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The Europe-U.S. Retail Trade Productivity Gap in a Rear-view Mirror

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Preliminary Draft

The Europe-U.S. Retail Trade Productivity Gap in a Rear-view Mirror*

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Abstract: Is the Europe-U.S. retail trade productivity gap a genuine phenomenon or the result of a variety of measurement issues? This research question, which raised concerns during most of the decade preceding the Great Recession, has two primary motivations. First, we hope to gain a better understanding of the Europe-U.S. market economy productivity gap, attributable almost solely to the retail trade sector. In particular, our goal is to answer the perplexing question that remains stubbornly relevant: "Can measurement errors, including those that arise from offshoring, explain all, some, or none of the productivity gap in this sector?" Second, this paper is about more than measurement differences. It also asks how much of the measured gap is attributable to transatlantic differences in the economic structures such as scale economies. With a harmonized measure of real output, the post-1995 period now reports a 0.5 percentage point productivity gap in favour of the U.S., down from the 'official' 1.5 percentage points. This new gap is further downgraded to one-quarter of a percentage point as a result of a counterfactual experiment that asks what would productivity performance look like had we accounted for differences in the economic structures between the two economies. The productivity gap in favour of the U.S. retail trade sector still holds albeit with a much more modest order of magnitude.

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1. Introduction

The puzzling development of the Europe-U.S. productivity gap in the post-1995 period has triggered a strenuous public policy debate in Europe.[1] The gap continues with no real sign of relief leading inevitably to Europe inability to restore its relative per capita income, just as it has already resulted in the deterioration of the real hourly compensation since 1995.[2] While this productivity shortfall might be described as one of Europe's major economic problem, the debate has considerably waned with the advent of the Great Recession whose impacts on the productivity outlook still remain ill-understood. But a central, underlying issue—whether the retail trade sector as the largest single contributor to the Europe-U.S. productivity gap represents a genuine phenomenon or a mere reflection of a faulty measure of real output—remains relevant.[3]

The retail trade sector, which includes jobs ranging from selling soft drinks at a convenience store to providing an expert-advice in areas such as healthcare or electronic products, has long been recognized as a member of the 'productivity laggards' before it became the primary source of the U.S. productivity revival during the decade preceding the Great Recession. Yet, all along, concerns have been expressed about the lack of consensus in the measurement of real output, combined with the potential overstatement of this sector's productivity performance. Together, these factors introduced considerable skepticism about the sustainability of the U.S. productivity revival.

Economists have undertaken the important task of coming into grip with the measurement of real output in the retail sector in an attempt to sort out the relative merits of the wide range of existing practices in the statistical system, particularly in Europe and the U.S. (see Triplett and Bosworth 2004 and Inklaar and Timmer 2008 for

[1] In this paper, the word 'Europe' is used in a generic sense. It refers to the 15 countries constituting the European Union before 2004—Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Spain, Portugal, Sweden, United Kingdom.

[2] During the 1995-2009 period, the U.S. economy labour productivity advanced at a 2.2% average, more than half that in Europe. During the same period, real hourly compensation in Europe dropped at a 1.1% average.

[3] This relevance has recently been reiterated by the European Central Bank (2011): "*The distributive trades sector has been undergoing substantial changes, in terms of, for example, growing consolidation and internationalisation and changing retail formats (e.g. the increasing market shares of supermarkets and hypermarkets, the growth of the discount sector and the expansion of private label brands). These developments influence competition and cost structure and play an important role in determining mark-ups and, thus, affect final consumer prices in the euro area. …However, productivity is comparatively low and the sector accounts for more than one-third of the widening in the aggregate productivity gap between the United States and the euro area that has occurred since the mid-1990s."*

an overview). This effort has culminated in recent years with the implementation by the U.S. Bureau of Economic Analysis (BEA) in its Annual Industry Accounts of the retail and wholesale distributive trade margin price indexes developed by the U.S. Bureau of Labor Statistics Services (BLS) Producer Price Index program. While these enhancements obviously beg the question whether the story on the industry allocation of the U.S. productivity revival has been altered in any shape of way, they also offer the opportunity to revisit their implications on the comparability between Europe and U.S. productivity performance.

Although great progress has been made in gaining a better grasp on the measurement of real output in the retail trade sector, concerns have nevertheless been raised about the role of the differences in the economic structures of this sector on the Europe-U.S. productivity gap (see Gordon 2004). An important aspect of these differing structures is the major reallocation process illustrated by the appearance of businesses with larger economies of scale. Meanwhile, the sector has not been immune of the recent wave of offshoring whereby imports from low-wage countries have been substituted for domestically produced final consumer goods as a result of the general globalization trend. However, no parallel attempt has been made heretofore as part of the growth accounting framework to cast a wider net in an effort to gain a better account for the Europe-U.S. productivity gap.

With the benefit of hindsight, enhanced source data and the support of an accounting framework, this paper revisits the measurement of real output in the retail sector, contrasts it with existing practice in the official statistics and places it in the broader context of the structural changes experienced by this sector. The central theme of this paper is to emphasize the presence of a wide range of sources of bias arising potentially from a variety of measurement issues combined with a productivity metric that inadequately control for differences in the economic structures.

The remainder of the paper is structured as follows. The next section develops the measurement framework which is general enough to accommodate the wide range of measurement issues that potentially hampers productivity measurement. Section 3 provides a new set of harmonized Europe-U.S. productivity estimates for the retail sector that control as much as possible for measurement differences and differences in underlying economic structures. Section 4 draws the main conclusions.

2. Gauging the Productivity Performance of the Retail Trade Sector

2.1. Set up

Cross country comparisons of productivity performance constitute an important tool for policy-making. The exercise generally gives rise to relative comparisons which can lead to explanations as to why a given country is shifting away from the world frontier. Policy is then reshaped accordingly.

The exercise is also complex. It requires reliable source data, comparable concepts and methods and, finally, a metric that accounts, as much as possible, for differences in structures between countries. While progress, illustrated by major international harmonization efforts and related data developments, has been considerable, some of these issues are still outstanding and tend generally to be more acute for comparisons at the industry level.[4] The retail trade sector is an interesting case in point. It is, therefore, the purpose of this section to canvass the variety of measurement issues.

This sector has undergone several structural changes that put to task the reliability of cross country comparisons along two important dimensions—whether the metric adequately accounts for differences in the structures across economies at a similar level of development and the extent to which the underlying data can reasonably track these changes. For example, the services provided by the retail trade sector have been reshaped in one form or another in the last two decades or so which begs the question as to how accurately the statistical system has been tracking them.

An important aspect of this structural transformation is the major reallocation process illustrated by the appearance of businesses with larger economies of scale and scope across categories such as general merchandise stores, drug stores, apparel stores, and grocery stores, leading to the displacement of individual, more specialized, boutique stores. The adoption of a 'better, faster and cheaper' technology, such as scanning equipment and integrated computer system, altered in a meaningful way the traditional business model, making it possible for retailers to increasingly by-pass

[4] The release of the OECD (2001) productivity manual, the EU-KLEMS dataset (see O'Mahony and Timmer 2009) and, more recently, the World Input Output Database (see Timmer et al. 2012) illustrate some of these efforts.

wholesalers and implement a leaner inventory strategy to achieve cost savings. The joint effect of technological change and the emergence of large retailers have shifted the balance of power from suppliers (manufacturers) toward retailers (Kumar 1996). This process culminated in recent years with the engagement of large retailers in direct imports of final goods from low-wage countries, making it possible to find new sources of cost-savings, while posing new measurement challenges in this business.

2.2. Classical Considerations

The Value of Retail Services and their Related Prices

Retail trade belongs to the class of intermediary industries. The output of retailers consists of a bundle that comprises the transfer of ownership of goods and the provision of a range of services to secure a sale (e.g. locational convenience for the transfer of goods, time convenience at which goods are available for sale, the time taken to execute the transfer, the range of products on offer and the extent and quality of customer assistance) (see Oi 1993, 2006; Betancourt 2004).

Clearly, the output of the retail trade sector is not represented by the actual goods sold but rather by the service they provide in facilitating the transfer of property rights of goods from producers to end users and in providing related services. An important implication of this type of the organizational structure is that the price paid by the consumer accounts explicitly for the price of the good and implicitly for the variety of the underlying services (Betancourt 2004, pp. 24-25). The presence of these implicitly priced services, which constitutes some of the defining characteristics of services industries such banking, insurance and distributive trade, begs the question as to how to value the output.

The System of National Accounts (SNA) has traditionally resorted to the notion of 'imputed service charge' measured in terms of 'margins.' In the case of banking, the imputed service charge is measured as the monetary interest received from lending deposited funds less the monetary interest paid on deposits (see Triplett and Bosworth 2004, chapter 7 and Diewert et al. 2011). In the case of insurance, it is actuarial premiums less claims (see Triplett and Bosworth 2004, chapter 6). As for the retail trade sector, the output is measured by the value of the trade margins on the goods

they purchase for resale, not the total value of the sales.[5] Formally, revenue sales of a retailer can be expressed as follows:

$$P_s Y_s = c_s Y_s + w_L L + w_K K + w_M M, \quad (1)$$

where P_s is the price of sales Y_s while w_τ represents the (rental) price (where applicable) of the input τ and c_s the cost of goods for resale (with $\tau = K, L, M$, representing, respectively, capital, labour and intermediate inputs). Retail trade margin is then measured as the difference between revenue sales and the cost of goods for resale:

$$P_s Y_s - c_s Y_s = w_L L + w_K K + w_M M. \quad (2)$$

While retail trade margin as a measure of retailers' nominal output has gained wide acceptance in official statistics, the BLS remains an exception. For both conceptual and practical reasons, the BLS productivity program has historically distanced itself from 'net output' concepts, which assume the existence of a technology with separable intermediate inputs from primary inputs (implying that these inputs are not substitutable), to 'gross' concepts.[6]

In the case of the retail trade sector, the separability assumption, which underlies the notion of gross margin, lacks empirical evidence, thereby creating an opportunity to exploit alternative measures of output such as sales (see Manser 2005, 31). Examples of durable goods delivered in a box to consumers who perform the assembly themselves or suppliers responsible for replenishing the store shelves of retailers are provided by Triplett and Bosworth (2004, 239) in support of the substitutability

[5] The SNA 2008 (Section 6.146, p. 113) explains as follows the measurement of output in retail and wholesale: ''*Although wholesalers and retailers actually buy and sell goods, the goods purchased are not treated as part of their intermediate consumption when they are resold with only minimal processing such as grading, cleaning, packaging, etc. Wholesalers and retailers are treated as supplying services to their customers by storing and displaying a selection of goods in convenient locations and making them easily available for customers to buy. Their output is measured by the total value of the trade margins realized on the goods they purchase for resale. A trade margin is defined as the difference between the actual or imputed price realized on a good purchased for resale and the price that would have to be paid by the distributor to replace the good at the time it is sold or otherwise disposed of. The margins realized on some goods may be negative if their prices have to be marked down. They must also be negative on goods that are never sold because they go to waste or are stolen*.'' (see The Commission of the European Communities et al. 2008).

[6] The most popular of these 'net' concepts is value added which has long been challenged by a large strand of the productivity literature. The objections range from the view that plants do not produce such things as real value added, see for example Oulton and O'Mahony 1994, p. 33 and Hulten 2000, p. 58) to more fundamental problems such as lack of empirical support. A study by Jorgenson et al. (1987) found that the conditions necessary and sufficient for the existence of a sectoral value-added function did not exist in forty out of forty-five industries analysed. Historically, BLS has used the concept of gross output originating (GPO) for its industry productivity series, a 'net' concept identical to value added and maintained by BEA. The devastating article by Mishel (1988) on the manufacturing GPO series triggered a credibility crisis that forced the BEA to suspend this program and to initiate a major review around the late 1980s. After a redesign, the BEA GPO program has been resumed in 1991, while the BLS moved to sectoral output, a 'gross' concept. See Mohr (1992).

assumption that underlies the notion of sales, a measure of output considered by the BLS superior to notion of retail margin. Admittedly, while some of the activities of the new business model introduced by big-box stores accord with the substitution between the cost of goods and the in-house labour cost, this does not seem to hold true for the entire retail business, which leaves the whole issue of non separability unsettled.

The price of retail services should have a dual property: first, reflect as closely as possible the distribution services rather than the prices of the goods sold by retailers per se and, second, abstract from any change in the quality of the goods and/or services that are priced. This can illustrated by the case of a representative profit-maximizing retailer operating under the following constant returns to scale technology $G(Q,Z) = Q \cdot g(Z)$, with Q and Z representing, respectively, the quantity of the good sold and the set of related services. The optimality condition for profit-maximization (using the same notation as above) yields:

$$P_s - c_s = g(Z). \quad (3)$$

Equation (3) states that the retail margin that results from selling one additional unit of a good equals the retailing services cost corresponding to this additional unit. With a linearization of the function $g(Z)$ and the addition of a set of fixed-effect dummy trend variables $D's$ and the error term ξ, we obtain the following hedonique specification:

$$P_s - c_s = \alpha_o + \sum_n \alpha_n Z_n + \sum_m \beta_m D_m + \xi. \quad (4)$$

Under standard conditions, the $\alpha's$ and $\beta's$ constitute unbiased parametres of the pure price change of the retail margin price index. Equation (4) suggests that retail margins tracks the movement of a pure price change of retail services and any departure from this concept can lead to a potential bias. For example, using the sales price P_s as a proxy of the price of retail services leads to biased parametres of equation (4), with a direction of the bias depending on the covariance between c_s and the right side variables.

Real Output and Productivity Measurement

While the aforementioned discussion emphasized that the notion of retail margin is regarded by the international community as the consensus view in the measurement of retailers' nominal output, our understanding of the industry allocation of the aggregate productivity is seriously constrained by a wide range, and sometimes inadequate, methods of constant price series output. Productivity analysis can only be as reliable as the constant price output series on which they are based.

We appeal to a simple framework that sorts out the competing approaches to the measurement of the volume of retail services and quantifies the potential bias that may arise from the departure from the 'ideal' approach outlined above. Differentiating (1) with respect to time and dividing by $P_s Y_s$ and rearranging terms yields the following identity between the primal and dual multifactor productivity growth $\left(\frac{\widehat{MFP}}{MFP}\right)$ formulas:

$$\frac{\widehat{MFP}}{MFP} = \frac{\widehat{Y_s}}{Y_s}(1 - s_c) - s_L \frac{\hat{L}}{L} - s_K \frac{\hat{K}}{K} - s_M \frac{\widehat{M}}{M} \equiv -\left(\frac{\widehat{P_s}}{P_s} - s_c \frac{\widehat{c_s}}{c_s}\right) + s_L \frac{\widehat{w}_L}{w_L} + s_K \frac{\widehat{w}_K}{w_K} + s_M \frac{\widehat{w}_M}{w_M} \quad (5)$$

with s_v $(v = c, K, L, M)$ representing the factor expenses shares in the revenue sales. Equation (3) calls for several remarks that illustrate the wide range of practices in the measurement of retail output and their related potential bias.

First, a common practice in the official statistics is to use the CPI as a proxy of retail margin price index, the preferable price index of retail margins.[7] As pointed out quite independently by Triplett and Bosworth (2004) and Gordon (2004), this approach has the perverse effect of assuming a one-to-one correspondence between the improvements in the good sold and the quality of the supporting services.[8] This perverse effect can be regarded as the statistical translation of the upward bias captured by $s_c \frac{\widehat{c_s}}{c_s}$ that affects the CPI movement $\frac{\widehat{P_s}}{P_s}$ on the right-hand side of equation (5). A primal counterpart to this result (see the left-hand side of equation (5)) is represented by the growth of real sales scaled down by the factor $(1 - c_s)$. The latter quantifies the upward bias that affects the real output series measured in terms of volume of retail sales.

Second, an alternative to the use of the sales price index is to rely on the concept of retail margin price index which has two variants. The explicit margin price index, developed by the BLS as part of the Service Producer Price Index program initiated in the mid-1990s, is collected directly from respondents margin prices (difference between selling price and purchase price of the last shipment received) for specific items. Its

[7] For example, prior to the 2010 comprehensive revision, BEA has used proxies based on components of the CPI and personal consumption expenditure (PCE) price index at the lowest level of commodity detail, assuming that the movement of the retail margin price index is proportionally driven by that of the CPI (or the PCE price indexes), where the factor of proportionality is defined by the margin to sales ratio (see Triplett and Bosworth 2004, 239 and Yuskavage 2006). The European statistical system is using a similar approach based on the assumption that the volume of margins track closely the volume of sales.

[8] Gordon (2004, 12) summarized the perverse effect as follows: "*The superior performance of U.S. retailing in achieving rapid productivity growth may in part be due to a measurement procedure that allows quality improvements in manufacturing to spill over to the retail sector*." This perverse effect has later been referred to as the 'inside-the-box' effect by Timmer et al. (2005).

competing measure, devised by Timmer et al. (2005), is implicitly derived from the joint movement of final sales price index and a constructed index of the cost of goods for resale.

The expression between parentheses on the dual side represents the implicit retail price margin growth and bears a resemblance with equation (17) in Inklaar and Timmer (2008). The expression contains variables that are readily available except for c_s which needs to be inferred from the weighted movements of domestic (P_D) and imports (P_M) prices (as in Inklaar and Timmer (2008)).

In recent years, import prices have been the focus of a great deal of attention largely because they are believed to miss much of the cost-savings that arise from the shift in sourcing to low-cost foreign suppliers—an phenomenon known as offshoring (see Houseman 2011). Much of this focus has been on manufacturing where offshoring makes its way through intermediate inputs. Any bias in the import prices leaves virtually unchanged gross output of manufacturing industry statistics. In contrast, offshoring in retail trade, which has so far been unexplored, occurs primarily through the imports of final goods and potentially lead to a downward bias of the volume of retail margins. The next section provides a thorough discussion about this issue.

2.3. Untapped Considerations

A Recent Development: Offshoring

The momentum gained in recent decades by multilateral trade liberalization created favorable conditions for structural changes in international trade with developing nations gaining prominence as new and low-cost suppliers of a wide range of final and intermediate goods. This development coincided with offshoring which has been an active research theme in recent years (see Houseman et al. 2011 for a nice overview from a U.S. perspective). Much of the focus of the recent literature has concerned itself with manufacturing where offshoring has been pervasive.

Retail trade is another sector where an abundant anecdotal evidence points to major retailers increasingly by-passing domestic suppliers of final goods to the benefit of foreign, low-cost sources. An important body of the recent literature suggests that 'big-box' stores have disproportionately contributed to the surge of consumer goods' imports from China and other less developed countries (Basker and Van 2008). For example, Wal-Mart, which accounts for over 15% of U.S. imports of consumer goods from China,

has seen its volume of imports from China increase 90-fold, compared to 30-fold for China's imports to the U.S. (see Basker and Van 2010).

This phenomenon seems to have spread out to Europe, where some large retailers already source an increasing share of their sales directly from abroad and away from domestic sources. For example, the survey carried out by Zentes et al. (2007) suggests that only large retailers from Austria, Germany and Switzerland have successfully engaged in direct importing. While this business model involves a significant sunk cost (e.g. operating buying office, search for suppliers, etc.) that limits entry, it makes it possible to generate significant variable cost savings that result from bypassing layers of intermediaries through dedicated buying offices.

Despite a growing body of anecdotal evidence in favour of offshoring, Europe and U.S. domestic markets of nonenergy final consumers goods remain relatively 'closed' with imports representing over the 1995-2009 period only 3.6% and 5.4%, respectively, of domestically produced goods.[9] Notwithstanding its modest importance, the share of imports to domestically produced final consumer spending in nonenergy goods has steadily increased since 1995, albeit at a much more rapid pace from the beginning of the present century, particularly in Europe (see Figure 1). As a result, the 2.0 percentage points difference in favour of the U.S. reported during the mid-1990s shrunk to 0.8 percentage point by 2009.

[Insert Figure 1]

Conceptually, these shifts in sourcing are the result of fundamentals such as cost savings from high-cost domestic suppliers to low-cost foreign suppliers.[10] While low-priced imported goods are increasingly found responsible in dampening inflation in both Europe (see Auer et al. 2011a, b) and the U.S. (see Feenstra 2010), the price index of imported non energy final goods is expected to advance at a lower pace than its

[9] These figures can be considered as a lower bound of the important of offshoring in the nonenergy final domestic demand goods. A thorough picture of offshoring would also have to take into account the imported content of personal consumer expenditures, an approach that covers imported final consumer goods but also imported intermediate inputs needed to produce domestically produced final consumer goods. Hale and Hobijn (2011) performed this kind of exercise for the U.S, which is beyond the scope of this paper.

[10] Another possible reason is the favorable movements in the exchange rate. The notion of exchange rate pass-through—the extent to which a change in the value of a country's currency induces a change in the price of the country's imports or domestic prices—has been largely investigated by the literature with, however, only limited empirical support. The presence of imperfect market structures, with a distribution sector using its own margins to dampen fluctuations of exchange rates to maintain stable prices and market shares, constitutes a credible explanation for the presence of a partial pass-through (see Campa et al. 2007).

counterpart for domestically produced goods in support of the shift in the sourcing of final consumer goods displayed in Figure 2. The results, reported in Figure 2, show that after a modest relative decline in the late 1990, the U.S. index remained virtually flat from 2002 onwards. While the European relative index reports a lower level than its U.S. counterpart, it also reached a similar plateau effect albeit from 2004 onwards. Therefore, the rapid growth of the imported share of nonenergy final consumer goods from low-wage countries seems to be at odds with the corresponding relative price index during the 2000s.

[Insert Figure 2]

The overstatement of the import price index is indicative of a substitution bias that results from an inadequate pricing method applied in markets with a high degree of products and/or firms turnover. Statistical agencies, in their attempt to track pure price changes, rely on a matched-model method where one model of a particular good is priced at the same outlet at regular time intervals. Generally, in their comparison of the price of the 'old' item supplied by the incumbent, originally used in the index, with the 'new' item supplied by the low-cost supplier, official statisticians adopt most of the time the so-called 'link-to-show-no-change' assumption. An important undesirable effect of this assumption is to arbitrarily attribute the entire price difference between the two items to quality change (see Triplett 2006 for a thorough review).

The order of magnitude of this bias, quantified by a growing body of the literature, has been found to be significant for both intermediate inputs and nonenergy final goods. Recent work by Houseman et al. (2011) on the U.S. manufacturing sector suggests an overestimation of mulifactor productivity growth and real value added between 1997 and 2007 in the range 0.1-0.2 and 0.2-0.5, respectively. Similar work by Inklaar (2012) on a cross-country basis during virtually the same period suggests a 0.4 percentage point upward bias for real value added. While this evidence points to an overestimation of the price index of imported intermediate inputs, its U.S. counterpart for final consumer goods has not been immune either. Reinsdorf and Yuskavage (2009) found a large upward bias for some commodity such as apparel and textile (+1.5 percentage point) and durable goods (+2 percentage points) during 1997-2007.

With the possible presence of an offshoring bias, the movement in the cost of goods sold inferred from those of the domestic and import prices suggested by Inklaar and Timmer (2008) needs, therefore, to be amended in the following way:

$$\frac{\widehat{c_S}}{c_S} = \omega_D \frac{\widehat{p_D}}{P_D} + \omega_M \left(\frac{\widehat{p_M}}{P_M} + \frac{\hat{\varepsilon}}{\varepsilon}\right), \quad (6)$$

with the extra term $\frac{\hat{\varepsilon}}{\varepsilon}$ capturing the offshoring bias and ω_j $(j = D, M)$ representing the relative weight of domestic prices and imported nonenergy goods. While the expectation is to have $\frac{\hat{\varepsilon}}{\varepsilon}$ report a negative trend, the real question is how large would it be. If some of the cost savings attributable to the shift in sourcing to low-cost foreign suppliers are not adequately reflected in the movement of the relative import price index then the retail margin price index will be underestimated as a result of the overstatement in the cost of purchased goods for resale. It follows an understatement of retailers' real output growth as much as productivity performance since the former affects the latter on a point-for-point basis.

The 'Scale' Factor

With its rich history beginning with the seminal work of Solow (1957), the growth accounting framework represented in equation (5) used in this paper constitutes the most natural metric to quantify productivity performance. Under the assumptions of perfect competition in both the output and inputs markets, perfect adjustments of inputs and constant returns to scale, this framework makes use economic theory to infer from national income data estimates of technical change that would otherwise be missing.

While economic growth, capital accumulation and technical change were topics once reserved for academic debates, the simplicity of the growth accounting framework, combined with its solid conceptual underpinnings, has contributed to move productivity to the forefront of policy debates. However, the popularity gained by this framework often came at the expense of the question whether the structures of the industry at hand are in conformity with its underlying assumptions.

Consider for example the assumption of constant returns to scale which may have been a reasonably close approximation to the retail market structures some three decades ago. Back then, individual boutique stores and department stores, with their entertaining window displays and their location in city centres where a critical mass of customers is available, dominated the retail business model in both Europe and the U.S. However, the landscape has been completely redrawn since the 1990s with the advent of the "big-box" format, particularly in the U.S. With their cost advantage arising from massive scale and a leaner inventory management, these new forms of retailers

have successfully offered consumers a wide range of products at better prices and, along the way, displaced, traditional, less efficient retailers.

In contrast, regulation in Europe in the form of land use restrictions to protect small shops from the competition of large-scale outlets increased the market power of incumbents and price margins, pushing up retail prices, and contributed to hamper productivity performance of this sector.[11] Therefore, a realistic approach requires the amendment of the growth accounting framework to reflect the presence of economies of scale in the U.S. while maintaining the assumption of constant returns to scale for Europe.

Similarly, if we accept the notion that more competitive markets translate into more frequent price changes and less segmented individual markets, then clearly the evidence of competitive retail markets seems more favourable to the U.S. However, the evidence based on markups indicates otherwise. The comprehensive study conducted by Christopoulou and Vermeulen (2010) for Europe and the U.S. suggests that, at a significant level of industry detail, markups of European retailers are more than twice those of their U.S. counterparts (1.49 vs. 1.19), suggesting that the efforts towards more competition initiated by the European Union led to mitigated results, while the presence of 'big-box' stores format and their stiff price competition in the U.S. translated to some market power. Evidence of scale economies is, however, scanty, generally available for a limited portion of the retail sector and for individual countries. For U.S. retail food stores, for example, scale economies have been estimated at 1.50, compared to 1.10 for large grocery retailing in Finland (see Ratchford 2003 and Aalto-Setälä 2001).

With this evidence in mind, the multifactor productivity trends reported by the literature cannot be regarded as a 'pure' indicator of technical change. The dual multifactor productivity framework reported in equation (3) needs to be adjusted ($\frac{\widehat{MFP}}{MFP}^{A}$) in the following way (see Kee 2004):

[11] Haskel and Sadun (2011) found that constraining entry of out-of-town large shops in the U.K. had an adverse effect on productivity. Their results suggest that a fall in shop sizes is associated with lowered multifactor productivity growth of about 0.4 per cent per annum, about 40 per cent of the post 1995 slowdown in U.K. retail multifactor productivity growth. They attributed this slowdown to firms losing scale and scope advantages. The cross country labour productivity comparisons made by Baily and Solow (2001) between the U.S, where planning and zoning regulations on retail development are more flexible, and the Netherlands (and South Korea), where regulations are more stringent, are largely more favourable to the U.S.

$$\frac{\widehat{MFP}^{A}}{MFP} = \frac{\widehat{MFP}}{MFP} - (\mu - 1)s_L\left(\frac{\widehat{w_L L}}{w_K K}\right) - (\phi - 1)\left(\frac{\widehat{w_K K}}{p_s Y_s}\right). \quad (7)$$

Heuristically, this means that the traditional measure of multifactor productivity defined in (5) must be downgraded by the respective contributions of markups ($\mu > 1$) and scale economies ($\phi > 1$) to arrive at a measure of 'pure' technical change. The remaining variables have previously been defined.

3. The Europe-U.S. Retail Trade Productivity Gap Revisited

3.1. Recent Developments in the U.S. Statistical System

The BEA Annual Industry Accounts provide a time series of estimates for gross output, intermediate inputs, and value added by industry in both current and chain-type volume indexes. Their recent integration to the benchrmark Input-Output accounts enhanced their reliability, with the result that they can now be regarded as an important building block of an integrated production account suitable for the growth accounting exercise.[12]

Once every five years, this set of accounts undergo a process of comprehensive revisions that feature in-depth revisions to sources, concepts and methods that generally require a multi-year effort with the goal to reliably reflect the changing structures of the economy on its long-term path (see Landefeld et al. 2008). The 2010 edition of the comprehensive revision, which conforms to this tradition, gave rise two broad sets of changes.

The first is a routine exercise meant to use the 'right levels' for gross output and intermediate inputs out of the benchmark Input-Output accounts to update the Annual Industry Accounts. This exercise generally leads to changes in the nominal values but also in chain-type volume indexes following the update of the commodity/industry weights. For example, with the availability of the 2002 economic census data collected every 5 years by the Census Bureau, detailed and accurate information on shipments, revenues, expenses, etc. are used to develop benchmarked Input-Output accounts. Furthermore, with the expansion of the industries' intermediate purchases content of some of the Census Bureau surveys and their availability on an annual basis, the Annual Industry Accounts enhanced considerably the annual accuracy of the intermediate input expense and value added by relaxing the assumption that the

[12] See Rassier et. (2007) for the process of this integration and its implications.

movement of real intermediate inputs is driven by that of the real output (see Mayerhauser and Strassner 2010).

The second is the use of the margin producer price indexes for retail and wholesale sectors. These new price indexes, developed by the BLS as part of the newly created Services Producer Price Index program, took over the BEA in-house price indexes, a variant of the official retail CPI and the PCE price indexes.

Table 1 reports the revisions in the values, chain-type price and volume indexes for gross output, intermediate inputs and value added between the 1998-2007 time-series based on the 2010 and 2004 comprehensive revisions performed by the BEA for the annual industry accounts. The focus of the table is on retail trade, though information for the private economy, the services sector and wholetrade sector has been added for reference. The main take away message is that the retail trade gross output price index (margin) has been upgraded by a hefty 1.2 percentage followed by a resonably high 0.7 percentage point downgrade in the nominal value of gross output. Altogether, these changes have translated into a huge 1.9 percentage point reduction in the growth of real gross output. The series related to value added experienced a similar change in the direction of the trend, albeit with much more pronounced revisions than gross output owing to moderate revisions in the intermediate output series.

Table 1. Sources of the Revisions of the Industry Accounts, 1998-2007
(Percentage points difference)

	ΔV(GO)	ΔV(II)	ΔV(VA)		ΔP(GO)	ΔP(II)	ΔP(VA)		ΔQ(GO)	ΔQ(II)	ΔQ(VA)
Retail trade	-0.7	-0.7	-0.6		1.2	-0.2	2.0		-1.9	-0.5	-2.6
Memo											
Private sector	-0.1	-0.3	0.2		0.2	0.3	0.1		-0.2	-0.6	0.1
Private services	-0.2	-0.6	0.1		0.3	0.4	0.2		-0.4	-1.0	-0.1
Wholesale trade	-0.4	-0.8	-0.2		-1.3	0.4	-2.1		0.9	-1.2	1.9

Note: Δ=Difference between the average annual growth rates of the post- and pre-revision estimates. V=Nominal value; P=Chain-type price index; Q=Chain-type volume index; GO=Gross output or gross margins, II=Intermediate inputs, VA=Value added. Pre-revision data on gross output and intermediate inputs are only available up to 2007. Numbers may not add up due to rounding errors.

These marked downward revisions in the real growth of the retail trade sector are contrasted with significant upward revisions for the wholesale industry, thereby leaving virtally unchanged the real output growth of the private services sector. [13]

[13] The examination of the implicit price indexes of both retail and wholesale suggests a revision in the price indexes, while the supporting Survey of Current Business articles to the current benchmark revision referred solely to changes in the deflator of the retail industry (see Mayerhauser. and Strassner 2010). In

3.2. Implications

The revision to real output has significantly altered the productivity performance of the U.S. retail trade sector, thereby leading to a significant revamp of the industry allocation of the private economy productivity performance. This revision has also translated into a lack of cross country comparability of the retail trade real output.

Labour productivity has experienced a 3.1 percentage points downward revision, of which a little more than 4/5 are attributable to output and the rest to hours at work. This contrasts markedly with wholesale where all of the 1.9 percentage points upward revision are due to the output (Figure 3). The productivity leadership now reported by the wholesale sector mirrors rather nicely the healthy performance shown in the last decade by Apple and Cisco, some of the high profile constituent firms of this sector.

[Insert Figure 3]

Of the 2.5 percent labour productivity growth reported by the U.S. private economy during the 1998-2008 period, 12% are attributable to wholesale compared to a modest 5.5% for retail, a major turnaround from the previous data vintage where the proportions were reversed. Overall, however, the contribution of distributive trade is now close to 20%, up from 17% prior to the 2010 historical revision (see Figure 4).

[Insert Figure 4]

We now turn to the impact of the BEA 2010 comprehensive revision on the comparability between Europe and the U.S. for the retail trade sector. Recall that prior to this revision, both Europe and the U.S. have been using a variant of the CPI which translated into a reasonably small gap in the output price index reported in Table 2 (+0.7 percentage point). The shift towards retail sales margin price indexes following the implementation of the 2010 revision has almost tripled this difference, suggesting the relatively lower pace of the retail price margin index compared to the sales price index. Much of the difference in the real output is attributable to differences in the movement of the nominal value of output which remained roughly unchanged as a result of the historical revision.

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a subsequent correspondence with the BEA staff, it was has been confirmed changes in price indexes also affected wholesale.

Table 2. Impact of the Bureau of Economic Analysis 2010 Comprehensive Revision on Europe-U.S. Retail Margin Data, 1995-2009 (Percentage Points)

	Nominal	Output Price	Real Output
	Pre 2010 Revision		
Europe *minus* U.S.	-2.5	0.7	-3.2
	Post 2010 Revision		
Europe *minus* U.S.	-2.7	1.9	-4.6

3.3. Towards a More Reliable Assessment of the Europe-U.S. Productivity Gap

Preliminary Remarks

The aforementioned developments have direct implications on the Europe-U.S. productivity comparisons. The official statistical series available through the EU-KLEMS, while they rest on methods that conform to best practices as defined by OECD (2001) productivity manual, make it impossible to assess whether the existing gap is a genuine phenomenon or the result of measurement differences. For example, with the U.S. now using a first-best method for real output and Europe still using a faulty measure, there is a need to bring both Europe and the U.S. to the same common denominator represented by the double-deflation technique as did Inklaar and Timmer (2008) in their cross-comparison of productivity performance. Similarly, offshoring bias, may potentially make its way to retail trade real output in both Europe and the U.S., which, as a result, requires a downward adjustment to the corresponding price index. Thus, it is important to harmonize the measurement of the underlying variables in a way to reliably quantify the difference in the productivity performance between the two economies.

The Source Data

The primary data source used for this exercise is the World Input Output Database (WIOD), considered as an attempt to extend the input-output tables from a national to a worldwide setting with the goal to quantify the commodity and industry inter-country flows of inputs, income generating output and final demand categories (see Timmer et al. 2012 for a description). The socio-economic accounts component of WIOD, which comprise a more current vintage of some of the EU-KLEMS series, have been used to derive price indexes of the inputs along with their corresponding share in total sales.

Within the WIOD, the final demand component of the World Input-Output tables and International Supply and Use tables in both current and constant prices have been used to construct the series on non-energy final consumer goods produced by Europe and the U.S. and those imported from low-wage countries.[14] Total sales of non energy final consumer goods in both current and constant prices are obtained from the sum of imports and domestic production of these goods with a proper account for transportation margins wholesale, retail distribution and commodity taxes. Implicit prices have been derived for imports, domestically produced and sales of non energy final consumer goods. The cost of goods sold is inferred from the imports and domestically produced price index of non energy final consumer goods weighted by their corresponding share in the total sales.

Quantitative Analysis

We begin the analysis with the main components underlying the movement of the retail margin price index reported in Table 3. The results reiterates some earlier findings such as the closed feature of the market for nonenergy final consumer goods in both Europe and the U.S., thereby contributing to close 90% in the movement of the cost of goods sold. While the contribution of imports to the cost of goods sold are the in same ballpark in Europe and the U.S., the contribution of domestic prices reveals striking difference, with European domestic price outpacing their U.S. counterpart by a wide margin. This different pattern in the producer prices between Europe and the U.S. is mirrored by the sales price indexes.

Table 3. Components of Retail Marginal Price Index, 1995-2009
(Average Annual Growth Rate in Percentage)

	Sales price index	Cost of goods sold	Contribution of	
			Domestic prices	Imported prices
Europe	0.96	0.77	0.69	0.08
U.S.	0.31	0.50	0.45	0.05

With the information reported in Table 3 combined with that on the input prices, we are now in a position to generate comparable multifactor productivity measures between Europe and the U.S. using the dual formula on the right-hand side of equation (5). The results, reported in Table 4, are based on the implicit measure of the retail margin price index without correction for offshoring bias. While both Europe and the

[14] These are : Brazil, China, India, Indonesia, Korea, Mexico, Taiwan and Turkey. Low-wage countries from Europe have not been considered given their small importance.

U.S. reported a reasonably rapid increase in the price of combined inputs, advancing at 2/3 of a percentage point, European retailers experienced a much more rapid decline in the retail margin price index than their U.S. counterparts, a reflection of a lagging productivity performance in Europe relative to the U.S. Over the 1995-2009 period, U.S. retailers reported a 0.7% average productivity growth compared to 0.2% for Europe.

Table 4. Multifactor Productivity Growth and Its Components

	Implicit retail margin price	Contribution of			Multifactor productivity
		Wages	Rental price of capital	Price of intermediate inputs	
Europe (1)	-0.43	0.49	-0.10	0.25	0.21
United States (2)	-0.01	0.34	0.00	0.33	0.66
Gap ((2) minus (1))					0.45

Before proceeding with any further analysis, it is useful to reconcile the results on multifactor productivity growth just presented with those recently published. These are the 2009 vintage of the EU-KLEMS gross output measure of multifactor productivity growth for Europe and U.S. retail sectors over the 1995-2007 period; Inklaar and Timmer (2008) devised for a sample of European countries and the U.S. over the 1987-2002 period a comparable measure of retail output based on the deflation of retail margins by a newly developed deflator of retail margin. These harmonized measures of retail margins facilitate the construction of comparable measures of multifactor productivity growth.

Differences with respect to time period and vintage of the data, which reflects both statistical as well as methodological changes, make a definitive reconciliation with our results impossible. Gross output based multifactor productivity estimates out of the EU-KLEMS dataset for Europe and the U.S. over the 1995-2007 period are, respectively, 0.2% and 1.6%. These results rest on measures of gross output deflated by sales price index, leading to an overestimated real output as a result of the perverse 'inside-the-box' effect referred to in our discussion on output measurement.

With the introduction of the retail margin producer price index in the 2010 historical revision, the retail trade sector reports a 2.6% average growth of its real gross output, a full 56% reduction from the figures reported under the old methodology. If we hypothetically assume that the estimates of retail trade output in the 2009 vintage of the

EU-KLEMS are overestimated by half, then Europe and U.S. multifactor productivity growth becomes, respectively, downgraded to 0.1% and 0.8% over the 1995-2007 period. This 0.7 percentage point gap in favour of the U.S. is 0.2 percentage point higher than our result reported in Table 4, mainly a reflection of the fact that our time period includes the effect of the Great Recession.

Using the gross output measure of multifactor productivity over the 1995-2002, Inklaar and Timmer (2008) reported a 0.23% and a 1.7% average growth, respectively, for their sample of European countries and the U.S.[15] Our results for the same period, respectively 0.29% and 1.4%, while lower in terms of order-of-magnitude, still confirm the presence of a significant gap. The difference in the estimates may be due to the detail, coherence and reliability in the source data made possible by the WIOD used in our paper, compared to the use of a set of disparate national accounts series in theirs.

Sensitivity of the Results to Offshoring Bias and Scale Economies

Our results suggest a 0.5 percentage point productivity gap (give and take) in favour of the U.S. over the 1995-2009, almost one-third of gap reported from the 2009 vintage of the EU-KLEMS. This new measure of the gap rests on similar measures of real output based on the implicit retail margin price. We now ask the question whether this new measure of the gap is robust to other sources of uncertainty such as those attributable to offshoring bias and the presence of scale economies in the U.S. retail sector.

Offshoring bias, which affects the imports prices that enters into the calculation of the cost of goods sold, is derived from the percentage point difference between an alternate import price and its official counterpart at the level of detail of the nonenergy final consumer goods reported in the WIOD final demand for both Europe and the U.S. The alternate price index was constructed by Inklaar (2012) on the basis of the detailed information available from the UN Comtrade database.[16] The price variation of the commodities imported by the 38 countries he considered, has been aggregated to the level of 16 industries (manufacturing, agriculture and mining) of the WIOD using the share of imported intermediate goods as a weight.[17] Out of these industries, we have considered the price change of the alternate import price index for manufacturing and

[15] Their sample represents 46% of the EU-15 retail trade sector. We have weighted their estimates of the individual countries by their respective share of gross output.
[16] The data were kindly provided to us by Robert Inklaar.
[17] While this kind of weight is not ideal for our needs, we hope that it does not introduce too much distortion at the level of aggregation that we have considered.

agriculture commodity output that matches our coverage of non energy final consumer goods. These price variations are then aggregate across commodity output for each year and then compared to the annual price variation based on the official import price index.

The weighted average difference in the variation between the alternate and the official import price index, reported in Panel A of Table 5, suggest a 0.10 and 0.13 percentage point upward bias, respectively for Europe and the U.S. Compared to the offshoring bias that imparts the imported intermediate inputs, this bias is relatively small, a result attributable to the combined effect of a limited scope of imports in the nonenergy final consumer goods along with the fact that imports are important for a few items such as textile products, electronics and electrical products. This bias affects the retail margin price index and, in turn, Europe and the U.S. multifactor productivity growth by, respectively, one-third and one-tenth of a percentage point. All in all, the productivity gap remains unchanged to offshoring bias.

Table 5. Accounting for Offshoring Bias in the Dual Multifactor Productivity Estimates and Its Related Components, 1995-2009
(Average Annual Growth Rate in Percentage)

A—Components of Retail Marginal Price Index Adjusted for Offshoring Bias					
	Sales price index	Cost of goods sold	Contribution of		
			Domestic prices	Imports price	
				Official	Offshoring bias
Europe	0.96	0.66	0.69	0.08	-0.10
United States	0.31	0.37	0.45	0.05	-0.13
B—Multifactor Productivity Growth and Its Components					
	Retail margin price	Contribution of			Multifactor productivity
		Wages	Rental price of capital	Price of intermediate inputs	
Europe (1)	-0.50	0.49	-0.10	0.25	0.14
United States (2)	-0.09	0.34	0.00	0.33	0.58
Gap ((2) *minus* (1))					-0.44

We now move to the impact of scale economies and markups, identified respectively by the parameters ϕ and μ in equation (7). The estimates of these parameters reported by the literature referred to earlier constitute a good starting point, albeit marked by a high degree of uncertainty as a result of differences in the

specification of the underlying model, coverage and time period.[18] Another important consideration is the disparate sources of these estimates. For these reasons, the values of for the parameters μ and ϕ are selected in a conservative way while still offering a minimum of internal consistency.[19] They are assumed to be 1.4 and 1.02 and 1.3 and 1.15, respectively, for Europe and the U.S.

With these values, markups and scale economies jointly contribute for about one third of the European and U.S. conventionally estimated multifactor productivity growth (see Table 6). This brings the 'pure' estimate of technical change down to 0.09% and 0.38%, respectively, for these two economies, which corresponds to about one-quarter of a percentage point gap, down from half of a percentage point in the absence of these adjustments.

Table 6. Adjusting Multifactor Productivity Growth to Markups and Scale Economies, 1995-2009 (Average annual growth rate)

	Baseline Multifactor Productivity Growth	Adjustments for		Adjusted Multifactor Productivity Growth
		Markups	Returns to Scale	
Europe (1)	0.14	0.05	0.00	0.09
United States (2)	0.58	0.10	0.09	0.38
Gap ((2) *minus* (1))	-0.44	-0.05	-0.09	-0.29

In the absence of the estimation of a full-blown model that accounts—explicitly and in an integrated fashion—for scale economies, markups and rigidities in the factor markets, these adjustments to the conventionally measured multifactor productivity growth can only be considered as rough, albeit informative, approximations of the presence of a potential bias arising from differences in the structures between these two economies.

4. Concluding Remarks

This paper provides a retrospective look at the Europe-U.S. productivity growth in the retail sector, asking whether the much heralded gap in favour of the U.S. is the result of

[18] For example, in the Christopoulou and Vermeulen (2010) model, scale economies are not explicitly accounted for, nor rigidities in the inputs markets.

[19] This internal consistency rests on the following identity (see Basu and Fernald 1997, 253) : $\phi = \mu(1-\pi)$, with π representing the profit margin. I am indebted to Robert Inklaar for bringing this point to my attention.

a ‘pure’ difference in efficiency with which inputs have been utilized across the Atlantic or a mere reflection of combined differences in measurement and in economic structures.

Getting to the bottom of this question is of central importance as the retail trade sector drives much of the Europe-U.S. market economy productivity gap. What emerged is a picture with two main themes, one of which aimed at providing a fresh look at the measurement of real output of the retail trade sector, while another brought to light issues that were concealed by the growth accounting literature. Both themes led to a more nuanced perspective on the differing transatlantic evolution of productivity growth that stands in a sharp contrast with the common wisdom.

First, this paper appealed to a unified framework to seek guidance on the desirable features a reliable measure of output ought to display. Not only did this framework led us to the concept of retail trade margin alongside its corresponding price index, but it also led us to cast a wider net to identify the shortcomings of competing approaches. An important aspect of this framework is to quantify the potential bias that arises from alternate measures such as real sales. For example, the 3.1% advance in real sales reported by the BLS labour productivity program over the 1995-2009 period overestimates by half the desirable measure represented by real retail trade margins.

Second, another contribution of this paper is to highlight that offshoring, as a major structural transformation in international trade, spread out from manufacturing to retail trade, where it is gaining increasing importance. While offshoring in retail trade is more about final consumer’s goods, compared to intermediate goods for manufacturing, both of them impart an upward bias on productivity performance through the same channel—the price index of imports. Offshoring bias in the retail sector amounts to roughly one-tenth of a percentage point, which represents only about one-quarter of its counterpart in manufacturing.

Third, growth accounting is organized around the concept of production function, where real output is assumed to be related to inputs, with the provision that they are efficiently utilized. This efficiency is known as multifactor productivity. Under constant returns to scale, marginal-cost pricing and perfect adjustment of inputs, Solow (1957) showed that multifactor productivity captures a shift in the production function, that is, technical change. The extent to which similar industries of countries at similar stage of

development meet these assumptions remains a fundamental empirical issue that can highlight valuable information on differences, or similarities, in economic structures. There is an abundant evidence—anecdotal or otherwise—that the U.S. retail trade sector differs in a meaningful way from its European counterpart, yet these differences have, to the best of our knowledge, never been explicitly accounted for in the productivity metric. Using a growth accounting metric to economies with different economic structures bears resemblance to using a Fahrenheit-based thermometer to track the temperature in both the U.S. and Europe!

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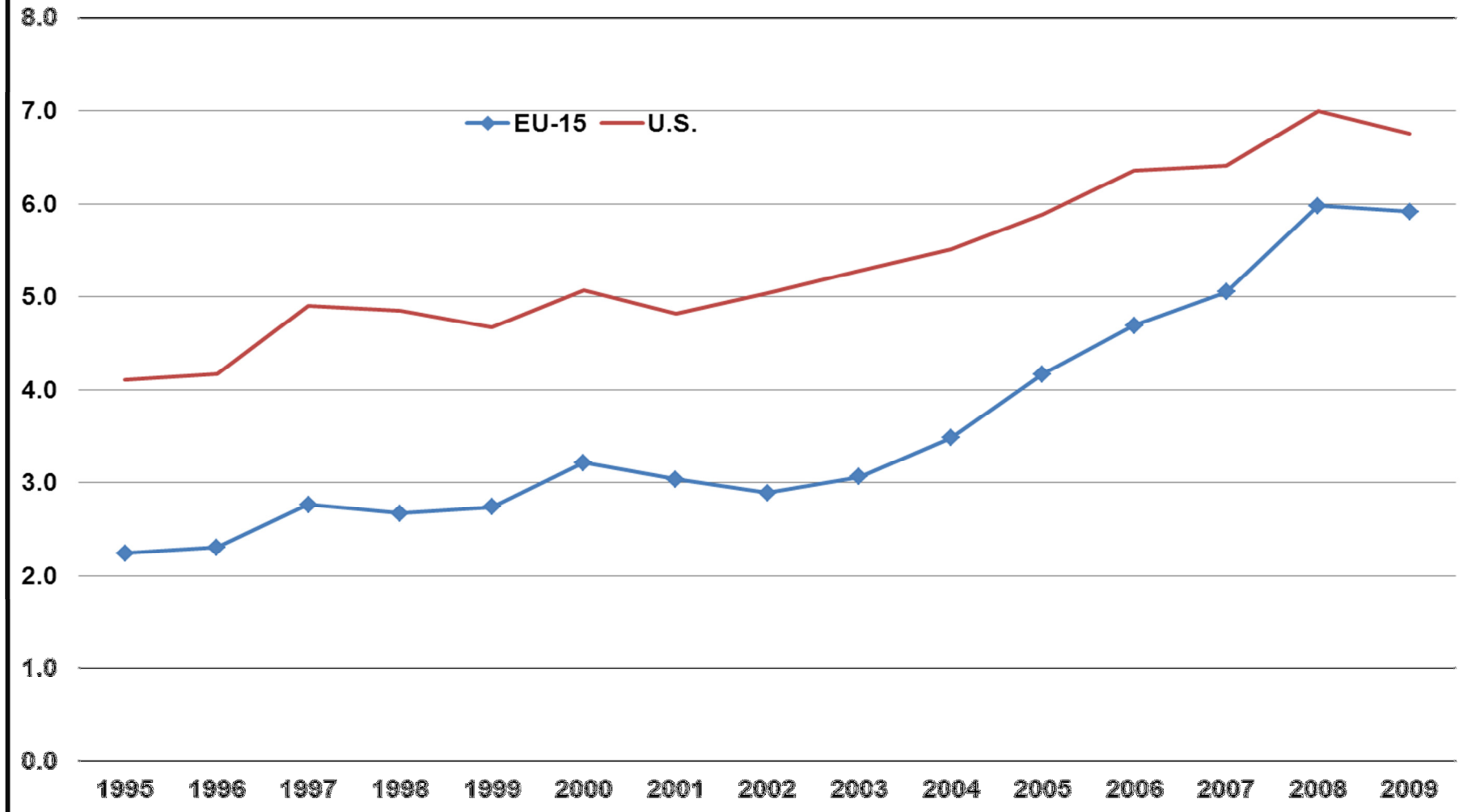
Figure 1. Nonenergy Final Consumers Goods Spending: Ratio of Imports from Developing Countries to Domestically Produced (Percentage)



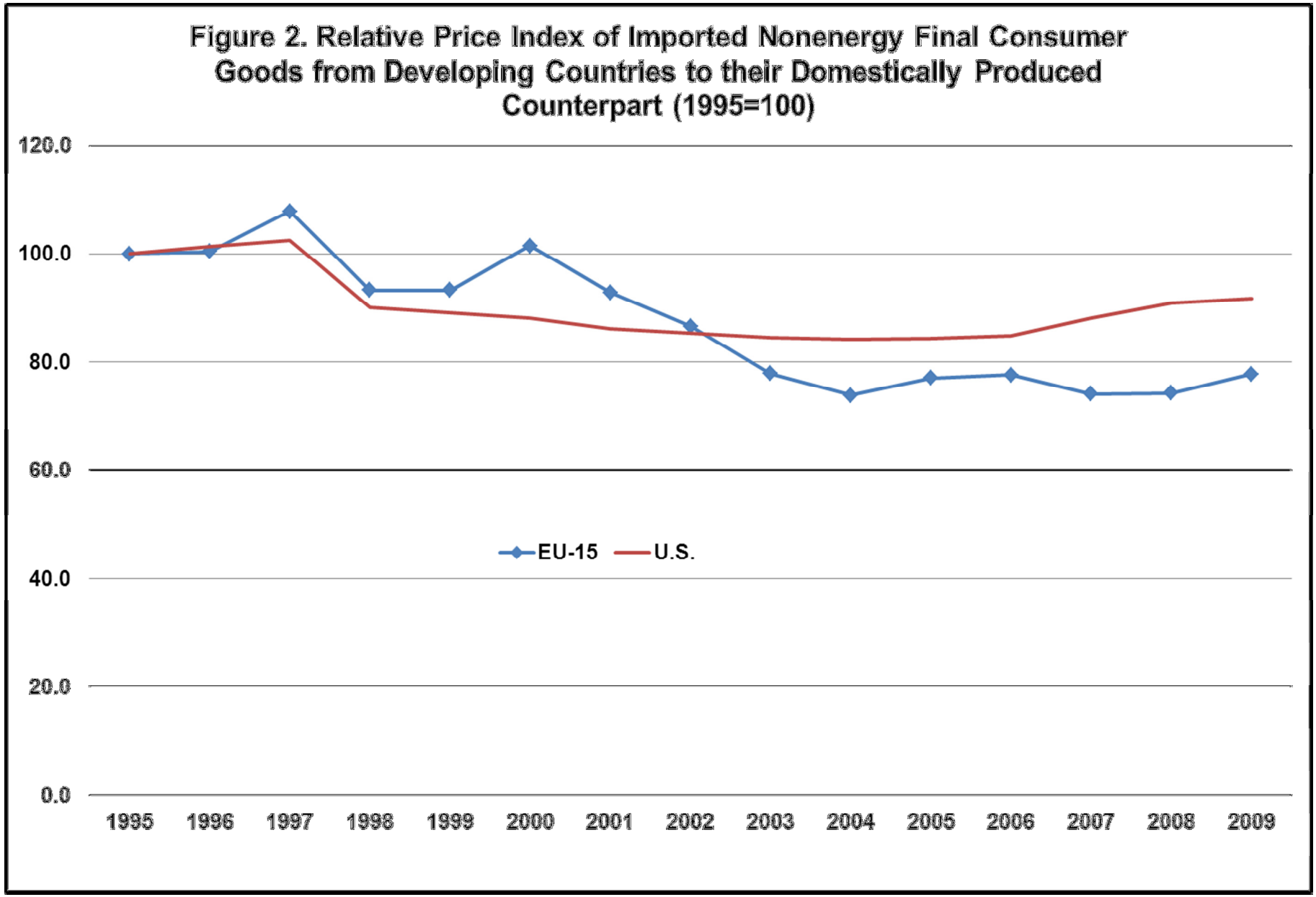
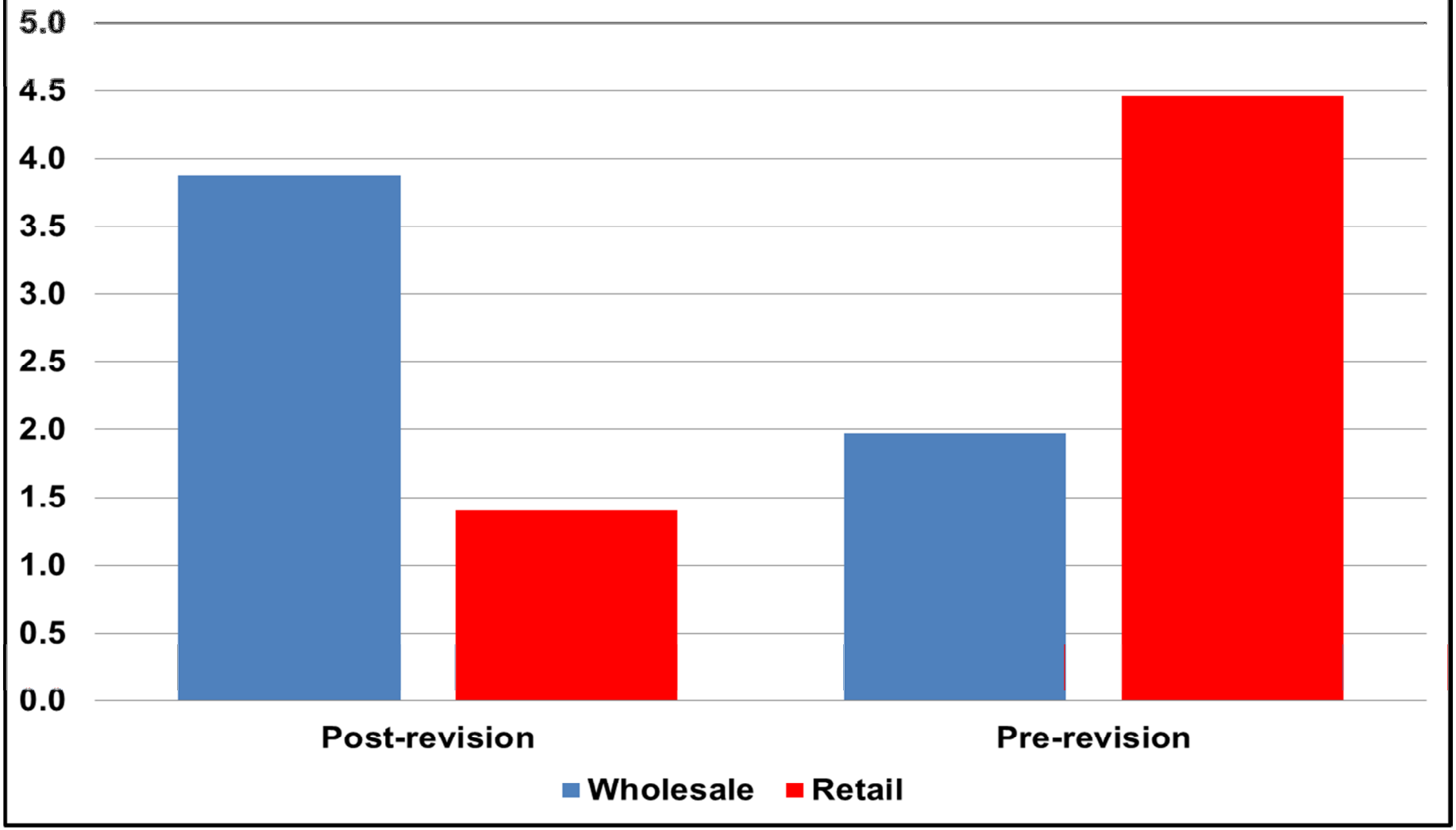


Figure 2. Relative Price Index of Imported Nonenergy Final Consumer Goods from Developing Countries to their Domestically Produced Counterpart (1995=100)
120.0
100.0
80.0
60.0
40.0
20.0
0.0
EU-15
U.S.
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009

Figure 3. Labour Productivity in the U.S. Wholesale and Retail Industries, 1998-2008
(Average Annual Growth Rate in Percentage)



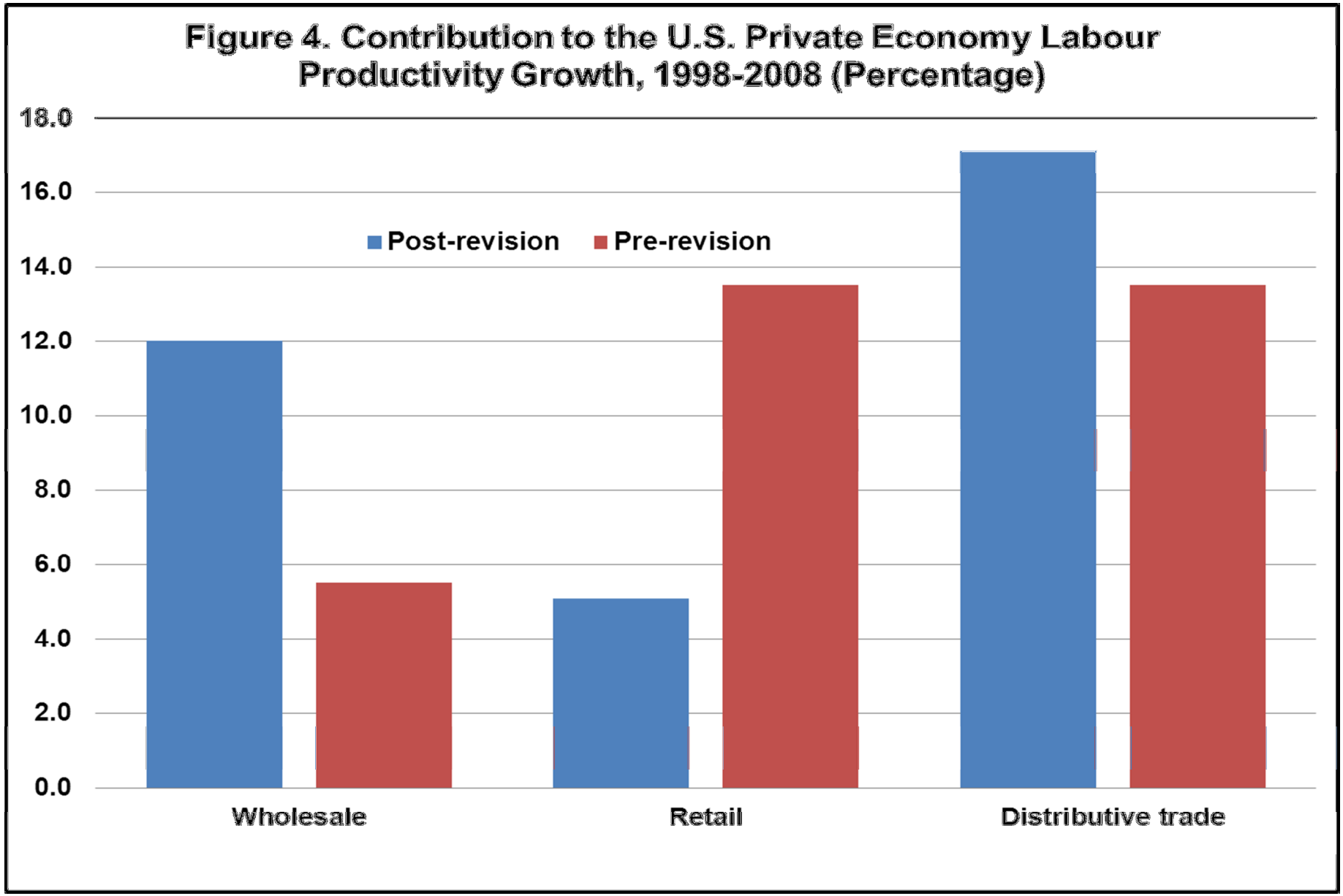


Figure 4. Contribution to the U.S. Private Economy Labour Productivity Growth, 1998-2008 (Percentage)
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
Post-revision
Pre-revision
Wholesale
Retail
Distributive trade