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Symmetrical Approaches for the Non-Survey Regionalization Techniques: Ameliorating the Flegg's Location Quotients[1]

Abstract. In most countries, policy planners face a lack of published primary regional and local input-output (I-O) data for analysing productive networks, which has led researchers to develop various non-survey techniques for the secondary estimation of regional and local intersectoral direct requirements coefficients, serving as the basis for calculating sectoral multipliers. This study seeks to improve non-survey regionalization techniques to better capture regional and local sectoral specializations and to produce more accurate sectoral multipliers for subnational development planning. The hypothesis is that a symmetrical and unrestricted use of the simple location quotient (SLQ), as part of the adjusted Flegg's location quotient (aFLQ), such as the proposed KFLQ variation, can provide a more reliable database for modelling regional development. Under this approach, regional and local coefficients are allowed to surpass national averages. For the empirical analysis, the productive network of the West Greece region was simulated. Weighted and non-weighted type I backward sectoral employment multipliers were estimated to illustrate the differences resulting from the application of various regionalization techniques. The hypothesis was tested using the assumption that the parameter δ should be set so that KFLQ approaches 1 when the regional-to-national size of a sector approaches its average national allocation across regions. For SLQ, this occurs for each sectoral indicator at approximately 1.5. This assumption resolves the problem of the previously arbitrary definition of the exponent δ.

Keywords: Regional input-output analysis, non-survey techniques, logarithmic Flegg's location quotients, KFLQ variation, West Greece region, employment

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ИССЛЕДОВАТЕЛЬСКАЯ СТАТЬЯ

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Симметричные подходы к расчету коэффициентов регионализации на основе безопросных методов: совершенствование коэффициентов локализации Флегга

Аннотация. В большинстве стран при разработке стратегий развития в части анализа производственных сетей сталкиваются с нехваткой первичных региональных и локальных данных «затраты–выпуск». Чтобы решить эту проблему, ученые на протяжении десятилетий занимаются разработкой безопросных методов для вторичного определения региональных и локальных межотраслевых коэффициентов прямых затрат, которые используются для оценки отраслевых мультипликаторов. Настоящее исследование сосредоточено на совершенствовании безопросных техник регионализации с учетом отраслевой специализации регионов и более точном расчете мультипликаторов для планирования развития на региональном и локальном уровне. Гипотеза исследования заключается в том, что симметричное и свободное от ограничений использование простого коэффициента локализации (SLQ) как части скорректированного коэффициента локализации Флегга (aFLQ), например, в предлагаемой вариации KFLQ, позволяет получить более надежную базу данных для моделирования региональных процессов развития. В этом случае действует принцип, согласно которому региональные и локальные межотраслевые коэффициенты прямых затрат могут превышать средние национальные значения для соответствующих отраслей. Для эмпирического анализа была смоделирована производственная сеть региона Западная Греция. Для демонстрации различий между методами регионализации были рассчитаны обратные мультипликаторы занятости типа I во взвешенном и невзвешенном вариантах по отраслям. Проверка гипотезы проводилась с учетом допущения, что параметр δ определяется таким образом, чтобы KFLQ стремился к 1, когда соотношение размеров отрасли в регионе и на национальном уровне приближается к среднему отраслевому распределению по всем регионам. Для SLQ это соответствует каждому отраслевому показателю примерно при значении 1,5. Такое допущение решает проблему произвольного выбора показателя δ в существующих методах.

Ключевые слова: анализ региональных таблиц «затраты-выпуск», безопросные методы, логарифмический коэффициент локализации Флегга, вариация KFLQ, Западная Греция, занятость

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Introduction

The limited availability of statistical data, particularly highly disaggregated information on regional and local productive structures, creates the need for secondary simulation of these networks. Such simulation makes it possible to analyse their current state and identify potential sectoral development paths and priorities (Flegg et al., 1995; Flegg & Webber, 1997, 2000; Bonfiglio, 2009; Flegg & Tohmo 2013; Zhao & Coi, 2015; Flegg et al., 2016; Lamonica & Chelli, 2018; Fujimoto, 2019; Flegg & Tohmo, 2019; Romero et al., 2019; Flegg et al., 2021; Azorín et al., 2022).

"Non-survey" or mechanical simulation techniques for deriving regional and local direct requirements matrices fall into two main categories: location quotient methods and commodity balance approaches. The first category includes both non-logarithmic and logarithmic location quotients. The non-logarithmic variants are historically older (Tiebout, 1967), while logarithmic location quotients represent ongoing efforts to improve these tools as secondary simulation methods used to derive regional and local direct requirements tables from national-level data (Round, 1972; Flegg et al., 1995; Flegg & Webber, 1997, 2000; Flegg & Tohmo 2013; Zhao & Coi, 2015; Flegg et al., 2016; Lamonica & Chelli, 2018; Fujimoto, 2019; Flegg & Tohmo, 2019; Flegg et al., 2021; Azorín et al., 2022).

The aim of this study is to improve the precision of secondarily derived regional and local direct requirements matrices. To this end, the author introduces and examines the non-conventional (symmetrical) adjusted logarithmic Flegg's location quotient (KFLQ). This measure offers a symmetrical alternative to the simple location quotient (SLQ) within the framework of the adjusted Flegg's location quotient (aFLQ). The study investigates the hypothesis that the proposed KFLQ variant can provide a more realistic and accurate data foundation for regional development policy.

The hypothesis is tested by simulating the intersectoral direct requirements matrix of the productive structure of West Greece and comparing three mechanical logarithmic techniques: the adjusted Flegg's location quotient (aFLQ), the augmented Flegg's location quotient (AFLQ) (Flegg & Webber, 1997, 2000), and the proposed KFLQ variant. Type I weighted and non-weighted backward employment multipliers (Kolokontes et al., 2020) are calculated and compared to highlight and clarify the differences among the simulation techniques.

The analysis confirms the hypothesis by providing a concrete rule for determining the parameter δ, addressing its previously arbitrary definition. The results also shed light on the productive structure of West Greece, identifying the most dynamic sectors for the region's long-term employment prospects (Kolokontes et al., 2020).

Critical Literature Review

Collecting primary data on regional or local transactions is both costly and time-consuming, which complicates the study of regional and local productive networks (Kronenberg, 2009; Lehtonen & Tykkyläinen, 2014). As noted in the introduction, a range of non-survey mechanical techniques has been developed to address these constraints when deriving sub-national direct requirements coefficients. These approaches also provide a fast and cost-effective tool for development planning in contexts where survey-based data are limited (Kronenberg, 2009; Lehtonen & Tykkyläinen, 2014; Zhao & Choi, 2015; Flegg & Tohmo, 2019).

The reliability of non-survey regionalization methods has long remained a subject of debate in academic literature. This discussion began in the 1950s, when the first attempts to estimate sub-territorial intersectoral direct requirements coefficients relied on "simple compressors" (Isard & Kuene, 1953; Moore & Petersen, 1955; Miller, 1957). These compressors were defined as ratios of: regional to national population (${}_{R}P$ / ${}_{N}P$), regional to national employment (${}_{R}E$ / ${}_{N}E$), and regional to national sectoral employment (${}_{R}E_j$ / ${}_{N}E_j$). However, scholars such as Moore & Petersen (1955), Czamanski (1969), Su (1970), and McCann & Dewhurst (1998) observed that a regional or local economy cannot be treated as a scaled-down version of the national economy. This observation is correct but incomplete: at the coefficient level, the national economic structure represents the average of all sub-territorial structures.

The literature shows considerable confusion between regional or local coefficients (such as intraregional intersectoral coefficients, interregional sub-territorial coefficients, and regional import or export coefficients) and their corresponding absolute magnitudes. While national intersectoral transactions for each sector pair (*j, i*) are sums of their sub-national components, such aggregation produces totals—not averages—unlike what is observed with coefficients. Differences in regional and local direct requirements coefficients reflect genuine variation in productive structures, driven by sectoral specialization. Sub-national sectoral specializations contribute to uneven spatial development. This manuscript examines the formation of national average coefficients without discussing the origins of these imbalances, treating them as an evident and ongoing phenomenon.

Consequently, the national direct requirements coefficients are defined as follows: ${}_{N}a_{ji} = [\sum_{R=1}^{k} {}_{R}z_{ji} / {}_{R}X_i] / k = (\sum_{R=1}^{k} {}_{R}a_{ji}) / k$ [*k* represents the number of regions/sub-territories (*R*), ${}_{R}z_{ji}$ represents the regional or local intersectoral transactional flows in nominal/absolute values, ${}_{R}a_{ji}$ denotes the corresponding regional or local intersectoral direct requirements coefficients, and ${}_{N}a_{ji}$ are the national average coefficients]. The nominal values of national intersectoral transactional flows for each sector pair (*j, i*) are represented as ${}_{N}z_{ji} = \sum_{R=1}^{k} {}_{R}z_{ji} = \sum_{R=1}^{k} ({}_{R}a_{ji})({}_{R}X_i)$ [*X* denotes output in the backward analysis]. These definitions and conventions apply throughout the remainder of this paper.

The debate over using location quotients as techniques for the secondary derivation of unknown regional and local data began in the 1960s with Leven (1964) and Haggett (1965 [2008]), following the pioneering work of Robert Murray Haig (1887–1953) on constructing location quotients. The two main approaches were the simple location quotient (SLQ) and the cross-industry location quotient (CILQ).

The simple location quotient is expressed as follows (Leven, 1964; Haggett, [(1965)2008]; Flegg et al., 1995; Flegg & Webber, 1997, 2000; Tohmo, 2004; Bonfiglio, 2009; Flegg & Tohmo, 2013a, 2016, 2019; Romero et al., 2019):

$$SLQ_j = ({}_RE_j / {}_RE) / ({}_NE_j / {}_NE), \quad (1)$$

the numerator represents the importance of sector j in the regional or local productive network in terms of employment, while the denominator reflects the corresponding significance of the same sector in the national productive network. In other words, the quotient measures the relative importance of sector j in the regional or local network compared to the national network. It should be noted that Equation (1) uses nominal/absolute values.

Using the derived sectoral SLQ, the coefficients of sub-territorial direct requirements matrices can be estimated via the following equation: ${}_Ra_{ji} = (SLQ_j)({}_Na_{ji})$.

Unfortunately, in the literature, the conventional application of SLQ is often overly conservative, restrictive, and prone to errors. Specifically, the standard derivation of regional and local coefficients using SLQ follows an unorthodox and asymmetric logic:

— if $SLQ_j < 1$, then: ${}_Ra_{ji} = (SLQ_j)({}_Na_{ji})$ and ${}_Rim_i > {}_Nim_i$ ['im' means the imports]

— if $SLQ_j = 1$, then: ${}_Ra_{ji} = {}_Na_{ji}$, and ${}_Rim_i = {}_Nim_i$

— if $SLQ_j > 1$, then it is replaced with $SLQ_j = 1$, to ensure that the following remains valid: ${}_Ra_{ji} = {}_Na_{ji}$, and ${}_Rim_i = {}_Nim_i$.

This treatment is unjustified because the quantities in the calculations are coefficients, not nominal values. The conventional approach assumes that the maximum value of any intraregional intersectoral coefficient is its national average: $\max({}_Ra_{ji}) = {}_Na_{ji}$ and ${}_Ra_{ji} \le {}_Na_{ji}$, confusing coefficients with their nominal/absolute measurements: $({}_Ra_{ji})({}_RX_i) \le ({}_Na_{ji})({}_NX_i)\ \forall R \subset N \Rightarrow {}_Rz_{ji} \le {}_Nz_{ji}\ \forall\ {}_Ra_{ji}$. It should be noted that ${}_RX_i = {}_NX_i$ only if $R = N$, and the fact that ${}_RX_i < {}_NX_i\ \forall R \subset N$ does not imply that the following is necessarily true: ${}_Ra_{ji} \le {}_Na_{ji}$.

Therefore, it must be clear that:

— if ${}_Ra_{ji} < {}_Na_{ji}$, then $({}_Ra_{ji})({}_RX_i) < ({}_Na_{ji})({}_NX_i) \Rightarrow {}_Rz_{ji} < {}_Nz_{ji}$, $\forall R \subset N$, as ${}_RX_i < {}_NX_i$, $\forall R \subset N$, and this means that when a disaggregating intraregional intersectoral direct requirements coefficient is smaller than its national average (${}_Ra_{ji} < {}_Na_{ji}$), then the nominal/absolute value of disaggregating intraregional intersectoral transactional flow (${}_Rz_{ji}$) is smaller than its national measurement (${}_Nz_{ji}$),

— and if ${}_Ra_{ji} > {}_Na_{ji}$, then again the inequation $({}_Ra_{ji})({}_RX_i) < ({}_Na_{ji})({}_NX_i) \Rightarrow {}_Rz_{ji} < {}_Nz_{ji}$, $\forall R \subset N$ remains in force; since the inequation ${}_Ra_{ji} > {}_Na_{ji}$ cannot override the inequation ${}_RX_i < {}_NX_i$, $\forall R \subset N$; even if a disaggregated sub-territorial (regional or local) direct requirements coefficient exceeds its national average (${}_Ra_{ji} > {}_Na_{ji}$), the corresponding nominal/absolute value of the sub-national intersectoral transactional flow (${}_Rz_{ji}$) remains smaller than its national counterpart (${}_Nz_{ji}$).

Thus, although the SLQ is not a "simple compressor," it is often treated as such in the literature. This approach generates significant discrepancies between the estimated sub-territorial intersectoral direct requirements coefficients (${}_Ra_{ji}$) and their actual values (${}_Ra^{\bullet}_{ji}$), typically resulting in underestimation: ${}_Ra_{ji} - {}_Ra^{\bullet}_{ji} < 0$. This observation can be seen in the data presented further on, in Table 2 (Section 4).

The limitations of the conventional SLQ approach led to the development of an alternative method, the cross-industry location quotient ($CILQ$), defined as:

$$CILQ_{ji} = ({}_RE_j / {}_NE_j) / ({}_RE_i / {}_NE_i), \quad (2)$$

The rationale behind $CILQ$ was to account for the dual nature of transactions between seller and purchaser sectors by considering the relative sizes of both sectors in the region compared to their national contributions. However, $CILQ$ has been shown to be unable to fully correct the one-by-one shrinkage of deviations $(\min[{}_Ra_{ji} - {}_Ra^{\bullet}_{ji}])$. In practice, the $CILQ$ approach fails to provide the intended improvement and has limited practical usefulness.

The perceived usefulness of $CILQ$ arises from its separation of sectors into sellers and purchasers, which forms its fundamental basis. However, this separation is largely illusory (for a detailed discussion on why, see Fujimoto (2019), Flegg et al. (2021), Kolokontes (2021). Such a separation is meaningful only in the context of quantity-oriented backward and "adjusted forward" models, i. e., models built on a different constructional philosophy (Kolokontes, 2021).

A parallel or simultaneous simulation of regional/local backward and their corresponding "adjusted forward" direct requirements matrices could assign a new role to the $CILQ$, as part of a broader scheme. However, this is beyond the scope of the present research. Applied alone, or in combination with other approaches (e.g., the FLQ formula) in a single direction—either backward or "adjusted forward"—$CILQ$ is of limited utility. In contrast, the SLQ, when treated with a suitable non-conventional approach, can serve as a reliable component in more complex models, yielding regional or local direct requirements matrices (backward or "adjusted forward") based on preliminary national matrices. For clarity and brevity, this paper focuses on backward models, though the same principles apply to frontloading adjusted approaches as in Kolokontes (2021).

Another important development in location quotients was the inclusion of the size of the studied sub-national productive network. For example, a “simple compressor” of regional-to-national employment ($_RE$ / $_NE$) could be included in a location quotient, which was not done in the original *SLQ* or *CILQ* formulas. This idea led to Round’s semi-logarithmic location quotient (*RLQ*), followed by the Elliott location quotient (*ELQ*) and Flegg’s location quotient (*FLQ*). Among these, Flegg’s formulas are currently the most reliable tools for regionalizing national data, although they retain limitations that require refinement. Specifically, their effectiveness is constrained by reliance on *CILQ* and by the conventional, restrictive, and erroneous use of *SLQ*.

Flegg, Webber, and Elliott (1995), building on Elliott’s development of Round’s logarithmic location quotient (*ELQ*), proposed the Flegg logarithmic location quotient (*FLQ*). This approach aimed to improve upon pre-existing non-logarithmic methods by creating a quotient that accounts for the size of the simulated regional or local economy in secondary mechanical constructions. The first form of *FLQ* was introduced in 1995:

$$FLQ_{ji} = CILQ_{ji}\lambda_r^{\beta} = CILQ_{ji}[({}_RE / {}_NE)/\log_2(1+\frac{{}_RE}{{}_NE})]^{\beta}, \quad \forall j \neq i \quad (3a)$$

in which: $CILQ_{ji}$ = 1 replaces each $CILQ_{ji}$ > 1 (reflecting the traditional/conventional way)

and

$$FLQ_{ji} = SLQ_j\lambda_r^{\beta} = SLQ_j[({}_RE / {}_NE)/\log_2(1+\frac{{}_RE}{{}_NE})]^{\beta}, \quad \forall j = i \quad (3b)$$

in which: SLQ_j = 1 replaces each SLQ_j > 1 (reflecting the traditional/conventional way), with β taking values within the range [0,5].

The construction of the *FLQ* is grounded in the *CILQ* $\forall j \neq i$ and *SLQ* $\forall j = i$. If β = 0, then $FLQ_{ji} = CILQ_{ji}$, $\forall j \neq i$; while $FLQ_{ji} = SLQ_j$, $\forall j = i$. If β ≠ 0, then the logarithmic term $\lambda_r^{\beta} = [({}_RE / {}_NE)/\log_2(1+\frac{{}_RE}{{}_NE})]^{\beta}$ introduces the dimension of the relevant size of the simulated regional or local economy into the location quotient. This means that the FLQ remains tied to the problematic CILQ and, in addition, uses the SLQ in its traditional (conventional) form. Furthermore, when the $CILQ_{ji}$ = 1 and SLQ_j = 1, then the $FLQ_{ji} = \lambda_r^{\beta}$.

In 1997, as part of their effort to improve the original FLQ formula, Flegg and Weber introduced the adjusted Flegg’s logarithmic location quotient (aFLQ), following the logic:

$$aFLQ_{ji} = CILQ_{ji}\lambda^* = CILQ_{ji}[\log_2(1+\frac{{}_RE}{{}_NE})]^{\delta}, \quad \forall j \neq i \quad (4a)$$

in which: $CILQ_{ji}$ = 1 replaces each $CILQ_{ji}$ > 1 (reflecting the traditional/conventional way), and:

$$aFLQ_{ji} = SLQ_j\lambda^* = SLQ_j[\log_2(1+\frac{{}_RE}{{}_NE})]^{\delta}, \quad \forall j = i \quad (4b)$$

in which: SLQ_i = 1 replaces each SLQ_j > 1 (reflecting the traditional/conventional way), with δ taking values within the range [0,1]. If δ = 0, then FLQ_{ji} = $CILQ_{ji}$, $\forall j \neq i$; while $FLQ_{ji} = SLQ_j$, $\forall j = i$. If δ ≠ 0, then the logarithmic term $\lambda^* = [\log_2(1+\frac{{}_RE}{{}_NE})]^{\delta}$ introduces the dimension of the relative size of the simulated sub-national economy. However, the adjusted *FLQ*, like the original formula, remains tied to the problematic *CILQ* and to the restrictive, conventional use of the *SLQ*. Additionally, when the $CILQ_{ji}$ = 1 and SLQ_j = 1, then the $FLQ_{ji} = \lambda^*$.

Long before the development of Flegg’s location quotients, Round (1978) questioned why regional coefficients should be simulated from national data only when the location quotients are below one (LQ_{ji} < 1), and not when they exceed one (LQ_{ji} > 1). His observation, however, remained purely theoretical. Drawing on Round’s idea, Flegg and Webber (2000) introduced the “augmented FLQ” (*AFLQ*). This augmented version was the first attempt to incorporate regional or local sectoral specializations into a fully non-survey regionalization procedure. The augmented Flegg’s location quotient (*AFLQ*) is defined as follows (Flegg & Webber, 2000; Flegg & Tohmo, 2013a; Flegg et al., 2016; Flegg & Tohmo, 2019; Flegg et al., 2021):

$$\text{if } SLQ_j \leq 1, \text{ then: } AFLQ_{ji} = aFLQ_{ji} \quad (5a)$$

via equations (4a) and (4b) [without replacements and if SLQ_j > 1 and $j \neq i$:

$$AFLQ_{ji} = aFLQ_{ji}[\log_2(1 + SLQ_j)] = CILQ_{ji}\lambda^*[\log_2(1 + SLQ_j)] = CILQ_{ji}[\log_2(1+\frac{{}_RE}{{}_NE})]^{\delta}[\log_2(1+SLQ_j)]$$

(reflecting the conventional way via the $aFLO_{ji}$), (5b)

while if SLO_j > 1 and $j = i$: $AFLQ_{ji}$ = $aFLQ_{ji}[\log_2(1 + SLQ_j)] = SLQ_j\lambda^*[\log_2(1 + SLQ_j)]$ =

$$SLQ_j[\log_2(1+\frac{{}_RE}{{}_NE})]^{\delta}[\log_2(1+SLQ_j)]$$

(reflecting the conventional way via the $aFLQ_{ji}$), (5c)

The incorporation of the regional/local sectoral specialization term, $[\log_2(1 + SLQ_j)]$, into the augmented approach of Flegg’s location quotient (*AFLQ*) was intended, on the one hand, to account for the potential specialization of sector j when simulating the regional or local productive structure; and, on the other hand, to address the apparent rigidity of the FLQ magnitude so that sectoral specialization could be effectively reflected through its logarithmic expression (Kowalewski, 2015; Flegg & Tohmo, 2019). In this vein, the following syllogism was adopted:

— $1 < [\log_2(1 + SLQ_j)] < SLQ_j$, $\forall SLQ_j > 1$ and

— $[\log_2(1 + SLQ_j)] = SLQ_j = 1$, $\forall SLQ_j = 1$,

— while $\forall SLQ_j < 1$, the specialization term, $[\log_2(1 + SLQ_j)]$, is not incorporated into the *AFLQ*, as shown by equations (4a) and (4b) through equation (5a).

The key limitation of the adjusted Flegg's location quotient (*aFLQ*) is that it inherently follows the conventional approach (4a, 4b) and therefore cannot generate values greater than one, overlooking regional or local sectoral specializations. Because the *SLQ* and *CILQ* systematically underestimate coefficients (see Table 2, Section 4), the conventional *aFLQ* and *AFLQ*, both of which rely on SLQ and *CILQ*, also inherit this underestimation. In the case of the *AFLQ*, the sectoral specialization scale $[\log_2(1 + SLQ_j)]$ does not resolve this issue; instead, it further reduces the estimated intraregional intersectoral direct requirement coefficients ($_Ra_{ji}$), intensifying the underestimation.

In other words, the adjusted Flegg's formula (*aFLQ*) cannot generate intraregional intersectoral direct requirements coefficients ($_Ra_{ji}$) that exceed the corresponding national sectoral averages ($_Na_{ji}$). The augmented Flegg's location quotient (*AFLQ*) inherits the same limitation, offering no substantive improvement and producing results that are almost identical to those of the *aFLQ*. As a result, *AFLQ* struggles to reveal regional or local sectoral specializations, even though addressing this issue was its primary purpose.

This weakness arises from the excessive and restrictive austerity embedded in *AFLQ*'s components, specifically:

— the conventional premise of the adjusted Flegg's quotient ($aFLQ \leq 1$) underlying the augmented expression, and

— the restrictive nature of the sectoral specialization scale $[\log_2(1 + SLQ_j)]$.

More precisely, the logarithmic sectoral specialization scale cannot, on its own, counteract the limitations imposed by the $aFLQ \leq 1$ convention. Yet this is exactly its intended role: to function as a counterweight to the excessive shrinkage of the components $_Ra_{ji}$ in simulated regional/local direct requirements matrices, a shrinkage generated by the conventional restriction $aFLQ \leq 1$ within the *AFLQ* formula.

This constitutes the first problem. Before proposing a solution, the second problem inherent in the Flegg's location quotient approaches must also be discussed.

Both the adjusted and augmented *FLQ* formulas (*aFLQ*, *AFLQ*) rely on the exponent δ. The literature has long debated the arbitrary determination of δ, prompting numerous empirical studies aimed at defining a narrower range of values for this parameter (McCann & Dewhurst, 1998; Bonfiglio, 2009; Flegg & Tohmo, 2013a, 2013b; Kowalewski, 2015; Zhao & Choi, 2015; Flegg & Tohmo, 2016, 2018; Lamonica & Chelli, 2018; Flegg & Tohmo, 2019; Fujimoto, 2019; Flegg et al., 2021). However, this approach is flawed.

Alternative methods were proposed by Kowalewski (2015) and Fujimoto (2019), but both are unrealistic due to the lack of adequate sub-national data. In comparison with the *aFLQ* technique, Kowalewski's (2015) sector-specific *FLQ* (*SFLQ*) differs in the exponent of its logarithmic term $\lambda^* = [\log_2(1 + \frac{_RE}{_NE})]^{\delta_i}$. Kowalewski proposed an ad hoc specification of the exponent δ_i for individual sectors or groups of sectors to improve the outcomes of Flegg's adjusted location quotient. While conceptually rational, this approach becomes impractical for highly disaggregated sub-territorial studies. Flegg and Tohmo (2019) and Flegg et al. (2021) correctly note that Kowalewski's method "introduces much greater complexity into the modeling process." Similarly, Fujimoto's approach and FLQplus (FLQ+) are even more complicated in practice and still fail to provide a clear, concrete method for determining δ.

In contrast to the increasingly complex and often unnecessary modifications, this manuscript, favoring simplicity and drawing on past approaches, proposes and applies a modified version of Flegg's formulae that can determine the magnitude of the component δ in a simpler and more logical way, as detailed in the following sections.

Sub-national specializations reflect real regional and local differences in productive factors, traditions, knowledge, technology adoption, and innovation drive (McCann & Dewhurst, 1998; Kronenberg, 2009; Lehtonen & Tykkyläinen, 2014). As Lehtonen and Tykkyläinen (2014) note, regional and local peculiarities significantly influence simulations of the sub-national productive nexus. Therefore, selecting an appropriate location quotient is crucial. Although LQs are often described as “a gamble” due to their conventional, restrictive, and asymmetric application, this critique highlights a real problem: the arbitrary choice of regionalization techniques can undermine the accuracy and reliability of intraregional intersectoral coefficient estimates.

In this context, beyond the conventional (traditional) use of location quotient techniques, a non-conventional routine is needed to account for sub-territorial specializations. This routine must overcome the flawed practice of setting ${}_{R}a_{ji}$ = ${}_{N}a_{ji}$ for all the cases where $LQ_{ji} \geq 1$, which ignores regional and local sectoral specializations. The goal is for this non-conventional approach to generate more realistic and accurate sub-national intersectoral direct requirements coefficients (${}_{R}a_{ji}$), derived from their national averages while reflecting regional and local specializations, but without relying on specialization scales like those used in *AFLQ*. At the same time, this approach should adjust the coefficients of regional/local sectoral imports (${}_{R}im_{j}$) to a more realistic level, following the logic:

— if $LQ_{ji} > 1$, then: ${}_{R}a_{ji} = (LQ_{j})({}_{N}a_{ji}) > {}_{N}a_{ji} \Rightarrow {}_{R}a_{ji} > {}_{N}a_{ji}$ and ${}_{R}im_{i} < {}_{N}im_{i}$

—if $LQ_{ji} = 1$, then: ${}_{R}a_{ji} = (LQ_{j})({}_{N}a_{ji}) = {}_{N}a_{ji} \Rightarrow {}_{R}a_{ji} = {}_{N}a_{ji}$ and ${}_{R}im_{i} = {}_{N}im_{i}$

— while if $LQ_{ji} < 1$, then: ${}_{R}a_{ji} = (LQ_{j})({}_{N}a_{ji}) < {}_{N}a_{ji} \Rightarrow {}_{R}a_{ji} < {}_{N}a_{ji}$, and only then ${}_{R}im_{j} > {}_{N}im_{i}$.

Furthermore, as discussed above, the proposed improvement must address the arbitrary determination of the exponent δ, which remains one of the most debated issues in Flegg’s location quotients (Bonfiglio, 2009; Flegg & Tohmo, 2013a, 2013b; Kowalewski, 2015; Zhao & Choi, 2015; Flegg & Tohmo, 2016; Lamonica & Chelli, 2018; Flegg & Tohmo, 2019; Flegg et al., 2021; Azorín et al., 2022). Accordingly, a rational specification of δ is essential.

Methodology and Data

The Transition to the Non-Conventional (Symmetrical) Use of SLQ

The key to this non-conventional methodological approach lies in the treatment of the simple location quotient (SLQ). To maintain simplicity, the main adjustment involves modifying its use so that regional and local sectoral specializations are properly captured, overcoming the limitations of asymmetric adjustments. The symmetrical, non-conventional approach to SLQ provides a clear path to achieve this goal. Table 1 presents the full syllogism:

Consequently, based on the illustrations in Table 1 and the critical analysis in Section 2, the three rules that the proposed non-conventional (symmetrical) methodological routine must follow are:

1. Avoid any reliance on the cross-sectional location quotient (*CILQ*), which is conventionally asymmetric by definition and can create distortions by separating sectors into sellers and purchasers.

2. Preserve the original *SLQ* magnitudes ($SLQ \geq 1$, $SLQ = 1$ & $SLQ < 1$) without adjustments when they exceed unity, allowing sectoral specializations to be more easily captured and avoiding the underestimations inherent in Flegg’s scale $[\log_2(1 + SLQ_j)]$ and the constraints of the *AFLQ* formula.

3. Include a component that moderates overestimations of *SLQ* without compromising the identification of significant regional/local sectoral specializations, which are reflected in *SLQ* values greater than one. For this purpose, Flegg’s logarithmic scale $\lambda^* = [\log_2(1 + \frac{{}_{R}E}{{}_{N}E})]^{\delta}$ is sufficient, as it also accounts for the relative size of the region.

The KFLQ Suggested Variation

Based on the prerequisite features outlined above, the author proposes the “non-conventional (symmetrical) approach of the adjusted logarithmic Flegg’s location quotient (KFLQ)” as follows:

$$KFLQ_j = SLQ_j \lambda^* = SLQ_j [\log_2(1 + \frac{{}_{R}E}{{}_{N}E})]^{\delta} \quad (6)$$

$$\forall SLQ_j > 1 \;\&\; \leq 1 \text{ and } \forall j \neq \;\&\; = i$$

The proposed non-survey regionalization technique offers two notable advantages:

1. Symmetry and Flexibility: It provides a unified, symmetrical application without arbitrary limits or restrictions, allowing regional/local intersectoral direct requirements coefficients to exceed their corresponding national averages: ${}_{R}a_{ji} > {}_{N}a_{ji}$.

2. Determination of the Exponent δ: The technique resolves the long-standing issue of defining the magnitude of the parameter δ. Using this approach, the specification of δ is no longer arbitrary, as the method establishes a clear criterion: “the coefficients SLQ_j that are close to 1,5 should be adjusted to 1 using the *KFLQ* formula, i.e $SLQ_j = 1.5 \Rightarrow KFLQ_j \approx 1$.”. The rationale behind this procedure is detailed in Section 3.

Table 1

Conventional vs. Non-Conventional Use of SLQ

If $SLQ_j \leq 1$:	If $SLQ_j > 1$:	If $SLQ_j > 1$:
Conventional and non-conventional approach:	**Conventional (asymmetric) approach:**	**Non-conventional (symmetrical) approach:**
${}_Ra_{ji} = (SLQ_j)({}_Na_{ji})$ $\Rightarrow {}_Ra_{ji} \leq {}_Na_{ji}$ and ${}_Rim_i \geq {}_Nim_i$ which means that both of these approaches apply the same logic in case of $SLQ_j \leq 1$.	If the magnitude of $SLQ_j > 1$, it is replaced by the restrictive threshold , and consequently: $SLQ_j = 1$, and hence: ${}_Ra_{ji} = (SLQ_j)({}_Na_{ji})$ $\Rightarrow {}_Ra_{ji} = {}_Na_{ji}$ That is, the equations: $\max({}_Ra_{ji}) = {}_Na_{ji}$ And, simultaneously, ${}_Rim_i = {}_Nim_i$, videlicet $\min({}_Rim_i) = {}_Nim_i$ are applied, meaning that the conventional (asymmetric) approach assumes that, at a minimum, regional/local import coefficients cannot fall below the corresponding national averages, while regional/local intersectoral direct requirements coefficients cannot exceed their national averages. Thus, the conventional (asymmetric) approach disregards regional/local sectoral specializations, conflating the magnitudes of intraregional intersectoral coefficients in the direct requirements matrices with the nominal or absolute values of regional/local transaction matrices (Z), which are, by definition, smaller than their corresponding national values. This confusion in the literature on regional/local simulation of direct requirements matrices arises from two main causes. First, there is a mix-up between coefficients and nominal/absolute values. Second, researchers often overlook the fact that national coefficients, unlike nominal/absolute values, represent proportional averages across all regions. As a result, some regions will have coefficients higher than the national average and others lower, reflecting regional/local specializations and the resulting uneven spatial development.	None replacement is applied, and hence: ${}_Ra_{ji} = (SLQ_j)({}_Na_{ji})$ $\Rightarrow {}_Ra_{ji} > {}_Na_{ji}$ and ${}_Rim_i < {}_Nim_i$, which means that a non-conventional (symmetrical) approach permits the regional/local intersectoral direct requirements coefficients to be higher than their national averages, indicating regional/local sectoral specializations, and implying regional/local imports coefficients smaller than their national average magnitudes.

Source: compiled by the author

Some Additional Observations

When simulating a regional/local direct requirements matrix ${}_RA = [{}_Ra_{ji}]$, the researcher essentially prepares the ground for deriving its corresponding Leontief inverse, ${}_RB = (I - {}_RA)^{-1} = [{}_Rb_{ji}]$. The Leontief inverse represents the total requirements matrix, constituting the basis for the calculation of any regional/local total multipliers (output, income, employment, and so forth).

A sub-national direct requirements matrix (${}_RA$) is the coefficients matrix corresponding to the first quadrant of the respective matrix of nominal/absolute regional/local transactional flows. In other words, the matrix (${}_RA$) is the basis of an open Leontief model. Hence, the sub-national direct requirements matrix (${}_RA$) and its Leontief's inverse (${}_RB$), as coefficients matrices of an open model, are enough for policy-planners to discern the following:

— Key sectors for short-to-medium-term planning, which can support the gradual reconstruction of the regional/local productive network during transitional periods;

— Propulsive sectors for long-term planning, i. e., sectors that reinforce targeted regional development.

Although Kronenberg (2009) argues that location quotients ignore cross-hauling, regional/local planning focused on a single sub-territorial productive network is adequately addressed using the KFLQ approach or any location quotient. This is because the open Leontief model is sufficient for regionalization and subsequent local planning. For a closed Leontief model, additional elements must be included:

— Household consumption and investment, government consumption and investment, and exports (from the second quadrant of the transactional flows matrix);

— Value-added factors, taxes, and imports (from the third quadrant of the transactional flows matrix).

Kronenberg's observations are influenced by the fact that his "CHARM method" belongs to the commodity-balance family, not location quotients. While he is correct that each sector simultaneously imports and exports, for single sub-national networks, imports and exports data are not required. In contrast, interregional and multiregional models do require these data, as interregional trading coefficients directly affect intraregional intersectoral coefficients. These considerations, however, fall outside the scope of this paper.

The simulation of single sub-national networks focuses exclusively on intraregional intersectoral flows, unlike interregional or multiregional models that emphasize interregional trading flows. Therefore, Kronenberg's CHARM method (2009) and the related comments by Flegg and Tohmo (2013b, 2018), Fujimoto (2019), etc., remain outside the scope of this study.

To clarify the non-conventional symmetrical *KFLQ* approach, the following points must be understood:

— ${}_RA = [{}_Ra_{ji}] = [(KFLQ_j)({}_Na_{ji})]$, signifies that the elements on the main diagonal of the simulated regional/local direct requirements matrix are: $(KFLQ_j)({}_Na_{jj}) \geq$ or $\leq {}_Na_{jj}$; while all the other elements of ${}_RA$ are: $(KFLQ_j)({}_Na_{ji}) \geq$ or $\leq {}_Na_{ji}$

— and

$$ {}_Rim_i = {}_Nim_i + (1/n)\sum_{j=1}^{n}[(1 - KFLQ_j)\,{}_Na_{ji}] \geq or \leq {}_Nim_i, $$

constructing a vector of regional/local sectoral values of imports, with

$$ {}_Rex_i = {}_Nex_i + (1/n)\sum_{j=1}^{n}[(KFLQ_j - 1)\,{}_Na_{ji}] \geq or \leq {}_Nex_i, $$

for the respective vector of sectoral exports

— and ${}_Rim_{ji} = {}_Nim_{ji} + [(1 - KFLQ_j)_N a_{ji}] \geq$ or $\leq {}_Nim_{ji}$, constructing an analytical matrix of regional/local values of intersectoral imports, with ${}_Rex_{ji} = {}_Nex_{ji} + [(KFLQ_j - 1)_N a_{ji}] \geq$ or $\leq {}_Nex_{ji}$, for the respective analytical matrix of sectoral exports.

The Data for the Empirical Example

For the empirical application of the *KFLQ* variation and its comparison with the *aFLQ* and *AFLQ* regionalization techniques, the symmetric Greek I-O table for 2015 (updated in 2018) from the Hellenic Statistical Authority was used, along with sectoral employment data for the same year, organized into a modified scheme of 59 sectors. The Hellenic Statistical Authority follows the standard Eurostat sectoral classification. The Standard Industrial Classification (SIC) codes for the 59-sector scheme are listed in column 2 of Table 2. The sectoral labels in column 1 of Table 2, denoted by letters of the English alphabet, correspond to the sectoral order in the symmetric Greek I-O table according to the SIC codes and facilitate the construction of Table 3.

The Typology of Weighted and Non-Weighted Type I Backward Employment Multipliers

The generalized expression of non-weighted type I backward multipliers for whatsoever factor "S" was identified in Kolokontes et al. (2020):

$$ SM = i'<S><X>^{-1}(I - A)^{-1}(i'<S><X>^{-1})^{-1} = $$
$$ i'<InSE>(I - A)^{-1}(i'<InSE>)^{-1} = i'(STM)(i'<InSE>)^{-1} = $$
$$ InDIrBSE'(i'<InSE>)^{-1} = rInDIrBSE \quad ' \quad (7) $$

in which: the symbol "<>" denotes a diagonal matrix; STM is the total coefficients matrix of factor '*S*' or else the Leontief's inverse matrix of factor '*S*'; *In* = initial, *D* = direct, *Ir* = indirect, *BSE* = backward effects of factor '*S*'; '*r*' means 'reformed', denoting the transition of type I multipliers to the unitary initial stimulus per sectoral factor '*S*'; and $<InSE> = <S><X>^{-1}$ represents the intrasectoral initial trends for the effects generation per kind '*S*'. In this study, the measured type '*S*' effects represent the impacts on regional employment (*E*).

Subsequently, $rInSE_i$ denotes the 'reformed *InSE*, and $rInSE_i = 1$ (while $InSE_i \leq 1$) on account of the architectonical construction of type I multipliers. Therefore, $InSE_i = (S_i / X_i)$ determines the initial intrasectoral trends for generating '*S*'-type effects per sector, while the corresponding sectoral expression for the estimated type I multiplier for factor '*S*' is defined by the following equation (Kolokontes et al., 2020):

$$ SM = (InDIrBSE_i / InSE_i) / rInSE_i = $$
$$ rInDIRBSE_i / rInSE_i = $$
$$ r(\sum_{j=1}^{n} b_{ji} InSE_j) / rInSE_i = r(\sum_{j=1}^{n} b_{ji} InSE_j) / 1 = $$
$$ r\sum_{j=1}^{n} b_{ji} InSE_j \quad (8) $$

with $rInDIrSE_i$ to measure the initial, direct and indirect spillovers of kind '*S*' of effects on the whole productive network due to an initial unitary change on the parameter '*S*' of sector *i* ($rInSE_i = 1$).

Particularly for the occasion of weighed measurements, the sectoral size-indicators has the generalized formula: $S_i / S = S_i / \sum_{i=1}^{n} S_i$. Multiplying the non-weighted sectoral type I backward multipliers with the sectoral size-indicators, the corresponding weighted sectoral type I backward multipliers are obtained.

The weighted and non-weighted type I backward employment multipliers per sector were estimated using the three non-survey regionalization techniques: *aFLQ*, *AFLQ*, and *KFLQ*. Weighted multipliers indicate the key sectors for short – to medium-term regional employment planning, while non-weighted multipliers highlight the potential of propulsive sectors that should drive long-term employment development in the region. Comparing the three versions of Flegg's location quotients demonstrates the advantages of the *KFLQ* variation.

Results

The first question to address is how the proposed non-conventional variation, KFLQ, can produce values close to one ($KFLQ \approx 1$), when the simple location quotient is close to 1,5, taking the region's size into account. For instance, in a simulation for West Greece, the region's size in terms of employment is: ${}_RE / {}_NE = 5.8$ %, and hence the parameter/exponent δ must be: $\delta = 0.14$ in order to obtain: $\lambda^* = 0.70380$, and marginally: $SLQ_j\lambda^* = (1.5)(0.70380) = 1.0557 \approx 1$. Analytically:

$$KFLQ_j = SLQ_j\lambda^* = SLQ_j[\log_2(1 + \frac{{}_RE}{{}_NE})]^\delta$$

$$\Rightarrow 1 \approx 1.5\lambda^* = 1.5[\log_2(1.058)]^\delta$$
$$\Rightarrow 1 \approx 1.5[3.32193\log(1.058)]^\delta$$
$$\Rightarrow 1 \approx 1.5[(3.32193)(0.02449)]^\delta$$
$$\Rightarrow 1 \approx 1.5(0.08135)^\delta$$

and if $\delta = 0.14$, then: $1.5(0.08135)^{0.14} = 1.5(0.70380) = 1.0557 \approx 1$; hence the desirable value for δ is 0,14 in order to achieve $KFLQ_j \approx 1$ for every $SLQ_j = 1.5$, given that the size of the simulated region is ${}_RE / {}_NE = 5.8$ %.

The magnitude $SLQ_j = 1.5$ can be considered sufficiently reliable for delimiting sectoral specializations, as it does not empirically produce false definitions, which can occur when SLQ_j is near to 1 and not so close to 1,5. At the same time, the magnitude $SLQ_j = 1.5$ is not very far from 1, meaning it does not hinder the identification of regional sectoral specializations. Furthermore, the extremely stringent scale $[\log_2(1 + SLQ_j)]$ is eliminated from the *KFLQ* variation, since this proposed version of Flegg's location quotient does not require it for determining sectoral specializations. In general, measurements of SLQ_j close to 1,5 are considered safe limits for sectoral specializations in the proposed logarithmic *KFLQ* variation, while the measurements over 1,8 provide sufficiently strong signals to highlight sectoral specializations without losing information, as occurs with the overly restrictive *AFLQ* approach.

Table 2 presents a comparison between calculations using the conventional (asymmetric) *SLQ* approach, the proposed non-conventional (symmetrical) *SLQ*, and the derived non-conventional (symmetrical) *KFLQ* version. Column [4] explains why the traditional asymmetric *SLQ* fails to reveal regional or local specializations, providing evidence that it tends to underestimate and distort the simulated regional/local intersectoral direct requirements coefficients. Column [3] shows how the non-conventional (symmetrical) *SLQ* tends to overestimate and distort these coefficients. Over time, numerous studies have addressed this issue (Tohmo, 2004; Flegg & Tohmo, 2013a; Flegg et al., 2016; Romero et al., 2019). Column [5] illustrates how the *KFLQ* corrects the non-conventional (symmetrical) *SLQ* base from column [3], thereby improving the derived regional/local intersectoral direct requirements coefficients and, ultimately, the calculations of sectoral multipliers for output, income, employment, and other measures.

As evident to the reader, the sectoral classification in columns [3] and [5] is identical, since the measurements from the non-conventional (symmetrical) *KFLQ* simply compress the corresponding measurements of the non-conventional (symmetrical) *SLQ*. Comparing columns [3] and [5] highlights the overestimations of the non-conventional *SLQ* regarding sectoral capabilities, which are corrected by the non-conventional logarithmic *KFLQ*. Unlike the adjusted or augmented Flegg location quotients (*aFLQ*, *AFLQ*), which distort sectoral specializations and rankings due to their conventional (asymmetric) components (*CILQ* and/or conventional *SLQ*), the *KFLQ* preserves the ordering and classification of sectors.

According to column [3] of the non-conventional *SLQ*, 15 sectors have measurements above unity ($SLQ_j > 1$). However, these measurements in column [4] of conventional *SLQ* approach are arbitrarily considered as equal to 1 ($SLQ_j = 1$) and this entails distortions (underestimations) during the construction of regional/local direct

Table 2

Comparison of Conventional SLQ, Non-Conventional SLQ, and the KFLQ Variation

Sectoral Notation [1]	Sectors [SIC Codes] [2]	Non-conventional Version of SLQ [3]	Conventional Version of SLQ [4]	Non-conventional KFLQ suggesting variation [5]	Regional to National Employment, Per Sector ($_RE_j$ / $_NE_j$) [6]
C	Fish, fishing and aquaculture products & supporting services [CPA_A03]	2,16415 (01)	1,00000	1,52308 (01)	12,47 % (01)
AV	Employment services [CPA_N78]	1,89631 (02)	1,00000	1,33458 (02)	10,92 % (02)
A	Agriculture and hunting products [CPA_A01]	1,82948 (03)	1,00000	1,28755 (03)	10,54 % (03)
T	Repair and installation services of machinery and equipment [CPA_C33]	1,63071 (04)	1,00000	1,14766 (04)	9,39 % (04)
BC	Creative, arts and entertainment services; library, archive, museum and other cultural services; gambling and betting services [CPA_R90-R92]	1,46192 (05)	1,00000	1,02887 (05)	8,42 % (05)
X	Constructions and construction works [CPA_F]	1,23049 (06)	1,00000	0,86599 (06)	7,09 % (06)
BF	Repair services of computers and personal and household goods [CPA_S95]	1.23010 (07)	1,00000	0,86572 (07)	7,08 % (07)
AZ	Education services [CPA_P85]	1,14892 (08)	1,00000	0,80859 (08)	6,62 % (08)
BE	Services furnished by membership organisations [CPA_S94]	1,14742 (09)	1,00000	0,80753 (09)	6,61 % (09)
BB	Social work services [CPA_Q87_Q88]	1,13951 (10)	1,00000	0,80196 (10)	6,57 % (10)
Y	Wholesale and retail trade and repair services of motor vehicles and motorcycles [CPA_G45]	1,09763 (11)	1,00000	0,77249 (11)	6.32 % (11)
AB	Land transport services and transport services via pipelines [CPA_H49]	1,08531 (12)	1,00000	0,76382 (12)	6,25 % (12)
AY	Public administration and defence services; compulsory social security services [CPA_O84]	1,05882 (13)	1,00000	0,74518 (13)	6,10 % (13)
AG	Accommodation and food services [CPA_I]	1,05733 (14)	1,00000	0,74413 (14)	6,09 % (14)
E	Food, beverages and tobacco products [CPA_C10-C12]	1,03736 (15)	1,00000	0,73008 (15)	5,98 % (15)
AA	Retail trade services (except of motor vehicles and motorcycles) [CPA_G47]	0,93565 (16)	0,93565	0,65849 (16)	5,39 % (16)
BA	Human health services [CPA_Q86]	0,88160 (17)	0,88160	0,62045 (17)	5,08 % (17)
S	Furniture and other manufactured goods [CPA_C31_C32]	0,84183 (18)	0,84183	0,59246 (18)	4,85 % (18)
BG	Other personal services [CPA_S96]	0,79095 (19)	0,79095	0,55665 (19)	4,56 % (19)
AT	Other professional, scientific and technical services; veterinary services [CPA_M74_M75]	0,77992 (20)	0,77992	0,54889 (20)	4,49 % (20)
U	Electricity, gas, steam and air-conditioning [CPA_D35]	0,76702 (21)	0,76702	0,53982 (21)	4,42 % (21)
AJ	Telecommunications services [CPA_J61]	0,69518 (22)	0,69518	0,48925 (22)	4,01 % (22)
AP	Legal and accounting services; services of head offices; management consulting services [CPA_M69_M70]	0,65231 (23)	0,65231	0,45908 (23)	3,76 % (23)

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Continuation Table 2

Sectoral Notation [1]	Sectors [SIC Codes] [2]	Non-conventional Version of SLQ [3]	Conventional Version of SLQ [4]	Non-conventional KFLQ suggesting variation [5]	Regional to National Employment, Per Sector ($_RE_j$ / $_NE_j$) [6]
P	Fabricated metal products, except machinery and equipment [CPA_C25]	0,65094 (24)	0,65094	0,45812 (24)	3,75 % (24)
AL	Financial services, except insurance and pension funding [CPA_K64]	0,63859 (25)	0,63859	0,44942 (25)	3,68 % (25)
G	Wood, products of wood and cork (except furniture) & articles of straw and plaiting materials [CPA_C16]	0,61215 (26)	0,61215	0,43082 (26)	3,53 % (26)
AM	Insurance, reinsurance and pension funding services, except compulsory social security [CPA_K65]	0,61101 (27)	0,61101	0,43001 (27)	3,52 % (27)
I	Printing and recording services [CPA_C18]	0,60517 (28)	0,60517	0,42591 (28)	3,49 % (28)
N	Other non-metallic mineral products [CPA_C23]	0,59608 (29)	0,59608	0,41951 (29)	3,43 % (29)
Z	Wholesale trade services (except of motor vehicles and motorcycles) [CPA_G46]	0,59187 (30)	0,59187	0,41655 (30)	3,41 % (30)
H	Paper and paper products [CPA_C17]	0,59110 (31)	0,59110	0,41601 (31)	3,41 % (31)
AX	Security and investigation services; services to buildings and landscape; office administrative, office support and other business support services [CPA_N80-N82]	0,58725 (32)	0,58725	0,41329 (32)	3,38 % (32)
J	Coke and refined petroleum products [CPA_C19]	0,56823 (33)	0,56823	0.39991 (33)	3,27 % (33)
AC	Water transport services [CPA_H50]	0,54731 (34)	0,54731	0,38519 (34)	3,15 % (34)
AF	Postal and courier services [CPA_H53]	0,50037 (35)	0,50037	0,35215 (35)	2,88 % (35)
AO	Real estate services & imputed rent of owner-occupied dwellings [CPA_L68A_L68B]	0,48893 (36)	0,48893	0,34410 (36)	2,82 % (36)
B	Forestry and logging products [CPA_A02]	0,48555 (37)	0,48555	0,34172 (37)	2,80 % (37)
AR	Scientific research and development services [CPA_M72]	0,44986 (38)	0,44986	0,31660 (38)	2,59 % (38)
AN	Services auxiliary to financial services and insurance services [CPA_K66]	0,42816 (39)	0,42816	0,30133 (39)	2,47 % (39)
AQ	Architectural and engineering services; technical testing and analysis services [CPA_M71]	0,42589 (40)	0,42589	0,29973 (40)	2,45 % (40)
R	Motor vehicles, trailers and semi-trailers; Other transport equipment [CPA_C29_C30]	0,39275 (41)	0,39275	0,27641 (41)	2,26 % (41)
AW	Travel agency, tour operator and other reservation services and related services [CPA_N79]	0,38361 (42)	0,38361	0,26998 (42)	2,21 % (42)
BD	Sporting services and amusement and recreation services [CPA_R93]	0,37673 (43)	0,37673	0,26513 (43)	2,17 % (43)
AH	Publishing services [CPA_J58]	0,37661 (44)	0,37661	0,26505 (44)	2,17 % (44)
AS	Advertising and market research services [CPA_M73]	0,37282 (45)	0,37282	0,26238 (45)	2,15 % (45)
M	Rubber and plastics products [CPA_C22]	0,36699 (46)	0,36699	0,25828 (46)	2,12 % (46)
O	Basic metals [CPA_C24]	0,34492 (47)	0,34492	0,24275 (47)	1,98 % (47)

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Ending of Table 2

Sectoral Notation [1]	Sectors [SIC Codes] [2]	Non-conventional Version of SLQ [3]	Conventional Version of SLQ [4]	Non-conventional KFLQ suggesting variation [5]	Regional to National Employment, Per Sector $({}_RE_j / {}_NE_j)$ [6]
AK	Computer programming with consultancy and related services & information services [CPA_J62_J63]	0,28868 (48)	0,28868	0,20317 (48)	1,66 % (48)
W	Sewerage; waste collection, treatment and disposal activities; materials recovery; remediation activities and other waste management services [CPA_C37-E39]	0,21831 (49)	0,21831	0,15364 (49)	1,26 % (49)
AI	Motion picture, video and television programme production services; sound recording and music publishing; programming and broadcasting services [CPA_J59_J60]	0,21034 (50)	0,21034	0,14803 (50)	1,21 % (50)
L	Basic pharmaceutical products and preparations [CPA_C21]	0,19214 (51)	0,19214	0,13522 (51)	1,11 % (51)
AE	Warehousing and support services for transportation [CPA_H52]	0,17290 (52)	0,17290	0,12168 (52)	1,00 % (52)
F	Textiles, wearing apparel and leather products [CPA_C13-C15]	0,16980 (53)	0,16980	0,11950 (53)	0,98 % (53)
D	Mining and quarrying products [CPA_B]	0,16678 (54)	0,16678	0,11738 (54)	0.96 % (54)
K	Chemicals and chemical products [CPA_C20]	0,13200 (55)	0,13200	0,09290 (55)	0,76 % (55)
AD	Air transport services [CPA_H51]	0,11831 (56)	0,11831	0,08326 (56)	0,68 % (56)
V	Natural water; water treatment and supply services [CPA_E36]	0,10873 (57)	0,10873	0,07653 (57)	0,63 % (57)
AU	Rental and leasing services [CPA_N77]	0,06928 (58)	0,06928	0,04876 (58)	0,40 % (58)
Q	Electrical equipment, Computers, electronic and optical products, Machinery and equipment [CPA_C26-C28]	0,03254 (59)	0,03254	0,02290 (59)	0,19 % (59)
Author's calculations.					
The Hellenic Statistical Authority is the source of primary data.					
Numbers in parenthesis represent sectoral rankings.					

requirements matrices. On the contrary, in column [5], in which the measurements of symmetrical (non-conventional) logarithmic *KFLQ* are recorded, the sectoral classification remains consistent with column [3], but only 5 sectors are identified as specialized ($KFLQ_j > 1$). These 5 sectors also show a high contribution to their national-level sectoral employment (${}_RE_j$ / ${}_NE_j$), as indicated in column [6].

This observation supports the author's view that a reliable guide for determining sectoral specializations using the *KFLQ* is the assumption that: "sectoral measurements $SLQ_j \cong 1.5$ define the austerity limit according to which regional/local sectoral classifications should be determined, corresponding to $KFLQ_j \cong 1$".

In this context, the *KFLQ* approach combines Flegg's logarithmic scale $\lambda^* = [\log_2(1 + \frac{{}_RE}{{}_NE})]^\delta$ resolving the difficulty of defining the exponent δ in a simple and empirical way. Taking the relative size of a studied region into account, for example, in terms of employment (${}_RE$ / ${}_NE$), the approach follows this rule:

"As the regional-to-national size of a sector trend to its corresponding average sectoral allocation across all regions: (${}_RE_j$ / ${}_NE_j$) → (100 / *Number_of_Regions*), e.g. in terms of employment, the *KFLQ* coefficient trends towards unity ($KFLQ_j \rightarrow 1$), for the value of δ that makes the simple location quotient close to 1,5 (videlicet: $SLQ_j \approx 1.5$)".

Put differently: "Using the *KFLQ* approach, the exponent δ is defined as the value that makes *KFLQ* approach 1, when a sector's regional-to-national size is equal to its average allocation, which occurs for every *SLQ* value near 1.5".

The *KFLQ*'s symmetry is dual: it applies both across sectors within a region and across the regional contributions to the national sectoral totals. It accounts for: the size of the region (${}_{R}E$ / ${}_{N}E$) ; the size of each sector in a region (${}_{R}E_j$ / ${}_{R}E$); the sectoral contribution of the region to the national total (${}_{R}E_j$ / ${}_{N}E_j$); and the hypothetical uniform allocation of sectors across regions (100 / *Number_of_Regions*). This dual symmetry allows *KFLQ* to identify sectoral specializations whenever $KFLQ > 1$, defining the specialized sectors in each region.

Using employment to define sectoral specializations is not ideal. For example, sectors with high employment may not correspond to those producing the largest gross output. However, employment data are often the best available proxy when regional gross output data are lacking. Ideally, sectoral specializations could be defined in terms of productivity, using a quotient like $[({}_{R}X_j / {}_{R}E_j) / ({}_{N}X_j / {}_{N}E_j)]$, which reflects both technology adoption and sectoral production functions. If such detailed data were universally available, non-survey regionalization methods would be unnecessary.

In practice, the *KFLQ* corrects both the underestimations of the conventional *SLQ* and the overestimations of the non-conventional *SLQ*, creating a reliable basis for estimating sectoral multipliers. It does so by isolating the positive aspects of Flegg's logarithmic location quotients, allowing the derivation of regional/local intersectoral direct requirements coefficients without barriers or constraints: ${}_{R}a_{ji} \geq$ or $\leq {}_{N}a_{ji}$.

At every point, comparing the secondary simulated/estimated coefficients with the primary calculated direct requirements coefficients, when primary data are available, shows that divergences from the original disaggregated elements are minimized under *KFLQ*. This is because the *KFLQ* formula introduces symmetry, absent in all conventional location quotients, and regionalizes it by incorporating regional/local sectoral specializations.

Ultimately, the *KFLQ* not only improves simulation outcomes but also provides flexibility in estimating regional/local sectoral specializations. This is achieved by correcting the underestimations inherent in adjusted and augmented Flegg location quotients (*aFLQ*, *AFLQ*), eliminating the overly stringent specialization scale $[\log_2(1 + SLQ_j)]$ and maintaining the logarithmic scale $\lambda^{*} = [\log_2(1+\frac{{}_{R}E}{{}_{N}E})]^{\delta}$ in combination with the non-conventional use of SLQ.

Illustrating that the average sectoral allocation per region (100 / *Number_of_Regions*) for the thirteen regions of Greece is 7,69 %, the data in Table 2 pinpoints sectoral specializations in West Greece in the following economic activities: (C) fish, fishing, and aquaculture products and supporting services [${}_{R}E_C$ / ${}_{N}E_C$: 12.47 %; $KFLQ_C$: 1.52308 & initial non-conventional SLQ_C: 2.16415; and ${}_{R}E_C$ / ${}_{N}E_C$: 12.47% > 7.69 %]; (*AV*) employment services [${}_{R}E_{AV}$ / ${}_{N}E_{AV}$: 10.92 %; $KFLQ_{AV}$: 1.33458 & initial non-conventional SLQ_{AV}: 1.89631; and ${}_{R}E_{AV}$ / ${}_{N}E_{AV}$: 10.92 % > 7.69 %]; (*A*) agriculture and hunting products [${}_{R}E_A$ / ${}_{N}E_A$: 10.54 %; $KFLQ_A$: *1.28755* & initial non-conventional SLQ_A: 1.82948; and ${}_{R}E_A$ / ${}_{N}E_A$: 10.54 % > 7.69 %]; (*T*) repair and installation services of machinery and equipment [${}_{R}E_T$ / ${}_{N}E_T$: 9.39 %; $KFLQ_T$: 1.14766 & initial non-conventional SLQ_T: 1.63071; and ${}_{R}E_T$ / ${}_{N}E_T$: 9.39 % > 7.69 %]; (*BC*) creative, arts and entertainment services; library, archive, museum and other cultural services [${}_{R}E_{BC}$ / ${}_{N}E_{BC}$: 8.42 %; $KFLQ_{BC}$: 1.02887 & initial non-conventional SLQ_{BC}: 1.46192; and ${}_{R}E_{BC}$ / ${}_{N}E_{BC}$: 8.42 % > 7.69 %].

The prominence of sector C stems from the region's specialization in fish farming. Agricultural activities are strong across all prefectures of the region. Vegetative activities in the prefecture of Ileia rank among the highest in Greece, while both vegetative and animal activities in Aetolia-Acarnania make a notable contribution to national output. The most urbanized prefecture, Achaia, hosts important wineries, breweries, and dairy industries. Sector BC benefits from the presence of museums and archaeological sites, such as ancient Olympia in Ileia, along with numerous other significant monuments throughout the region.

Although sectors A and C are clearly regional specializations, the food and beverages sector (*E*) has not yet reached this level according to the KFLQ [${}_{R}E_E$ / ${}_{N}E_E$: 5.98 % < 7.69 %; $KFLQ_E$: 0.73008 & initial non-conventional SLQ_E: 1.03736], as the marginal value relative to unity of the non-conventional *SLQ* (SLQ_E: 1.03736) falls below 1 with the *KFLQ* ($KFLQ_E$: 0.73008). This means that West Greece is not fully exploiting the potential to develop its processing industry based on outputs from its primary sectors. Instead, the region primarily serves as an interregional supplier of agri-food products, particularly to neighbouring regions such as Central Greece, Attica, and the Peloponnese.

Other productive activities with a non-conventional SLQ higher than one but a KFLQ below unity are as follows: the constructions (*X*) [${}_{R}E_X$ / ${}_{N}E_X$: 7.09 % < 7.69 %; $KFLQ_X$: 0.86599

& initial non-conventional SLQ_X: 1.23049]; the repair services of computers and personal and household goods (BF) [$_RE_{BF}$ / $_NE_{BF}$: 7.08 % < 7.69 %; $KFLQ_{BF}$: 0.86572 & initial non-conventional SLQ_{BF}: 1.23010]; the accommodation and food services sector (AG) [$_RE_{AG}$ / $_NE_{AG}$: 6.09 % < 7.69 %; $KFLQ_{AG}$: 0.74413 & initial non-conventional SLQ_{AG}:1.05733 which are closely linked to the food and beverages sector (E).

Table 3 presents estimates of weighted and non-weighted type I backward employment multipliers calculated using the adjusted and augmented Flegg's location quotients (aFLQ and AFLQ), as well as the proposed KFLQ variation. Weighted indices reveal the key sectors for short – to medium-term employment planning in West Greece, and, as expected, sectoral classification based on weighted indicators is more influenced by regional specializations. Non-weighted type I backward employment multipliers, in contrast, identify the sectors with the highest potential for job creation in the long-term regional development plan.

Consequently, among the sectors capable of supporting the productive network of West Greece during its transitional period, agriculture and hunting products (A) [weighted $t.I - BEM_{(KFLQ)A}$: 0.28224 (1st); $_RE_A$ / $_NE_A$: 10.54 %; $_RE_A$ / $_RE$: 22.63 % (1st)] stand out due to their size. The potential growth and scale of the accommodation and food services sector (AG) [weighted $t.I - BEM_{(KFLQ)AG}$: 0.13312 (2nd); $_RE_{AG}$ / $_NE_{AG}$: 6.09 %; $_RE_{AG}$ / $_RE$: 9.53 % (3rd)] and the food and beverages sector (E) [weighted $t.I - BEM_{(KFLQ)E}$: 0.12599 (4th);$_RE_E$ /

Table 3

Weighted and Non-Weighted Type I Backward Employment Multipliers by the aFLQ, AFLQ and KFLQ

Sect. [1]	weighted t.I-BEM by aFLQ [2]	weighted t.I-BEM by AFLQ [3]	weighted t.I-BEM by KFLQ [4]	non-weighted t.I-BEM by aFLQ [5]	non-weighted t.I-BEM by AFLQ [6]	non-weighted t.I-BEM by KFLQ [7]
A	0,25832 (01)	0,27239 (01)	0,28224 (01)	1,14175 (46)	1,20392 (40)	1,24747 (28)
B	0,00092 (51)	0,00094 (51)	0,00095 (50)	1,10923 (49)	1,14021 (48)	1,15347 (43)
C	0,00891 (19)	0,00926 (19)	0,00952 (18)	1,14191 (45)	1,18724 (41)	1,22003 (33)
D	0,00072 (55)	0,00073 (55)	0,00066 (54)	1,49457 (15)	1,51707 (15)	1,36363 (15)
E	0,08661 (06)	0,10972 (04)	0,12599 (04)	2,45374 (04)	3,10846 (03)	3,56935 (03)
F	0,00151 (46)	0,00154 (46)	0,00152 (44)	1,20411 (38)	1,23455 (37)	1,21673 (34)
G	0,00256 (34)	0,00257 (34)	0,00251 (34)	1,28536 (25)	1,28806 (28)	1,25728 (26)
H	0,00205 (41)	0,00207 (41)	0,00194 (41)	1,75844 (08)	1,77441 (08)	1,65684 (07)
I	0,00245 (37)	0,00246 (37)	0,00238 (36)	1,12859 (48)	1,13049 (49)	1,09575 (50)
J	0,00507 (26)	0,00515 (26)	0,00429 (27)	6,80242 (01)	6,90523 (01)	5,76151 (01)
K	0,00058 (56)	0,00059 (56)	0,00053 (56)	1,47635 (18)	1,49024 (18)	1,35635 (16)
L	0,00103 (50)	0,00104 (50)	0,00093 (51)	1,47910 (17)	1,49358 (16)	1,33791 (18)
M	0,00202 (42)	0,00205 (42)	0,00188 (42)	1,59235 (12)	1,61336 (12)	1,47942 (01)
N	0,00303 (33)	0,00305 (33)	0,00290 (33)	1,41370 (19)	1,42442 (19)	1,35479 (17)
O	0,00246 (36)	0,00247 (36)	0,00225 (37)	1,71464 (09)	1,72613 (09)	1,56855 (09)
P	0,00735 (23)	0,00738 (23)	0,00707 (22)	1,25851 (31)	1,26344 (31)	1,21015 (36)
Q	0,00025 (58)	0,00025 (58)	0,00022 (58)	1,48242 (16)	1,49099 (17)	1,32365 (20)
R	0,00075 (53)	0,00075 (53)	0,00071 (53)	1,22601 (35)	1,23125 (38)	1,16502 (42)
S	0,00556 (25)	0,00558 (25)	0,00545 (25)	1,23358 (34)	1,23954 (34)	1,20977 (37)
T	0,00471 (27)	0,00476 (27)	0,00477 (26)	1,28798 (24)	1,30290 (25)	1,30452 (22)
U	0,00706 (24)	0,00709 (24)	0,00689 (24)	1,26580 (30)	1,27176 (30)	1,23543 (29)
V	0,00029 (57)	0,00030 (57)	0,00027 (57)	1,56822 (14)	1,59965 (13)	1,45463 (13)
W	0,00126 (48)	0,00127 (48)	0,00121 (48)	1,23785 (32)	1,25063 (32)	1,18812 (38)
X	0,06290 (07)	0,06362 (07)	0,06367 (07)	1,27142 (29)	1,28599 (29)	1,28701 (24)
Y	0,01997 (12)	0,02001 (12)	0,02000 (12)	1,05826 (52)	1,06054 (53)	1,05991 (52)
Z	0,02456 (10)	0,02506 (10)	0,02379 (10)	1,36573 (20)	1,39355 (20)	1,32289 (21)
AA	0,13047 (02)	0,13062 (02)	0,13043 (03)	1,02948 (57)	1,03070 (57)	1,02922 (57)
AB	0,03128 (09)	0,03172 (09)	0,03181 (09)	1,20797 (37)	1,22488 (39)	1,22819 (31)
AC	0,01102 (18)	0,01133 (17)	0,00924 (19)	2,60584 (03)	2,67700 (04)	2,18419 (05)
AD	0,00073 (54)	0,00073 (54)	0,00056 (55)	2,43646 (05)	2,46266 (05)	1,86263 (06)

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Sect. [1]	weighted t.I-BEM by aFLQ [2]	weighted t.I-BEM by AFLQ [3]	weighted t.I-BEM by KFLQ [4]	non-weighted t.I-BEM by aFLQ [5]	non-weighted t.I-BEM by AFLQ [6]	non-weighted t.I-BEM by KFLQ [7]
AE	0,00189 (43)	0,00192 (43)	0,00180 (43)	1,35352 (21)	1,37818 (21)	1,28800 (23)
AF	0,00256 (35)	0,00256 (35)	0,00245 (35)	1,14896 (43)	1,15207 (45)	1,10199 (48)
AG	0,12169 (03)	0,12854 (03)	0,13312 (02)	1,27651 (27)	1,34842 (23)	1,39644 (14)
AH	0,00175 (44)	0,00176 (44)	0,00147 (46)	1,57238 (13)	1,58393 (24)	1,32635 (19)
AI	0,00085 (52)	0,00086 (52)	0,00081 (52)	1,22116 (36)	1,23824 (35)	1,16647 (41)
AJ	0,00747 (22)	0,00752 (22)	0,00704 (23)	1,33405 (23)	1,34225 (24)	1,25765 (25)
AK	0,00218 (38)	0,00220 (38)	0,00206 (38)	1,27802 (26)	1,29383 (26)	1,21092 (35)
AL	0,01336 (15)	0,01354 (15)	0,01295 (15)	1,27275 (28)	1,28969 (27)	1,23334 (30)
AM	0,00417 (28)	0,00418 (28)	0,00377 (28)	1,35015 (22)	1,35395 (22)	1,22006 (32)
AN	0,00155 (45)	0,00156 (45)	0,00148 (45)	1,23409 (33)	1,24061 (33)	1,17386 (40)
AO	0,00378 (29)	0,00402 (29)	0,00343 (30)	4,64760 (02)	4,94994 (02)	4,22445 (02)
AP	0,01949 (13)	0,01953 (13)	0,01939 (13)	1,04681 (55)	1,04890 (55)	1,04130 (55)
AQ	0,00838 (21)	0,00840 (21)	0,00826 (21)	1,06026 (51)	1,06273 (51)	1,04555 (54)
AR	0,00137 (47)	0,00140 (47)	0,00127 (47)	1,63770 (10)	1,67269 (10)	1,51950 (10)
AS	0,00210 (39)	0,00211 (39)	0,00201 (39)	1,17679 (41)	1,18231 (43)	1,12628 (46)
AT	0,00359 (30)	0,00362 (31)	0,00355 (29)	1,14078 (47)	1,15000 (47)	1,12798 (45)
AU	0,00019 (59)	0,00019 (59)	0,00017 (59)	1,60834 (11)	1,64449 (11)	1,47222 (12)
AV	0,00119 (49)	0,00120 (49)	0,00120 (49)	1,05789 (53)	1,06236 (52)	1,06374 (51)
AW	0,00358 (31)	0,00366 (30)	0,00329 (31)	1,77419 (07)	1,81093 (07)	1,62801 (08)
AX	0,01112 (17)	0,01116 (18)	0,01075 (17)	1,17095 (42)	1,17518 (44)	1,13236 (44)
AY	0,10819 (04)	0,10852 (05)	0,10853 (05)	1,17990 (40)	1,18353 (42)	1,18362 (39)
AZ	0,09514 (05)	0,09529 (06)	0,09534 (06)	1,01709 (59)	1,01875 (59)	1,01929 (58)
BA	0,05061 (08)	0,05081 (08)	0,05055 (08)	1,10045 (50)	1,10484 (50)	1,09909 (49)
BB	0,00844 (20)	0,00846 (20)	0,00846 (20)	1,03418 (56)	1,03644 (56)	1,03698 (56)
BC	0,01355 (14)	0,01399 (14)	0,01419 (14)	1,19740 (39)	1,23666 (36)	1,25468 (27)
BD	0,00207 (40)	0,00208 (40)	0,00200 (40)	1,14667 (44)	1,15166 (46)	1,10685 (47)
BE	0,01156 (16)	0,01218 (16)	0,01246 (16)	2,15812 (06)	2,27418 (06)	2,32602 (04)
BF	0,00313 (32)	0,00313 (32)	0,00313 (32)	1,05030 (54)	1,05237 (54)	1,05196 (53)
BG	0,02185 (11)	0,02188 (11)	0,02186 (11)	1,01856 (58)	1,01987 (58)	1,01905 (59)
Author's calculations.						
The Hellenic Statistical Authority is the source of primary data.						
Numbers in parenthesis represent sectoral rankings.						

${}_NE_E$: 5.98 %; ${}_RE_E$ / ${}_RE$: 3.53 % (8th)] also place these sectors high in priority.

In contrast, according to the non-weighted type I backward employment multipliers for the region, the most promising sectors are the following: coke and refined petroleum products (*J*) [$t.I - BEM_{(KFLQ)J}$: 5.76151 (1st)]; the agri-food sector (*E*) [$t.I$ - $BEM_{(KFLQ)E}$: 3.56935 (3rd)]; water transport services (*AC*) [$t.I - BEM_{(KFLQ)AC}$: 2.18419 (5th)]; air transport services (*AD*) [$t.I - BEM_{(KFLQ)AD}$: 1.86263 (6th)]; and travel agencies, tour operators, and other reservation-related services (*AW*) . Furthermore, a careful comparison of the estimates in Table 3 shows how the *KFLQ* approach improves the estimation of both weighted and non-weighted multipliers and enhances sectoral classification.

Discussion and Conclusion

Regional or local intersectoral direct requirements coefficients are often confused with their nominal/absolute transactional values, which leads to the use of conventional non-survey regionalization techniques with a non-symmetrical structure and thus hinders the accurate identification of regional or local sectoral specializations. It is also often overlooked that national transactional flows are the sum of all regions, whereas national intersectoral direct requirements coefficients are proportional averages of all regions. Consequently, some regions will have higher intraregional intersectoral direct requirements coefficients and others lower than the corresponding national averages.

The variation proposed in this paper, *KFLQ*, as a "non-conventional and symmetrical approach of the adjusted Flegg's location quotient," aims to overcome the limitations of mechanical regionalization techniques in capturing regional and local specializations. The *KFLQ* approach avoids the overly rigid scaling $[\log_2(1 + SLQ_j)]$ of augmented Flegg's location quotient (*AFLQ*) and, due to the symmetry of its components, provides a more realistic alternative to pre-existing methods. It allows for the derivation of regional and local intersectoral direct requirements coefficients without the barriers and constraints inherent in traditional approaches: ${}_R a_{ji} \geq$ or $\leq {}_N a_{ji}$.

The *KFLQ* variation combines Flegg's logarithmic scale $\lambda^* = [\log_2(1 + \frac{{}_R E}{{}_N E})]^\delta$ with a non-conventional use of *SLQ*, solving the difficulty of defining the exponent δ in a simple and rational manner. Taking the relative size of a region, e.g., in terms of employment, into account (${}_R E$ / ${}_N E$), the following rule is applied: as the regional-to-national size of a sector approaches its corresponding average regional distribution (${}_R E_j$ / ${}_N E_j$) → (100 / *Number_of_Regions*), the proposed non-conventional and symmetrical location quotient tends toward unity ($KFLQ_j \to 1$). In this context, the exponent δ is defined as the value for which the respective sectoral SLQ is close to 1,5 (videlicet: $SLQ_j \approx 1.5$). Put differently, applying the *KFLQ* approach, the exponent δ is determined so that the *KFLQ* approaches 1 when the regional-to-national size of a sector approaches its average sectoral allocation across all regions, a situation corresponding to every sectoral *SLQ* measurement being close to 1.5.

The symmetrical logic of *KFLQ* is therefore dual: it applies both across sectors within a region and across regions within a national sector. The approach accounts for the size of the region (${}_R E$ / ${}_N E$) ; the size of each sector in the region (${}_R E_j$ / ${}_R E$) ; the region's contribution to the national sector (${}_R E_j$ / ${}_N E_j$); and the hypothetical uniform sectoral allocation across regions (100 / *Number_of_Regions*), regardless of the specific units used. This dual symmetry allows the *KFLQ* index to identify sectoral specializations for any sector *j*, with a KFLQ value greater than 1 indicating a specialization ($KFLQ_j > 1$).

The research hypothesis states that a symmetrical and unrestricted treatment of the simple location quotient (*SLQ*), as part of the adjusted Flegg's location quotient (*aFLQ*) and implemented in the proposed *KFLQ* variation, can provide a more reliable database for analysing developmental patterns. This hypothesis is verified using the rule for defining the exponent δ. The *KFLQ* approach produces higher-quality simulated matrices of regional and local intersectoral direct requirements coefficients, which serve as the basis for deriving corresponding regional/local Leontief inverse matrices (i. e., regional/local total requirements matrices) and type I (weighted and non-weighted) multipliers for any measuring factor (output, income, employment, etc.).

The empirical application used to illustrate the technical scope of this study also generates insights about the region under study. Based on the weighted type I backward employment multipliers, the sectors most suitable for supporting employment in West Greece in the short – to medium-term transitional period for restructuring the productive network are the following: agriculture and hunting products (A), food and beverages (E), accommodation and food services (AG), and retail trade (excluding motor vehicles and motorcycles) (AA).

When considering the non-weighted type I backward employment multipliers for long-term improvement of West Greece's economic network, priority sectors include coke and refined petroleum products (J), the agri-food sector (E), water transport services (AC), air transport services (AD), and paper products (H). Regional planning should leverage the strengths of the food and beverage processing sector (E) intraregionally, building on regional specializations in agriculture and hunting (A) and fishing and aquaculture (C). Improvements in water and air transport infrastructure (AC, AD) would enhance the region's tourism potential, supporting travel agencies, tour operators, and related services (AW), while promoting historical sites and natural assets such as mountains, rivers, and coastline, in conjunction with museum and cultural services (BC). This also requires stronger marketing and international outreach to maximize the benefits for the accommodation and food services sector (AG) in connection with the agri-food sector (E). The increased mobility generated by these developments would additionally boost the construction sector (X).

It should be noted, however, that this represents only one side of West Greece's development policy. For precise and effective planning, policymakers must consider forward multipliers alongside backward multipliers, using an appropriately adjusted frontloading model (Kolokontes, 2021).

In conclusion, the main contribution of this study is that, by following the proposed *KFLQ* variation, the choice and application of location quotients (LQ) is no longer a matter of guesswork.

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