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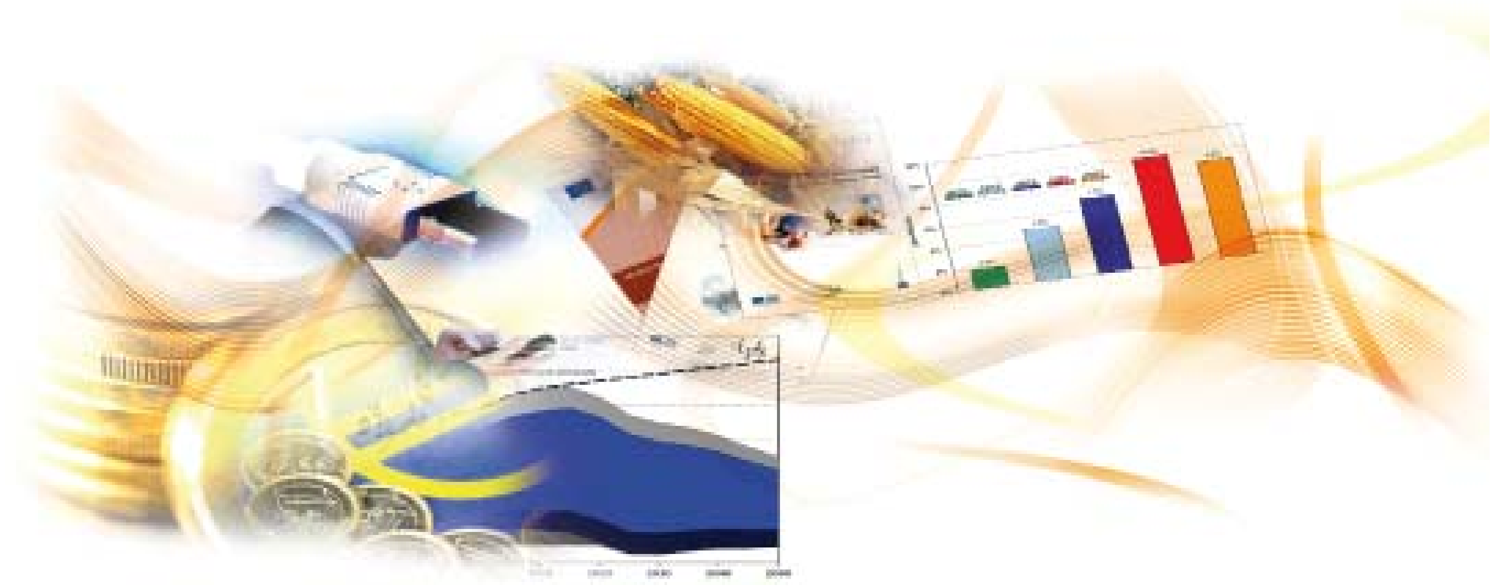

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THE RURAL-URBAN SPILLOVERS OF EU STRUCTURAL POLICIES IN CORDOBA, SPAIN

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Disclaimer

The views expressed are purely those of the authors and may not in any circumstances be regarded as stating an official position of the European Commission or the Universidad Pablo de Olavide.

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1. Introduction

While the link between the funding and the efficiency of public policies has always been a concern to policy-makers, the issue has become even more acute because of recent debt crises in European Union countries. In particular, facing strong budget pressures, the largest public policies in the European Union budget, i.e. Common Agricultural Policy (CAP) and Regional Policy, have been under increased scrutiny. While the former originally deals with European agriculture and rural areas and the latter with economic growth and convergence between EU regions, both policies also share a common objective of territorial cohesion (or balanced regional development), but operate through different intervention schemes: respectively, rural development funds (i.e. CAP Pillar 2), and structural and cohesion funds. This common objective has been introduced through the Lisbon Treaty, which states that the EU should promote not only economic and social cohesion but also territorial cohesion, i.e. a more balanced development of economic activity across all of its regions, inclusive of urban and rural areas.

Theoretical considerations with respect to the origins of rural economic growth are at the core of the debate about territorial cohesion in the EU and discussions about the future of rural development and regional policies. Arguably, regional policies implicitly tend to consider that rural areas in the EU are secondary and that they should support regional growth from an urban-dominated perspective (COPUS et al., 2011a). Theoretically, this policy rationale may be justified if the linkages between urban and rural areas are strong (HENRY et al., 1997). Otherwise, when the linkages are weak, a more targeted development policy may be needed for rural areas to ensure balanced regional development (ROBERTS, 2000). Recent EU policy documents corroborate the view that urban growth drives rural areas due to strong linkages between rural and urban areas (COPUS et al., 2011b), suggesting that regional policies should be focusing on urban development rather than rural development.

Yet, there is a lack of research and evidence-base to validate such policy conclusions. The sparse economic literature relative to this issue provides some answers through the evaluation of rural-urban spillovers. In an application to the Scottish region of Grampian, ROBERTS (2000) finds that spillover effects from urban to rural are stronger than vice-versa. In a somewhat related application to Greece, PSALTOPOULOS *et al.* (2006) find that most of the spillovers induced by farm policies implemented in the rural region of Archanes benefit more to the nearest urban region of Heraklion rather than to the neighboring rural region (Nikos Kazantzakis). However, these studies have used Social Accounting Matrix[1] (SAM) models, which ignore the existence of price adjustments and crowding out effects, while those can be particularly important in the case of public policies financed by EU funds (IN 'T VELD, 2009). SAM models are typically based on strong restrictive behavioral assumptions[2] and often produce upwards-biased estimates of the magnitude of impacts (MCGREGOR et al., 1996; KILKENNY, 2008). Given the systematic overestimation of impacts by SAM models, Computable General Equilibrium (CGE) models are theoretically sounder for an impact analysis where productive capacity is affected (SEUNG et al., 1997) and have already been used for the assessment of EU policies (e.g. LIMA AND CARDENETE, 2008).

The aim of this report is to evaluate the nature and size of these linkages in the province of Cordoba (Spain) in order to contribute to the debate on regional and rural development policies and their efficiency to meet the objective of balanced development. We use a CGE model to evaluate spillovers between rural and urban areas in the province of Cordoba, Spain. Our methodology is dynamic which allows us to examine the impacts of structural policies (specifically directed towards urban or rural areas) over time because a transitory policy shock may have effects which last over several years. Similarly to ROBERTS (2000), due to the bi-regional nature of the SAM, the CGE model allows taking into account the impacts of urban and rural development policies on both urban and rural areas of the region under study. This distinction is important as the impacts may be spatially dependent within a region and may differ significantly from one area to another due to the heterogeneity of territorial economic tissues, which imply area-specific price adjustments, investment patterns and crowding-out effects.

The report is organized as follows. Section 2 presents the urban-rural SAM of the Spanish NUTS-3 region of Cordoba. Section 3 describes the structure of the CGE model. Section 4 explains the policy scenarios, the model calibration and the systematic sensitivity analysis. Results are analyzed in section 5. Section 6 concludes.

[1] Psaltopoulos et al. (2006) use an interregional SAM framework.

[2] These assumptions include the absence of factor substitution in production and commodity substitution in consumption or the fixity of prices.

2. Rural-Urban SAM of Cordoba

The starting point of the exercise is to build an integrated representation of the economy studied into a Social Accounting Matrix (SAM). Such process typically involves some heavy workload related to building and regularly updating SAMs on the base of raw statistical data. This is why, with respect to regional SAMs, work aiming at portraying consistently a large number of different regions relies on the regionalization of SAMs elaborated at a larger scale (PSALTOPOULOS et al., 2011b). Yet, there are few cases where the official regional statistics departments (where existing) have published an official SAM; this is the case of Andalusia (Spanish NUTS-2 region), for the year 2005 (INSTITUTO DE ESTADISTICA DE ANDALUCÍA, 2009).

For the purpose of the study, a SAM has been elaborated for the province of Cordoba (NUTS-3 level) in a series of steps. The first step is the regionalization of the official regional SAM for Andalusia (NUTS-2 level), on the base of complementary official statistics concerning the share of Cordoba in Andalusia in terms of total GDP and of output for determined sectors. Following a Cross-Entropy Method (CEM) (ROBINSON et al., 2001), a balanced SAM for Cordoba is constructed with the same 104 accounts as for the SAM Andalucía, reflecting the same technical coefficients but with a total output equal to approximately 11% of the Andalusia output (with a higher share concerning agriculture, forestry and fishing). The second phase consists in re-aggregating accounts of low interest for our research question and dis-aggregating those accounts of interest, e.g. agricultural activities. The third phase consists in the rural-urban disaggregation of sectors, households and factors of production, performed through the utilization of "superior" official secondary data, e.g. regional and municipal data on population, employment, regional households surveys, collected by the regional statistical office of Andalusia, data on number of firms per municipality specifically for food industry (CAMARA DE COMERCIO DE CORDOBA, 2009). Similarly, Labor Force surveys are used to split labor between skilled and unskilled labor with different features according to sectoral and rural/urban features. The criterion whether a sub-area is rural or urban is derived from JONARD et al. (2009). In the case of this province, this classification grid is simply traduced by the fact that the only municipality with a population density over

150 inhab/km^2 is urban and all the others rural. Therefore, only the LAU-2 area of Cordoba capital is considered as urban while all other municipalities of the province are rural. Finally, the fourth stage involves the application of the cross entropy optimization procedure in order to estimate a balanced SAM for the province of Cordoba.

The accounts included in the SAM are shown in Appendix 1. Each production sector is represented in the rural and urban part of the SAM (even though their significance in each area may be very different), resulting in 36 sectors in total[3]. Twelve different farm accounts are distinguished in the SAM according to farm type, farm size and rural/urban location, using accountancy data from FADN (Farm Accountancy Data Network). Only the two major farm types in the region, i.e. specialist arable crops and specialist permanent crops (mainly olive groves and citrus fruit orchards), are shown separately, with the remaining FADN farm types aggregated into an "Other" category. In terms of other sectors, the main sectors of interest for assessing the impact of rural development are disaggregated: forestry, fishing, food industry, utilities (for renewable energies), tourism (hostelry and restaurants under NACE[4]), trade, transport, private and public services. The 15 commodity accounts in the Cordoba SAM reflect closely the production sectors; they are not disaggregated urban/rural as the assumption of identity of commodities produced by both urban and rural areas seems, arguably, reasonable for a small regional economy (PSALTOPOULOS et al., 2011b). Four factors of production are distinguished – two types of labor (skilled and unskilled), capital and land. Land is defined such that it only includes agricultural and forestry land. Three different household groups are distinguished: Farm households – Households managing farms throughout the province; urban households – other Households resident in Cordoba capital; rural households – other Households not resident in Cordoba capital.

A single government account, single ROW (Rest of the World) account (including rest of Andalusia and rest of Spain) and single Investment-Savings account are distinguished. Such bi-regional SAM allows capturing the regional GDP (Gross Domestic Product) and its spatial distribution between rural and urban sub-areas.

[3] The table also indicates their SIC2003/NACE revision 1.1 classifications.
[4] Classification of Economic Activities in the European Community

3. Bi-regional CGE model

The model used for the analysis is a recursive dynamic CGE model[5], which is solved one period at time. Within each period the basic building block is a static CGE model drawing on the standard IFPRI framework (LOFGREN et al., 2002). Drawing on THURLOW (2008), the static model can be extended by allowing period-to-period updating of key model parameters, either endogenously or exogenously, and then solving the model recursively in each period. In this way it is possible to generate a dynamic time path for model simulations. Furthermore, a number of modifications have been made so that the model is adapted to reflect the nature of the region and to capture the rural and urban areas within this region study.

3.1 Production behavior

Each production activity produces one or more commodities in fixed proportions per unit of activity. Production is modeled as a two-layered structure. At the top level, technology is specified by a constant elasticity of substitution (CES) function of the quantities of value-added and aggregate intermediate input. At the bottom level, each activity uses composite commodities as intermediate inputs, where intermediate demand is determined using fixed Input-Output (I-O) coefficients. Value added is a CES function defined over factors of production, labor, capital (and land where appropriate), which are spatially specific. Profit-maximizing behavior implies a derived demand for the factors of production up to the point where the marginal revenue product of the factor is equal to its price. A key element is that the production activities are spatially disaggregated, i.e. they are explicitly based in either the rural or urban part of the region.

3.2 Commodities

While activities are spatially differentiated, commodities are not, in order to reflect the fact that the market integration of the rural and urban areas in the study region is very

[5] An abridged version of the model can be found in Table A3.

high. Each domestic commodity is produced by one of more activity and where necessary aggregated via a CES function. This is then allocated to either domestic sales or exports via a constant elasticity of transformation (CET) function. Domestic sales of the aggregate commodity are then combined with imports via a CES function to create a composite commodity which is consumed domestically as private, public consumption, intermediate demand and investment demand. The non-linear (dis)-aggregation of output into exports and domestic sales, and domestic sales and imports to composite commodity, is a standard approach in the CGE literature known as the Armington approach. Effectively, it prevents complete specialization so that the model outcomes can reflect the fact that regions may both import and export a broad commodity category. To justify this, we need to assume that there is some imperfect substitutability or that product differentiation exists across import, export and domestic commodity categories, which is not captured by the broad commodity definition (LOFGREN et al., 2002).

3.3 Households, Government and the Rest of the World

Households in the model receive income from factors of production (in proportions determined initially at the base year level), transfers from Government and transfers from the rest of the national economy/world. They pay income tax, save a given proportion of their income and demand commodities. They use their income to pay direct taxes, save (using a fixed marginal propensity) and make transfers to other institutions. Their remaining income is spent on the consumption of marketed commodities. In common with most standard CGE models, this allocation is based on linear expenditure system (LES) demand functions. Like production activities, households are disaggregated according to their farm/rural/urban status.

The Government sector in the model represents the combined function of local and national government in the region. As is typical, government is treated as passive actor, collecting taxes, consuming and making transfers, at exogenously given rates. Hence, the Government collects various types of taxes (direct taxes from households, activity taxes from production sectors, indirect tax on commodities and transfers from the Rest of the World (ROW) and receives transfers from other institutions. It then uses this income to purchase commodities for its consumption and for transfers to other institutions.

Government savings are the residual given by the difference between government income and spending.

The representation of the ROW is assumed to capture both economic relationships with the rest of the national economy and third countries. By aggregating across the rest of the country and rest of the world, the models ignore certain trade relations and balances between the region and other parts of the country; in other words, the model ignores inter-regional feedback effects (including associated effects on labor migration). However, arguably, this is not critical considering the policy issue analyzed in this report, which concerns EU Regional Policies and Rural Development Policies.

3.4 Between-period updating

In the between-period component, a number of the parameters of the within period model are updated endogenously using outcomes of the model solution in the previous period as well as exogenously. As a result, the model is able to generate a path for the regional economy under an alternative policy scenario. The updating of the model parameters between periods draws on the extension of the static IFPRI model undertaken by THURLOW (2008). The systematic exogenous adjustments in parameters such as total or factor-specific productivity or government spending growth (cuts) means the projected base path of the model is able to produce “realistic” trends in key variables in the base path solution. Population and labor supply are exogenous between periods. The approach is simplistic, ignoring intra-regional migration and associated effects on the labor market, but, as with the treatment of the Rest of the World, a more comprehensive treatment was not considered necessary given the focus of the report. Instead, a more sophisticated treatment of population labor market dynamics is left as a possible future improvement to the model. It should be noted that population changes are assumed to change subsistence consumption levels by changing the demand system parameters (i.e. shift the intercept of demand).

In contrast to the other model parameters, capital adjustment for each sector between periods is typically endogenous, with investment in the solution of the model in period *t-1* used to update capital stocks before the model solution in period *t.* Investment in any period is by commodity. As in the Thurlow model, to map this to capital stock in activities we employ the simple assumption that the commodity composition of capital stock is identical across activities. Effectively, the allocation of new capital across activities then uses a partial adjustment mechanism, with those activities where returns are higher than average obtaining a higher than average share of the available capital. This then determines, after accounting for (exogenous) depreciation, for the adjustment in capital stock in each activity. Alternatively, the growth rate of capital stock in a specific sector may be set exogenously. In this case, the amount of investment required for this sector is calculated and then the amount of investment available for endogenous allocation reduced accordingly.

4. Policy simulations

The purpose of the report is to assess the impacts of structural policies (Regional policies and Rural Development programmes), specifically applied either to the urban or rural area of the NUTS3 region of Cordoba with respect to the baseline scenario[6]. This will allow us to evaluate whether urban and rural development programmes, respectively representative of Regional Policy and CAP Pillar 2, can fulfill the objective of balanced regional development. This section briefly reviews the calibration of the model and the implementation of policy scenarios.

4.1 Policy scenarios

We design and simulate two alternative scenarios over the time span 2006-2012. The first one (''URB") is an urban development programme, which could arguably represent a stylized implementation of regional and cohesion policy programmes while the second alternative scenario ("RUR") is a rural intervention, representative of a stylized rural development programme under the CAP. Both policy scenarios are designed exactly in a similar manner so as to ease the comparison of induced effects and area-

[6] Note that the baseline scenario incorporates the CAP Health Check. In 2005 (base year for the SAM construction), the Rural development policy was not yet split clearly in three axes as it is the case during the financial period 2007-2013. However, from data on the implementation in 2007-2011 of the RDP (Rural Development Policy) in Cordoba, the respective distribution between each Axis is as follow: 29% for Axis 1 (focusing on agriculture and forestry sectors competitiveness), 63% for Axis 2 (environmental measures) and 8% for Axis 3 (diversification and quality of life), mainly concerning on-farm diversification and village renewal, i.e. 2.5 millions € per year.

specific spillovers. It is assumed that each policy scenario will affect the same sectors with the same amplitude, but within each corresponding area (urban and rural respectively). Thus, for instance, only rural (urban) activities are directly affected by the implementation of a rural (urban) development programme. In the simulations, policy shocks amount to 0.4% of regional GDP and are only implemented in the first year of the time span i.e. 2006. Doing so allows us to examine the lasting effects of the initial shock. One of the challenges for such modeling and evaluation exercise lies in the fact that authorities do not collect information identifying the destination of structural policies spending by economic activity or sector. A full and detailed mapping of regional, cohesion or rural development funds spent in Cordoba would require an exhaustive survey of all legal entities under which such expenditure are activated as well as all individual projects in order to calculate the extent to which each activity (or sector of the SAM) is concretely affected in total by such funds. Instead, an average reasonable[7] distribution of the shock between a few sectors of the SAM has been assumed, reflecting the presumed impacts of structural policies measures on the economy of Cordoba (Table 1). As there is uncertainty on the extent to which the sectors are affected, we account for this in the policy evaluation by running systematic sensitivity analyses (SSA).

Table 1. Average decomposition of sectors benefitting from urban/rural development policies

	Share of total shock
Tourism	25%
Public services	25%
Construction	20%
Other services	20%
Forestry	10%

Source: Authors' assumptions

[7] The relevance of these assumptions has been discussed with policy analysts and other policy makers of EU rural development programmes.

4.2 Model calibration and closure rules

The CGE model calibration requires the specification of elasticities and closure rules. This parametric calibration aims at reflecting the regional economic structure. Concerning the closure rules, for the current account it is assumed that the real exchange rate is flexible while foreign savings (the current account deficit) is fixed. Given that all other items are fixed in the external balance (transfers between the rest of the world and domestic institutions), the trade balance is also fixed. For the Savings/Investment balance, investment is considered fixed while savings adjust. For the government balance, as in the case of several CGE models on small regional economies, it was assumed that government savings (the difference between current government revenues and current government expenditures) is a flexible residual while all tax rates are fixed. In other words, level of direct and indirect tax rates, as well as real government consumption, are held constant. As such the balance on the government budget is assumed to adjust to ensure that public expenditures equal receipts.

As for the factors closure rules, for capital we assume that it is sector-specific for the agricultural sector (can move between agricultural farm-sectors), while for the non-farm economy, it is mobile between sectors and between the rural and urban parts. In the case of land, it is assumed as mobile between agricultural sub-sectors. Finally, for labor, a segmented labor market by skill level and free movement of labor between the rural and the urban areas are assumed. For skilled and unskilled labor, a neoclassical closure rule was chosen. The choice of closure rules is selected so as to reflect the manner in which the regional economy operates. In this particular case, the choice of government account balance and the external balance was selected mainly due to the size of the region. To some extent the closure rule for savings and investment is driven in part by the focus of the report and the manner in which policy shocks are simulated in the model while, in the case of the capital market, the level of sectoral aggregation in the model made the assumption of capital immobility more suitable than other available alternatives.

4.3 Systematic sensitivity analysis

CGE models suffer from a long-recognized problem in the literature regarding the uncertainty affecting the model elasticities – i.e. the parameters may be known imprecisely – and its corollary, being that the degree to which the elasticities drive the model outcomes can be critical. This is especially true for regional models because there is typically a lack of reliable data at regional level, often obliging researchers to make discretionary choices for the elasticity values. To circumvent this issue, a systematic sensitivity analysis is implemented to ensure that the values chosen for those parameters do not dramatically affect the analysis. A SSA allows taking into account the existence of parametric uncertainty and provides more information on the accuracy of the simulation results. As in other studies, we use a Gaussian Quadrature that approximates the moments of the joint distribution of the parameters using a discrete joint probability distribution evaluated over a finite number of points. We apply the Stroud approach (STROUD, 1957). The variance for each parameter is consistent with the assumption that observed parameter values are drawn from independent uniform distributions with lower and upper bound equal to +/-50 per cent of the mean estimate. For a model with T jointly distributed parameters, there are 2T Stroud points at which the model must be evaluated. In this case, we use production and trade elasticities as well as the share of benefitting sectors (Table 1) for the Stroud analysis and the model is solved 140 times.

5. Results

This report aims at comparing the impacts of EU structural policies programmes, i.e. Regional Policy and Rural Development Programme, of similar order and amplitude, applied respectively to the urban or rural area of the same region, so as to shed insights on potential spillovers and their capacity to induce balanced regional growth. Table 2 presents the average impacts of the policy scenarios with respect to the baseline over the period 2006-2012 obtained via the SSA. In general, results show that "regional" urban development policies have more impacts than rural development policies on total GDP. Indeed, the average impact of urban development policies on total GDP (0.40%) is positive and twice more the impact of rural development policies (0.14%). This might seem to support the idea that regional growth is mainly an urban phenomenon but this result must be understood in the light of the region specificities.

Table 2. Average impacts per year, over 2006-2012

	Baseline (million €)	Urban development policy shock (in %)	Rural development policy shock (in %)
Total GDP	8,546	0.40	0.14
		(0.017)	(0.011)
Urban GDP	3,755	-0.35	-0.31
		(0.016)	(0.011)
Urban Primary	118	0.89	1.28
		(0.054)	(0.054)
Urban Secondary	1,027	-0.03	-0.32
		(0.021)	(0.011)
Urban Tertiary	2,609	-0.51	-0.33
		(0.016)	(0.013)
Rural GDP	4,790	0.95	0.47
		(0.018)	(0.012)
Rural Primary	856	-0.16	-0.50
		(0.037)	(0.031)
Rural Secondary	2,499	0.80	0.77
		(0.017)	(0.009)
Rural Tertiary	1,435	2.20	0.75
		(0.014)	(0.011)

Standard deviations in parentheses.

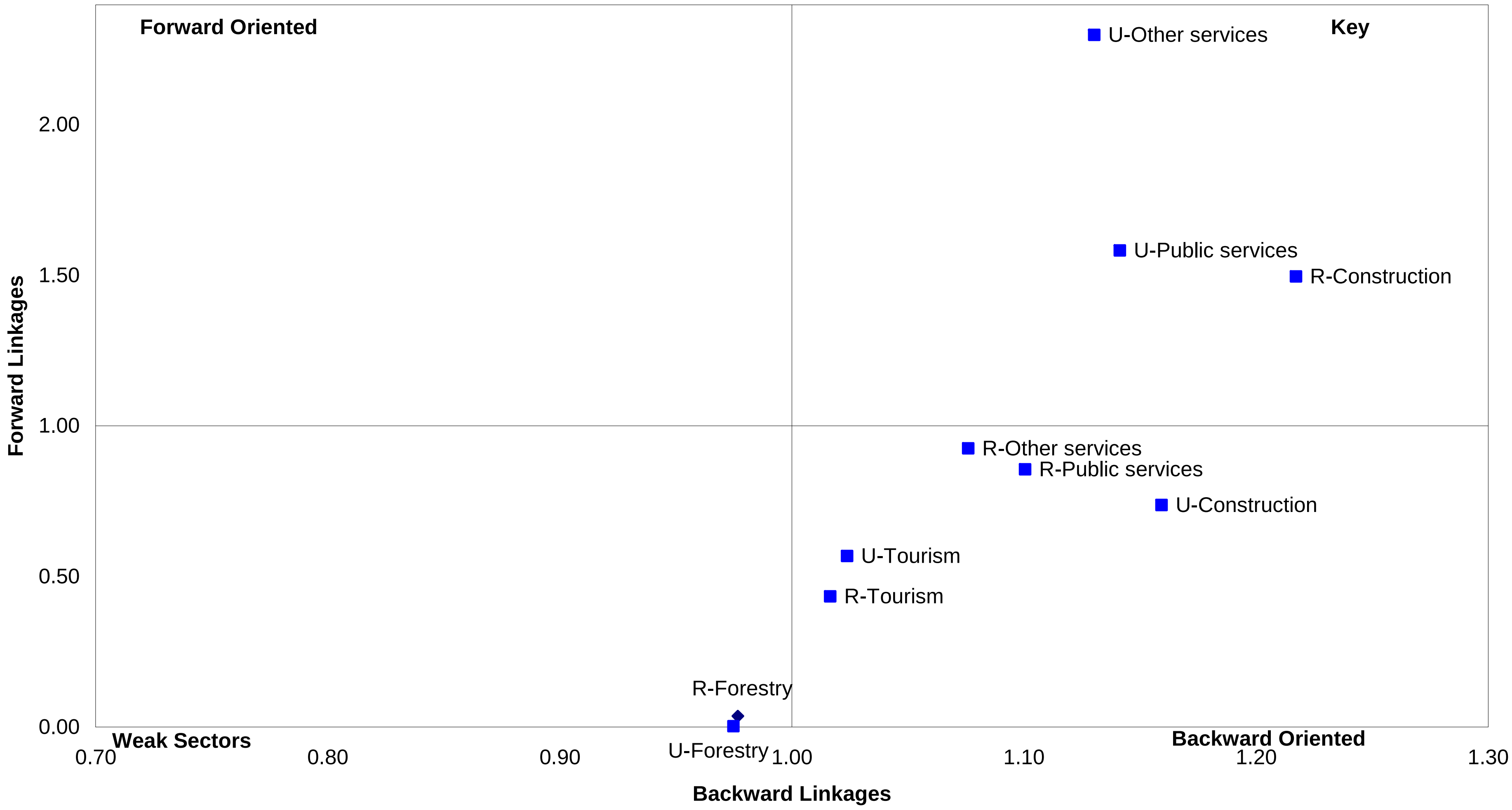

Figure 1. Weighted backwards and forwards linkages, Cordoba 2005

In particular, as shown in Figure 1, two of the urban activities benefitting from the policies are key sectors (private and public sectors), while only one in the case of rural activities (construction). However, the result does not only depend on backward/forward linkages but also on the share of each sector in the urban and rural activities. Further, when focusing at the area level, the pattern of impacts is somewhat different and justifies *ex post* the need of an urban-rural modeling. While both scenarios imply a strong impact on the rural area, they also have negative impacts on the urban area. As explained in the introduction, this latter result can be partly explained by the fact that previous studies have either used I-O or SAM models. These do not include price adjustments and crowding out effects and can, by construction, only lead to positive effects (PHIMISTER AND ROBERTS, 2012). In contrast, when accounting for those effects, we show that EU-funded policies may possibly create undesired effects, i.e. a reduction in economic growth of a particular area in a region, here the urban area (-0.35% for urban development measures and -0.31% for rural development measures). We hypothesize that the main factors, which are at work and explain the negative impact on the urban area, are the existence of leakages outside the region's boundaries and of crowding-out effects.

In addition, our results confirm that in the region of Cordoba, urban development policies generate much higher impacts on rural GDP than rural policies do. In other words, development policies in the urban area have more impacts on rural development than specifically-targeted rural development programs. Under these assumptions, in that particular case, the regional policy (as opposed to rural-targeted) approach is likely to be more appropriate even for rural areas, because urban-rural linkages are strong. This is consistent with ROBERTS (2000) and supports the view that urban centers spill over economic growth to surrounding rural areas. Yet, there are significant sectoral differences (e.g. urban secondary, urban tertiary, rural tertiary) which suggest that the main findings do not uniformly apply to all economic sectors in the Cordoba economy. For example, both scenarios can have very similar effects on the rural secondary sector, while having clearly different patterns of impacts on the urban secondary sector. In fact, in the urban primary sector, rural-urban spillovers are such that it is contrary to the result obtained at the area level. This last result has to be considered with caution, as this sector is particularly small.

Table 2 is informative in that average impacts give a clear intuition with respect to the final impacts of both scenarios; yet, it fails to be more insightful about the dynamics of the impact patterns. On the contrary, Figures 2-7 display the impulse responses functions of total, urban and rural GDP to the implemented policy scenarios[8]. Such diagrams are especially helpful in that they also display confidence intervals that provide easily understandable information regarding the robustness of the impact estimates, the immediate impact of policies and the length of impacts.

The key finding is that both policies are regionally efficient, in that they induce more economic growth than they cost in terms of budget. This is consistent with LIMA AND CARDENETE (2008), which find that regional funding has contributed to Andalusian regional development. We here confirm this result at a more disaggregated level. Indeed, in the short run, Figures 2 and 3 clearly show that the positive initial impact on total GDP is similar for both policy scenarios. Indeed, 37 per cent of the budgetary costs of rural development policies are compensated by the increase in GDP in the initial year of the policy implementation. The calculation of impact multipliers[9], respectively 0.37 for the rural policy and 0.43 for the urban one, stresses that the immediate impacts implied by both shocks are very much alike. However, cumulative[10] multipliers show that the pattern of results is significantly different in the medium run: 7.50 for the urban policy against 2.13 for the rural one. Despite higher leakages, urban structural policies have a lot more positive impacts on the region's GDP than rural policies. Also, Figure 3 shows how the positive impact on regional GDP of the rural development programmes dies down after 2009 while the impact of urban development programmes lasts slightly longer as displayed in Figure 2.

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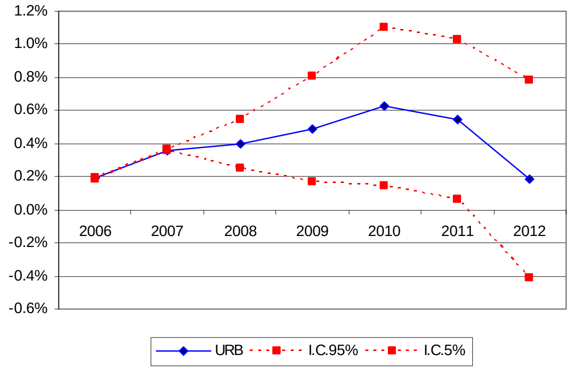
[8] Impulse response functions at sector level are available in Appendix.

[9] The impact multiplier is the ratio of the change of output to a policy change, i.e. the introduction of urban (or rural) development program.

[10] The cumulative impact is the ratio of the cumulative change of output (between 2006 and 2012) to a policy change.



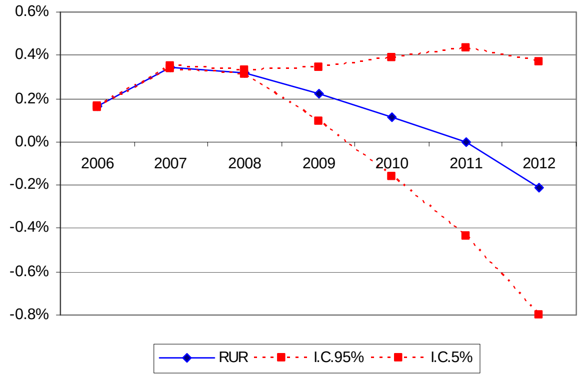
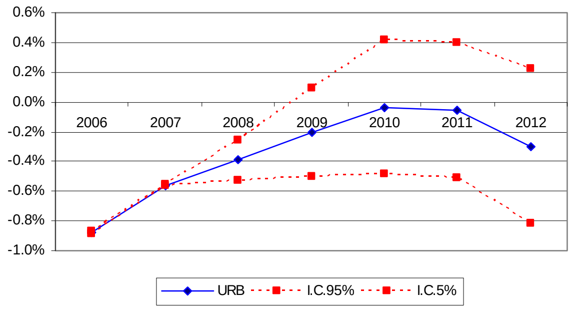


Figure 2. Impacts of urban policy on total GDP

Figure 3. Impacts of rural policy on total GDP



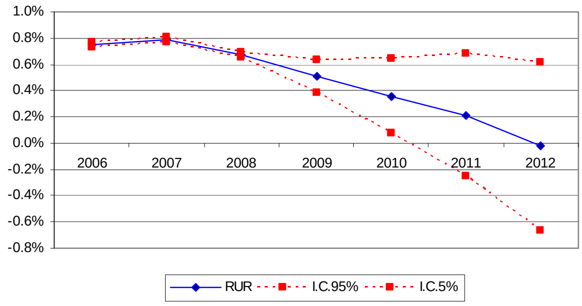
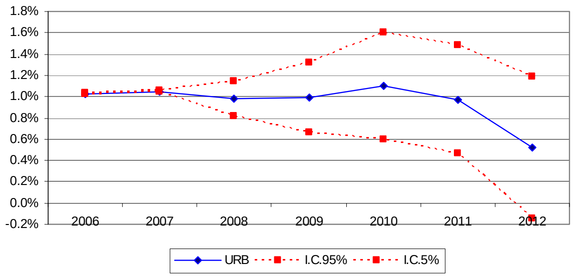


Figure 4. Impacts of urban policy on urban GDP

Figure 5. Impacts of rural policy on urban GDP



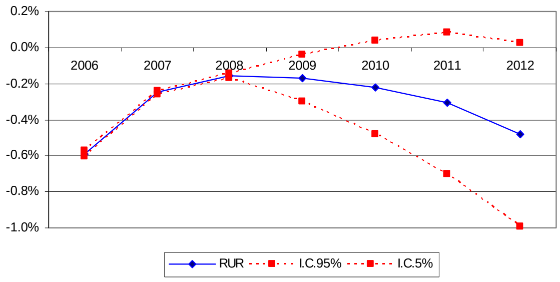


Figure 6. Impacts of urban policy on rural GDP

Figure 7. Impacts of rural policy on rural GDP

To sum up, the final effect of policy changes on regional GDP results from the existence of conflicting and non-linear effects, which occur in both urban and rural areas. In fact, while the impact of both scenarios is positive in the rural area, their effect is negative in the urban area. Figures 4 and 5 suggest that the negative impact is being driven by large crowding-out effects, which gradually disappear after a few years. Additional to such effects, higher leakages from urban areas towards the outside world (regions in Spain and other countries) strongly offset some potential positive impacts induced by policy shocks, leading at the end to a negative impact in the urban area. Thus, results show that benefits mainly go to the rural area of Cordoba, suggesting strong linkages between urban and rural areas. More fundamentally, results also highlight a key policy implication; that is, although the regional economy may grow on average, the implementation of specific development policies may simultaneously result in unbalanced regional development because it could potentially lead to lesser growth in a particular area of a region.

6. Conclusions

Because of the current economic and financial situation, the main EU policies (Common Agricultural Policy and Regional Policy) are under strict scrutiny in terms of their impact, efficiency and effectiveness. Both policies include measures aiming at improving territorial cohesion, one with a specific rural-targeted perspective (Pillar 2 of the CAP), the other with a broader perspective and a large focus on urban areas. Debates on the complementarities and synergies between both types of measures are lively and in the context of the next financial period 2014-2020, the adoption of common strategic framework for all structural policies is foreseen.

This report assesses the impacts of urban and development policies in the particular case of the Spanish province of Cordoba. The modeling framework follows specific assumptions concerning the structure of the economy (e.g. regionalized rural-urban SAM) and, unlike previous studies, explicitly includes price adjustments and crowding out effects. In this context, we show that the impact of a policy shock representing the implementation of structural policies has impacts significantly different whether they are applied to the urban or rural area of the same region. Specifically, we find that urban-rural spillovers are stronger, which result in a more beneficial overall effect of urban development programmes on the economy of Cordoba. We also show that the impact of each policy option is significantly different within each area. This confirms the necessity of a rural-urban modeling for the *ex ante* assessment of policies aiming at territorial cohesion. Given that sectors in each sector are affected in different ways, it is possible that structural policies may not compatible with "balanced" development between rural and urban areas in the medium run.

Another key finding is that both urban and rural development programmes in our Spanish application are regionally efficient, in that their returns in terms of GDP are higher than their budgetary costs. While this initial impact is similar at first, simulations show that urban development favored by Regional Policy results in more economic growth.

Finally, further research remains needed as each region has its specificities. With different sectors benefitting from policy measures or different economic structures, which are translated in the urban/rural split of economies, results of similar simulations might lead to different conclusions.

Appendix

Appendix 1: Cordoba SAM accounts

Table A1. Production sectors accounts (disaggregated rural / urban) & Commodities accounts

SAM Code	Name	NACE
1	Small fieldcrops farms	01 (part)
2	Large fieldcrops farms	01 (part)
3	Small permanent crops farms	01 (part)
4	Large permanent crops farms	01 (part)
5	Small other farm types	01 (part)
6	Large other farm types	01 (part)
7	Forestry	02
8	Fishery	05
9	Mining	10 to 14
10	Food manufacturing	15
11	Other manufacturing	16 to 36
12	Utilities	37, 40, 41
13	Construction	45
14	Wholesale and retail trade	50-52
15	Hotels and restaurants	55
16	Transport and communications	60-64
17	Financial services	65-70
18	Public service activities	71-95

Table A2. Factors and institution accounts

SAM Code	Name
52	Unskilled labour
53	Skilled labour
54	Capital
55	Land
56	Rural Household
57	Urban Household
58	Farm Household
59	ATAX - activity taxes
60	STAX – commodity taxes
61	YTAX – income taxes
62	Government
63	Investment-Savings
64	Rest of the World

Appendix 2: Version of RURAL ECMOD model

Table A3. Abridged Mathematical Version of RURAL ECMOD Model

Within Period CGE Model (IFPRI, 2002)

Prices		
Absorption:	$PQ_c(1-tq_c)QQ_c = PDD_cQD_c + PM_cQM_c$	(A1)
Marketed output value:	$PX_cQX_c = PDS_cQD_c + PE_cQE_c$	(A2)
Import price	$PM_C = pwm_c(1+tm_c)EXR$	(A3)
Export price	$PE_c = pwe_c(1-te_c)EXR$	(A4)
Activity revenue/costs	$PA_a(1-ta_a)QA_a = PVA_aQVA_a + PINTA_aQINTA_a$	(A5)
Production and Trade		
CES Technology: Activity Production Function:	$QA_a = \alpha_a^a(\delta_a^aQVA_a^{-\rho_a^a} + (1-\delta_a^a)QINTA_a^{-\rho_a^a})^{-\frac{1}{\rho_a^a}}$	(A6)
Leontief technology: Demand for aggregate value-added:	$QV_a = iva_aQA_a$	(A7)
Leontief technology - Demand for aggregate intermediate input:	$QINTA_a = \text{int}a_aQA_a$	(A8)
Value added and factor demands:	$QVA_a = a_a^{va}(\sum_{f\in F}\delta_{fa}^{va}QF_{fa}^{-\rho_a^{va}})^{-\frac{1}{\rho_a^{va}}}$	(A9)
Output transformation (CET function):	$QX_c = \alpha_c^t(\delta_c^tQE_c^{\rho_c^t} + (1-\delta_c^t)QD_c^{\rho_c^t})^{\frac{1}{\rho_c^t}}$	(A10)
Composite supply (Armington function):	$QQ_c = \alpha_c^q(\delta_c^qQM_c^{-\rho_c^q} + (1-\delta_c^q)QD_c^{-\rho_c^q})^{-\frac{1}{\rho_c^q}}$	(A11)
Output aggregation function:	$QX_c = \alpha_c^{ac}(\sum_{\alpha\in A}\delta_{ac}^{ac}QXAC_{ac}^{-\rho_c^{ac}})^{\frac{1}{\rho_c^{ac}-1}}$	(A12)
Institution Block		
Factor income:	$YF_f = \sum_{a\in A}WF_f\overline{WFDIST}_{fa}QF_{fa}$	(A13)
Institutional factor incomes:	$YIF_{if} = shif_{if}[(1-tf_f)YF_f - trnsfr_{ROWf}EXR]$	(A14)
Income of domestic non-government institutions	$YI_i = \sum_{f\in F}YIF_f + \sum_{i\in INSDNG}TRII_{ii'} + trnsf_{igov} + trnsfi_{ROW}EXR$	(A15)
Household consumption expenditure	$EH_h = (1-\sum_{i\in INSDNG}shii_{ih})(1-MPS_h)(1-TINS_h)YI_h$	(A16)

Household consumption demand for marketed commodities (similar for home commodities):	$PQ_cQH_{ch} = PQ_c\gamma^m_{ch} + \beta^m_{ch}(EH_h - \sum_{c\in C} PQ_c\gamma^m_{ch} - \sum_{a\in A}\sum_{c\in C} PXAC_{ac}\gamma^h_{ach})$	(A17)
Government revenue:	$YG = \sum_{i\in INSDNG} TINS_i YI_i + \sum_{f\in F} tf_f YF_f + \sum_{a\in A} tva_a PVA_a QVA_a + \sum_{a\in A} ta_a PA_a QA$ $+ \sum_{c\in CM} tm_c\, pwm_c QM_c EXR + \sum_{c\in CE} te_c\, pwe_c QE_c EXR +$ $+ \sum_{c\in C} tq_c PQ_c QQ_c + \sum_{f\in F} YIF_{govf} + trnsf_{govROW} EXR$	(A18)
Government expenditure	$EG = \sum_{c\in C} PQ_c QG_c + \sum_{i\in INSDNG} transf_{igov}$	(A19)
System Constraint Block		
Factor Market:	$\sum_{a\in A} QF_{fa} = \overline{QFS}_f$	(A20)
Upward Sloping Labour Supply (Thurlow, 2008)	$\frac{QFS_f}{QFS^0_f} = \left(\frac{RWF_f}{RWF^0_f}\right)^{etas_f}$	(A21)
Average Real Wage	$RWF_f = \left(\frac{YF_f}{QFS_f}\right) \Big/ \left(\frac{CPI_f}{CPI^0_f}\right)$	(A22)
Composite commodity markets:	$QQ_c = \sum_{a\in A} QINT_{ca} + \sum_{h\in H} QH_{ch} + QG_c + QINV_c + qdst_c$	(A23)
Current account balance:	$\sum_{c\in CM} pwm_c QM_c + \sum_{f\in F} trnsfr_{ROWf} = \sum_{c\in CE} pwe_c QE_c + \sum_{i\in INSD} trnsfr_{iROW} + \overline{FSAV}$	(A24)
Government balance:	$YG = EG + GSAV$	(A25)
Saving-Investment Balance:	$\sum_{i\in INSDNG} MPS_i(1 - TINS_i)YI_i + GSAV + EXR\overline{FSAV} = \sum_{c\in C} PQ_c QINV_c + \sum_{c\in C} PQ_c qdst_c$	(A26)
Total absorption:	$TABS = \sum_{h\in H}\sum_{c\in C} PQ_c QH_{ch} + \sum_{a\in A}\sum_{c\in C}\sum_{h\in H} PXAC_{ac} QHA_{ach} +$ $+ \sum_{c\in C} PQ_c QG_c + \sum_{c\in C} PQ_c QINV_c + \sum_{c\in C} PQ_c qdst_c$	(A27)

DEFINITIONS OF MODEL PARAMETERS/VARIABLES

Sets

$a \in A$	activities (disaggregated according to rural-urban status)
$c \in C$	commodities
$c \in CM$	imported commodities
$c \in CE$	exported commodities
$f \in F$	factors (disaggregated according to rural-urban status)

$i \in ISNDNG$ domestic non-government institutions

$h \in H$ households (disaggregated according to rural-urban status)

Parameters

α_a^a efficiency parameter in the CES activity function

α_a^{va} efficiency parameter in the CES value added function

α_c^t CET function shift parameter

α_c^q Armington function shift parameter

α_c^{ac} shift parameter for domestic commodity aggregation function

marginal share of consumption spending on marketed commodity *c* for household *h*

δ_a^a CES activity function share parameter

δ_{fa}^{va} CES value-added share parameter for factor *f* in activity *a*

δ_c^t CET function share parameter

δ_c^q Armington function share parameter

δ_c^{ac} share parameter for domestic commodity aggregation function

γ_{ch}^m subsistence consumption of marketed commodity *c* for household *h*

subsistence consumption of home commodity *c* from activity *a* for household *h*

ρ_a^a CES production function exponent

ρ_a^{va} CES value-added function exponent

ρ_c^t CET function exponent

ρ_c^{ac} domestic commodity aggregation function exponent

iva_a quantity of value-added per activity unit

$\text{int}\, a_a$ quantity of aggregate intermediate input per activity unit

tq_c rate of sales tax

tf_f direct tax rate for factor f

tva_a rate of value-added tax for activity *a*

tm_c import tariff rate

te_c export tax rate

$shif_{if}$ share for domestic institution *i* in income of factor *f*

$trnsfr_{if}$ transfer from factor *f* to institution *i*

pwm_c import price (foreign currency)

pwe_c export price (foreign currency)

$qdst_c$ quantity of stock change

$etas_f$ labour supply elasticity factor *f*

v_f capital stock depreciation rate

β^a capital sector mobility factor

Exogenous Variables

$\overline{QFS}_f$ quantity of factor supplied

$\overline{WFDIST}_{fa}$ wage distortion factor for factor *f* in activity *a*

$\overline{FSAV}$ foreign saving (foreign currency unit)

MPS_i marginal propensity to save for domestic non-government institution

$\overline{CPI}$ consumer price index (normalized)

Endogenous Variables

PQ_c composite commodity price

PDD_c demand price for commodity produced and sold domestically

PE_c export price (domestic currency)

PM_c import price (domestic currency)

PX_c aggregate producer price for commodity

$PXAC_{ac}$ producer price of commodity *c* for activity *a*

PDS_c supply price for commodity produced and sold domestically

PVA_a value-added price (factor income per unit of activity)

QA_a quantity (level) of activity

QQ_c quantity of goods supplied to domestic market (composite supply)

QD_c quantity sold domestically of domestic output

QE_c	quantity of exports of commodity
QM_c	quantity of imports of commodity
$QXAC_{ac}$	quantity of marketed output of commodity *c* from activity *a*
QX_c	aggregate marketed quantity of domestic output of commodity
QVA_a	quantity of (aggregate) value-added
$QINTA_a$	quantity of aggregate intermediate input
$QINT_{ca}$	quantity of commodity *c* as intermediate input to activity *a*
QF_{fa}	quantity demanded of factor *f* from activity *a*
QH_{ch}	quantity consumed of commodity *c* by household *h*

quantity of household home consumption of commodity *c* from activity *a* for household *h*

$QINV_c$	quantity of investment demand for commodity
QG_c	government consumption demand for commodity
YF_f	income of factor *f*
WF_f	average price of factor *f*
YIF_{if}	income to domestic institution *i* from factor *f*
YI_i	income of domestic nongovernment institution
EH_h	consumption spending for household
EXR	exchange rate (local currency unit per foreign currency unit)
$TINS_i$	direct tax rate for institution *i*
YG	government revenue
EG	government expenditures
$GSAV$	government savings
$TABS$	total nominal absorption
RWF_f	average real wage by factor
η^a_{ft}	share of new capital time *t* factor *f*
ΔK^a_{fat}	New Investment by factor, activity and period
AWF^a_{ft}	Average Capital Rental Rate by factor and period

Appendix 3: Elasticities for model calibration

Table A4. Elasticities of substitution between factors (bottom level), Cordoba

Small farms – Other Agriculture	0.2
Small farms – Permanent crops	0.2
Small farms – Field crops	0.2
Large farms – Field crops	0.2
Large farms – Other Agriculture	0.2
Large farms – Permanent crops	0.2
Fisheries	0.2
Forestry	0.2
Food	0.8
Mining	0.2
Manufacturing	0.8
Utilities	0.8
Transport	0.8
Construction	0.8
Commerce	0.8
Tourism	0.8
Public	0.8
Other services	0.8

Notes: Elasticities are assumed identical for rural and urban sectors of each type. The top-level factor elasticity is set at 0.2 for all sectors.

Table A5. Armington and CET elasticities, Cordoba

	Armington elasticity	CET elasticity
C-Field crops	2	1.6
C-Permanent crops	2	1.6
C-Other Agriculture	2	1.6
C-Forestry	2	1.6
C-Fisheries	2	1.6
C-Mining	2	1.6
C-Food	0.5	0.5
C-Manufacturing	0.5	0.5
C-Utilities	0.5	0.5
C-Construction	0.5	0.5
C-Commerce	0.5	0.5
C-Tourism	0.5	0.5
C-Transports	0.5	0.5
C-Other services	0.5	0.5
C-Public	0.5	0.5

Table A6. LES elasticities for market demand, Cordoba

	Urban households	Rural households	Farm households
C-Field crops	0.33	0.33	0.33
C-Permanent crops	0.33	0.33	0.33
C-Other Agriculture	0.33	0.33	0.33
C-Forestry	0.33	0.33	0.33
C-Fisheries	0.33	0.33	0.33
C-Mining	1	1	1
C-Food	1	1	1
C-Manufacturing	1	1	1
C-Utilities	1	1	1
C-Construction	1	1	1
C-Commerce	1	1	1
C-Tourism	1	1	1
C-Transports	1	1	1
C-Other services	1	1	1
C-Public	1	1	1

The household Frisch parameters (which measure the elasticity of the marginal utility of income) were set at the default level of -1 for all household types.

Appendix 4: Sectoral impacts of urban/rural development policy scenarios

Panel A1. Impacts of urban development policies

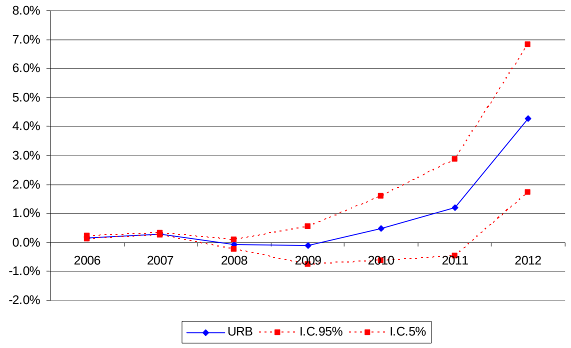


Figure A1. Impacts of Urban policy urban primary sector

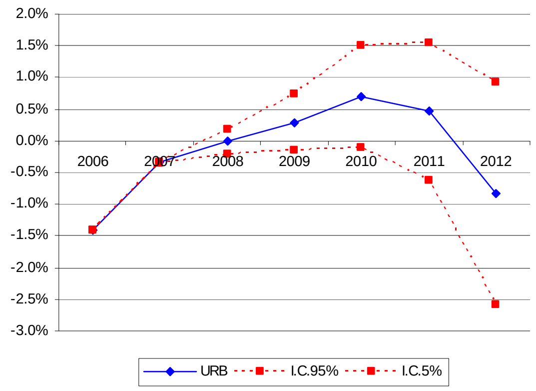


Figure A2. Impacts of Urban policy rural primary sector

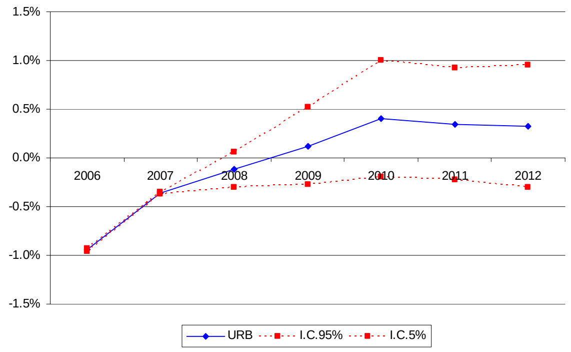


Figure A3. Impacts of Urban policy urban secondary sector

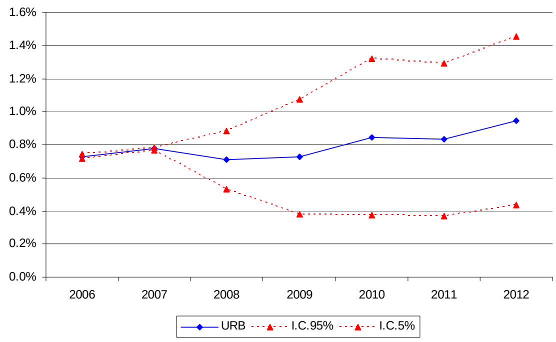


Figure A4. Impacts of Urban policy rural secondary sector

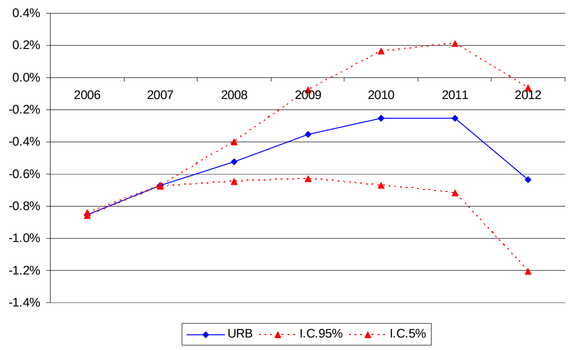


Figure A5. Impacts of Urban policy urban tertiary sector

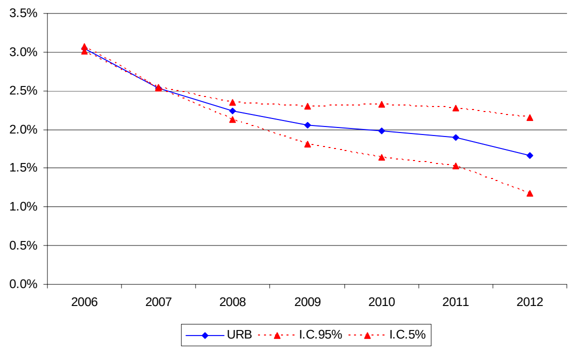


Figure A6. Impacts of Urban policy rural tertiary sector

Panel A2. Impacts of rural development policies

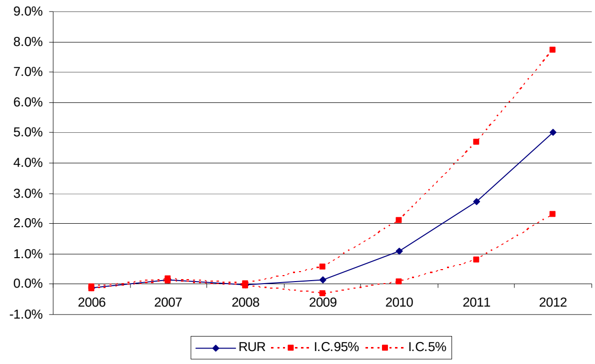


Figure A7. Impacts of rural policies urban primary sector

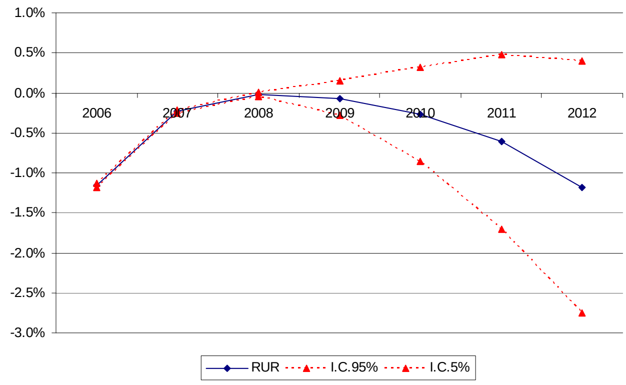


Figure A8. Impacts of rural policies rural primary sector

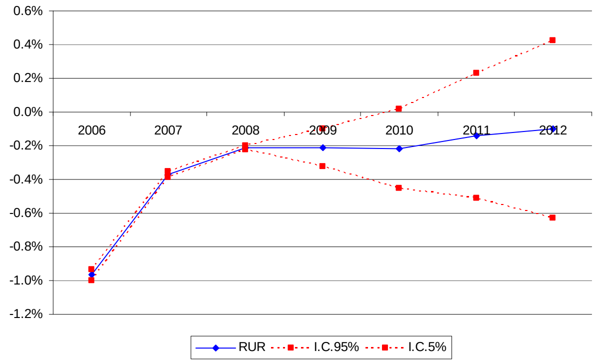


Figure A9. Impacts of rural policies urban secondary sector

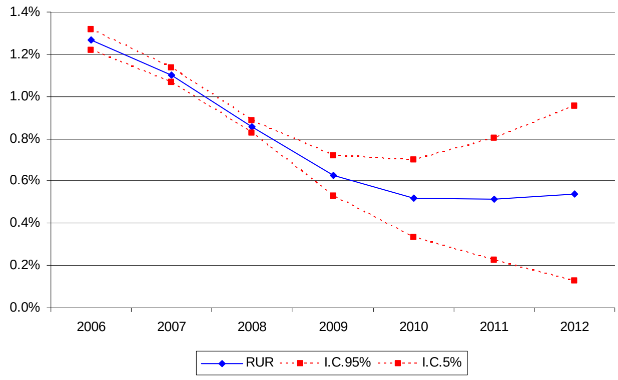


Figure A10. Impacts of rural policies rural secondary sector

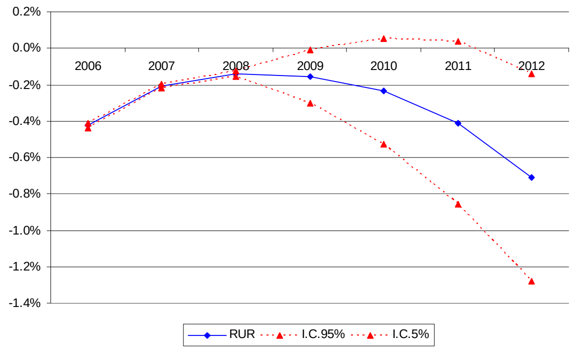


Figure A11. Impacts of rural policies urban tertiary sector

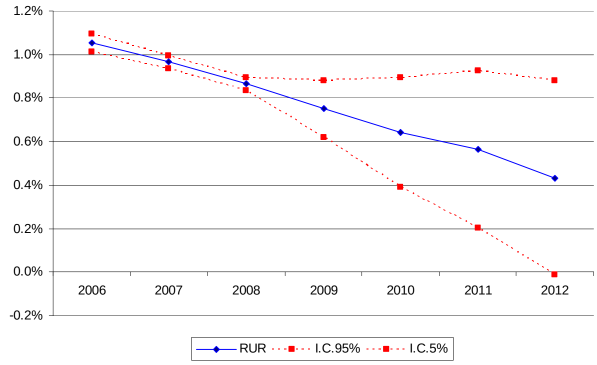


Figure A12. Impacts of rural policies rural tertiary sector

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Abstract
The European Union's Regional Policy and Common Agricultural Policy share a common objective of balanced regional development; in practice, they are implemented in very distinct ways as regional policies mainly focus their strategy on urban development while the CAP Pillar 2 is based on a program which is specifically targeted at rural areas. Understanding the origins of economic growth in rural and urban areas is at the core of the debate on territorial convergence and the future of both policies. This report assesses the impacts of Regional and Rural Development Programmes on the Spanish economy of Cordoba using a bi-regional CGE model in order to shed light on their capacity to fulfil the objective of balanced regional development.

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