessary to extend the HERMIN model analysis to the regional level.
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