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► **To cite this version:**

Dominique Vollet, Francis Aubert, Quentin Frère, Denis Lépicier, Stéphanie Truchet. The Importance of Integrating Supply-Side Factors in Economic Base Models. *Growth and Change*, 2018, 49 (1), pp.203-222. 10.1111/grow.12223 . hal-02483333

HAL Id: hal-02483333

<https://institut-agro-dijon.hal.science/hal-02483333v1>

Submitted on 13 Mar 2023

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**The Importance of Integrating Supply Side
Factors in Economic Base Models**

DOMINIQUE VOLLET, FRANCIS AUBERT, QUENTIN FRERE, DENIS LEPICIER
AND STEPHANIE TRUCHET

ABSTRACT :

Economic base (or export-base) theory (EBT) is often presented as a Keynesian-inspired theory that only accounts for demand-side factors. However, the recent integration of supply-side factors into economic base models (EBMs) can contribute to renewing applications of this type of model in regional economics. This paper proposes a literature review focused on new EBMs that explicitly take into account supply effects and includes both North American and European studies. It first explains why integrating supply-side factors is relevant for EBMs. Second, the paper shows how to integrate these supply-side factors into the various types of models, focusing on two production factors: land and its amenities and labor. Third, the paper discusses the conditions for integrating such supply-side factors into EBMs.

KEYWORDS: regional economics, economic base models, regional impact evaluation

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Introduction

Since the 1950s, regional economics have provided specific models to represent regions. In particular, these models allow economists to account for the limited size of regional economies on the one hand and the significance of the interregional mobility of production factors on the other hand. Multiregional input-output (MRIO) models have been developed at the regional scale, while economic base models (EBM), based on the key role played by external demand in regional growth, have been developed at the interregional scale.

The former has led to regional models of computable general equilibrium (CGE). These are built as a disaggregation of national models and have been further improved to create multiregional CGE models. First created in the 1980s (Liew 1984), multiregional CGE models benefit from the analytical power of CGE models and treat a variety of regional development issues (Giesecke and Madden 2013).

The latter evolved separately to take into account various dimensions of regional economic systems beyond demand effects, including supply effects and production factor endowments (Mac Ferlane et al. 2016). Today, EBMs may be considered, to some extent, to be monoregional CGE models. In comparison to multiregional CGE models, they present two specificities: theoretical straightforwardness and ease of implementation. Indeed, the simplification of the regional economy into only two sectors, exporting and residential, facilitates the interpretation of results by focusing on the degree of openness and integration of regional economies. Moreover, monoregional CGE models, such as EBMs, do not necessitate building a complicated social accounting matrix (SAM), identifying interregional flows and estimating interregional exchange elasticities. These advantages are obtained at the cost of the model's ability to take into account the neighboring regions' effects and adjustments, particularly on the factors market.

These models are still frequently used in regional economics, despite the various critiques leveled over the past 30 years (Richardson 1985; Krikelas 1992; Kilkenny and Partridge 2009). The main issue concerns their inability to improve the estimations' robustness and their lack of adaptability to various regional and sector contexts, e.g., closure of industries, such as defense (Droff and Paloyo 2015), sustainable management of natural resources in Europe (Guimaraes et al. 2014), or tourism and culture in the USA (Mulligan et al. 2013; Markusen 2007).

This article proposes a literature review focused on new EBMs that explicitly takes into account supply effects. These EBMs benefit from the great adaptability inherited from regional impact models on the one hand and from the analytical ability of CGE models on the other hand. Successive improvements of EBMs, however, have been made at the expense of various hypotheses for the regional economy. First, the size of regions conditions the validity of revised EBMs. Indeed, small geographical dimensions make regions particularly sensitive to spillover effects, commuting flows, and spatial interactions between neighboring regions after a demand shock. Moreover, few mechanisms may be considered to be endogenous within a small region. Second, the time horizon of EBMs may be questioned: is economic base theory a theory of long-run growth and development or a theory of short-run fluctuations? By estimating economic base multipliers, EBMs are relevant to identifying the specificities of regional economies in the short run. Difficulties may arise in the long run, however, when adjustments occur on the factor market, especially through the labor factor. EBMs do not own the necessary dynamic analysis ability, while the static comparative analysis may limit their explanatory power.

The remainder of the paper is organized as follows. Section 1 explains the relevancy of taking into account supply-side factors in EBMs from the theoretical basis of the economic base theory initiated in the 1950s. Section 2 shows how to integrate these supply-side factors

into the various types of EBMs, focusing on two production factors: land and its amenities and labor. Section 3 discusses the conditions for integrating such supply-side factors into EBMs. Finally, we argue that time horizon and region size play a strategic role when implementing EBMs.

Teachings from the forgotten debates between founders: Why integrating supply-side factors in economic base theory is important

Seminal distinction between basic and non-basic activities

EBMs are founded on the distinction between two different spheres in the regional economy: basic *versus* non-basic activities.

Regarding the former activities, the founders of economic base theory¹ identified two broad categories of “primary” or “basic” activities in the 1920s: those that sold a physical product outside the city or region and those that lived on “imports” of revenues originating from the outside (students, external visitors, or renters in the previous examples). In fact, they had already distinguished what would later be called productive basic activities and residential basic activities.

In an initial article on economic base theory published in 1955 in the *Journal of Political Economy*, North suggested “that a region could be defined as a territory within which there was a common export base” (Parr 2015). Then, he clearly distinguished basic activities from non-basic activities or “residential activities.” For him, the term refers to an activity linked to the local market and whose resulting products or services are intended for a population that lives and consumes locally. In his view, it is therefore the location of consumption that determines the non-basic character that is assimilated with “residential” character.² In this

article, North also addressed the particular role of non-earning incomes and highlighted their ambiguous status. The author then recognized that these “residential” activities are more basic than non-basic in nature.

In an article published in response to North (1955), Tiebout (1956b) contributed to clarify the concept of an “export-base.”³ Like North, he defined the export base as activities coming from the outside, but he took care to explicitly include revenues from commuting as well as private and public capital flows (central government transfers).

Debates on the respective role of basic and non-basic activities in regional growth

In the 1950s, the theoretical debates between North and Tiebout went far beyond the discussion of the notions of basic and non-basic activities and addressed their respective influence on regional growth. One of the main sticking points between the authors is the place allocated to the export base in regional growth.

For North (1955), the sole source of regional growth is external demand: “Clearly, the export base plays a vital role in determining the level of obsolete and per capita income in a region... residential industry depends entirely on demand within the region.”⁴ For the author, the possible outside economies within regional exports reinforce their competitiveness. The development of organizations specialized in marketing, ease of transportation, credit, a well-trained workforce, and subcontracted activities then support the development of the export base (North 1956).

Conversely, Tiebout (1956a) challenged the idea that exports are the only driver of regional growth: “There is no reason to assume that exports are the sole or even the most important autonomous variable determining regional income... However, in terms of causation, the nature of the residential industries will be a key factor in any possible

development.” He even referenced Adam Smith, for whom an increasing division of work can lead to regional growth without the development of exports. Further in the article, Tiebout discussed the export-base to non-basic activities ratio. He explained that, if we consider a region’s limits, transportation network, market, and production factor endowments as given, the region could then channel its efforts into the breakdown between basic and non-basic activities. In the cases where export activities are too great (on this point, Tiebout provides no criteria for judgment), it could be pertinent to move a part of the resources toward non-basic activities. Possibilities of regional growth could therefore exist with a decrease in exports, representing a complete reversal of perspective in relation to the usual recommendations put forward by base models, notably in the perspectives raised by North.

In his reply, North (1956) acknowledged that the authors agreed on the fact that the export base does not constitute the only source of regional growth. Contrary to his seminal article of 1955, he even recognized that non-basic activities do not play a purely passive role. North continued to think, however, that the basic export base represents the most important regional growth factor and denied the simultaneous possibility of regional growth and a decline in exports while proposing arguments involving international commerce.

In a final article, Tiebout (1962) maintained that regional economies can also grow thanks to “non-basic” activities in cases where these activities retain revenue for the local economy.

Exogeneity versus endogeneity of the costs of production factors

Tiebout’s argument defending the existence of regional growth factors other than exports is mainly based on supply-side factors. Indeed, Tiebout (1956) noted that, given the transport network, the size and location of markets, and factor endowments, the export base could be a necessary and sufficient condition for regional growth only if the region could compete with

other regions in the export market. This would imply an ability to produce outputs at a lower cost. According to him, a region's ability to find an export base thus depends on the value of units of output as well as on the cost of inputs. Furthermore, he considered that the determination of the factor costs depends in part on the nature of regional non-basic activities. He illustrated this point by a hypothetical peninsula in New Jersey where a coalmine was found. If the zone is completely surrounded with sand without the possibility of cultivation and if transport costs are found to be very high, there is nothing to indicate that this mining activity can develop because of the high cost of providing non-basic services. In other words, it is the capacity to develop an export base that determines regional growth, but in terms of causality, it is nature and the costs affecting non-basic activities that constitute key factors in their development. He concluded by remarking that, in North American and European economic history, cities developed around sites surrounded by fertile plains and not in lands that were unfavorable for cultivation.

In his reply, North (1956) recognized that Tiebout's argument on the costs of production factors was valid and that the region's ability to export depends both on the labor supply and the transfer costs.

Merrifield's (1987, 1990) works allowed for further discussion of the influence of production factors. According to the author, the fact that the multiplier is constant in equilibrium constitutes an important limitation of EBMs. Indeed, this leads to the assumption that productive factors are exogenous, that is to say, available in unlimited quantities and at constant prices. This assumption would be reasonable if the factor mobility was perfect (which is not realistic for labor supply) or if a close substitute could replace less mobile factors (which is not possible in the short term). Thus, the author proposed an examination of the economic base multiplier from a neoclassical perspective and built a model with endogenous factor prices. Among others, Merrifield (1987) showed that the marginal

multiplier decreases when the wage elasticity of labor supply, the elasticities of factor substitution, and the price elasticity of demand for non-basic outputs increase, whereas it increases with the income elasticity of demand for non-basic outputs.

Validity conditions of economic base models: Time and space

As shown in the debates between North (1955, 1956) and Tiebout (1956b), considering the exogeneity or endogeneity of the supply-side factor costs raises questions about the validity conditions of the EBM in relation to time and space.

Regarding the spatial conditions, Tiebout (1956b) considered that the validity of an EBM depends on the size of the region and its neighborhood. Indeed, for the author, the smaller the region, the more open it will be and the more the regional growth will depend on exports. Moreover, the larger the region, the more frequently the determinants of income (including factor costs) will be endogenous. Furthermore, Tiebout (1956b) assumed that exports often result from exchanges between the region and its neighborhood and that export receipts decrease with distance. Consequently, the exports of a region will depend on the characteristics of the neighboring areas, and their volume will increase with the incomes of the neighboring areas. Tiebout (1956b) concluded that the idea of the export base is more relevant for small regions and particular areas, such as satellite cities in the suburban fringe located near the market. This point was not really discussed by North (1956), who also considered it essential to take into account the size of the region and its neighborhood.

The debate between North (1956) and Tiebout (1956b) regarding the short or long-term validity of the EBM was more noteworthy. Before developing controversial considerations⁵ on the differences between regional growth and regional development, Tiebout (1956b) mentioned the short-term validity of the economic base. He considered that, in the long term,

other factors affecting non-basic activities, such as consumer behavior, must be integrated (for example, by means of equations describing structural balances) (Tiebout 1962). Although he considered Tiebout's distinction between regional growth and economic development spurious, North (1956) also concluded that EBMs are not relevant to analyzing long-run economic growth. In his view, the study of long-run growth requires integration of the determinants of efficiency changes as well as those of labor and capital inflows.

How to integrate supply-side factors into economic base models

One of the most recent articles strongly attacking the use of EBMs is that of Kilkenny and Partridge (2009). Nevertheless, it remains unclear whether they are not themselves convinced of the interest of those EBMs that integrate the supply characteristics of services. We can interpret the objective of their article as showing the unsuitable character of economic base models that are limited to traditional farming and industrial bases, especially rural policies limited to supporting farming activities. The authors are also aware of the significant limits of the assignment method used in their article, as we have noted: "The data show that service sector employment can grow a rural economy. Therefore, policies... that focus on the factor supply-side, such as local amenities, immigration, factor accumulation are likely to be more effective than export sector support" (924).

In this context, we propose to successively examine two sets of supply-side factors that we consider crucial for increasing the relevance of EBMs: amenities and labor.

The influence of amenities on basic and non-basic activities

Amenities and natural endowments impact regional growth through both basic and non-basic activities. Many studies have highlighted the major role played by place-specific natural

attributes in the growth of rural or non-metropolitan areas (Power 1996; Deller et al. 2001; Olson and Munroe 2012) and in basic activities, in particular. Power (1996) was one of the first to argue that the natural landscape is an essential part of a community's economic base. Furthermore, amenities play a role in non-basic activities at two levels: on the one hand, they cause differences in local consumption characteristics and encourage matching between a supply of new types of goods and services and latent local demand; on the other hand, they stimulate the import-substitution phenomenon.

Cortright (2002) most explicitly asserted the differences in the characteristics of local consumption as a source of growth. The characteristics of local consumption can indeed support the conception of new products that are first developed locally and then widely exported. Cortright (2002) pointed out the example of beer consumption and the development of micro-breweries in Portland, Oregon, in North America. He was the first to reintroduce regional differences in consumer spending preferences and behaviors, making explicit reference to the seminal reflections of Tiebout (1962). He based his reasoning on a comparison of two sets of elements concerning the region of Portland, Oregon (USA): the specific characteristics of consumer spending behavior from survey data and the location quotients of employment of certain employment categories (see Appendix A). He drew a number of conclusions about regional politics. For him, it was essential to cultivate regional specificities in terms of consumer preferences and spending behaviors, which create new knowledge and sources of innovation.

The possibility of substituting external purchases of services by local purchases thanks to amenities (green or urban) was first studied by Rutland and O'Hagan (2007). Starting with a review of the debate between North and Tiebout, these authors proposed an examination of the role of potential exchanges of services that have become increasingly significant for the validity of EBMs. Rutland and O'Hagan (2007) provided a method for estimating the

“localness” of a regional economy from a method based on minimum requirements (174). To measure whether the economies of Canadian cities were becoming more “local,” they proposed a measure of the total degree of “localness” for each category of city size (see Appendix B). This was obtained by multiplying the minimum share of employment for each category of activity by the proportion of jobs of this activity for the category of size as a whole. It is, in fact, a weighted average of the different minimum shares of each size category, such that:

$$L = \sum_i (m_i/u_i)u_i \quad (1)$$

where L denotes the degree of “localness” or local character, m_i is the minimum share of employment in activity i , and u_i is the proportion of jobs in activity i for the category of size as a whole. The authors mentioned the inherent limitations of the minimum requirements method, notably the assumption of homogeneity of spending behavior and of the level of productivity. They showed that, in the period 1986-2001, Canadian cities were increasingly oriented toward the satisfaction of local needs. The authors drew both theoretical and empirical conclusions. From a theoretical point of view, they explicitly rehabilitated Tiebout’s contributions concerning the possibility of an endogenous source of growth from non-basic activities (181). From an empirical point of view, they recommended continuing to stimulate growth by external revenues but also limiting leaks by substituting external purchases by local manufacturing or provisions of goods and services (182). Christofakis and Gkouzos (2014) used the same index L as Rutland and O’Hagan (2007) to measure the local character of employment catchment areas for all Greek prefectures between 2000 and 2009. For Canadian cities, the index increased for all size categories.

Therefore, amenities made limits between basic and non-basic activities more permeable. Markusen (2007) expressed this idea more explicitly through the concept of the “consumption

base,” which is defined as the part of local consumption sold to local residents in place of the external provision of imported goods or services because of amenities and which can be a source of regional growth for this reason. She replaces the formalization of the multiplier of the base adopted hitherto to express a link between total employment and basic employment using an equation linking total employment with basic employment plus employment linked to consumption base:

$$\Delta E = \frac{1}{1 - \alpha} (\Delta E_X + \Delta E_C) \quad (2)$$

where ΔE denotes the variation in total employment, α is the marginal propensity to spend locally, and ΔE_X and ΔE_C denote the variation in basic employment and in consumption base employment, respectively. The author applied this notion to the cultural sector in several rural zones of Minnesota and showed the extent to which a more diversified cultural supply could constitute a consumption base by avoiding external spending on travel for local inhabitants. Dissart and Vollet (2011) also applied this concept in France for a set of activities linked to landscape amenities. Based on the “forming of a consumption base theory,” Ruault and Proulhac (2014) highlighted the role of the fragmentation of places of consumption between the “departments” of the Paris region (food and leisure industries in Paris and specialization of the periphery in everyday purchases). Guimaraes et al. (2014) proposed an original model of the economic base by combining their model with an ecological analysis (Systems Approach Framework or SAF) for the integrated management of a coastal zone (the Guadiana Estuary in Portugal). The authors underlined that “Markusen (2007) pointed out the role of tourism activities that also serve local consumption as a strategy to enhance the contribution of tourism sector to the local development. The importance of golf activities in Castro Marim is an example that demonstrates how local consumption of tourism activities has not been an implemented strategy...” (68).

Using data from three different census years, Mulligan and Vias (2011) estimated the effect of natural amenities on non-basic employment and introduced interaction effects between basic employment and natural amenities:

$$N = \beta_0 + \beta_1 T + \dots + \beta_k \text{Contx} + \beta_l \text{Conte} + \varepsilon \quad (3)$$

where the multiplier effect is:

$$M = 1/(1 - \beta_1 - \beta_l \text{Conte}) \quad (4)$$

Contx represents a vector of contextual variables that reflect the local attributes (i.e., natural amenities with two separate variables: standardized county-level index generated from six environmental subindices and a dummy variable distinguishing counties having coastal locations).

Conte, when used, is composed of the pooled dataset. The results show that natural amenities have become increasingly important in determining the size of the multiplier. For Mulligan and Vias (2011, 999), “at least one observer has even called for a new, consumption-driven base theory to replace traditional export base theory.”

Differences in consumption behaviors can be integrated into other kinds of models, such as input-output models. Billings (1969) and Merrifield (1987) demonstrated theoretically that both economic base and input-output approaches produce identical multipliers. Mulligan et al. (2013) showed that they generate comparable economic base multipliers (the comparison was made across 577 non-metropolitan US counties in the year 2000). Nevertheless, Hughes (1997) noted that “the IO approach is most activity inclusive incorporating, for example, household consumption effects beyond the first round.”

Strategic integration of the labor supply in the latest economic base models

The reasoning behind economic base theory starts with the regional economy being in a static state in the absence of exogenous incomes; sales of export goods provide the injection of additional revenues needed to trigger regional growth. In the steady state, revenue and population are considered constant; in a dynamic state, monetary flow growth is introduced through export revenues, while the population remains constant. Thus, in a given area and in the short run, any increase in employment in the basic activities sector, following growth in exports, lowers employment in the non-basic activities sector once labor is mobile between sectors (Polzin 1977). In the long run, a rise in employment in the basic activities sector is likely to create employment growth in the residential sector (non-basic activities), depending on the elasticity of the labor supply. Polzin's regression estimates for selected areas (SMSAs) from 1950 to 1970 suggest that increases in basic activities induce more than sufficient immigration to offset the effects on the local labor market. This is one of Tiebout's criticisms with regard to North's work – the neglect of factorial adjustments by keeping to them in the short run – which corresponds to a consensus giving economic base theory an effective role in explaining short-run fluctuations but an inability to provide a complete explanation of long-run regional growth.

Labor supply considerations can affect regional growth in two ways to be examined through economic base theory. The first is factorial adjustment on the job market; the second is the possibility of a relatively independent population dynamic in relation to local employment.

Employment growth in the basic sector (a new firm or new external demand) will create non-basic sector jobs to a magnitude that will depend on the qualification level of the jobs (employee skill level and the firm's technological level). This effect comes from an increase in demand for non-basic sector goods and services due to the increase in the number of employees and rising wage rates. On the other hand, the effects are weak for other basic

sectors because they are subjected to rising wages, while their prices are determined outside the area, although this is offset by a demand effect in intermediate consumption (according to the location of the supply chain) and agglomeration externalities. Using metropolitan-level data from the 1980, 1990, and 2000 US censuses, Moretti (2010) estimated the sensitivity of spillover effects according to employee skill level by using an instrumental variable built from national sectorial data to control for the effects of exogenous shifts on demand for work.

He estimated the following models:

$$\Delta N_{ct}^{NT} = \alpha + \beta \Delta N_{ct}^T + \gamma d_t + \varepsilon_{ct} \quad (5)$$

$$\Delta N_{ct}^{T1} = \alpha' + \beta' \Delta N_{ct}^{T2} + \gamma' d_t + \varepsilon'_{ct} \quad (6)$$

where ΔN_{ct}^{NT} and ΔN_{ct}^T are, respectively, the log first difference of the number of jobs in the tradable and non-tradable sectors in city c , ΔN_{ct}^{T1} is the log first difference of jobs in a randomly selected part of the tradable sector, and ΔN_{ct}^{T2} is the log first difference of jobs in the rest of the tradable sector.

By considering skilled workers with varying college education levels *versus* unskilled workers with a high school education or less, he demonstrated that one additional skilled job in the basic sector generates 2.5 jobs in the non-basic sector, while adding one additional unskilled job in the basic sector generates only 1.04 jobs in the non-basic sector.

The market adjustment of production factors presupposes an elastic supply. When applied to labor, this elasticity depends on migration and the population's rate of participation in the activity. Concerning labor mobility, if the function of workers is solely dependent on the rate of net wages relative to the cost of living in each region, then mobility will be perfect and the

labor supply infinitely elastic. More realistically, however, if we take account of workers' preferences for certain locations and criteria, such as amenities, independent of the job market, households' residential destinations are also influenced by regional living environment characteristics. Research by migration specialists has shown that since the 1970s, climatic and quality-of-life factors have assumed relative importance in relation to economic determinants in migratory plans (Greenwood 1970; Cebula and Vedder 1973; Graves 1976). This decision-making process was summed up by Mulligan and Vias (2011): "Households are often willing to substitute low-wage, high amenity locations for high-wage, low amenity locations" (1000).

At a smaller spatial level, the labor supply depends on the population's rate of participation in the activity. Here, too, the economic determinants influencing whether an individual will decide to go on the job market are compounded by other determinants. Moretti and Thulin (2013), assuming perfect labor mobility across sectors within a region and identical amenities for all cities, compared the effects of rising demand for basic-sector work in the United States and Sweden. They built on Moretti's work on the United States (2010) with a similar study of Sweden (1994-2008) at the level of "labor market regions." The empirical results converged to show that the value of the multiplier depends on the technological level of activities and jobs as well as on the elasticity of the labor supply – "higher labor mobility means smaller wage increases and therefore a larger multiplier" (344). Differences between the countries also emerged, albeit mainly in local labor supply elasticity. Employment multipliers are less differentiated in Sweden due to lower wage differentials (which reduces the effect of skill levels) and/or its social insurance system, which, being more advantageous for employees, reduces variations in the labor supply. At a more sharply spatial level and for small areas, the area of the labor market may be questioned because of the substantial interregional population movements of commuters.

In the long run, labor supply thus plays an important role in explaining employment dynamics in the basic and non-basic sectors as well as how they interact. Some significant changes are underway, however, that challenge the idea that demand for labor can be derived from final demand. A large body of empirical research has shown that population changes precede job changes in both the United States and Europe. Such relative autonomy of population growth in relation to local jobs gives further fodder to the thesis of the “local consumption base,” since these new households’ incomes frequently rely on social transfers of external origin. As Storper’s position attests, however, the debate over causality is far from settled: although “a great deal of urban economics and regional science claims that migration is the chicken [...], the contrary view that I will defend [...] is that individuals and households [...] are the egg, with the chicken being the location of jobs and opportunity to earn income” (Storper 2013, 15).

Empirical analysis of validity conditions of economic base theory

Determining basic and non-basic activities: the relevance of bifurcation methods

As shown in Section 1, the delimitation between basic and non-basic activities is a controversial point, and the foundations of economic base theory hold the possibility of integrating the physical export of goods and the local spending of outside revenue in the base. It is important to include non-earning income, which varies across different types of economies (Bain 1984; Mulligan and Gibson 1984; Kendall and Pigozzi 1994; Nesse 2014; Hodge 1991). To determine the basic nature of revenue, two sets of conceptions are used. For some, geographic origin is the only thing that counts, while others select another criterion: the dependence or independence of this revenue on the level of regional production and on a set

of its characteristics (Stabler and St Louis 1990). The level of regional production directly influences the number of households in a region, and consequently the number of tourists or travelers visiting local households, as well as the number of households eligible for different forms of transfer (unemployment or retirement benefits). This link will be stronger when local households are immobile, thereby explaining the phenomenon of “depreciation” observed locally after the closing of establishments that are big local employers - cf. the applications of EBMs by Rioux and Schofield (1990). Inversely, if retirees and the unemployed are very mobile, leaving and arriving from certain regions, the dependence on or links between the regional capacity of production and level of transfers are much weaker. For example, retirees have a greater proclivity for moving to regions that are deemed pleasant places to live. Farness (1989, 321) noted the following: “If the economic base model is to be analytically useful, it must be recognized that a share of the visitor population and components of the government transfer income are endogenous. They are functionally related to regional levels of economic activity and therefore functionally related to the truly exogenous regional production.”

He has proposed one of the most accomplished classifications of regional production from the point of view of economic base theory. Regional production is classified according to the place of residence of the buyer, the place of delivery of the production, the source of revenue spent, and the (in)dependence of regional production. We end up with a classification of regional production in nine categories:

I. Goods and services sold and delivered to external buyers

II. Goods sold to non-resident visitors (travelers)

A. Dependent on regional levels of production (sold to business travelers with regional destinations and visitors of friends and relatives)

- B. Independent of regional levels of production (sold to travelers with no particular link to the region)*
- III. Goods sold to residents who finance their purchases with legal revenues derived from outside the region
- A. Private interregional transfers (income, revenue from investments, etc.): 1- Dependent on regional levels of production; 2- Independent of regional levels of production;*
- B. Public transfers (old age, unemployment and job security allowances, agricultural, etc.): 1- Dependent on regional levels of production; 2- Independent of regional levels of production;*
- IV. Goods sold to residents who finance their purchases with revenues derived from sales of illegal goods to nonresidents
- V. Goods sold to residents (households, businesses, local governments) who finance their purchases with income earned from regional production

These nine categories are then classified according to their basic or non-basic status and according to the place of residence of the buyer, product delivery, the origin of revenue expended, and its dependence on regional production. Comparing these criteria with each of the nine categories defined previously, we obtain the classification presented in Appendix C1.

Only categories I and V – for which the buyer’s residence, the place of delivery, and the source of the flow of money are either regional or extra-regional – can be classified without any ambiguity as basic or non-basic. For others that have mixed characteristics, identification and classification problems arise. The share of revenues from extra-regional sources that depend on regional characteristics is thus classified as non-basic because of its endogenous

character in relation to the local economy. This is typically the case with spending by travelers who are visiting friends who live in the region, revenues from investments placed by local households, or national benefits for old age/solidarity for which the volume depends directly on the number of local households and therefore the level of regional production (categories II-A, III-A1, III-B1).

In the same vein as Farness (1989), articles aiming to locally estimate the diversity of regional bases note “local” retirees (“aging in place retirees”) and “outsiders” (i.e., attracted by the quality of life) (Hodge 1991; Serow and Haas 1992; Vollet and al. 2005; Nesse 2014; Calafati 2015).

The applications conducted along the same lines as the work by Davezies (2012), more on a national level, consider the revenues of all retirees as basic, even if the definitions proposed for the residential base are more open from this point of view: “the residential base regroups the revenue captured by territories thanks to their residential ‘assets’” and “we speak more of residential base to indicate all of the revenue captured by territories independent of their productive capacity” (Pecqueur and Talandier 2011, 35). For support in making public decisions, some authors (Vollet et al. 2005) provide estimations of basic revenues in a fairly broad range according to whether they include “local” retirees or are limited to “external” retirees. In addition to the difficulty of data collection, each estimation presents a different interest: a wide range highlights a reliance upon national redistribution mechanisms, and a narrow range underlines the importance and potential of attracting new retired populations to local activities on the basis of the attractiveness of the zone over the recent period.

It is more difficult to address the case of public or non-profit jobs, whether they are linked to local authorities or to the state. If we refer to the spirit of the founders, Sombart identified among the “city formers” or basic revenues “a king who collects taxes” (Krumme 1968). North American applications (Hirschl and Summers 1982; Mulligan and Vias 2011) consider

a “Public Administration (PADMN)” as able to correspond to a basic and non-basic demand according to the type of need it is answering. For Talandier (2008, 38), in France, the public base comprises “salaries of non-commuting civil servants”; however, he pointed out that “We estimate that a third of the territorial civil service is directly paid through local taxes and not by the state, subtracting from the public base.” Segessmann and Crevoisier (2013, 716) distinguished between three scenarios for Swiss cantons: local and canton administrations come under the residential economy (respectively “local” and “urban”), while the federal administration is exporting.

Finally, to integrate supply-side factors into EBM, the choice of bifurcation method plays a fundamental role (see the results of Gerking and Isserman (1981) or Nishiyama (1997)). It is necessary to exclude excessively simplistic bifurcation methods (e.g., the assignment method) that are based on wrong assumptions, especially because of the increase in mobility and the role of supply-side factors in this mobility (as a reminder, in the assignment method, it is assumed that misallocations of industry as a basic activity are offset by those assigning all tertiary activities as non-basic). The mobility of retirees and commuters depends on the characteristics of various regional supplies (work, services, and businesses), the roles of which have become increasingly important in contemporary regional economics.

Interactions between the local supply of amenities and the sensitivity of workers or of the population to these amenities complicate the previous nine category classifications. A low supply of amenities makes the area less attractive to external workers, while the marginal multiplier effect of job categories rather than basics will tend to be lower than the average multiplier effect and vice versa (see Appendix C2). Moreover, a high supply of amenities makes non-resident visitors less sensitive to their initial visiting reasons (e.g., visits to friends or family, as in category II-A). As a result, a significant share of their spending is basic (because it depends on non-resident demand, that is, external demand), whereas it is

considered to be basic because it was mainly devoted to the resident population. Therefore, increasing mobility tends to make straightforward bifurcation methods unreliable as an assignment method.

The time horizon of economic base models

The time horizon of the base multiplier may be questioned. Because of the seminal theoretical debates initiated by North (1955) and Tiebout (1956) (cf. Section 1.2), the question of whether economic base theory is a theory of long-run growth and development or a theory of short-run fluctuations remains controversial.

In an initial study, McNulty (1977) used income data for 41 SMSAs in the southeastern United States to estimate a set of differential regional multipliers, such as:

$$\Delta N = \beta_0 + \beta_1 \Delta B_1 + \dots + \beta_k \Delta B_k + \Delta \varepsilon \quad (7)$$

where ΔN is the change in non-basic activity, ΔB_i is the change in the i th basic activity sector, the β s are the parameters to be estimated, and ε is the random term. Estimating the model over various time periods, McNulty (1977) showed that the model explained the data better (higher R^2) when long time differences were used rather than short time differences. This result was interpreted as meaning that economic base theory is more a long-term than a short-term regional analysis theory.

Gerking and Isserman (1981), however, highlighted various methodological flaws in McNulty's (1977) study, the main one being that the model design did not test for the existence of a lagged impact of basic activities on non-basic activities. As there were no time-lagged variables, the estimates merely tested immediate effects over a shorter or longer time period.

Instead, the model to be estimated should be dynamic, as in Sasaki (1963) or Moody and Puffer (1970), where non-basic activities are explained by the present and past values of non-basic and basic activities. More precisely, in Sasaki's (1963) model, non-basic employment in period t (N_t) is explained by previous total employment ($T_{t-k} = N_t + B_t$):

$$N_t = \beta_0 + \sum_{k=0}^x \rho_k T_{t-k} + \varepsilon_t \quad (8)$$

Similarly, Moody and Puffer (1970) specified and estimated an economic base model with an adjustment mechanism. Although this second approach is more convincing, the two studies drew opposite conclusions: Sasaki (1963) concluded that the multiplier effect was felt in the short run (within a year), while Moody and Puffer found it in the long run (several decades) (1970). Beyond the differences in the data samples and lag model designs, the bifurcation method itself may also explain these opposite results.

Gerking and Isserman (1981) estimated a model similar to Sasaki's (1963) model (equation 2) for three SMSAs (Los Angeles, Miami, and Pittsburgh) using three different bifurcation methods: the minimum requirement, the location quotient, and the assignment method. Comparing the estimation results obtained for each of the nine cases, they observed that the bifurcation method dramatically drives the conclusion. The minimum requirement and the location methods both indicate short lags in all three SMSAs, while the assignment method always indicates a long-run effect. Los Angeles is the most illustrative case: the entire impact multiplier is felt within the first year when using the minimum requirement or the location method, while 95% of the total impact multiplier is experienced in the second and subsequent years when using the assignment method. Therefore, the apparently contradictory results of Sasaki's (1963) and Moody and Puffer's (1970) studies could merely be due to the different bifurcation methods chosen.

Using a dynamic version of the traditionally static location quotient (Lesage and Reed, 1989), Lesage (1990) used the error-correction mechanism methodology to identify both long-run equilibrium relations and short-run dynamic interactions between basic and non-basic activities. The results showed evidence of cointegration, indicating a long-run relationship between basic and non-basic activities. It also revealed that the inclusion of the error-correction variable improved forecasting accuracy, which emphasizes the importance of short-run dynamics. A few years later, however, Nishiyama (1997) contradicted this initial result, as he found no cointegration for the states of California, Massachusetts, or Texas; however, he confirmed the observation of Gerking and Isserman (1981) regarding the sensitivity of the results to the bifurcation method used.

The time horizon of the base multiplier remains controversial (Bloomquist 1988; Harris et al. 1992; Kaarlsson et al. 2015). Empirical results have been contradictory, depending on the data samples, designs, and especially the bifurcation method used, but these seminal works called for additional studies on the temporal path of regional growth (e.g., Kraybill and Dorfman 1992).

Integration of city size and sub-regional movements in economic base models

For many years, central place theory and economic base theory developed separately and in parallel. Since the late 1970s, however, the literature has sought to establish connections between these theories in order to better take into account the influence of regional size and geographical characteristics. Following Dacey (1966) and Beckmann and McPherson (1970), Parr et al. (1975), Nourse (1978), and Berry et al. (1988) showed that both theories are equivalent at the city level and that the resulting multipliers are the same from a formal point of view. Thus, according to Nourse (1978), the central place population is a multiple of the

proportion needed in the city to serve the hinterland, which may be considered to be the base population. The empirical implications of these theoretical works are three-fold.

A first strand of the empirical literature has analyzed the influence of location by integrating city size and distance to the city among other community characteristics. Shahidsaless et al. (1983) thus estimated local multipliers, such as:

$$(\Delta E_{nb})_i = \beta_0 + (\beta_1 - 1)\Delta E_{bi} + f(z)\Delta E_{bi} + \varepsilon_i \quad (9)$$

where E_{nbi} is non-basic employment in community i ; E_{bi} is basic employment in community i ; ε_i is the random error term; and $f(z) = f(L_i, P_i, M_i)$, with L_i being the location of the community i , P_i its population size, and M_i the type of manufacturing in community i . The results show that distance from a central place affects local multipliers, but this influence depends on the basic sector (agriculture, manufacturing, or third sector).

A second strand of empirical studies has sought to refine analysis of intra-regional interdependencies by distinguishing between export incomes according to their origin. In line with their previous work, Olfert and Stabler (1999) calculated cross-community multipliers in addition to the own community multiplier for the same 598 communities classified in six functional levels. The cross-community multiplier is defined as the impact on community j resulting from an autonomous expenditure increase initiated in community i . Thus, the combination of own and cross-community multipliers produces system-wide multipliers, which show the system-wide impact of spending initiated at any level in the hierarchy. The results show that cross-community multiplier effects are small for intermediate-sized rural communities and suggest that the central place role of these communities is weak and probably declining. Conversely, larger multiplier effects are observed at higher levels of the trade center system, which may generate conditions conducive to the development of agglomeration economies. Regarding the existence of agglomeration economies, Coulson et

al. (2013) examined the link between economic bases and the price of real estate. The authors used indices of employment growth and integrated the possibility of agglomeration economies derived directly from the first intuitions of Tiebout (1955): “Particular firms are seen as drivers for local economies, not only because they create exogenous spending in and of themselves but also because they often act as triggers for the agglomeration of their industries in particular areas” (1024). They thus showed that the diversity of regional bases decreases the volatility of housing prices. We should note that the question of the importance of the diversity of local bases is the subject of growing investigation in the literature. For example, one of the very first models aims at measuring the effects of the diversification of the local economic base and the stability of local tax revenue by associating EBM and portfolio theory from corporate finance (Yan 2011). According to this theory, diversification helps to reduce the risk or variability of different crises: high levels of revenues and a diversified economic base are said to protect the region from external crises and economic changes and to increase its capacity to repay debt. A study conducted by Yan (2011) in counties in the North American state of Georgia using tax data from 1985 to 2004 showed that the diversification of tax revenue (which is often presented as an objective for the management of local finances) has highly variable effects according to the more or less stable nature of the local economic base.

In an analysis of residential economics in Swiss cantons, Segessmann and Crevoisier (2013, 2016) explicitly admitted the role of factors relating to the supply of services and implicitly recognized the existence of economies of agglomeration in this sector. They distinguished employment that comes from the “urban residential economy” and that is divided spatially according to the hierarchy of urban centers in a dynamic of interregional competition (hospitals, supermarkets, etc.) from that coming from the “local residential economy” that is located close to customers, without the possibility of playing on the

agglomeration forces (i.e., retail stores, local banks, and local administration). Another approach was adopted by Haining (1980, 1987), where exogenous incomes are subdivided into long-distance income movements (extra-regional) and short-distance movements (inter-community). According to the author, investment income, government outlays, and export income earned by the sale of primary and secondary products tend to be associated with extra-regional transfers, whereas the wages of commuting workers represent leakages out of one community but internal to the region. Using employment data for 276 non-metropolitan counties and autoregressive response models, Haining (1987) estimated different models related to rural \ or urban income. Moreover, each model consists of both a long-distance exogenous component and an inter-county exogenous component. Finally, in the urban model, the inter-county component is broken down into several functions of income levels in order to distinguish between the flows according to the different order levels. The first-order urban model is thus:

$$Y_{1,i} = \beta_0 + \beta_1 [X_{1,i} + k_1 \Psi_{1;1,i}] + \varepsilon_1 \quad (10)$$

where Y_1 is the total income of a place of first order, $k_1 Y_1$ is the income-creating propensity to consume in the first-order center, X_1 is the export sector income in the 1st order center, and 1 is the total rural income in the hinterland of the i^{th} first-order place. The results ascertain the influence of geographical organization within the region and suggest a possible loss of income in the first-order centers located between or close to two areas of highest urbanization, which may be due to better opportunities for spending in those higher order urbanized areas.

A third strand of empirical studies has analyzed the relationship between the multiplier value and the size and functional level of cities. These theoretical works conclude that as city size increases and higher orders are attained, the multiplier becomes larger. This relationship may arise from consumer spatial behavior. Indeed, the size of the multiplier increases as the propensity to outshop in other communities decreases, and the latter is expected to occur as

the functional level of the city increases (Olfert and Stabler 1994). The link between the multiplier size and the city functional level may also depend on the labor market. A larger labor pool will reduce in-commuting.

Several empirical studies have sought to test the relationship between multiplier values and city functional levels. Among them, Olfert and Stabler (1994) classified 598 communities into six functional levels according to the number and complexity of their functions. Using estimates of the marginal propensity to import and the marginal propensity to consume locally, they calculated community level multipliers for each of the six functional levels and compared the resulting values. The results confirm the theoretical predictions and show that the smallest communities have the smallest multipliers. The authors conclude that development expenditures have a better chance of success at stimulating the local economy in intermediate-sized rural centers than in the smallest ones, as in this latter case, the initial expenditures are likely to be almost entirely leaked from the community.

Conclusion

Presented as a theoretical framework attentive to demand and inspired by Keynes, the inclusion of supply-side factors in EBMs has been the subject of debate since the 1950s, initiated by Douglas North and Charles Tiebout, making contemporary EBMs closer to monoregional CGE. Two features are strategic for implementing EBMs with supply-side factors: the time horizon and the size of the region.

The time horizon of EBMs is frequently questioned and is still a debated issue for both EBMs and models that include supply-side factors. The empirical literature has shown contradictory results depending on the data samples, designs, and especially the bifurcation method used. The use of rudimentary bifurcation methods, such as the assignment method,

does not appear to be appropriate. By contrast, classifications based on various local mobility features and amenity endowments are relevant to improving the accuracy and validity of EBMs. Moreover, the use of certain econometric techniques (such as error-correction models in time-series data) could provide an even more dynamic character to the models (see notably Lesage 1990; Droff and Paloyo 2015 390). Thus, contrary to Margarian (2013), the effect of coordination is not necessarily convergent but could be path-dependent unequal development.

The size of the region determines the agglomeration forces in both basic and non-basic activities, as revealed by Segessmann and Crevoisier (2013, 2016) with their distinction between the “urban residential economy” and “local residential economy.” Moreover, the choice of the size of the region reveals a dilemma in the theoretical scheme for EBMs that includes supply-side factors: either it is a small region with a small degree of economic integration, where the interdependency between production factors, population, and the rest of the national economy is so intense that monoregional modeling becomes difficult; alternatively, it is a bigger region with a higher but limited degree of economic integration to ensure that the region does significantly impact the national economy; or, finally, multiregional modeling would be more relevant than monoregional modeling. Future works implementing EBMs should address this dilemma.

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Appendix A Relationships between behaviors and location quotients of linked activities

(>1) for the region of Portland in 1996

	Distinctive behaviors	Location quotient (value in parentheses), possible presence of industry cluster
Recreation and fitness	More outdoor activities (e.g., goes camping twice as often, 60% more hiking, 40% more golf, 50% more hunting, 20% more fishing than average Americans).	Sporting goods manufacturing (1.28), sporting goods and bike-shop (1.18); location of many specialized firms (Nike, Columbia Sportswear, Jantzen).
Literacy	More reading (+37%) and less TV (-10%).	Bookstores (1.58), commercial printing (1.52); cluster of publishers and printing firms.
Technical competence	More regular use of personal computer (15% more), ranked 11 th in metropolitan areas for internet access.	Semi-conductors (9.43), computers (2.36); location of many firms specialized in software and hardware (In-Focus, Sequent) and independent service providers.
Environmental orientation	Buying of organic food (+14%), committed to wildlife preservation or to the environment (+15%).	Lawn and garden services (1.28), horticulture (1.94).
Drinking to your health	Portland = ranked 3 rd (after Seattle and San Francisco) for the number of bars, high consumption of alcohol (+17%).	Brewing industry (2.93), wineries (2.73).

Source: from Cortright (2002): Table 1, 13 and data 8-9

Appendix B Estimation of the localness of Canadian cities between 1986 and 2001

	1986	1991	1996	2001
Metropolitan cities	0.76	0.8	0.84	0.82
Medium-sized cities	0.69	0.71	0.73	0.73
Small central cities	0.66	0.68	0.72	0.69
Small peripheral cities	0.55	0.52	0.59	0.6

Source: from Rutland and O'Hagan (2007): Tables 1 to 4, 175-179.

Appendix C1 Classification of regional production according to the basic or non-basic status of the activities

	Basic or non-basic status		Place of the buyer's residence		Place of delivery		Source of revenue		
	<i>Basic</i>	<i>Non-basic</i>	<i>Regional</i>	<i>Extra-regional</i>	<i>Regional</i>	<i>Extra-regional</i>	<i>Regional</i>	<i>Extra-regional dependent on regional production</i>	<i>Extra-regional independent of regional production</i>
<i>I</i>	x			x		x			x
<i>II - A</i>		x		x	x			x	
<i>II - B</i>	x			x	x				x
<i>III - A1</i>		x	x		x			x	
<i>III - A2</i>	x		x		x				x
<i>III - B1</i>		x	x		x			x	
<i>III - B2</i>	x		x		x				x
<i>IV</i>	x		x		x				x
<i>V</i>		x	x		x			x	

Appendix C2 Impact of local amenity supply on labor elasticity and basic/non-basic feature of activities

	<i>High supply of amenities High sensitivity of workers and population</i>	<i>Low supply of amenities Low sensitivity of workers and population</i>
<i>Categories of jobs rather basics (I, II-B, III-A2, III-B2, IV)</i>	High elasticity of labor Maximum multiplier effect	Low elasticity of labor Limited multiplier effect
<i>Categories of jobs rather non-basics (II-A, III-A1, III-B1, V)</i>	Significant share of basic jobs	Insignificant share of basic jobs

NOTES

¹ Werner Sombart is generally recognized as the founder of the concept (Krumme 1968). He made the distinction between “actual city founders,” whose activities “enabled them to bring in money from outside the city,” and the “passive or secondary city founders,” whose activity depended on the former. Krumme (1968) highlighted that Sombart had already identified several categories of “city founders”: “a manufacturer who sells industrial products to the outside;” “a student who is supported by his parent in another place;” “a merchant who profits from trade with the outside;” “an author whose writings are being bought outside the gates.” In the same way, Alexander (1954) came to the conclusion that authors such as Aurousseau or Olmsted (1921, in Alexander 1954) distinguished between two types of activities: “primary” economic activities (currently understood as basic) or “ancillary” activities (currently understood as non-basic or domestic activities).

² North (1955) borrowed the term “residential” from Vining (1946), who spoke of “residential industry” and had already borrowed the term from the non-published work of P.S. Florence (cf. North 1955, 249).

3. Tiebout (1956) distinguished the concept of export-base, developed in regional analysis to identify the main autonomous variable determining the level of regional revenue, from that of the economic base, rather in vogue with planners and researchers interested in urban issues.

4. North’s work in the 1980s and 1990s insisted on the role of institutional factors as key factors in regional growth: “*The most fundamental long-run source of change is learning by individuals and entrepreneurs of organizations...*” (North 1994, p. 361).

5. This point was to be the subject of sharp criticism from his detractors, with North leading the way in an article in the form of a counterargument.