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Relocation and Inequalities between Skilled and Unskilled in Northern Countries: Simulation Using a CGE Model

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ABSTRACT: The aim of this paper is to analyze the impact of offshoring on employment in France. In economic analysis, is often associated the phenomenon of relocation to the problem of unemployment. Using a Computable General Equilibrium Model (CGEM), we simulate the relationship between offshoring to the CEECs and the rising inequality between skilled (TQ) and unskilled (TNQ) workers. In order to study this impact, we will initially talk about theoretical and empirical contributions explaining the relation "relocation-employment". In a second step, we will develop a CGE model (the model is implemented in GAMS) to test the impact of offshoring to the CEECs on wage and unemployment rate for skilled and unskilled workers. The simulation results show that there is a negative effect of offshoring on the situation of TNQ in terms of wages and employment and a rather positive effect on TQ. This confirms the "Stolper-Samuelson" theorem.

Keywords: Relocation; FDI; Skilled and Unskilled workers; Inequality; Wage; CGEM.
JEL Classifications : F12 ; F16 ; F21

1. Introduction

The extent of wage inequality and unemployment experienced by many industrialized countries, including France, has rekindled concern that existed in the 90s, due to the competition conducted by developing countries or countries with low wages (LWC). This threat is combined with two sets of phenomena which have, a priori, negative effects on employment. It is, on the one hand, the rise of new emerging countries (China, India ...) and the enlargement of Europe with the accession countries of Central and Eastern Europe (CEECs), that are an inexhaustible resource of labor (unskilled and skilled) who can substitute for that of France and other industrialized countries (Raouf, 2010). On the other hand, the increase in capital transfers, and especially production units through offshoring (delocalization)[1].

In France, the issue of relocation and its impact on labor market creates a lively debate. Emerging countries and CEE countries are receiving the most relocation in *stricto sensu*.

Regarding the impact on employment, perspectives and results differ among economists, even empirically. For many economists, relocation is not a problem for industrialized countries: the game market achieves an optimal situation and any interventionist measure of protection is a violation of market equilibrium and impact growth in developing countries. Others believe, however, that the issue of relocation raises problems regarding growth and jobs in the origin countries.

The facts reveal a distortion and a widening gap in wage and inequality between TQ and TNQ. There is a form of "de-industrialization" of wealthy countries and increased in intensity of manufactured exports from the LWC and emerging market assets. However, for some time, offshoring

[1] Relocations involve any general or partial closure of production units in the country and the concomitant reopening of a production unit abroad, or the use of subcontracting without changing the destination of the goods or services. However, any creation of new entities (ex nihilo or Greenfield) abroad cannot be considered as relocation when neither employment nor exports are affected. This is rather a FDI.

also involve areas that are more technologically intensive, such as automotive and electronics, see Artus (2006). They also relate to more business services through the development of ICT (call centers, accounting and computer science).

We will try in this paper, using a simulation model; to analyze the links that can exist between relocations, increased unemployment and wage inequality in France. We focus on the interactions between FDI outflows, increase of imports and employment in France. Specifically, this is to simulate, using a computable general equilibrium model (CGEM), the impact of relocation to CEECs on SK and USK in France, to assess a possible widening inequalities between the two factors which commonly known under the "Stolper-Samuelson theorem". The choice of France and CEECs meets the requirement to work on North-South relocation and that the CEECs are considered as LWCs.

To do this, we will discuss initially theoretical and empirical contributions in explaining the relationship between relocation and employment. In a second step, we present a static CGEM developed for the case of France. The simulation in this model, in a prospective sense, was done through the increase in FDI outflows to CEECs, which are considered as relocations (Markusen, 1997). Results and sensitivity tests are presented in the third step.

2. Theoretical and Empirical Analysis of Relocation-Employment Relationship

2.1. Relocation-employment: the lack of a theoretical consensus

Offshoring is the result of interaction between FDI, outsourcing abroad and international trade. The dynamics of these interactions may lead to positive or negative effects on employment, directly or indirectly. The effects may vary according to time, in the short term or long term. In general, there is a close relationship between relocation and unemployment. In this sense, relocation is considered as a dreadful factor in the destruction of employment in the North.

Until now, there is no solid theoretical foundation that deals directly the question of the impact of offshoring on employment in the countries of origin. The majority of studies examined this relationship indirectly referring to the relationship between FDI and trade. They depart from the idea that a substitution relationship between FDI and trade has negative impact on employment, while a complementary relationship is positive. The literature has generally treated the FDI-employment link as a result of the substitution-complementary relationship between FDI and trade.

Although the impact of relocation will be weak or negligible at the national level due to creation/destruction process, the local impact on jobs may be important. This requires mechanisms for redistribution among those receiving settlements abroad, and those who suffer (Mucchielli et al., 2005).

This is the relocation of the wider business which may have a negative impact on employment. Relocation can take two forms of investment: vertical and horizontal. In the case of vertical FDI, we find a complementary relationship, which means that the effect on employment must be positive. However, if FDI is considered a relocation strategy that allows exploiting the comparative advantage of the host country in terms of labor cost opens (low wage), FDI can have a negative effect on employment of the investor country. The effects of offshoring on employment may be: direct effects and / or indirect effects.

2.1.1-The direct effects

- **Negative effects**: direct negative effects occur in the case where the company partially or completely relocating operations abroad any products or services relocated to the new location to serve the local market. The impact on employment is direct, and may be felt most keenly at regional and local level. There is then a perfect substitution between domestic and foreign labor force. The same thing happens when a company decides to stop its activity and use international outsourcing.
- **Positive effects**: Relocation may be considered beneficial when used as a recovery strategy or restructuring and to save a part of the job threatened. It may be the only way to save the future of the company in terms of profitability. It is then to answer the question: what happens if companies don't allow relocating? To answer this question, a series of studies conducted in the case of Italy bring interesting results. During the period 1994-1998, Navaretti et al. (2002) and of Navaretti and Castellani (2003) find that firms that invest abroad are those use the most of labor on the domestic market. Offshoring can be seen as a solution for companies threatened bankruptcies and layoffs.

2.1.2-Indirect effects

- **Negative effects**: These are the effects of offshoring on employment in other sectors or other companies that have links with industries or companies that relocate. This situation is often present in the case of sub-contractors who find themselves forced to turn to relocate their activities to accompany their order donors.
- Another indirect effect that could be detrimental to the industry of the country of origin lies in the fact that companies that relocate participate in a major way to the transfer of technology to abroad. This transfer of technology can become competitive threat, especially if it takes the form of relocation of research and development.
- **Positive effects**: This is the side that is rarely studied in this question. The analyzes carried out on this subject pass over the benefits and positive side of relocation. There are jobs created indirectly by the relocation. When sector relocate strongly, as in the case of textiles, metallurgy and automobile, other sectors benefit from this situation. Jobs lost directly in an area are created indirectly in other sectors. This corresponds to the Schumpeterian concept of creative-destruction. When companies outsource textile, other companies are developing to export capital goods, business services such as expertise and intermediate goods.

Theoretically, outsourcing companies focus on high value-added activity allowing relocation benefits to TQ. This trend is accelerating when the industrialized countries are forced to adopt the strategy of the top out to face competition from emerging countries.

Another advantage provided by the relocation is in terms of improving welfare of the consumer due to a significant decline in prices of some imported products. The offshore products are cheaper than the same products made in the country. And firm competitiveness increases when it concern imports of intermediate goods.

Rising inequality between TQ and TNQ in the North results in an increase in the real wage differential in economies where wages are relatively flexible as in the case of the United States, and an increase in unemployment TNQ in countries where there is a minimum wage (France). Several theoretical explanations trying to determine the causes of these findings:

- The classic standard model based on the HOS theory and the Stolper-Samuelson effect;
- The technology as a source of imbalance in the labor market by Krugman and Stolper;
- Impact of relocation North-South kind;
- The new theory of international trade and imperfect competition;
- The new economic geography with the agglomeration of firms.

The debates are multiple. Many prominent economists are interested in this issue. Among them it is worth mentioning the arguments of Samuelson (2004) on this subject which is more pessimistic and Bhagwati et al. (2004) who established several scenarios sometimes positive and sometimes negative, and other economists in this area.

However, offshoring like trade with LWCs and technological progress are involved in increasing imbalances. This is a normal phenomenon of transformation of productive tool which creates a new kind of international division of labor. We can describe this phenomenon as the result of globalization and international competition, where firms make their choice of location.

2.2. Empirical estimates

Several studies and reports have attempted to assess the extent of offshoring. The majority concludes that a small extent of this phenomenon and places them in a broader sense of economic openness. Indeed, the entire reports and studies highlight an important weakness of these analyzes, namely the lack of accurate measurement of the phenomenon, especially when it comes to assessing its impact on employment. Among the methods or the most used by economists to understand this phenomenon, we quote the main approaches:

- The macroeconomic approach based on international trade data: the employment content of trade;
- Approach based on FDI and corporate restructuring;
- Microeconomic Approach;
- Econometric approach;

And the approach of general equilibrium model that we apply in this work.

The macroeconomic approach, based on data from the national accounts and the balance of trade is in a broad sense to talk of relocation when there is a substitution of foreign production to domestic production to serve the same demand. This criterion leads to the conclusion that all import flows conceal a form of outsourcing. Following this analysis, outsourced jobs correspond to the set of jobs it would take to produce the same goods imported. This is the approach taken in the report of Arthuis (1993) and OECD (2007).

The equivalent direct jobs contained in imports is the number of jobs needed if we produced in the country imported goods and services. Given the small share of emerging countries (low-wage) in trade of industrialized countries, the approach of job content often leads to a limited impact of offshoring on employment in developed countries.

In the case of France, Fontagne and Lorenzi (2005) estimate a balancing of jobs embodied in trade flows with these countries in the order of 1% of industrial employment. With a similar methodology, Boulhol (2004) estimates the number of jobs lost in the industry due to exchange French with LWCs between 1978 and 2002, about 250 000 jobs or about 15 % of the decline in industrial jobs. Result does not necessarily reflect the impact of offshoring simply but full exchanges. The approach of FDI is generally applied in the context of trade type North-South, where we can calculate the share of FDI to developing countries. According to various estimates (see Grignon, 2004; Drumetz, 2004 and Fontagne and Lorenzi, 2005), the impact of offshoring to the LWCs remains limited. FDI outflows from France to these countries do not exceed 10 % of total French FDI.

Building on individual company data, the microeconomic approach is initiated by INSEE (French statistical institute) and OECD. It concerns the relocation narrowly and broadly with a reduction in production and workforce of the firm relocates. The growth of FDI firms abroad can be considered as a presumption of relocation. This approach is also based on the decline in exports and import growth of parent firms or reducing domestic production offset by international outsourcing.
The application of microeconomic approach requires access to individual data from firms in the country that is relocating as well as information on the nature and destination of investment. This allows giving a precise assessment of the extent of offshoring and its impact on employment. But the collection of information requires very detailed investigations and also involves a collaboration of companies, which is a very difficult task.

By choosing this approach, Aubert and Sillard (2005) estimate that about 95,000 industrial jobs were eliminated in France and relocated abroad between 1995 and 2001 , an average of 13,500 each year. It is very difficult to establish a link between offshoring and employment from this approach, because we must also see the indirect effects of offshoring on employment. They could be negative in most cases, but also positive.

The econometric approach is to measure an indirect impact of offshoring on employment through an econometric estimation of the demand for labor. It assumes that relocation involves job losses in the country. Among the studies using this approach, we find the study of Strauss-Kahn (2003), which focuses on the impact of international vertical specialization of labor on the demand for unskilled labor in France between 1977 and 1993. It concludes that this specialization explains between 11 and 15 % decline in the share of low-skilled jobs between 1977 and 1985, and 25% of it between 1985 and 1993. Boulhol (2004), in a study of 16 OECD countries from 1970 to 2002, concluded that trade with emerging markets explains 10% of the decline in the share of total employment in France and 15% in OECD average.

The method of job content (also known as the balance in jobs), (Wood (1994), Sachs and Shatz (1994)), does not elucidate a rigorous relationship between outsourcing companies and the decline in employment in the industrialized countries. However, the general equilibrium approach allows formalizing causes redistribution of capital and correcting the offshoring of phenomena outside the redistribution of capital. General equilibrium models provide the opportunity to test empirically what has been described above, including the remuneration of the factors of production, skilled and unskilled labor, changes in the terms of trade, export growth and imports, etc. They also measure the benefits in terms of social welfare.

The approach by the CGE is not spared criticism. It has drawbacks and limitations (often related to the complexity of the construction of these models), but it allows us to combine and reconcile the different approaches and try, in a prospective sense, to know what the effects of offshoring to LWCs (here CEECs), on employment, prices and welfare in France. The strong point of

this method is its solid microeconomic foundations. The CGE model describes the behavior of all economic agents.

From our comparative static CGE model in which we will present in the second section, we introduce two exogenous shocks to this: the first is a doubling of outward FDI (FDIO) to these countries, which is an indicator of increased offshoring and the second is done through a 20% increase in the level of imports from the CEECs with a simultaneous increase in the Armington elasticity of substitution. The increase in the elasticity of substitution (50% increases) between local and imported intermediate inputs allows us to simulate an increase in imports of intermediate goods, which is also considered as an indicator of relocation.

3. Model and Data

The model that we present in the following is a real model that is in line with those developed by Devis et al. (1982) , De Melo and Tarr (1992) and Rutherford and Tarr (2003). This model closer to the models developed by Decreux et al. (2003), Bontout and John (1998), Bchir et al. (2002) and Karim and Bouzahzah (2013). Our model is distinguished by the inclusion of capital movements, especially FDI, as several studies have concluded that the movement of capital to LWC and relocations are complementary, see Markusen (1997). We disaggregate the labor on SKW and USKW to assess the impact by category and as a consequence, assessing the degree of inequality.

To account outflows of FDI to the CEEC as well as imports and exports, we distinguished the world into two regions. The first is the CEECs (as the LWC) where FDI outflows are mostly considered as relocations and imports from these countries are substitutes for domestic products (intermediate goods), the second region is represented by the countries of the rest of world.

To do this, we construct at first the Social Accounting Matrix (SAM) of France in 2006. The choice of 2006 is explained by two reasons: first, it is a recent year when little work using recent data. This year also coincides with a very marked increase in movements offshoring to LWCs. Second, we do not want to work on a more recent base year, for one simple reason, to avoid the effects of the financial and economic crisis that began in the summer of 2007, during which the level of unemployment increased without considering the effects of relocation.

The choice of functional forms (Appendix 1) will be described in detail. Following the steps of building a CGEM, then we will specify the process of macroeconomic closure of the model and the calibration parameters. So we get the equilibrium reference (baseline). Once the baseline is established, we will conduct various simulations that we have mentioned above. Based on the results of these simulations, while still modest, we finally discuss the impact of capital flows on the labor market in France as well as on the major macroeconomic variables of the country.

3.1 The SAM of France

We used three main sources of data in the construction of this matrix: TEE, TES and employment surveys from INSSE. The SAM contains all flows of the real economy. We disaggregated economic activity in two main areas, the area of manufactured goods (Sec1), which produces commodity 1 (B1) and the service sector (Sec2) producing commodity 2 (B2). We grouped the agricultural activities in the first sector. This simplistic and highly aggregated distinction activity (two sectors and two goods, where each sector produces one product) is mainly due to lack of data at much disaggregated level on accounts TQ and TNQ for each sector as well as the unavailability of FDI related data at the sector level. The matrix that we use for France is composed of twenty-one (21) accounts:

- In statements 1 and 2 properties B1 and B2, which in turn correspond to manufactured goods and services are represented;
- In the statements 3 and 4 are the two sectors, each represented by a representative firm producing good manufacturing (3) and services (4);
- In the statement of 5, it is the first factor of production, namely capital; In the statements 6 and 7, there is the labor factor, disaggregated into skilled labor (TQ ,7) and unskilled labor (TNQ , 6) ;
- At statement 8, we find households with a representative household;
- At statement 9, there is the government;
- From 10 to 15 statement, are shown the different taxes: TRC (10) are taxes on products, TRK (11) represents the tax on capital TRLQ (12) and TRLNQ (13) are successively taxes the TQ

and the TNQ. TRM (14) represents the income taxes on imports and finally TRY (15) which is the income tax;

- In the statement 16, we find the CEE region;
- The rest of the world (RDM) is in the account (17);
- On the statement 18, figure savings;
- In the statement 19, there is inward FDI (on line) or outgoing (column) CEEC;
- In the statement 20, there is outward FDI (column) and inward FDI (on line) ROW;
- We find The Total in statement 21.

3.2 The algebraic structure of the model

We emphasize that this analysis approach using a CGE model is an attempt to assess. The mobilization of this methodology in the case of France and very particularly regarding FDI flows is a first attempt. We do not claim in any way the validity of the theoretical results that we develop in the future. We build a CGE model with an open economy by introducing imports (Mi) and exports (Ei). Products according to their destinations (products for the domestic market or for export) and according to their origins through the Armington assumption (1969) produced locally or imported are distinguished. Prices also differ, local products in local currency, imports are in U.S. $ and CIF (Cost, Insurance, Freight) and exports in U.S. $ and FOB (Free On Board). To transform the national currency into the global market (U.S. $) we use the exchange rate.

The internal consistency of the SAM and the three equilibria, see Decaluwé et al. (2001), namely, the market clearing for goods and services, equality between savings and investment balance the trade balance, are insured. We consider the French economy with the following characteristics:

- Households: A representative household maximizes its utility function LES (Linear Expenditure System) under the constraint of income.
- There are two commodities in the economy, used for final consumption and production as intermediate consumption. Some of these goods are imported.
- Factors of production: capital, skilled labor (TQ) and unskilled labor (TNQ) and intermediate goods (which are produced in both sectors).
- There are two sectors where each one is represented by a firm that produces one domestic commodity. Each sector exports part of its production abroad (ROW and CEECs). Sectors receive FDI from ROW (inward FDI) and perform investment abroad (outward FDI).
- Production of goods is governed by a CES (imperfect substitutability between factors of production) production function. The production function is modeled in a conventional manner by a multilevel (nested) production function:
    - The first level describes, in the one hand, the distribution of production between the factors of production, which is the value added (VA) and intermediate consumption (IC) through a Leontief function. On the other hand, for each sector, the production is sold in part on the local market and some abroad (exports) and described by a function with constant elasticity of transformation (CET).
    - The second level highlights the imperfect substitutability between factors of production (capital and labor) through a CES function (Constant Elasticity of Substitution).
- Demand is modeled on two levels:
    - At the first level, there is the final consumption and intermediate consumption of both goods (manufactured goods and services) which are two very substitutable goods.
    - At the second level, taking into account the taste for variety of consumer demands goods are differentiated by country of origin: goods imported or locally produced goods, called a composite good. The demand function of composite properties is defined by a CES function as the Armington assumption. This assumes an imperfect substitutability between domestic production and imports more realistic hypothesis relative to considerations of the classical theory.
- The labor and capital are mobile between sectors and are fixed exogenously. Capital mobility internationally is characterized by movements and FDI flows.
- Savings and investment are endogenous.
- Unemployment is endogenous, it is determined in equilibrium.

- The state maximizes a Cobb-Douglass utility in its income constraint and taxes are endogenous function.
- The economy is open, we import and export goods to both ROW and to the CEECs.
- The exchange rate is flexible with ROW and draw with the CEECs.
- The capital and labor are non-negotiable factors.

The choice of functional forms and macroeconomic closure are presented in Appendix 1.

4- Simulation Shocks, Interpretation of Results and Sensitivity Analysis

4.1-First simulation: Shock of outward FDI growth

We conducted a 50% increase of FDI to the ROW and a doubling of outward FDI to the CEECs. A simple shock on outward FDI to CEECs hasn't any effect on the remaining variables. This is due to the low share of FDI in CEECs, which represents only 3.6% of total FDI outward flows in France. At the same time, FDI outflows from France represent only 3.5% of the national production for the year 2006. To clearly identify the movements of relocation, we are forced, in a prospective logic model to simultaneously increase outward FDI to the ROW and those to the CEECs.

In this first scenario, we fixed the supply of labor and the supply of capital and inward FDI to avoid direct compensation through FDI. We also chose the price of capital as numerary. The rest of prices are flexible including remuneration of TQ and TNQ. The simulation results are shown in Table 1, are expressed as percentage relative to the baseline, also keeping the values of the reference state.

Following a rapid increase in outward FDI to CEECs accompanied by a 50% increase of outward FDI to the ROW and keeping the supply of fixed jobs for the two categories of workers, we notice a generally, the existence of a relatively small negative effect on all macroeconomic variables, except for the labor market.

As regards the labor market, the two key parts in this scenario that traces acceleration movements' relocation. First, the results are significant and show an increase in the level of unemployment of the two categories of workers (UNEMPQ, UNEMPNQ) after the shock. In contrast, the increase in unemployment rate of USK is larger than that of SK. USK unemployment rate rises by 11.02% while SK unemployment rate increases by 2.8%.

Secondly, according to the results of the simulation for labor compensation, salaries TNQ (PLNQ) decreases from 1.45% and salary TQ (PLQ) rose 0.47%. According to these results, TQ receive outputs of FDI in terms of remuneration, while in TNQ lose.

These results suggest that rather offshoring has a negative effect on the situation of TNQ and a positive effect for TQ in terms of remuneration. The increase in the unemployment rate TQ after the shock is relatively low (2.8%) compared to the magnitude of the shock. This disparity in the effect of offshoring between a negative effect on the NQT and a positive effect on the TQ explains, in part, the inequalities between the TQ and TNQ in most industrialized countries.

In this framework, the effect of offshoring on employment is very similar to the effect of international trade with PBS developed by neoclassical theory, known as the Stolper-Samuelson effect. From these analyzes we can say with a faster flow of offshoring are the NQT who are most affected, a situation which results in an increase in unemployment TNQ.

As we detailed in the model functions in the production block, FDI is a part of the national production. With this shock, the model results show that domestic production declines 0.87% in the first sector and 0.73% in the second sector. This decrease in production was offset by a sharp increase in imports of the order of 4.63% in the second sector. The increase in imports is due to the substitutability between domestic goods and imported goods (Armington assumption). In addition, there has been an increase in exports of about 0.086% to well 1 and 3.2% in respect of the property 2. This result can be explained by the fact that the sector employs over 2 TQ than TNQ and strong substitutability between the composite factor and the factor TNQ.

Despite a decrease in household income (-0.21), the well-being measured by the consumer utility has increased significantly from 0.69%. This stability and even a small increase in welfare is mainly due to a decrease in savings (-4.02%). Importantly, the impact of increased FDI outflows or relocation is done in a static framework keeping fixed inward FDI, which can overestimate the negative impact of offshoring on employment.

In general terms and at the macro level, we saw a decrease in unemployment in France and in most industrialized countries between 1995 and 2006. For France, this rate increased from 11.6% in

1995 to 9.5% in 2006, this decrease was accompanied by a sharp increase in the stock of outward FDI, which rose from 19% to 41% of GDP for France during the same period, according to the OECD sources 2006. Without also forget that unemployment TNQ is twice larger than that of TQ.

Table 1. The results of the first shock

Variables	Description	Initial level	Variation in %
Y_index	Household income	1849,8	-0,215
S_index	Total saving	381,7	-4,022
CBUD_index	Household budget	1098,96	1,39
KS_index	Total capital	507,3	0
LSQ_index	Total TQ (total Skilled labor endowment)	557,262	0
LSNQ_index	Total TNQ (total unskilled labor endowment)	666,436	0
UNEMPQ_index	Unemployment of TQ	51	2,886
UNEMPNQ_index	Unemployment of TNQ	110	11,02
PK_index	Initial return to capital (K)	1	0
PCF_index	Price of composit factor	2	-3,791
PLQ_index	Initial wage rate of TQ	1	0,474
PLNQ_index	Initial wage rate of TNQ	1	-1,456
U_index	Household utility	424,78	0,693

Variables	Description	initial level		Sec 1 en %	Sec 2 en %
		Sector 1	Sector 2		
P_index	Composite commodity price index	1	1	0,234	1,315
PD_index	Domestic output price index	1	1	-0,504	0
PDD_index	Domestic output price index home market deliveries	1	1	0,345	1,399
PE_index	Export price index	1	1	0,016	0,016
PM_index	Import price index	1,255	1,305	0,016	0,016
X_index	Index of domestic sales	1602,7	1736,4	-0,892	-0,634
XD_index	Index of gross domestic production	1465,1	1780,9	-0,871	-0,734
XDD_index	Index of domestic production delivered to home markets	1064,8	1633,7	-1,22	-0,963
K_index	Index of capital demand	170,3	290	-0,569	0,202
I_index	Index of labor demand	291,59	90,1	-4,246	-5,268
LQ_index	Initial labor demand of TQ	240,38	139,08	-0,757	-0,082
LNQ_index	Initial labor demand of TNQ	132,59	398,33	-2,089	-2,495
E_index	Index of demand for exports	389,1	95,39	0,086	3,205
M_index	Index of demand for imports	428,6	78,69	-0,242	4,632
FDIO_PECO	FDI outflows to CEECs	2	1,1	100	100
FDIO_index	FDI outflow to ROW	12,33	69,82	50	50
FDII_index	FDI Inflow	11,12	51,88	0	0

Indeed, the results of this simulation are taken with caution, because it is made in a logical prospective analysis, which is to know what the effects of a possible acceleration of movements without relocation of changes in FDI inflows

The results on the impact of offshoring on employment are consistent, in general, with what provides the general theory of trade. But it must be supplemented by the inclusion of inward FDI, the effects of adjustments and training and the impact of technical progress. This can be also responsible for the deterioration of the situation of TNQ in industrialized countries, particularly in France.
The effect of technical progress on employment (see Krugman (2000)), is comparable to that relocation. In this model we have not considered the impact of technical progress on employment, which may also overestimate the impact of offshoring on employment.

4.2 Second simulation: Shock of import growth

The purpose of this second scenario is to always test the impact of offshoring on employment in France, playing another indicator that can explain an increase in offshoring. This is to increase imports in general and those from CEE 20% by doubling along the Armington elasticity of substitution. This scenario reflects indirectly increasing the import of intermediate goods from the PBS which are usually caused by relocation. We compare the results of this shock with the first simulation. The results of this simulation are presented in Table 2. They are organized in the same way as the first simulation.

Table 2. The results of the second shock

Variables	Description	Initial level	Variation in %
Y_index	Household income	1849,8	0,0021
S_index	Total saving	381,7	2,575
CBUD_index	Household budget	1098,96	1,196
KS_index	Total capital	507,3	0
LSQ_index	Total TQ (total Skilled labor endowment)	557,262	0
LSNQ_index	Total TNQ (total unskilled labor endowment)	666,436	0
UNEMPQ_index	Unemployment of TQ	51	-1,63
UNEMPNQ_index	Unemployment of TNQ	110	1,44
PK_index	Initial return to capital (K)	1	1,54
PCF_index	Price of composit factor	2	0
PLQ_index	Initial wage rate of TQ	1	0,864
PLNQ_index	Initial wage rate of TNQ	1	0,41
U_index	Household utility	424,78	0,545

Variables	Description	Initial Level Sec 1	Initial Level Sec2	Sec 1 %	Sec 2 %
P_index	Composite commodity price index	1	1	1,354	0,022
PD_index	Domestic output price index	1	1	1,146	0
PDD_index	Domestic output price index home market deliveries	1	1	4,71	0,332
PE_index	Export price index	1	1	-4,43	-4,43
PM_index	Import price index	1,255	1,305	-4,43	-4,43
X_index	Index of domestic sales	1602,7	1736	0,583	-0,012
XD_index	Index of gross domestic production	1465,1	1781	1,631	-0,401
XDD_index	Index of domestic production delivered to home markets	1064,8	1634	-8,781	-1,239
K_index	Index of capital demand	170,3	290	1,519	-0,371
I_index	Index of labor demand	291,59	90,1	1,205	2,55
LQ_index	Initial labor demand of TQ	240,38	139,1	1,79	0,028
LNQ_index	Initial labor demand of TNQ	132,59	398,3	1,41	-0,733
E_index	Index of demand for exports	389,1	95,39	31	14
M_index	Index of demand for imports	428,6	78,69	20	20

FDIO_index	FDI outflow	14,32	70,91	0	0
FDII_index	FDI inflow	11,12	51,88	0	0

Overall, in this second scenario, the results are fairly similar to the first scenario. There remains, unsurprisingly, that the wages of TQ and TNQ successively increased 0.86% and 0.41% in contrast to the first shock. On the volume of employment, neoclassical logic is maintained with increase in unemployment and decrease of TNQ unemployment TQ, but with very low amplitude. Unemployment rises by 1.44% for TNQ and decreases by 1.63% for TQ.

These results are consistent with the empirical results related to the impact of international trade with PBS employment in industrialized countries, and with the results of Bontout (1998) and Cortes and Jean (1997a). They find that a one percentage point increase in the rate of import penetration leads to a 0.4% increase in the TQ / TNQ ratio in the industry concerned.

4.3-Sensitivity Analysis

Using a CGE course called sensitivity analysis to key parameters used in this case elasticities to test the robustness of the model and evaluate the corresponding error margins. Therefore, we tested the sensitivity of results to changes in values of the elasticities of substitution between factors and between products, choosing low values (half of the initial value) and high values (double the initial value) compared to baseline and is "running the model" with the new elasticities. We simulate the same shocks for different elasticity of substitution between σF_i factors and the elasticity of substitution between goods σA_i values.

The results are very close to the initial results. No change in the sign of the change of variables, but rather the magnitude of the variation has changed for some variables such as production for the domestic market decreased much more in the second shock due to the increase the elasticity of substitution between domestic goods and imported goods.

The sensitivity of the results is however much lower for shock related to FDI. However, we believe that the high level of aggregation used in the model (two areas) may be misleading, which is a limitation of our model. That is why we remain modest about the importance and credibility of the results, which remain questionable. Lack of data at the industry level, a more detailed breakdown will be more realistic results.

5. Conclusion

Apart from the significant increase in unemployment TNQ in the first shock (11.02%), impacts simulated in this model have yielded modest results (at the change of variables compared to baseline). This drawback is due to the fact that we worked on price of work (wages) flexible. If we introduce price stickiness factors or at least that of TNQ, because of a minimum wage in France, unemployment TNQ increase more than in the case of flexible wages.

These results should be taken with caution, as we noted above, because the problem of employment is a very complex issue where many factors may occur simultaneously. Relocations clearly contribute to the deterioration of the situation of unskilled in areas or specific sites, but they are not responsible for unemployment is structural rather. They may even be the source of job creation, or at least the preservation of jobs positions on the national territory.

The CGE model used as an alternative approach allowed us to evaluate, in an indirect way by using the IDE, the impact of offshoring on employment in France. The goal was not to give a definitive answer, but rather to propose an indicative quantitative estimation. It was specifically to test the impact of outflows of FDI to these countries relative wages of TQ and TNQ, as well as the level of unemployment for the two categories of workers.

According to our results, the outputs of FDI have a low impact on the economy in general, but relatively high on the labor market. These results show that for both shocks, the Stolper-Samuelson effect (lowering of real wages rare factor) is maintained with a deterioration of the situation of TNQ and improving the situation of TQ. However, the negative effects on unskilled employment remain low relative to the size of the shock (50% increase of outward FDI with a doubling of FDI to CEECs) and different concerns from the public debate.

We have supported the idea that the problem of inequality between TQ and TNQ in France and in many industrialized countries, finds its explanation in a complex set of structural policy, institutional and economic factors. It would be unwise to blame unemployment and the deterioration of the TNQ single phenomenon of relocation. It is clear to accept the idea that offshoring may be responsible for unemployment and widening inequality at the local level, where companies and subcontractors in a specific industrial area relocate. However, if we think at the macro level through training and destruction-creation effects of productive activities, relocation can also play a positive role in preserving jobs.

We emphasize that this analysis approach using a CGE model is an attempt to assess. Mobilization of this methodology in the case of France and very particularly in regard to FDI is a first attempt. We do not claim in any case, the theoretical validity of our results.

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Appendix 1: The algebraic notation of model functions

The consumer program: LES utility function - a consumer who disposes of income (Y), has de choice between two commodities C_1 and C_2 , with prices P_1 and P_2 , respectively. Y, P_1 and P_2 are exogenously given.	$$U = (C_1 - \mu H_1)^{\alpha HLES} * (C_2 - \mu H_2)^{(1-\alpha HLES)}$$ $$CBUD = (1+tc_1).P_1.C_1 + (1+tc_2)P_2.C_2$$ $$CBUD = (1-ty).Y - SH - COTH$$ with, *tc(sec)* is the rate of tax on final consumption, ty is the tax rate on income, SH represents savings of households, where: $$SH = mps.Y$$ mps is the marginal propensity to save and $COTH$ is the household contributions paid to the government.
- to calibrate parameters : $\alpha HLES$ and μH_i (the minimum level of consumption or subsistence):	$$\alpha HLES = \frac{(1+tc_1).PD_1^0.C_1^o - (1+tc_1).PD_1^0.\mu H_1}{CBUD^0 - (1+tc_1).PD_1^0.\mu H_1 - (1+tc_2).PD_2^0.\mu H_2}$$ $$\mu H_1 = C_1^o + \alpha HLES.[(1+tc_1).PD_1]^{-1}.CBUD^0.\Phi^{-1}$$ $$\mu H_2 = C_2^o + (1-\alpha HLES).[(1+tc_2)PD_2]^{-1}.CBUD^0.\Phi^{-1}$$
with Φ is the parameter Frisch which represents the elasticity of the marginal utility in relation to the expense, equal to: - Household income consists of income from capital, labor and transfers. - $UNEMP$: total unemployment of skilled and unskilled workers in the economy ; - $UNEMPQ$: unemployment of skilled ; - $UNEMPNQ$: unemployment of unskilled ; - PLQ, $PLNQ$ and PK are successively the TQ price, the TNQ price (corresponding salary) and the capital price (interest) ; - LSQ, $LSNQ$ et KS represent de total supply of TQ total supply of TNQ and the total capital endowment ; - $TKRDM$: transfer of capital income to RDM (Rest of the world) ; - TRF and $TRDM$ are successively transfers from the government to households and transfers to households from RDM.	$$\Phi = \frac{d\lambda}{dCBUD}.\frac{CBUD}{\lambda} = -\frac{CBUD}{(CBUD - (1+tc_1).PD_1.\mu H_1 - (1+tc_2).PD_2.\mu H_2)}$$ $$Y = PK.KS - TKRDM + PL.(LS - UNEMP) + TRF + TRDM$$ $$LS = LSQ + LSNQ$$ $$PL.(LS - UNEMP) = PLQ.(LSQ - UNEMPQ) + PLNQ.(LSNQ - UNEMPNQ)$$
Investment demand :	$$U = I_1^{\alpha I}.I_2^{(1-\alpha I)}$$ Sous la contrainte : $S = PD_1.I_1 + PD_2.I_2$ Avec : $S = SH + PCINDEX.SG + ER.SF + SE(sec1) + SE(sec2)$
Phillips curve **(unemployment)**	$$\left(\frac{PL^1/PCINDEX^1}{PL^0/PCINDEX^0} - 1\right) = phillips.\left(\frac{UNEMP^1/LS^1}{UNEMP^0/LS^0} - 1\right)$$
Supply - Intermediate commodity With : io_{11} is the share of intermediate commodity XD_{11} in the production of commodity XD_1. io_{21} is the share of intermediate commodity XD_{21} in the production of commodity XD_1. io_{11} and io_{21} are the Technical coefficients of output. - calibration of Technical coefficients :	$$XD_i = f(FC_i, LNQ_i, XD_{ii}, XD_{ji})$$ $$XD_i = g_i(VA_i, IO_i)$$ $$VA_1 = g_{11}(FC_1, LNQ_1)$$ Et $$IO_1 = g_{12}(XD_{11}, XD_{21})$$ $$VA_i = \left[\gamma F_i * FC_i^{-\rho F_i} + (1-\gamma F_i) * LNQ_i^{-\rho F_i}\right]^{-1/\rho F_i}$$ $$XD_i = aF_i * VA_i$$ $$io_{11} = \frac{XD_{11}^0}{XD_1^0}$$ Et $$io_{21} = \frac{XD_{21}^0}{XD_1^0}$$

- **Firm's behavior** - Elasticities of substitution of the two CES functions **;** $\boldsymbol{\sigma F_i}$ (*elasticity of substitution between composite factor and the TNQ*) and $\boldsymbol{\sigma C_i}$ (*elasticity of substitution between capital and TQ)*: - calibration of parameters : With: $FDIO_i$ is outward FDI, which includes outward FDI to the RDM and outward FDI to the CEEC. $PFDIO_i$ is the price of $FDIO_i$. SE_i represents Firm's saving.	$XD_i = aF_i * [\gamma F_i * FC_i^{-\rho F_i} + (1-\gamma F_i) * LNQ_i^{-\rho F_i}]^{-1/\rho F_i}$ $FC_i = aC_i * [\beta_i * K_i^{-\rho C_i} + (1-\beta_i) * LQ_i^{-\rho C_i}]^{-1/\rho C_i}$ With the intervention of the government, the constraint of producer wrote (1+tfc).PFC. FC_i + (1+tl).PLNQ.LNQ_i where : (1+tfc).PFC. $FC_i = (1+tk).PK.K_i + (1+tl).PLQ.LQ_i$ $\sigma F_i = \frac{1}{1+\rho F_i}$ $\sigma C_i = \frac{1}{1+\rho C_i}$ $\gamma F_i = \frac{(1+tfc)PFC^0/(1+tl)PLNQ^0}{(1+tfc)\,PFC^0/(1+tl)PLNQ^0 + \left(\frac{FC_i^0}{LNQ_i^0}\right)^{-1/\sigma F_i}} = \frac{1}{1+\frac{(1+tl)PLNQ^0}{(1+tfc)PFC^0} + \left(\frac{FC_i^0}{LNQ_i^0}\right)^{-1/\sigma F_i}}$ $\beta_i = \frac{(1+tk)PK^0/(1+tl)PLQ^0}{(1+tk)\,PK^0/(1+tl)PLQ^0 + \left(\frac{K_i^0}{LQ_i^0}\right)^{-1/\sigma C_i}} = \frac{1}{1+\frac{(1+tl)PLQ^0}{(1+tk)PK^0} + \left(\frac{K_i^0}{LQ_i^0}\right)^{-1/\sigma C_i}}$
The openning of the economy Domestic product (XD_i) can be sold on domestic market (XDD_i) as the foreign market in form the export (E_i). the transformation of the domestic product is modeled using a CET function.	$XDD_i = (1-\gamma T_i)^{\sigma T_i} * PDD_i^{-\sigma T_i} * [\gamma T_i^{\sigma T_i} * PE_i^{1-\sigma T_i} + (1-\gamma T_i)^{\sigma T_i} * PDD_i^{1-\sigma T_i}]^{\sigma T_i/(1-\sigma T_i)} * (\frac{XD_i}{aT_i})$ $E_i = \gamma T_i^{\sigma T_i} * PE_i^{-\sigma T_i} * [\gamma T_i^{\sigma T_i} * PE_i^{1-\sigma T_i} + (1-\gamma T_i)^{\sigma T_i} * PDD_i^{1-\sigma T_i}]^{\sigma T_i/(1-\sigma T_i)} * (\frac{XD_i}{aT_i})$
Demand - the domestic demand originates from domestic (XDD_i) and foreign resources (M_i). We adopt the commonly used Armington assumption and define a composite commodity (X_i). This composite commodity is either used as an input into the production process of the two domestically produced commodities (X_{ij}), or is sold for final use: private consumption (C_i), government consumption (CG_i) and investment (I_i). - $PM_i = (1+tm_i).ER.PWMZ_i$ while $PWMZ_i$ is the world price of imports, ER is the exchange rate and tm_i represents tariffs ; - $PE_i = ER.PWEZ_i$ with $PWEZ_i$ is the world price of exports.	$M_i = \gamma A_i^{\sigma A_i} * PM_i^{-\sigma A_i} * [\gamma A_i^{\sigma A_i} * PM_i^{1-\sigma A_i} + (1-\gamma A_i)^{\sigma A_i} * PDD_i^{1-\sigma A_i}]^{\sigma A_i/(1-\sigma A_i)} * (\frac{XD_i}{aA_i})$ $XDD_i = (1-\gamma A_i)^{\sigma A_i} * PDD_i^{-\sigma A_i} * [\gamma A_i^{\sigma A_i} * PM_i^{1-\sigma A_i} + (1-\gamma A_i)^{\sigma A_i} * PDD_i^{1-\sigma A_i}]^{\sigma A_i/(1-\sigma A_i)} * (\frac{XD_i}{aA_i})$ $P_i.X_i = PM_i.M_i + PDD_i.XDD_i$ $X_i = aA_i.[\gamma A_i.M_i^{-\rho A_i} + (1-\gamma A_i).XDD_i^{-\rho A_i}]^{-1/\rho A_i}$
Government - the government receives taxes (from taxes on commodities, on labor, on capital and on income) and social contributions (*COTH*), makes transfers (TRF) (for unemployed) and other transfers (TRO) as pensions. TRDM is transfers for ROW. - *trep : the government pays unemployment benefits to the household at the replacement rate, denoted by « trep* On the basis of statistical transfers of unemployment, we use a value of 70% for this parameter. – $PCINDEX$ is the Laspeyres consumer price index.	$TAXR = \sum_{i=1}^{2} (tc_i.C_i.PD_i + tk_i.K_i.PK + tl_i.LQ_i.PLQ + tl_i.LNQ_i.PLNQ + tm_i.ER.PWMZ_i.M_i) + ty.Y + COTH + TRDM$ $TRF = trep.(PLQ.UNEMPQ + PLNQ.UNEMPNQ) + PCINDEX.TRO$ $PCINDEX^t = \frac{\sum_{i=1}^{2}(1+tc_i^t).PD_i^t.C_i^0}{\sum_{i=1}^{2}(1+tc_i^0).PD_i^0.C_i^0}$ t =0,1 GBUD= $TAXR - TRF - PCINDEX.SG$ where SG denote the real savings by the government. We assume that the government maximizes a

<table>
<tr><td>- The calibration of the parameters.</td><td>Cobb-Douglas utility function :
$U(CG_1, CG_2, KG, LG) = CG_1^{\alpha CG_1}.CG_2^{\alpha CG_2}.KG^{\alpha KG}.LGQ^{\alpha LGQ}.LQGNQ^{\alpha LGNQ}$
with :
$\alpha CG_1 + \alpha CG_2 + \alpha KG + \alpha LGQ + \alpha LGNQ = 1$
$\alpha CG_i = P_i^0.CG_i^0/(TAXR^0 - TRF^0 - PCINDEX^0.SG^0)$
$\alpha KG = PK^0.KG^0/(TAXR^0 - TRF^0 - PCINDEX^0.SG^0)$
$\alpha LGQ = PLQ^0.LGQ^0/(TAXR^0 - TRF^0 - PCINDEX^0.SG^0)$
$\alpha LGNQ = PLNQ^0.LGNQ^0/(TAXR^0 - TRF^0 - PCINDEX^0.SG^0)$</td></tr>
<tr><td>Market clearing
In the benchmark equilibrium all prices are equal to one, except the import prices in local currency, because of the presence of tariffs.</td><td>$K_1 + K_2 + KG = KS$
$LQ_1 + LQ_2 + LGQ = LSQ - UNEMPQ$
$LNQ_1 + LNQ_2 + LGNQ = LSNQ - UNEMPNQ$
$X_1 = io_{11}.XD_1 + io_{12}.XD_2 + C_1 + CG_1 + I_1$
$X_2 = io_{22}.XD_2 + io_{21}.XD_1 + C_2 + CG_2 + I_2$</td></tr>
<tr><td>The Trade balance equilibrium
with : SF is the Foreign Savings. TKRDM are capital income paid to ROW. TRDMH are transfers to household by ROW and TRDM are transfers to government by ROW.

- We adopt the classical closure rule of the model where the investment is not exogenous, it adjusts to the total savings available from the following relationship:</td><td>$\sum_{i=1}^{2} PWMZ_i.M_i + TKRDM + FDIO = \sum_{i=1}^{2} PWEZ_i.E_i + TRDMH + TRDM + FDII + SF$

$S = SH + PCINDEX.SG + ER.SF + SE(sec1) + SE(sec2)$</td></tr>
<tr><td>Elasticities</td><td>
<table>
<tr><th></th><th>commodity1 C_1</th><th>commodity2 C_2</th></tr>
<tr><td>Income elasticity LES-CES : $\boldsymbol{\sigma_{C_{i/Y}}}$</td><td>0.75</td><td>1.25</td></tr>
<tr><td>CES elasticity : $\boldsymbol{\sigma F_i}$</td><td>0.7</td><td>1.1</td></tr>
<tr><td>CES elasticity : $\boldsymbol{\sigma C_i}$</td><td>0.4</td><td>0.6</td></tr>
<tr><td>CET elasticity : $\boldsymbol{\sigma T_i}$</td><td>4</td><td>3</td></tr>
<tr><td>Armington elasticity : $\boldsymbol{\sigma A_i}$</td><td>3</td><td>4</td></tr>
</table>
Source : Yapaudjian et al. (2003), Decreux et al. (2003)
</td></tr>
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