

FACTOR CONTENT AND INTERMEDIATE TRADE: WHAT MATTERS FOR POLICY?

Susan F. Stone¹
OECD

Abstract

Recent work in the trade literature has shown the importance of intermediate trade flows and the pivotal role of production networks in trade patterns. There have even been suggestions that trends underlying these phenomena (ie improved information technology and offshoring) have made the concept of Comparative Advantage irrelevant for trade policy. They argue that trade patterns are no longer matters of resource endowments and factor content, rather trade relies on well placed policies and technology transfer to leapfrog the development process. This paper addresses the question: to what extent is factor content still reflected in trade patterns? We contend that while trends reflect the process of production fragmentation the fundamental role of factor content is still very evident in trade patterns. This is still shown when we account for intermediate trade in our analysis. However, the forces of production fragmentation and offshoring are evident. Trade patterns are now just as reliant on the cost of moving goods and tasks, as they are on the particular endowment structure of an economy.

Keywords: Factor content, intermediate goods, input-output tables, trade

JEL: F1, F11, D5

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I. Introduction

Globalisation and openness-based growth strategies are at the forefront of public debate in international trade. Issues such as competition with labour-intensive imports, deepening of global imbalances and offshoring have induced concern over a range of issues including employment, exchange rates and the role of trade in long term growth. The uneven pace of recovery from the Financial Crisis and recent events in Japan have cast doubt on the unprecedented level of integration of global markets. Policymakers are asking to what extent is this interdependence a ‘natural’ phenomenon based on market outcomes. It is within the context of Comparative Advantage that these concerns have traditionally been addressed.

The concept of Comparative Advantage inspired much of the economic policy making post-WWII, most notably the push for multilateral trade liberalisation under the auspices of the GATT and the WTO as well as regional integration and unilateral trade liberalisation efforts. Yet, the policy implications of the concept have recently been a subject of a passionate debate. Higher levels of economic development have been linked in the literature with specialisation in human capital and technology-intensive products. This gave credence to the idea that one could ‘guide’ or ‘direct’ comparative advantage. There are those who now argue that the fundamental development path outlined in the theory of Comparative Advantage is no longer appropriate in a world of integrated markets and fast-changing information technology. Specialisation and growth are not tied to things like factor content and trade, but rather are easily influenced by policy and getting the mix of specialisation right can permanently and positively, influence long run economic growth (Rodrik 2006). Freidman (2005), for example, argued that the “world is flat”, a commercial level playing field where historical and geographical divisions are becoming increasingly irrelevant and all competitors have an equal opportunity, emphasising inter-individual and inter-company competition and rendering comparative advantage largely irrelevant.

This paper presents an analysis completed of comparative advantage from the perspective of factor services embodied in traded outputs. It takes a closer look at the underlying forces in factor markets and how they potentially drive Comparative Advantage. The paper begins with a discussion of the Factor Content Theory of Comparative Advantage and briefly reviews the empirical literature examining factor content of trade within this framework. It then examines relative resource use and relationship to endowments and trade. The final section offers some conclusions and areas of policy relevance.

II. The Heckscher-Ohlin Theory of International Trade

The Heckscher-Ohlin theory of international trade states that comparative advantage is derived from differences in relative factor endowments across countries and relative intensities with which factors are used across sectors.² A country will have an advantage, *vis a vis* other countries, in producing goods in those sectors which use factors it holds in relative abundance. Vanek (1968) formalised the link between factors used in the production of a country’s goods and services and its trade by comparing the relationship between those factors embodied in a country’s production versus those embodied in its consumption. This has become known as Heckscher-Ohlin-Vanek (HOV) model of international trade.

² The model was originally formulated by Heckscher (1919) and further developed by Ohlin (1933) and formalised by Samuelson through a series of papers between 1948 and 1953. The model is often also referred to as the Heckscher-Ohlin-Samuelson model.

The HOV model has been subject to extensive empirical scrutiny with an uneven record of success. The problem is that the lack of a clearly differentiated framework relating endowments and trade makes it impossible to test HOV against a well-specified alternative. Thus, researchers have been focusing on what version of a constantly evolving HOV model best fits the data. Starting with Leontief (1953) through Trebler (1995), HOV failed most major empirical challenges.³ Trebler (1995) found that the measured net factor content of trade using a HOV framework is essentially zero, calling this the “case of the missing trade”. He then develops a specification that allows for home bias in consumption and international technology differences and the model successfully fits the data. However Gabaix (1997) showed that this improved model is based on a set of carefully chosen specifications and when the estimated parameters are tested to see if they successfully reconcile the predicted with the measured factor content of trade, no real improvement is observed.

Work following Trebler began to focus on why HOV models performed so badly. Measurement error tended to be the most common explanation – factors are not well defined or are not captured well enough in the value of trade (Fisher and Marshall 2008); significant aggregation bias existed in measures of trade used (Feenstra and Hanson 2000); incorrect assumptions were being made regarding returns to scale (Antweiler and Trebler 2002) and difference in technology (early examples include Trebler and Zhu 2000, Hakura 2001 and Davis and Weinstein 2001). Romalis (2004) showed that transport costs and monopolistic competition are important determinants of the structure of trade and need to be incorporated into the HOV framework. In the end, what this body of work showed was that by improving specifications and including more realistic elements of trade, the HOV framework performs well.

The Model

We start with the Heckscher-Ohlin-Vanek (HOV) model which is set in a multi-good, multi-factor world and focuses on the factor service content, such as labour, capital and land that are embodied in the exports and imports of countries. Vanek (1968) showed that a country’s net factor content of trade equals its own factor endowments minus its share of the world factor endowments, share being based on the country’s share of world expenditures. So for country i , $F^i = V^i - s_i V^w$, where F^i is the factor content of its net trade, V^i, V^w , its and the world’s factor endowments respectively and s_i its share of world expenditures. Measuring factor content of trade using expenditure shares, however, does not capture the true factor services utilised by a particular country (Deardorff 1982). Thus, a better measure of factor content is using consumption shares.

Thus, the HOV model of international trade can be stated as:

$$F^i \equiv AT^i = V^i - s^i V^w, \quad (A1)$$

In this specification, A is the input requirements matrix, T is the vector of net trade for i , such that F is the vector of factor content in net exports. V^i is the vector of factor endowments in country i , V^w is the vector of world factor endowments and s^i is country i ’s share of total world consumption. According to equation (A1) net exports for each factor is positive (negative) if, and only if, the country’s endowments of the factor are greater (lower) than the content of its total domestic consumption of that factor.

As stated above, studies have shown that the simple HOV model is strongly rejected by the data. However a model that allows for technological differences, a breakdown in factor price equalization, the existence of nontraded goods and the costs of trade is consistent with data (Davis and Weinstein 2001). Further work on the importance of intermediates in trade has shown the importance of

³ For an extensive review of empirical studies during this period see Leamer and Levinsohn (1995).

incorporating these flows into the basic HOV framework (Reimer (2006) and Trefler and Zhu (2010)). We will take these issues in turn.

Common technology matrix

Many studies attempt to accommodate differing technology matrices by adjusting parameter estimates to account for potential measurement error across economies. Davis and Weinstein (2001), Reimer (2006) and Bowen et al (1997) for example take this approach. Others adjust the technology matrices for productivity differentials, using the United States as a base (Davis and Weinstein (2003) and Trefler and Zhu (2010) and Reimer 2006)). Under this hypothesis, the technologies of countries differ only by a Hicks-neutral shift parameter that can be characterised by a country-specific technology shift with respect to the US. Finally, there are examples where researchers have incorporated specific country technology matrices in the analysis. For example, Hakura (2001) used OECD input output tables to allow for varying technology across four OECD members and found this improved the fit of the model significantly. However, this was applied to a subset of trading nations and applied a common technology to *all* inputs (domestic as well as imported).

In the approach applied in this paper we make no adjustment for productivity differences among countries for two reasons. First, studies examining the factor content generally look at a subset of countries and thus apply a common reference base (either technology matrix or productivity adjustment). For example, Reimer examines the factor content of trade in the context of two entities: the United States, and an agglomeration of technology matrices for the rest of the world (ROW). He then adjusts this ROW matrix for productivity differences with respect to the base country, the United States. In this study, we apply country-specific technology matrices for each of the economies examined and thus the differences in the technologies applied in each region are captured in their own technology matrices.

On a more practical basis, the primary reason for the implementation of this adjustment in the literature is to improve the performance of their measured factor content when tested against the theoretically predicted value. It is not the purpose of this work to test the validity of the HOV model. Indeed, as briefly outlined above and in much more detail in the various works cited, this service has been performed. Rather we are using the model to measure factor content and fully expect these values to diverge precisely based on their productivity differentials. To do *a priori* adjustment for these differences is to reduce the information available in the measured values themselves.

Factor price equalisation

The failure of factor price equalisation (FPE) can lead to important differences in the technology matrices for traded and nontraded goods. The input coefficients differ in tradables because the failure of FPE has led countries to specialise in different goods. They differ in nontradables because the same goods are produced with different factor proportions. To the extent that FPE breaks down, the standard HOV needs to be adjusted to account for departures in the factor usage of nontradables goods from world averages.

The need to make this adjustment is tied to the standardisation of technology matrices across countries. Again, we are not applying world averages when inputting our technology matrices so the adjustment is not as critical for our database. However, this issue does come into play when determining which data measurement (ie values versus units) arises. If the only reason that factor prices differ is due to factor-augmenting productivity differences, then we can use the reported values as representative of efficiency-adjusted factor usage as this measure is well suited for calculations of the input matrices. However, it is well acknowledged that FPE breaks down for reasons beyond quality differences. To the extent this breakdown is not captured, it is preferable to measure factor usage in terms of physical units and adjust for international quality differences in a different manner.

Converting to physical units poses several problems for the analysis presented here. First, it dramatically reduces the number of factors available for examination to those with relevant, observable price information, *i.e.* total labour and capital. It also removes a source of information on factor-augmenting productivity differences which, as explained above, we purposefully make no adjustment for. Finally, as stated above, studies of factor content are designed to test the differential between fit of the theoretically-constrained model (for example, under assumptions of the realisation of factor price equalisation) and measured values. We, on the other hand, are interested in what measured values say about revealed patterns of trade between countries. The theory often factors away the exact differences we hope to observe. Thus, we maintain measurement using values as opposed to units.⁴

Intermediates

While previous studies have incorporated intermediates into their analysis, they are generally treated as non-traded (for example Davis and Weinstein (2001) and Hakura (2001)). Reimer developed an approach allowing for internationally traded intermediate inputs in to the calculation of factor content. Theoretical proofs for such an approach were further provided in Trefler and Zhu (2010), that demonstrated the class of models that completely characterises, and are implied by, the Vanek prediction of the factor content of trade, including a traded intermediate sector. This section relies upon these theoretical developments to construct measures of factor content that accounts for both technological differences across country's production processes while explicitly including trade in intermediate goods that does not impose the importing country's technology, but rather allows for the producing a country's choice in techniques.

Consider an economy with k factors and i goods so that the Leontief matrix is:

$$D(I - B)^{-1} \quad (A2)$$

Where each column of the $k \times i$ matrix D consists of primary factor inputs and each column of the $i \times i$ matrix $(I - B)^{-1}$ captures the total intermediate inputs in the production of a good or service.⁵ Proper measurement of B ensures that the matrix of direct and indirect factor requirements includes all the services of k endowments. In addition, by defining each D and B matrix through each country's unique input-output structure, we capture the technological differences in production needed to completely define the factor content approach.

Referring back to the original HOV equation (A1), we can restate it as follows:

$$F_k^i \equiv AT_k^i$$

with A now defined as

$$A^i \equiv D^i(I - B^i)^{-1} \quad (A3)$$

and thus:

$$F_k^i = D_k^i(I - B^i)^{-1}T_k^i \quad (A4)$$

⁴ As a means of comparison we adjusted for prices in the capital resource using data from two different sources: the Penn World Tables (as in Trefler and Zhu (2006)) and prices derived directly from the GTAP database (as in Reimer (2006)) and found no substantial qualitative differences in the results at the sector level.

⁵ See Trefler and Zhu (2010) for the technical proof.

Trefler and Zhu (2010) argue while several studies have applied equation (A4) to measure factor content, they have not done so consistently, nor fully accounting for international technological diversification. They show that the definition of factor content of trade needs to satisfy three criteria: 1) must be Vanek-relevant, that is consistent with the Vanek prediction that factor content is defined as in (A1); 2) the definition has a clear and useful economic interpretation; and 3) the definition does not require restrictions on the form of international choice of technology. However, arriving at such a definition of factor content when international technology matrices are allowed to vary has proven difficult.

As stated above, Reimer (2006) does allow for internationally determined and traded intermediate inputs in his model. He uses a horizontal concatenation of country-specific direct factor input matrices to construct B in equation (A4) and thus provide an indication of how much of the world's factor k is embodied in i 's production of a good. However, Reimer's model consists of two countries: the US and the ROW and two factor inputs, labour and capital. Thus, it does not completely specify a variety of international technological choices. As we are attempting to measure the factor content (and thus input matrices) for 44 regions and 5 factors of production, applying such an approach becomes unwieldy, not to mention involving the loss of a tremendous amount of detail.

Trefler and Zhu (2010) developed a more generalised approach relying on the proportionality assumption to recover a B matrix that is consistent with their three criteria. They derive an adjustment parameter, θ to recover the share of domestic consumption, including intermediates, sourced locally.⁶ Thus, we are able to estimate the world trade in intermediate inputs – that is, those sourced (and produced) locally and those sourced (and produced) overseas – by defining B as:

$$B_j^i = B^i * \theta_j^i \quad (A5)$$

Where B_j^i is the input matrix of i sourced from j and θ is defined as:

$$\theta_j^i(g) \equiv \frac{M_j^i(g)}{Q_i(g) + M_i(g) - X_i(g)} \quad \text{for all } j \neq i \quad (A6)$$

Where Q is output of good g in i , M is imports of good g (in the numerator into i from j , and the denominator is i 's total imports of g) and X is the exports of g from i . Thus $\theta_j^i(g)$ is the share of domestic absorption that is sourced from country j . Summing over all j sources and subtracting from 1 provides the share of good g that is sourced locally.

Referring explicitly to an intermediate input matrix of dimensions g, h (input of good g into industry h), we define $B_j^i(g, h)$ as elements of B_j^i and $\hat{B}_i(g, h)$ as elements of $\hat{B}_i \equiv \sum_j B_j^i$. We then have:

$$\begin{aligned} \sum_{j \neq i} B_j^i(g, h) &= \hat{B}_i(g, h) \sum_{j \neq i} \theta_j^i(g), & (\text{imported intermediates}) \\ B_i^i(g, h) &= \hat{B}_i(g, h) \theta_i^i(g), & (\text{local intermediates}) \end{aligned} \quad (A7)$$

⁶ Again, Trefler and Zhu (2010) report the details on the derivation of θ .

And further, a simple extension leads us to:

$$B_j^i(g, h) = \hat{B}_i(g, h) \theta_j^i(g) \text{ for all } i \text{ and } j \quad (\text{A8})$$

As expressed in equation (A5), where equation (A5) suppresses the (g, h) reference to industries. When Trefler and Zhu (2010) applied this adjustment to data for 41 countries, focusing on labour inputs, their results show a 95% consistency rate with predicted values, as opposed to the 34% reported in previous studies.

By measuring the amount of factors used *worldwide* to produce a country's trade flows, we can say that the factor requirements matrix for country i 's trade is constructed accounting for the complete production process of each good that enters into net exports and adding up the factors actually used, including those used in producing intermediate inputs overseas (Deardorff 1982). This will further allow us to analyse the role of intermediate inputs in trade, by comparing the F derived in equations (A1) with its counterpart expressed generally in equation (A4), and adjusted by (A5).⁷

III Measuring Factor Content

In order to better understand the potential drivers of the factor content of trade, it is important to understand the relative factor endowment structure both within, and between, countries, and how that has changed over time. According to equation (A1), net exports of a factor is positive (negative) if the country's endowment of the factor is great (lower) than its content of total domestic consumption, that is if $V_k^i - s^i V_k^w > 0$, for factor k . Additionally, it is possible to look at a country's relative factor abundance (each endowment relative to other endowments within a country) by examining the variables normalised by the factor content of the country's consumption. Again, from equation (A1) we can define the following:

$$c_k = V_k^w * s \quad (\text{A9})$$

where s remains the country's share of world consumption, V_k^w is the world endowment of factor k and c_k is the content of factor k in domestic consumption (Muriel and Terra 2009). The factor abundance test can be compared across the various factors k such that:

$$\frac{V_k^i}{c_k} > \frac{V_{k'}^i}{c_{k'}} \quad (\text{A10})$$

The relationship in (9) states that the content of factor k in net exports is higher (lower) than that of factor k' if factor k is relatively more abundant (less abundant); where factor contents are normalised by domestic consumption. We can also restate these values, measuring factor abundance by income rather than consumption, adjusting this value to take account of the trade balance as in Bowen and Sveikauskas (1992). To account for a country's income level (Y_i) adjusted by the trade balance (b_i) we can restate c_k as follows:

$$c_k^b = \frac{Y_i}{Y_i - b_i} * c_k \quad (\text{A11})$$

⁷ The author wishes to thank Frank Van Tongeren for use of his program which greatly simplified the calculation of these values.

and rank each factor accordingly.

Total endowment stocks have been growing across both OECD and SEMs, with SEMs experiencing faster growth across the board. Within the OECD, skilled labour stocks grew 6.5 times faster than unskilled while the SEMs skilled labour growth rate exceeded its unskilled rate at a slower rate (2.7 times). We also observe diminishing wage bill to value added ratio, on average, across the OECD in manufacturing and a rise in SEMs. However, as stated, this trend more likely reflects a decline in the value added in manufacturing among OECD countries as a whole rather than an absolute decline in labour usage. Indeed, labour productivity continues to grow at a robust rate among OECD countries, especially in Korea, Estonia and Poland. There was also strong productivity growth in China and Vietnam among the SEMs. We now look to see how these trends are reflected in trade patterns.

The work presented here makes two major advancements over these existing measures of factor content. First, as in Treffer and Zhu (2010), we rely on individual countries' technology matrices rather than the existing approach of using a single matrix adjusted for production technology differentials. We then apply a definition of factor content that measures the amount of factors used *worldwide* to produce a country's trade flows, and we apply this across a set of 5 factors of production, including a breakout of skilled and unskilled labour. Thus we construct a more complete factor requirements matrix for a country's trade by allowing for differentiated production processes including those inputs used in producing intermediate inputs overseas (Deardorff, 1982). Finally, we apply this approach to different time periods to observe how the factor content of trade has changed. By comparing the equations derived without directly accounting for intermediate inputs with those that do, we can analyse the role of intermediate inputs in trade and the determination of a country's comparative advantage.

Data

This work relies primarily on data from the Global Trade Analysis Project (GTAP). This publicly available, completely documented (Dimaranan and McDougall (2002) and Badri and Walmsley (2008)) database provides input-output tables for between 45 and 85 countries (depending on the database version), 57 sectors and 5 factors of production. It consists of independently compiled country-specific input-output tables (thus allowing us to recover country-specific technology matrices) which are reconciled to bilateral trade data and other statistics. The data have been through seven public releases and have been extensively tested by members of the GTAP consortium and other researchers.

In order to observe the factor content in different time periods, we use three of the GTAP databases to derive the necessary components of this part of our analysis. These databases are version 5, corresponding to a base year of 1997; version 6 corresponding to a base year of 2001 and version 7, corresponding to a base year of 2004. We include individual OECD economies where information is available as well as selected emerging economies (SEMs).⁸

VI Does Trade Reflect Factor Content?

How has factor usage within a country changed over time?

We calculate factor rankings for each country in the sample for the three time periods: namely 1997, 2001 and 2004 and rank the factors to determine the relative abundance as revealed by the country's

⁸ SEMs include Brazil, China, India, Indonesia, and South Africa, Argentina, Malaysia, Thailand, Bangladesh, Hong Kong, Singapore, Russia, Vietnam and Egypt where data is available.

trade position, and examine how this has changed over time. The relative factor abundance values and their rankings are presented for OECD and SEM countries in Tables 1 and 2, respectively.⁹

The two tables present 3 pieces of information: (1) the calculated factor abundance measure for each of the 5 resources, relative to the other resources within each country; (2) the rankings for each of these factors of production relative to the other factors for each of the three years; and (3) the standard deviation of the factor abundance measures for each year. As shown in the table, in all three years, the relative rankings for most OECD economies have remained consistent which means there have been no significant changes in relative factor endowments within each of these economies in the time period examined. Most OECD economies consistently rank skilled labour and capital at the top of their relative resource endowments as measured by the factor services employed. The rankings for Mexico, Chile, Hungary, Poland and Turkey show a greater reliance on land and natural resources. Australia also shows a high reliance on natural resources, but unlike the other countries listed, capital and skilled labour are also significant factors. Within their own resource structure, capital ranks first in Austria, France, Germany, Italy and New Zealand for each of the three years examined. Denmark, Sweden, Switzerland, the UK and US all consistently rank skilled labour as number 1, relative to their other resource use. These countries show a high use of labour in general, with unskilled labour ranking second.

Despite the relative stability in rankings of endowments in OECD countries, there have been some noteworthy developments among member states. Into the 2000s, both skilled and unskilled labour moved up in ranking over capital for Australia. New Zealand experienced a small change in its endowment rankings with the role of natural resources declining and unskilled labour increasing. Korea shows an increase in the prominence of capital in place of unskilled labour while Japan's unskilled labour and capital both increase their rank relative to the use of their other resources, namely skilled labour. The increasingly significant ranking of unskilled labour in Japan (as foreshadowed by their large stock of unskilled endowment) is reflected in employment growth patterns. Between 1990 and 2009, the only employment sectors which enjoyed consistent positive growth in Japan were labourers, service workers and professional and technical workers (Statistical Bureau Office of Japan 2010). The first two categories, which experienced the fastest growth, are dominated by unskilled workers. Spain, Poland and Hungary all saw their top ranked resource move from land in 1997 to capital by 2004.

Land and natural resources hold the dominant positions in the SEMs for each of the three time periods (Table 2). As with the OECD, the rankings show little movement over this time. Exceptions are Brazil and South Africa who both experienced a shift away from land and resource extraction to a greater reliance on capital and labour. In both these economies, capital was ranked the highest in 2004. All countries examined show relatively low rankings in the use of skilled labour.

A notable difference between the two country groupings is in the standard deviation of the abundance measure. This measure provides some insights in the changing endowment structure and the relative intensities with which resources are used within each economy examined. The more dominant one or two resources are in terms of their relative intensity, the greater the spread in values among the resources and the greater the standard deviation. Thus, it is interesting to see if these values have changed over the three time periods examined.

We see countries like France, the UK and Germany with small and fairly constant measures of standard deviation, implying the relative intensity of factor usage has changed little over the three time periods. Greece and Russia exhibit large standard deviations implying dominance in a specific resource – in Russia's case natural resources. Greece's standard deviation declined significantly in

⁹ We report rankings using adjusted income shares. The rankings using consumption shares were qualitatively similar and are available upon request.

2004 as capital and labour began to play a greater role in its economic activities diversifying away from natural resources. Interestingly enough, the US shows a slightly increasing standard deviation among its factor measures while its actual rankings remain stable. This is due to an increasing use of labour relative to that of capital. Mexico and Chile, on the other hand, experienced a decline in their standard deviation. For Mexico, there was a relatively small change in the use of labour and capital across its economic activities while for Chile the use of labour increased relative to that of capital. What is interesting for Chile is that while the relative rankings of the two labour and capital measures do not change, the relative abundance measure shows a convergence in the intensity of usage.

Among most of the SEMs, there is much greater variation within each country's resource ranking as shown by the standard deviations. The exceptions are Brazil, which has the lowest standard deviation of all economies reported here, and South Africa whose measure substantially declined in 2004. This implies that Brazil has employed the five resources measured here with relatively equal intensity in each of the three time periods. Thailand's standard deviation has increased as evidenced by the large and increasing factor abundance measure for land. This would imply that agricultural products are taking a larger role while capital usage shows a relative decline. India remains dominated by its land usage as does Indonesia. However, Indonesia's factor abundance measures for land and natural resources have declined somewhat indicating a potential increase in the diversity of other resources used.

What the above discussion highlights is a relatively stable factor abundance story for most of the advanced OECD countries.¹⁰ However, the dynamics of changing market structure are evident, as illustrated by the changing ranks and growing dispersion of relative factor abundance measures in, for example, the US and South Korea. Chile, Mexico and Poland show decreasing variation among measures of factor abundance which could imply, as revealed by factor abundance measures, established production patterns. Turkey, on the other hand, shows increasing dispersion potentially indicating a changing relative factor base.

SEMs, for the three time periods examined, show a relatively consistent factor ranking, still heavily dependent on land (*i.e.* agricultural) and natural resources. However, movement to capital goods can be observed in the case of Brazil and to a lesser extent, Indonesia. Most countries continue to show a factor endowment story related to agriculture and natural resources.

Overall, these results are consistent with those observed in factor endowment trends. The stability in both groups of countries' rankings is a possible reflection of the large established factor stocks in these economies. That is, the large share of capital and skilled labour stocks in the OECD and the unskilled labour stocks in the SEMs. However, the small shifts in rankings and the changing abundance measures, along with their standard deviations, show an emerging trend of diversification into using capital and skilled labour for SEMs and a subtle shift in the OECD endowment usage as well.

How has factor content of trade changed over time?

We calculate a measure of factor content for each of the five GTAP factors for the three time periods (1997, 2001 and 2004) based on a derivation of the basic equation shown in (1) and presented in the figures 1 and 2.¹¹ Positive values are an indication of a comparative advantage as implied by exporting abundant factors of production, while a negative value reflects a negative factor content of trade.

¹⁰ While we are able to look at a greater level of factor disaggregation than previous studies, our measures are still quite broad. It is to be expected that if we could conduct this analysis at an even more refined level of inputs (*e.g.* different types of skilled labour) we may see different patterns emerging.

¹¹ The values at the economy-wide level were scaled by relative income measures to ease comparisons.

For ease of discussion, we present a measure of factor content of trade for three factors: skilled labour, unskilled labour and capital, for OECD economies (Figure 1) and SEMs (Figure 2). As expected, most of the OECD countries show a deficit in unskilled labour (panel a). The notable exceptions are Japan and Korea who have surpluses in each of the three years, as do, albeit to a lesser extent, Australia, Chile, Finland, Ireland, Slovenia, Switzerland, Estonia, Turkey and the US. This outcome is consistent with the rankings of relative factor abundance presented in the previous discussion. For example, the US and Japan had the highest OECD stocks of unskilled labour and both show labour in general (skilled and unskilled) as a consistently ranked highly utilised resource relative to the other resources used. A notable exception is Korea. Its unskilled labour stocks were not significantly higher than other OECD countries, showing a trade deficit in this factor (France, for example) yet its relative factor usage ranking for unskilled labour was behind both land and capital in 2001 and 2004 (Table 2).

The highly positive values for both Japan and the US in its factor content of skilled workers shown in the following panel (b) is again a reflection of the abundance of labour reported for these countries. France, Italy and Germany, among others, are all shown to have deficits in their factor content of trade in skilled workers. This is in fact surprising as most OECD countries have a relative abundance of skilled workers *vis a vis* the rest of the world and skilled labour ranks as Italy and Germany's second most intensively used resource (table 1). However, where these countries show a consistent comparative advantage is in the area of capital (panel c), where all three have relatively large positive values (France excepting in 2004). Mexico's increase in capital stock and its associated increase in relative usage rank are reflected in its positive factor content of trade for capital. This trend is observed despite Mexico's falling capital/labour which is more a reflection of faster labour growth than declines in capital stock. While the measure experienced a downturn in 2004, it was strongly positive in 1997 and 2001. Other countries with factor content surpluses in capital include New Zealand, Ireland and Chile and the newly emerging OECD economies of Poland, Hungary, Slovenia, Estonia and Turkey.

The US and the UK are shown to have a negative factor content of trade in capital in each time period examined. This could be due to the "de-industrialisation" of these economies as identified elsewhere (OECD 2009). The increasing use of resources in the production of services is something that was observed throughout the OECD but especially so in countries such as the UK and US. The share of manufactured exports from the top OECD exporters has been declining over the period 1990-2007.

The three panels in Figure 2 look at the same measures for the SEMs. As expected, almost all show a comparative advantage in unskilled labour judging by the factor content of their trade. Some countries, Thailand, Russia and South Africa, show a negative factor content of trade in more recent years, but for South Africa and Russia, this is not a consistent pattern and for Thailand, it is decidedly smaller in recent years. Neither South Africa nor Thailand (information was not available for Russia) have large stocks of unskilled labour with respect to the SEMs examined. Again, as expected, all show a negative balance in skilled labour with the exception of Brazil and Malaysia who both show a positive factor content of trade in this resource in more recent years (2001 and 2004). Interestingly, relative stocks of skilled labour with respect to other SEMs were no higher in these two economies and skilled labour actually ranked 5th in Malaysia's relative factor usage (Table 2).

Another interesting observation can be seen in the patterns revealed when looking at capital. All of the SEMs show at least one period with positive factor content for capital. This implies that the trade balance in goods using capital is positive and thus these countries have a comparative advantage in this resource. A possible explanation for this pattern is the growing industrial production base of these economies, especially those in Southeast Asia. OECD countries are moving toward services and away from traditional 'capital intensive' manufacturing and the slack is being picked up by SEMs. As these countries increase their inflow of FDI and expand their own higher value-added manufacturing processes, the capital content of their trade should necessarily increase. We saw this by the increased

rank of capital usage in some of these economies, China especially, implying growing participation of relatively capital intensive goods in their trade.

These outcomes are consistent with the growth in capital stocks in SEMs and a slower investment rate among OECD countries observed elsewhere (OECD 2009). Further, we see that the majority of OECD countries which have an increase ranking in capital factor usage are emerging OECD economies like Poland, Mexico and Estonia while only a few SEMs show an increased ranking of capital (China, Thailand and South Africa). However, the increasing in relative ranking for China is small, indicating that their factor usage is still dominated by other factors, *i.e.* labour.

When we observe, however, the relative contribution of labour and capital as measured in countries' capital/labour ratios, we see that capital still dominates among OECD countries. What this implies is that while the production base is shifting, it is shifting slowly. OECD countries still employ a relatively large share of capital reflective of their large capital stocks while SEMs employ larger shares of labour, reflective of their stocks. However, among those sectors seeing the most growth in each region (*i.e.* services in OECD and manufacturing in SEMs) we see the potential reversal of these resource uses. Overall, the base is dominated by capital in the OECD with changes in labour, while the base is dominated by labour in SEMs and capital is driving the change. This may also imply something about the nature of traded versus non-traded goods. Overall, according to resource rankings, the relative use of labour by OECD countries has remained fairly stable while capital has increased. However, the factor content of resources implies these rankings will change to reflect a declining use of capital among traded goods, and a possible reflection of the shift from manufacturing to services.

What role has intermediate inputs played in measuring factor content of trade?

We next look at what including intermediate trade does to the mix. Comparing factor content of trade both with (equation A4) and without (equation A1) intermediate input trade allows us to get an idea of how such trade influences the outlook on trade and relative positions *vis a vis* trading partners. outlook. We take the US and China as examples.¹²

China

We examine the trends in factor content across sectors for three factors of production: skilled labour, unskilled labour and capital. Given that most imported intermediate shares are in the manufacturing sector, we begin our analysis in this area. In addition, because we are comparing with the US and the changing nature of the two economies stresses the role of services, we include this sector as well.

Figure 3 shows the factor content of Chinese trade for skilled labour in three time periods: 1997, 2001 and 2004. The bars represent the factor content of trade as defined by equation *without* explicitly accounting for intermediate inputs and the dots are defined *with* intermediate inputs. While measures without show a consistently negative balance across both sectors and time periods, there are significant difference when accounting for intermediates.

When examining skilled labour, accounting for intermediate inputs in the calculation of factor content reduces the observed deficit, or creates a small surplus, in almost every sector. Notable exceptions are the chemical and rubber sector (crp) and the trade (retail and wholesale, trd) sector in 2001. Thus, for example, it would appear that the inputs which China accesses from the rest of the world are more skill intensive in the production of electronics and other manufacturing goods. Across the sectors of textiles (tex), wearing apparel (wap) and leather (lea), the same phenomenon is observed, although to

¹² While similar comparisons are available for all covered countries, as two of the largest trading nations, we focus our discussion on these two countries.

a lesser extent. An outlier is the other services sector consisting of public administration and government services (osg). Here, especially in 1997 and 2001, we see a large surplus reduced to a small deficit in 1997, balanced trade in 2001 when accounting for the factor content of intermediate inputs. This would imply that China was importing intermediate inputs that are non-highly skill intensive, or at least less skill intensive than non-traded intermediate inputs. By 2004, this trend had reversed itself and including intermediate imports leads to a slightly larger surplus, implying that more skilled labour was now being sourced internationally.

Turning to unskilled labour, shown in Figure 4, the pattern of comparative advantage appears to be changing regardless of intermediate inputs (although these inputs impact the results as well). In 1997 and 2001, we observe surpluses in sectors using unskilled labour (before adjusting for intermediate inputs). These include construction (cns), chemicals and rubber, non-metallic minerals (nmm, such as cement, lime and concrete), trade and other business services (obs). By 2004 none of the sectors show a surplus in unskilled labour. This is consistent with the decline in the relative abundance ranking for unskilled labour in China between these two time periods. However, once we account for the factors embodied in intermediate inputs, we observe a number of strong surplus sectors. These include electronics (ele), other manufacturing (omf), textiles, wearing apparel, leather and lumber (lum). Again, this could be an indication of China's own increasing use of production outsourcing, especially in the textiles and electronics sectors.

Capital shows a different story to that of labour (Figure 5). In most of the sectors, in all three time periods, China has a small surplus in capital, and we see this trend strengthening in 2004. However, as distinct from labour, including intermediates creates a smaller surplus and even a deficit in many sectors including paper products (ppp), petroleum and coke (p_c), chemical and rubber, iron and steel (i_s), motor vehicles (mvh), other machinery and equipment (ome) and trade. By 2004 many services sectors see shrinking surpluses when intermediate inputs are accounted for, including finance and banking (ofi) and other business services. As stated above, this implies that most imported intermediate inputs are more capital intensive than other inputs while imported intermediate inputs into chemicals and machinery and equipment, for example, are less capital intensive in 2004. While we do not have detailed source information for intermediate inputs to China, looking at total imports provides some explanation. Japan remains a major source of imports across four of the five sectors in 2004. Taiwan and Korea also contribute significantly to imports of chemicals and rubber and other machinery and equipment while Hong Kong is by far the largest supplier of imports in the trade sector, all sectors with implied higher capital input in imported than domestic intermediates. However, among those sectors which showed lower capital intensity in imports – electronics and other manufacturing – Malaysia, India and Thailand were also significant sources of imports.

The United States

Figure 6 shows the same three sets of graphs for the United States, that is, the evolution of surplus/deficit sectors with and without intermediate inputs for skilled labour. Across all three time periods the US shows a significant surplus in skilled labour in the services sector with other business services showing particular strength in 2004. Other sectors, such as motor vehicles, other machinery and equipment, chemicals and rubber, construction and trade had shown relatively strong surpluses with smaller values in 2004.

Intermediate inputs make less of a difference in the overall results of the US data over each successive period. Indeed, by 2004 the only sectors outside services that experience a relatively large shift is other machinery and equipment and, to a lesser extent, chemicals and rubber. These small changes are in contrast to China who shows large changes in each time period. While this does not indicate that the US has fewer imported intermediate inputs than China (indeed the many cases the US imports more), rather that the resource profile in the inputs are more similar to those sourced from within the US.

Much the same pattern holds for unskilled labour in that there are small differences with and without intermediate inputs in sectors outside services (Figure 7). Here, however, many of the sectors go from large surpluses to balanced trade, implying that the US imports unskilled-intensive intermediates. Sectors that maintain their surplus, albeit at a lower level include other transport equipment (otn), banking and business and government services sectors. Again, this implies that the US trade in goods using unskilled labour is generally in balance with the exception of a few sectors, and trade in intermediate inputs have only a limited role to play in this story.

As noted above, the role of capital in US trade is not as large as one would have expected *a priori* (Figure 8). Indeed, across the manufacturing sectors there are no significant surplus sectors in any of the three time periods examined with most of these sectors remaining more or less in balance. However, there are significant deficits across many of the services sectors. In 2004, the deficit in other business services sector was particularly large. Indeed, all of the service sectors (with the exception of the transport sectors) show deficits in each period. Thus, it would appear that these sectors are driving the deficit in capital observed for the US in Figure 1.

When adjusting for intermediate inputs, the deficits in the services sector change considerably. Most of the deficit sectors move to a balanced trade or even surplus as in the case of other business and government services. One of the issues with the measurement of capital is that we are unable to determine what part of the imported intermediate goods are made with the exporting country's capital from that which may be produced with US capital employed overseas. Thus, while it appears that the US is a net importer of capital in these sectors, it may be that a large part of the capital is owned by US companies. Grossman and Rossi-Hansberg (2009) show that trade between U.S. companies and their foreign subsidiaries accounted for 47% of US imports in 2005. Further they show that US imports in "Business, Professional and Technical Services" (which overlaps with our other business services) grew in real terms by more than 66% between 1997 and 2004.

V Summary and policy implications

From this analysis we can see what has been a growing acknowledgement in trade circles: intermediate trade matters. Further, we see that it affects factors differently. Thus if policy is to be effective, it must rely on analysis which includes intermediate trade and the embodied factor services in this trade, and includes it in a meaningful way, *i.e.* measured in terms of value added. How this information can be used in the formation of trade policy will be discussed in more detail in the fourth paper of this series.

Overall, resource endowments, and their impact on production costs, remain an important determinant of trade patterns. However, these costs may change over time in response to a host of 'organic' phenomena such as: factor accumulation, technological and productivity, knowledge spillovers or technology transfer; geographical agglomeration or dispersion of economic activity or changes in consumer preferences. It has been also found that these costs, and thus trade patterns, change in response to policies that influence: physical and human capital accumulation; availability of credit; availability of energy; regulatory quality and labour market rigidity. Yet, the desirability of using policy to influence trade flows remains less clear. Evidence would suggest that it is rather an exception than a rule that governments can sustainably and beneficially influence trade patterns, particularly when these efforts do attempt to ignore pre-existing historical, geographical or technological factors.

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Table 1 Factor rankings, OECD countries

		Land	Rank	Unskilled labour	Rank	Skilled labour	Rank	Capital	Rank	Natural resources	Rank	Std Dev.
Australia	1997	0.617	5	0.862	4	1.048	3	1.056	2	1.758	1	0.380
	2001	0.881	5	1.103	3	1.288	2	0.909	4	2.297	1	0.522
	2004	0.731	5	1.179	3	1.278	2	1.015	4	1.456	1	0.246
Austria	1997	0.459	4	0.888	2	0.808	3	1.197	1	0.124	5	0.370
	2001	0.560	3	0.582	2	0.545	4	1.210	1	0.136	5	0.344
	2004	0.782	2	0.642	4	0.712	3	1.117	1	0.136	5	0.316
Belgium	1997	0.248	4	1.035	2	1.186	1	0.913	3	0.045	5	0.453
	2001	0.225	4	0.907	2	1.107	1	0.877	3	0.052	5	0.416
	2004	0.287	4	0.690	3	0.846	2	1.007	1	0.213	5	0.310
Canada	1997	0.351	5	1.093	2	0.728	4	0.854	3	1.718	1	0.453
	2001	0.520	5	1.078	2	0.866	4	0.879	3	1.634	1	0.366
	2004	0.304	5	1.088	2	1.001	3	0.893	4	1.713	1	0.450
Chile	1997	1.816	1	0.796	4	0.541	5	1.351	3	1.527	2	0.470
	2001	2.321	1	0.876	4	0.608	5	1.283	3	1.625	2	0.600
	2004	1.412	1	0.989	4	0.709	5	1.354	3	1.386	2	0.277
Denmark	1997	1.024	2	0.985	3	1.153	1	0.732	4	0.510	5	0.230
	2001	0.592	5	1.152	2	1.343	1	0.774	3	0.727	4	0.282
	2004	0.595	5	0.983	2	1.217	1	0.870	3	0.855	4	0.202
Estonia	1997	..	..	..	..	..	..	..	..	..	..	..
	2001	1.361	2	1.307	3	0.859	5	0.967	4	1.436	1	0.229
	2004	0.785	3	0.906	2	0.704	5	1.312	1	0.737	4	0.222
Finland	1997	1.179	1	0.840	4	0.937	2	0.902	3	0.411	5	0.250
	2001	0.669	4	0.948	3	1.072	1	0.977	2	0.441	5	0.233
	2004	1.135	1	0.919	4	1.090	2	1.082	3	0.288	5	0.316
France	1997	0.688	4	0.768	3	0.811	2	1.068	1	0.095	5	0.322
	2001	0.568	2	0.518	4	0.565	3	1.121	1	0.090	5	0.328
	2004	0.682	3	0.624	4	0.771	2	0.944	1	0.102	5	0.283
Germany	1997	0.303	4	0.918	3	1.003	2	1.009	1	0.202	5	0.358
	2001	0.410	4	0.734	3	0.786	2	1.026	1	0.219	5	0.286
	2004	0.339	4	0.798	3	0.855	2	0.962	1	0.155	5	0.316
Greece	1997	2.807	2	1.044	4	1.053	3	0.754	5	4.834	1	1.549
	2001	1.049	4	1.228	3	1.281	2	0.814	5	5.263	1	1.676
	2004	1.361	2	0.849	4	0.879	3	1.387	1	0.298	5	0.400
Hungary	1997	1.618	1	0.823	3	0.618	4	1.155	2	0.423	5	0.422
	2001	1.607	1	0.781	3	0.562	4	1.255	2	0.318	5	0.468
	2004	1.213	2	0.768	3	0.666	4	1.229	1	0.153	5	0.398
Ireland	1997	0.694	4	0.969	2	1.107	1	0.929	3	0.257	5	0.298
	2001	0.767	4	1.093	2	1.284	1	1.074	3	0.214	5	0.375
	2004	0.754	4	0.847	3	0.903	2	1.420	1	0.221	5	0.382
Italy	1997	0.832	2	0.714	4	0.818	3	1.208	1	0.122	5	0.351
	2001	0.522	4	0.602	3	0.717	2	1.246	1	0.128	5	0.361
	2004	0.599	4	0.614	3	0.653	2	1.237	1	0.114	5	0.357
Japan	1997	0.217	4	1.092	2	1.123	1	0.976	3	0.177	5	0.428
	2001	0.221	4	1.064	2	1.071	1	0.914	3	0.190	5	0.401
	2004	0.237	4	1.111	1	1.031	3	1.089	2	0.118	5	0.443
Korea	1997	2.200	1	1.273	2	0.887	4	1.193	3	0.471	5	0.572
	2001	2.287	1	1.161	3	0.815	4	1.232	2	0.285	5	0.657
	2004	2.969	1	1.232	3	0.830	4	1.314	2	0.193	5	0.920

Table 1 ('cont) Factor rankings, OECD countries

		Land	Rank	Unskilled labour	Rank	Skilled labour	Rank	Capital	Rank	Natural resources	Rank	Std Dev.
Luxembourg	1997	0.526	4	1.025	2	1.148	1	0.878	3	0.050	5	0.397
	2001	0.481	4	1.144	2	1.357	1	0.951	3	0.050	5	0.472
	2004	0.594	4	0.758	3	0.918	2	1.213	1	0.031	5	0.393
Mexico	1997	2.381	1	0.623	4	0.397	5	1.458	3	2.336	2	0.830
	2001	1.438	3	0.664	4	0.480	5	1.526	2	1.849	1	0.527
	2004	1.592	1	0.477	4	0.444	5	0.803	2	0.735	3	0.415
Netherlands	1997	0.302	5	0.895	3	1.011	1	0.937	2	0.588	4	0.265
	2001	0.288	5	0.647	3	0.779	2	0.972	1	0.625	4	0.224
	2004	0.387	4	0.617	3	0.768	2	1.054	1	0.344	5	0.261
New Zealand	1997	0.546	5	0.965	2	0.839	4	0.979	1	0.946	3	0.162
	2001	0.918	4	1.093	2	0.909	5	1.124	1	1.071	3	0.091
	2004	0.849	4	1.131	2	0.907	3	1.228	1	0.632	5	0.211
Poland	1997	1.762	1	0.895	4	0.635	5	0.980	3	1.501	2	0.414
	2001	1.658	1	0.831	4	0.562	5	1.048	3	1.068	2	0.362
	2004	1.048	2	0.692	3	0.542	5	1.128	1	0.666	4	0.230
Portugal	1997	1.442	1	1.016	3	1.315	2	0.659	4	0.342	5	0.408
	2001	0.657	4	1.069	2	1.409	1	0.710	3	0.338	5	0.368
	2004	0.706	4	0.861	3	0.974	2	1.024	1	0.264	5	0.274
Russia	1997	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000
	2001	1.333	2	1.091	3	0.651	5	0.869	4	9.346	1	3.352
	2004	1.600	2	0.821	4	0.579	5	1.211	3	6.026	1	2.019
Slovak Republic	1997	..	..	..	..	..	..	..	..	..	..	..
	2001	1.056	2	0.715	3	0.526	4	1.465	1	0.440	5	0.377
	2004	1.266	2	0.673	3	0.495	4	1.349	1	0.232	5	0.436
Slovenia	1997	..	..	..	..	..	..	..	..	..	..	..
	2001	0.529	4	1.143	1	0.899	3	0.901	2	0.395	5	0.273
	2004	0.964	3	1.079	1	0.752	4	1.004	2	0.223	5	0.310
Spain	1997	1.153	1	0.897	4	0.942	3	1.100	2	0.423	5	0.258
	2001	0.622	4	0.826	3	0.884	2	1.163	1	0.440	5	0.245
	2004	0.680	4	0.976	2	0.971	3	1.162	1	0.166	5	0.348
Sweden	1997	0.436	4	0.967	2	1.254	1	0.627	3	0.256	5	0.361
	2001	0.292	4	0.847	2	1.080	1	0.680	3	0.277	5	0.313
	2004	0.351	4	0.672	3	0.843	1	0.823	2	0.162	5	0.270
Switzerland	1997	0.704	4	1.030	2	1.215	1	0.814	3	0.072	5	0.390
	2001	0.637	4	0.909	2	1.071	1	0.840	3	0.089	5	0.340
	2004	0.433	4	1.073	2	1.121	1	0.933	3	0.024	5	0.424
Turkey	1997	1.146	2	0.830	3	0.534	5	1.479	1	0.679	4	0.340
	2001	1.124	1	1.098	2	0.660	4	1.021	3	0.631	5	0.216
	2004	1.373	1	1.024	3	0.635	4	1.297	2	0.370	5	0.385
United Kingdom	1997	0.511	5	1.017	2	1.176	1	0.820	3	0.565	4	0.255
	2001	0.227	5	0.992	2	1.163	1	0.809	3	0.545	4	0.331
	2004	0.197	5	0.952	2	1.078	1	0.813	3	0.447	4	0.327
United States	1997	0.457	4	1.063	2	1.263	1	0.924	3	0.407	5	0.337
	2001	0.431	4	1.106	2	1.292	1	0.946	3	0.340	5	0.375
	2004	0.347	4	1.185	2	1.382	1	0.697	3	0.343	5	0.427

Source: Author's calculations based on GTAP database versions 5, 6 and 7.1.

Table 2 Factor rankings, selected emerging economies

		Land	Rank	Unskilled labour	Rank	Skilled labour	Rank	Capital	Rank	Natural resources	Rank	Std Dev.
Argentina	1997	2.559	1	1.074	3	0.631	5	1.149	2	0.807	4	0.683
	2001	1.239	1	0.928	2	0.708	5	0.817	4	0.885	3	0.178
	2004	2.412	1	1.019	3	0.694	5	0.915	4	1.779	2	0.639
Bangladesh	1997	4.907	1	1.125	3	0.541	5	0.986	4	2.244	2	1.576
	2001	5.926	1	1.348	3	0.645	5	1.025	4	2.535	2	1.922
	2004	6.934	1	1.380	3	0.624	5	1.163	4	2.058	2	2.298
Brazil	1997	1.105	2	0.946	3	0.766	4	1.125	1	0.516	5	0.228
	2001	0.695	5	0.885	2	0.841	3	0.953	1	0.741	4	0.094
	2004	0.965	2	0.898	4	0.768	5	1.034	1	0.933	3	0.088
China	1997	4.538	1	1.427	3	0.557	5	1.009	4	3.115	2	1.483
	2001	5.320	1	1.705	3	0.679	5	1.089	4	2.947	2	1.672
	2004	4.555	1	1.371	4	0.672	5	2.341	3	3.171	2	1.363
India	1997	9.398	1	0.913	4	0.321	5	1.122	3	1.408	2	3.402
	2001	10.063	1	1.169	3	0.604	5	1.094	4	1.435	2	3.605
	2004	10.688	1	1.199	3	0.569	5	1.194	4	1.324	2	3.856
Indonesia	1997	7.438	1	1.164	4	0.378	5	1.363	3	4.800	2	2.678
	2001	5.799	2	0.809	4	0.375	5	1.368	3	6.158	1	2.534
	2004	7.059	1	1.101	4	0.418	5	1.371	3	4.109	2	2.468
Malaysia	1997	5.034	2	1.035	4	0.572	5	1.796	3	5.550	1	2.080
	2001	1.240	3	1.309	2	0.664	5	1.154	4	4.631	1	1.434
	2004	1.309	2	1.243	3	0.599	5	1.211	4	4.833	1	1.519
South Africa	1997	..	..	..	..	..	..	..	..	..	..	..
	2001	0.502	5	1.166	2	0.876	3	0.849	4	2.601	1	0.732
	2004	0.425	5	0.973	3	0.828	4	1.180	1	0.998	2	0.254
Thailand	1997	3.115	1	0.404	4	0.235	5	2.233	2	1.161	3	1.099
	2001	4.317	1	0.690	4	0.434	5	1.459	3	1.499	2	1.383
	2004	4.752	1	0.682	4	0.421	5	1.591	2	1.314	3	1.558
Vietnam	1997	4.727	1	0.967	4	0.466	5	1.194	3	4.139	2	1.768
	2001	6.324	1	1.183	4	0.466	5	1.317	3	4.359	2	2.240
	2004	8.165	1	1.314	3	0.634	5	1.039	4	6.031	2	3.072

Source: Author's calculations based on GTAP database versions 5, 6 and 7.1.

Figure 1 Country level measures of factor content, OECD countries



Figure 2 Country level measures of factor content, selected emerging economies

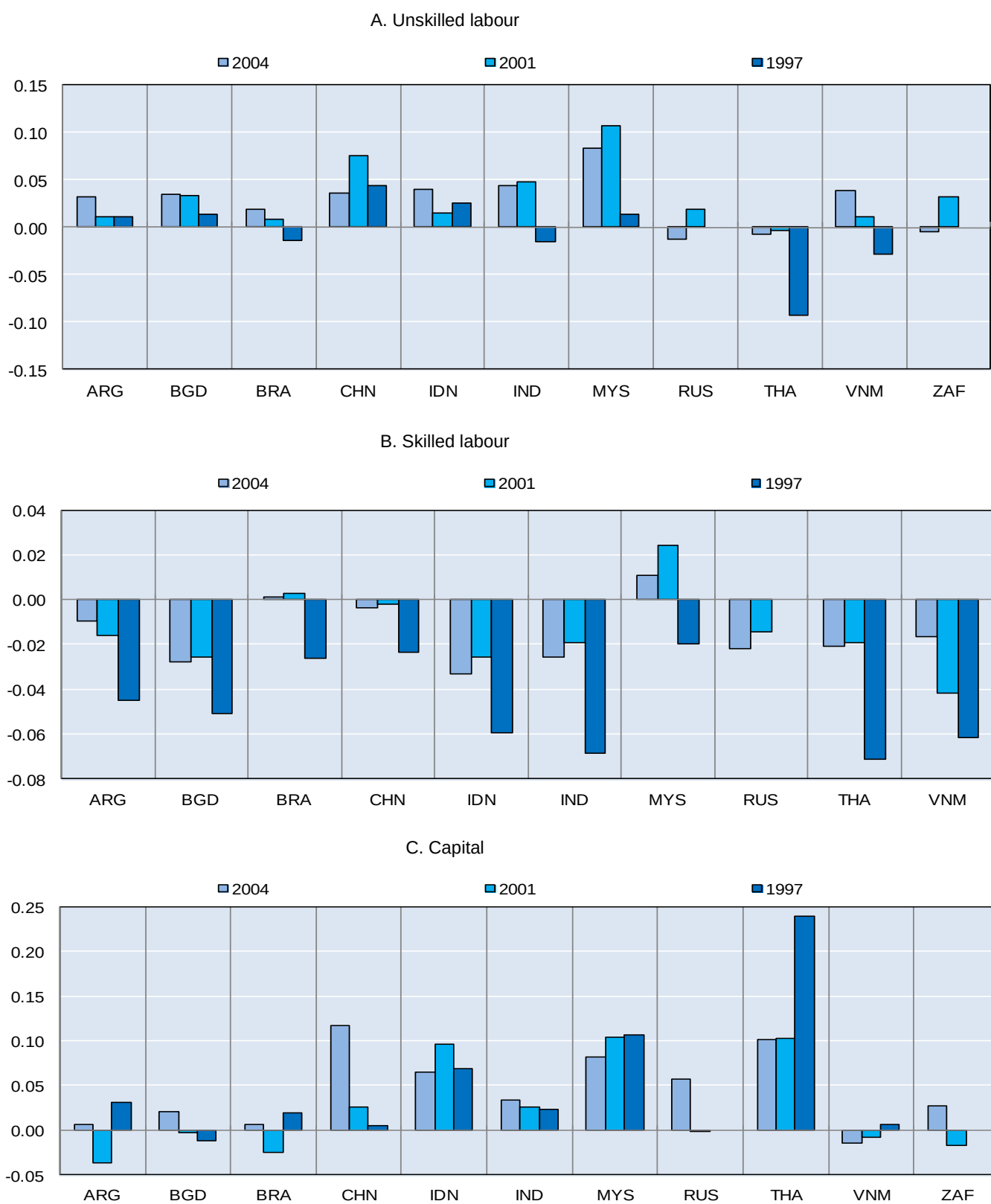


Figure 3 China skilled labour

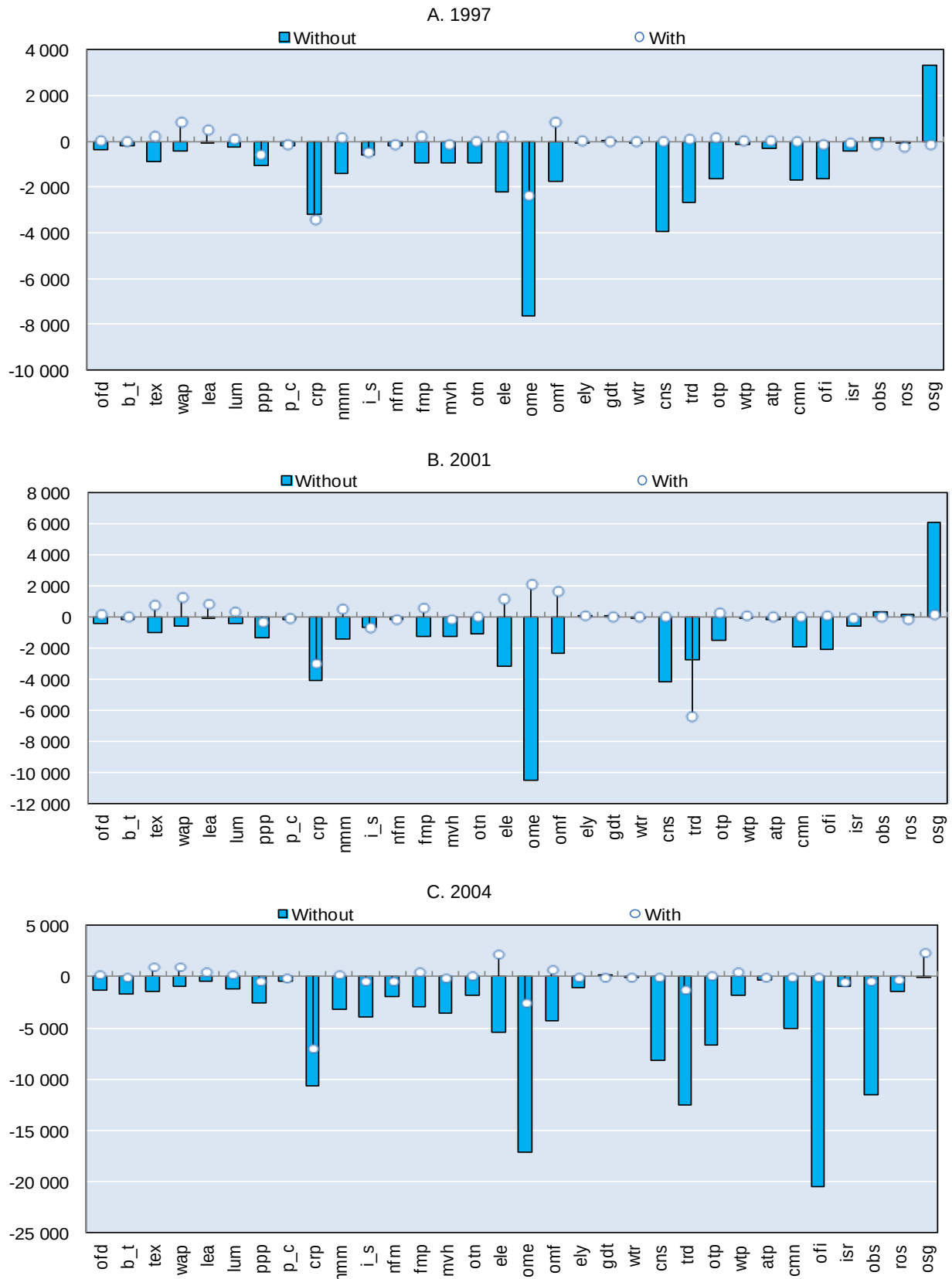
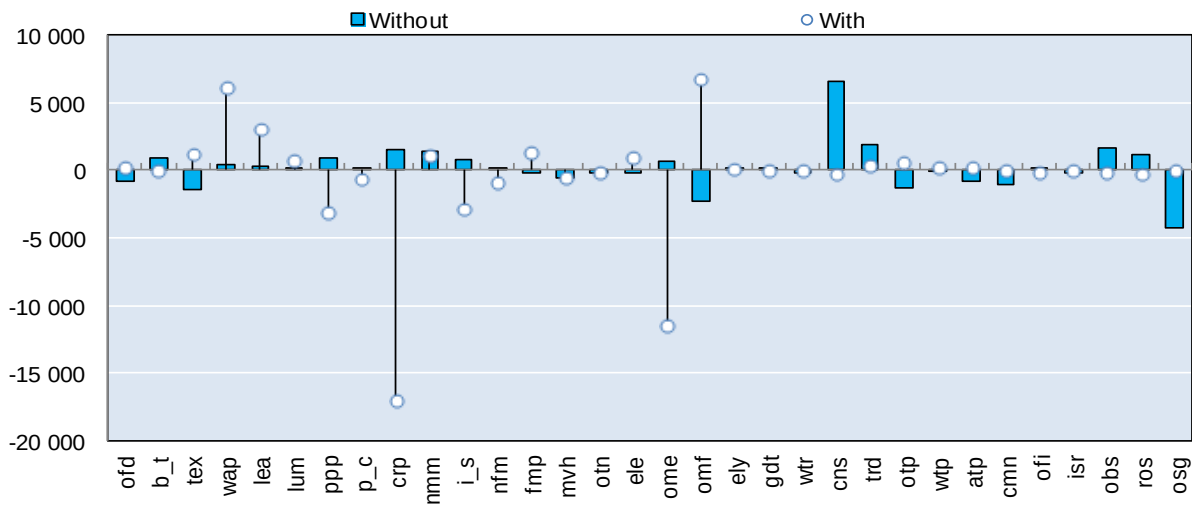
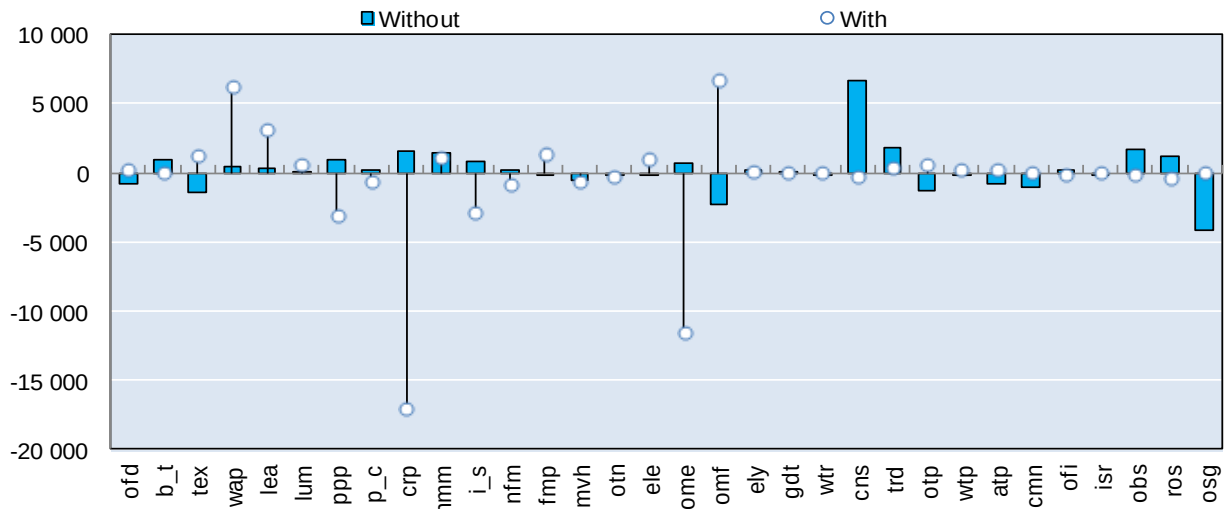


Figure 4 China unskilled labour

A. 1997



B. 2001



C. 2004

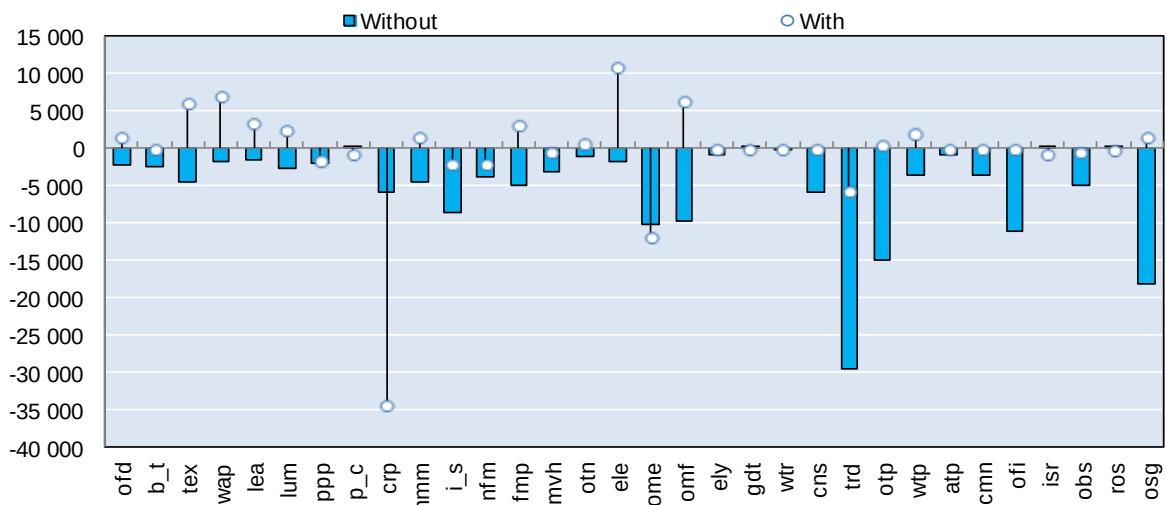
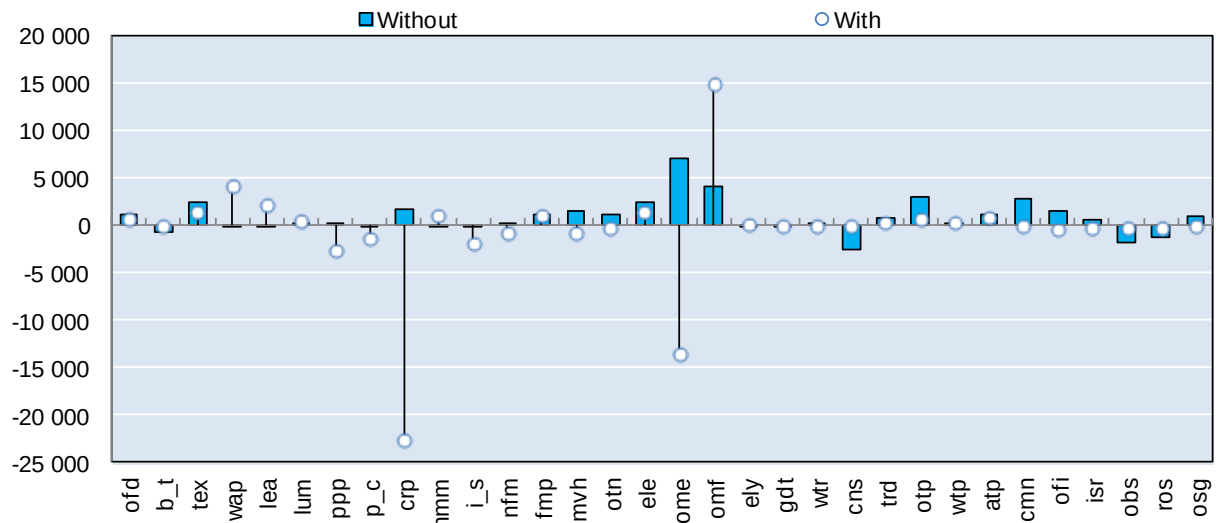
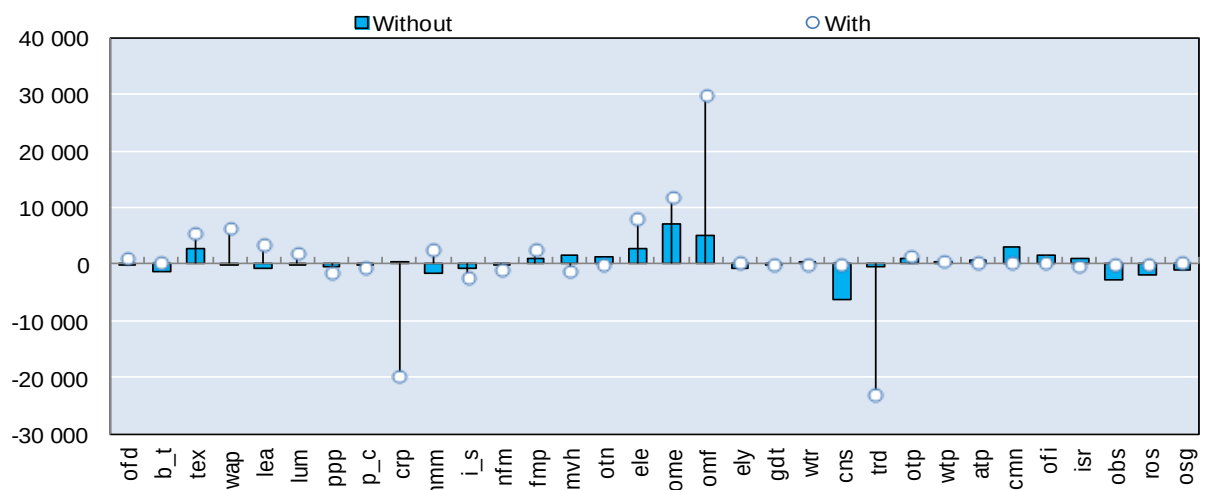


Figure 5 China capital

A. 1997



B. 2001



C. 2004

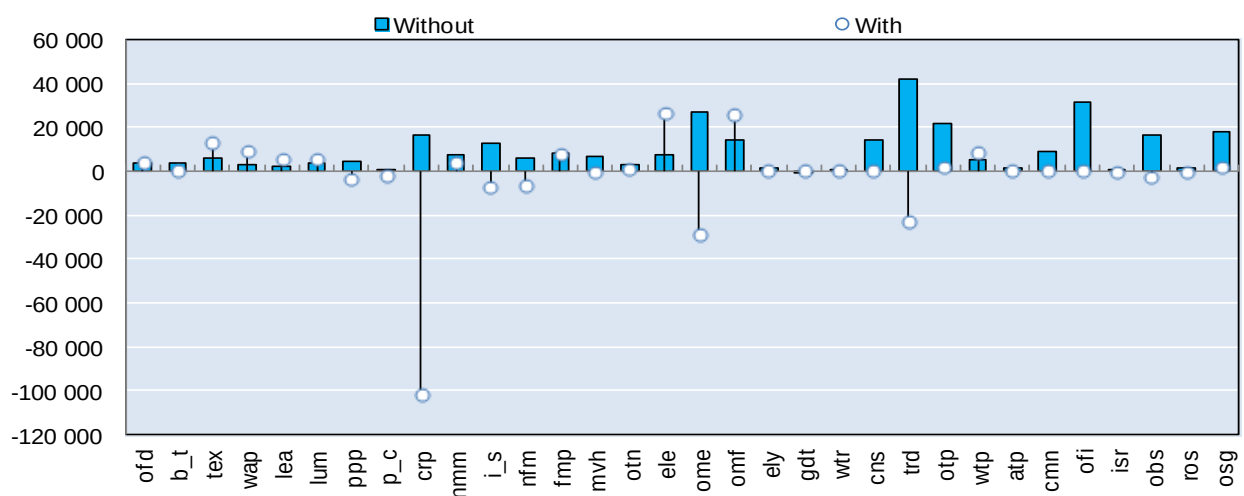
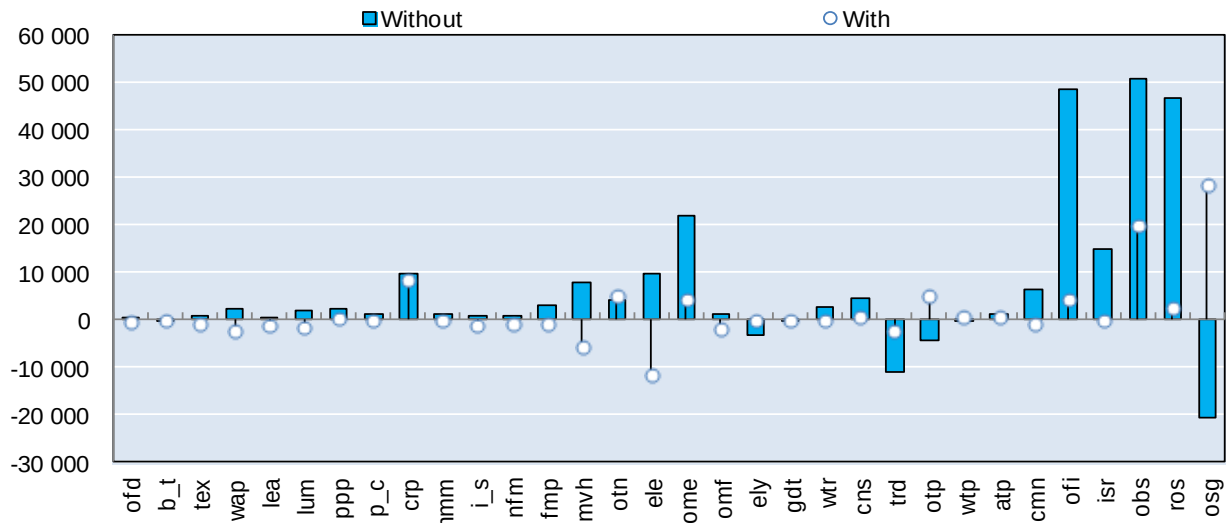
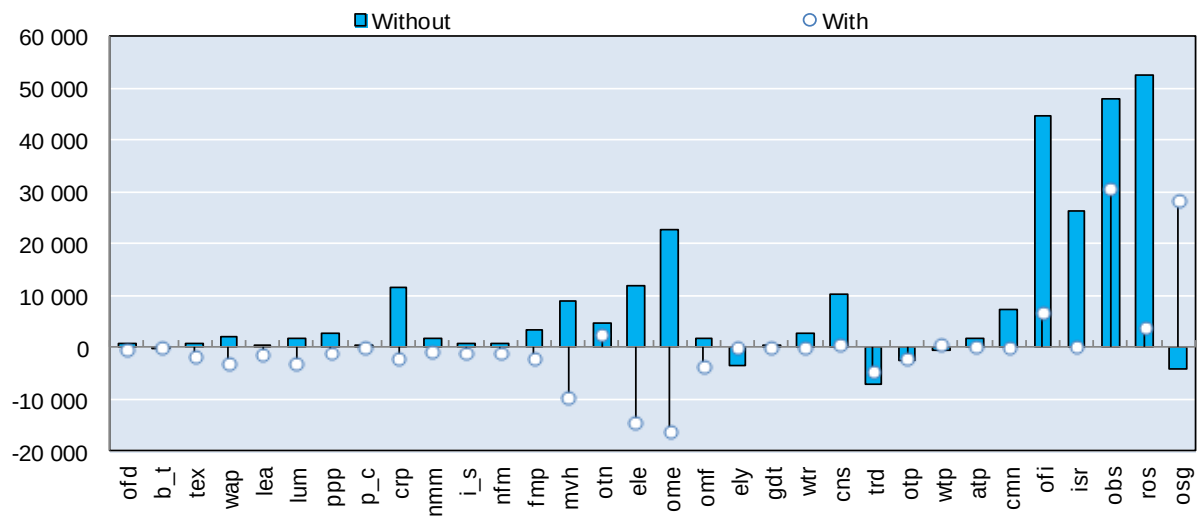


Figure 6 US skilled labour

A. 1997



B. 2001



C. 2004

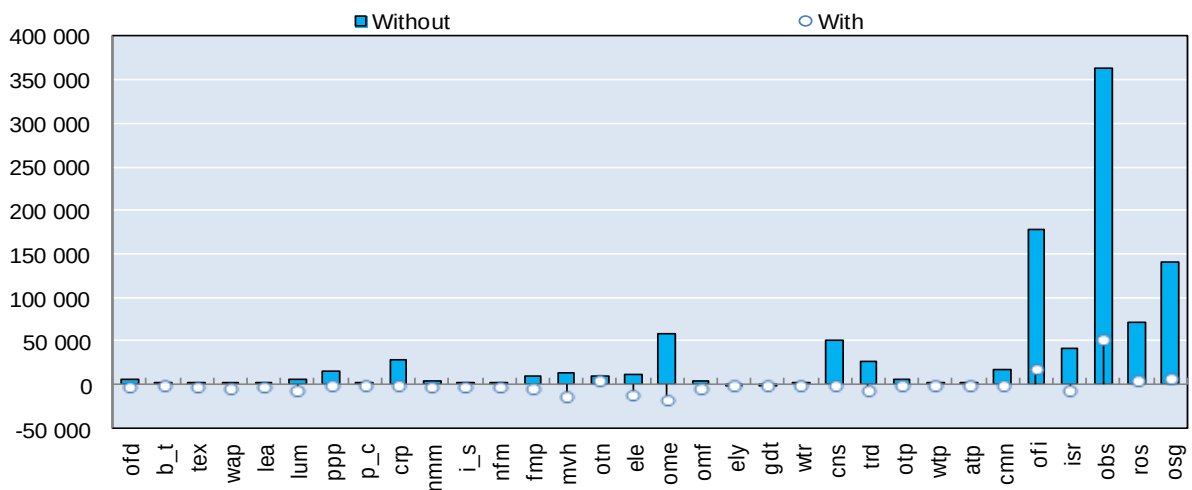
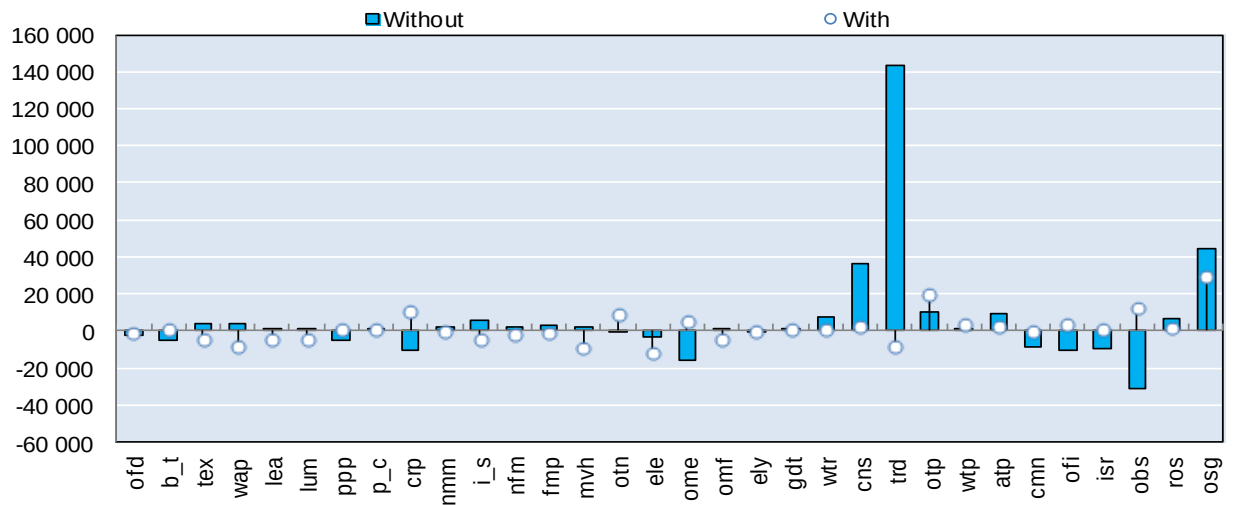
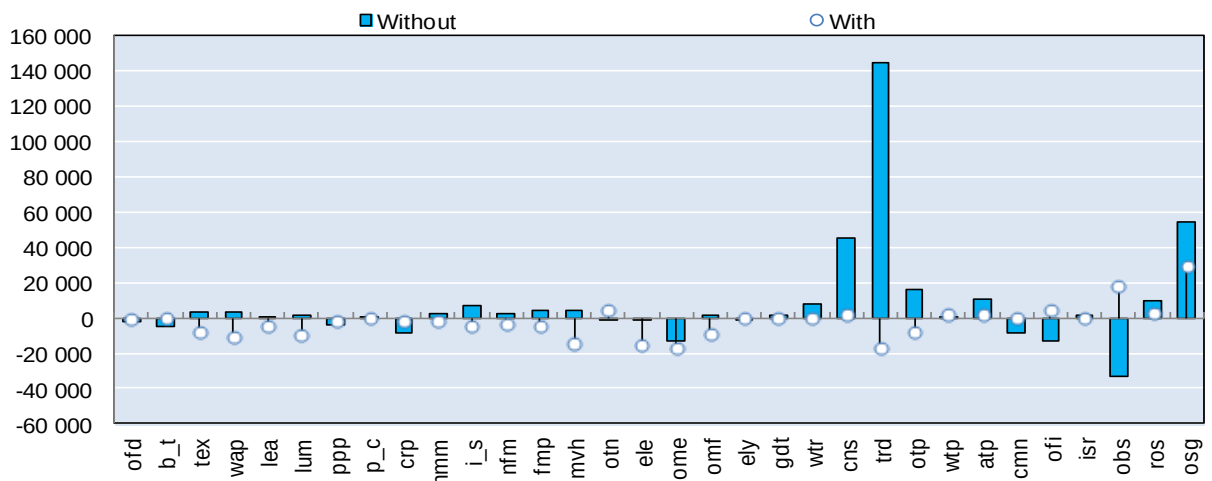


Figure 7 US unskilled labour

A. 1997



B. 2001



C. 2004

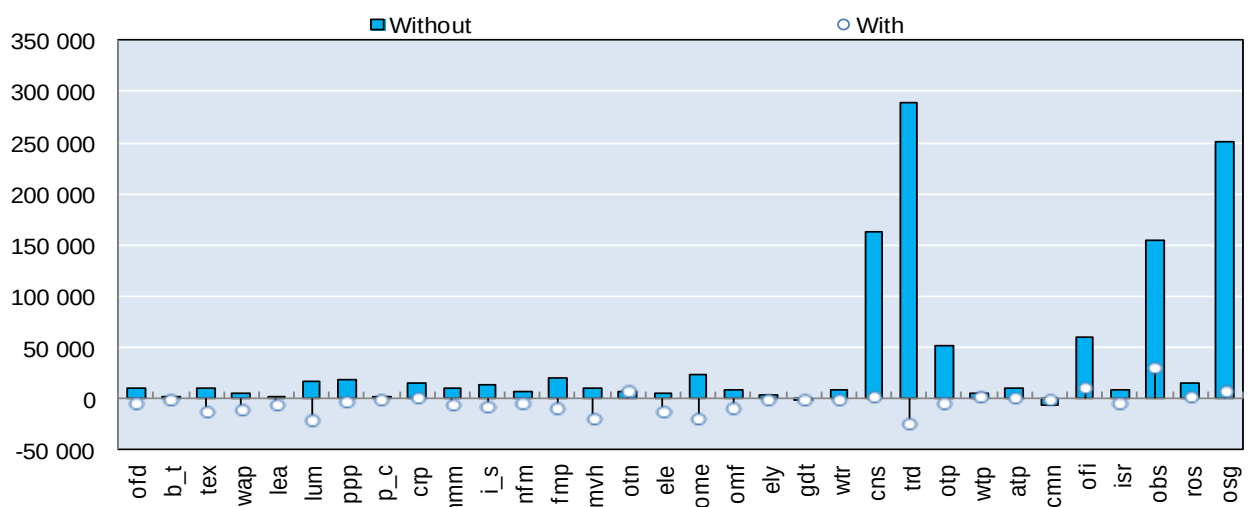
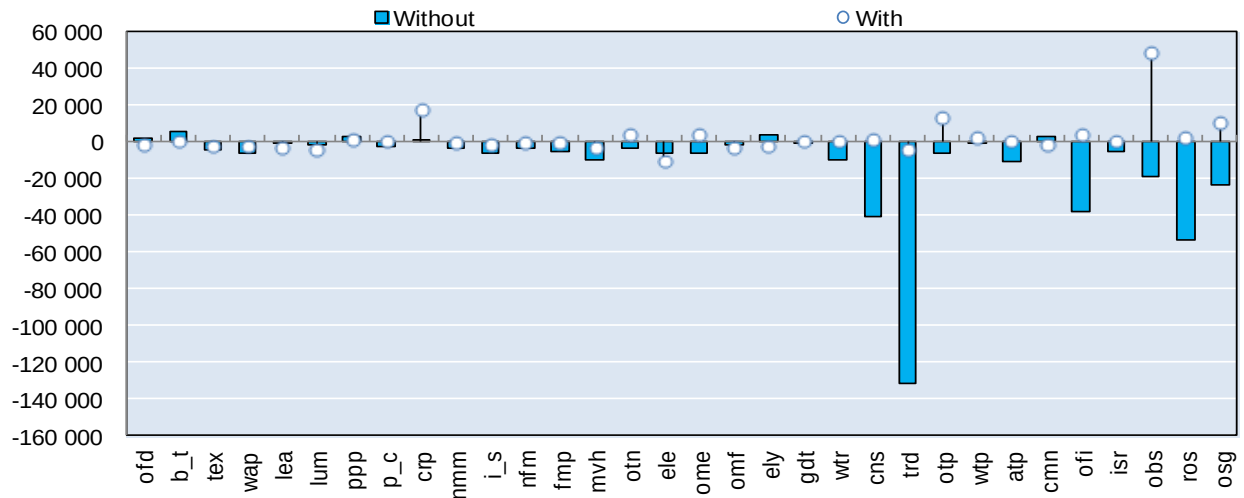
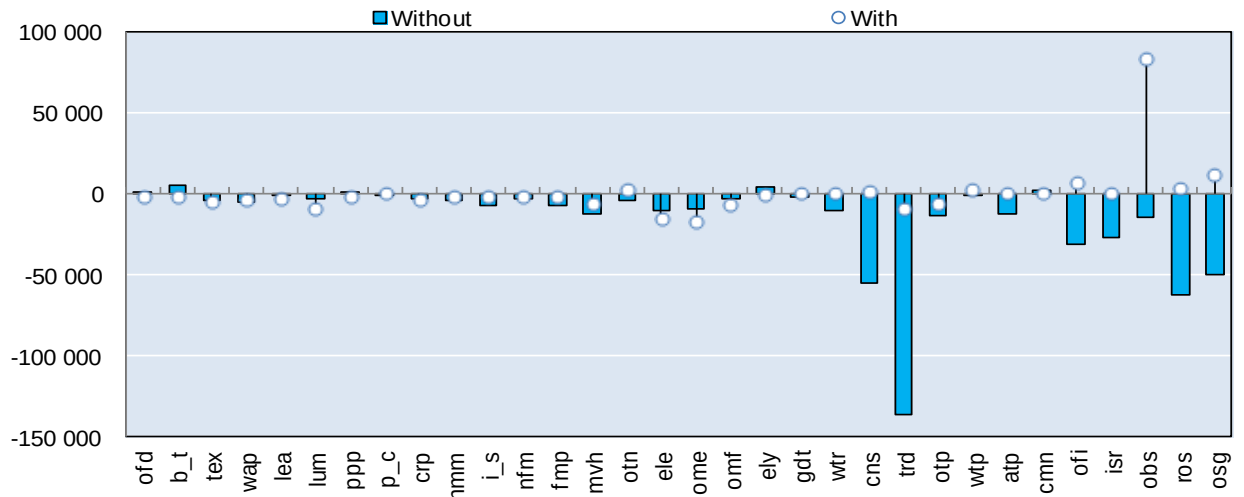


Figure 8 US capital

A. 1997



B. 2001



C. 2004

