Monetary Integration and the Nontradable Sector

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Abstract:

This paper investigates the mechanisms behind the accumulation of current account deficits in the Euro area periphery since the single currency's inception. It describes the dynamics of the nontradable sector following monetary integration. It then analyzes both the role of monetary and incomplete market integration on the allocation of abundant capital flows from abroad in this sector. Building a model of a small borrowing economy, I show how monetary integration fueled capital inflows in the periphery and how this capital was endogenoulsy allocated in the nontradable sector. The economy includes both a tradable and a nontradable sector, the nontradable sector being characterized by monopolistic competition whereas the tradable sector is perfectly competitive. Two mechanisms are at play to explain the allocation of capital: a demand-boom with higher tradable goods consumption sustained through imports since nontradable goods must be produced domestically; and lower real borrowing costs in the nontradable sector –the more so that rents are increasing in this sector relative to the tradable one. This capital allocation resulted in an hypertrophy of the nontradable sector through an increase in its relative output and employment. It boosted aggregate output growth and triggered a real currency appreciation that deteriorated the current account deficit.

Keywords: current account deficits, monetary integration, nontradable sector, two-sector model, Euro area.
JEL classification: E32, F15, F32, F36, F45

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Contents

1. Introduction

Greece, Ireland, Portugal and Spain have accumulated large current account deficits since the Euro's inception (Table 1). First interpreted as good imbalances, current account deficits were supposed to reflect a catch-up and convergence process of the poorest countries of the area[1]. The single currency was expected to make balance of payments irrelevant between the member states[2]. As a result, private leverage was overlooked in the governance of the area and only fiscal deficits were subject to a surveillance. This view was called into question in the aftermath of the 2008-2009 recession. The crisis revealed the importance of private indebtedness and its link with public debt, this 'doom loop' was a powerful driver of the Eurozone's subsequent crisis (Hale and Obstfeld, 2014). Greece, Ireland, Italy, Portugal and Spain, faced 'sudden stops' (Merler and Pisani-Ferry, 2012) and were forced to adjust sharply in a context of low growth and low inflation. The idea that current accounts deficits reflected a convergence process was challenged (Eichengreen, 2010).

Debates emerged to reassess the mechanisms behind the accumulation of current account deficits in the Euro area periphery. Diverging price and wage inflation between the core and the periphery were pointed out as key factors. Between 1999 and 2007, countries running the largest deficits were the ones facing the biggest increases in Unit Labor Costs (ULC, Table 1). These evolutions did not result from a Balassa-Samuelson effect[3]: productivity levels did not converge appreciably in the tradable sector across countries (Estrada et al., 2013). They reflected diverging evolutions between nontradable and tradable sectors: whereas prices converged in the tradable sector across countries[4], prices did not converge in the nontradable sectors. There had been substantial relative inflation differentials in some countries between the two sectors, and these patterns explain most of the divergence in price inflation across countries.

In this paper, I further investigate the mechanisms behind the accumulation of current account deficits in the periphery. I first show stylized facts supporting the idea of an hypertrophy of the nontradable sectors relative to the tradable sectors in the Euro area periphery. Then, building on a model of a small open economy, I show that the endogenous allocation of imported capital had a strong impact on the sectoral allocation of labor and output, and on the real developments in the nontradable sector. Capital inflows had effects similar to a Dutch disease[5] and the sudden stop arising in 2010 revealed the solvency issue associated with it.

The impact of EMU on the global pattern of gross international financial flows is well documented (Hale and Obstfeld, 2014): the compression of bond spreads in the Euro area periphery following

[1] In their seminal paper of 2002, Blanchard and Giavazzi showed that financial integration and lower interest rates along with goods markets integration were supposed to lead both to a decrease in saving and an increase in investment in poorer countries, and so, to large current account deficits. Deficits reflected the first stage of convergence and were supposed to be reduced as countries converged.

[2] Ingram pointed out in 1973 that "the traditional concept of a deficit or a surplus in a member nation's balance of payments becomes 'blurred'" (Ingram, 1973, p.15).

[3] The Balassa-Samuelson effect states that, assuming the law of one price holds for tradable goods, productivity growth in this sector pushes real wages up both in the tradable sector and in the nontradable one. This results in an increase in the relative price of nontradable goods and thus in a real-exchange rate appreciation.

[4] Price differentials substantially decreased in the tradable sectors across the Euro area, see ECB (2006); Martin and Méjean (2008); Estrada et al. (2013).

[5] The Dutch disease relates to the lowering relative price of tradable goods, inducing a shift of productive factors to the nontraded sector, thereby reducing the size of the country's traditional export sector. This problem was called the "Dutch disease" with reference to the decline of the manufacturing sector in the Netherlands after the discovery of a large natural gas field, and was first analyzed by Corden and Neary (1982).

Table 1 – Current accounts, unit labor costs, house price indices and domestic credit, 2007/1999.

	Current accounts in % of GDP, p.p.	Unit labor costs, nominal, %	House price index, real, %	Domestic credit to private sector, %
Germany	8.4	-1.0	-18.9	-11.0
Portugal	-1.2	17.4	-2.9	48.5
Italy	-2.2	16.8	36.9	29.2
France	-3.8	12.5	65.4	92.7
Ireland	-6.3	28.1	58.3	95.7
Spain	-6.7	21.4	48.1	51.2
Greece	-9.1	19.4	50.9	23.2

Source: author's calculations using AMECO, Eurostat and OECD.

monetary integration and the ascending phase of the global financial cycle (Rey, 2013) led to a substantial increase in private leverage in the peripheral countries. Taking the form of a credit boom (Table 1), intermediated by the countries in the core Euro area (Hale and Obstfeld, 2014; Waysand et al., 2010), these capital inflows were mainly allocated to the nontradable sector (Giavazzi and Spaventa, 2010).

I model the effects of this capital allocation on sectoral dynamics, and show that it led to an hyperthrophy of the nontradable sector and to a real appreciation. Giavazzi and Spaventa (2010) already showed that if a country borrows mainly to finance the production of nontradable goods, then the condition for the sustainability of external borrowing becomes more stringent. However, the authors do not model the allocation decision by which capital is invested in the nontradable sector. Few papers, to my knowledge, show what mechanisms could have been at play to explain the hypertrophy of the nontradable sector. Fagan and Gaspar (2007) show how capital inflows in the periphery fueled a demand boom. Sy (2014) shows how this consumption boom could have been emphasized by a relaxation of the credit constraint in the non-tradable sector of the periphery. A strand of the literature show that this demand boom fueled an increase in house prices and a degradation of current account deficits, both empirically (Geerolf and Grjebine, 2013, 2014), and theoretically (Ferrero, 2012). However, not all peripheral countries were concerned by a housing bubble (housing prices fell between 1999 and 2007 in Portugal, see Table 1). Moreover, these papers analyze the impact of monetary integration only on the consumption side and do not model impacts of capital flows on the production side. Reis (2013), studying the case of Portugal, suggests that capital inflows in the country were misallocated within the nontradable sector due to financial frictions, lowering this sector productivity, and leading the economy into a slump. More recently, Kalantzis (2015) shows how –in a small open economy– an increase in financial openness resulting in capital inflows can be followed by an increase in the relative size of the nontradable sector, and increase the financial fragility of the economy.

I depart from the previous analyses in two ways: I study the impact of reduced interest rates following monetary integration on both the demand and supply sides; and I suggest that capital inflows in the nontradable sectos were not only fueled by monetary integration but also by an incomplete market integration. Indeed, as European integration fostered market integration in the goods sector, strong differences in regulations in the services sectors remained. As a result, nontradable sectors

enjoyed –on average– higher and increasing markups and profit margins relatively to the tradable sectors[6]. These differences seem to have contributed to maintain persistent inflation differentials across countries (Bénassy-Quéré and Coulibaly, 2014).

Using an intertemporal model of the balance of payment with two key ingredients, I suggest a new explanation for the endogenous allocation of capital inflows in the nontradable sectors of the peripheral countries. First, the economy comprises both a tradable and a nontradable sector. Second, the nontradable sector is characterized by a monopolistic competition whereas the tradable sector is perfectly competitive. Two mechanisms are at play to explain the allocation of capital after monetary integration: a demand-boom with higher tradable goods consumption sustained through imports since nontradable goods must be produced domestically; and lower real borrowing costs in the nontradable sector. Incomplete market integration reinforced the latter mechanism: by increasing the markup in the nontradable sector relatively to the tradable sector (see Figure 2), market integration in the tradable sectors fueled an increase in relative (nontradale to tradable) prices and thereby reinforced the decrease in real borrowing costs in the nontradable sector. As a result, the interest rate fell by 2 p.p. more in terms of nontradables than in terms of tradables over 1999-2007 in peripheral countries (see Table 2). Abundant capital flows were allocated to the nontradable sector, fueling its hypertrophy through increased employment and output, to the expense of the tradable sector. It drove a real exchange rate appreciation and significantly deteriorated current account deficits.

The remainder of the paper is divided into two sections. Section 2 shows the hypertrophy of non-tradable sectors in the Euro area periphery between 1999 and 2007 using a new database allowing to compare trade in goods and services and national accounts data at a sectoral level. Section 3 develops the theoretical framework to analyze the impact of both monetary and incomplete market integration on structural change and sectoral dynamics in peripheral economies.

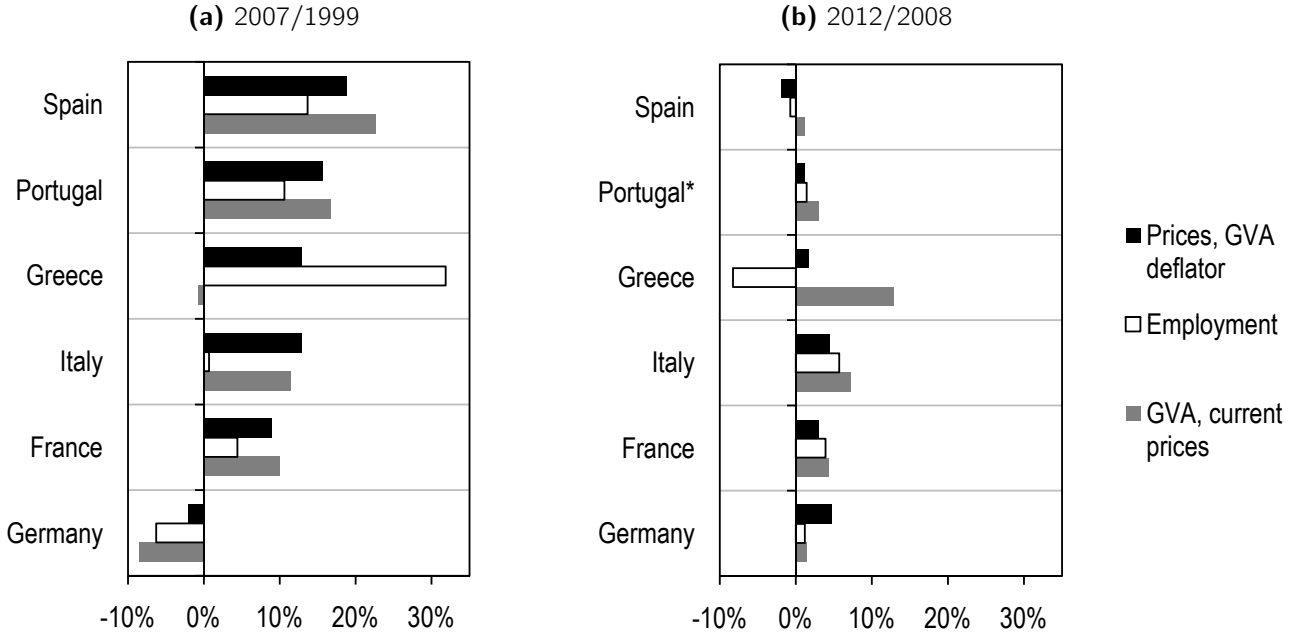
2. Stylized Facts: The evolution of tradable and nontradable sectors in the Euro area

Figure 1 describes the evolution of the nontradable sector (N) relative to the tradable sector (T), for 6 countries of the Euro area, for two subperiods (2007/1999 and 2009-2012), using three indicators: gross value added (GVA) at current prices, employment and prices (GVA deflators). Details on the database used and the definitions of the tradable and nontradable sectors are given in Appendix 1. The Figure for the 1999-2007 period highlights the similar pattern in all peripheral countries: the hypertrophy of the nontradable sector. The three indicators increased sharply in the nontradable sector relative to the tradable sector in Spain, Portugal and Greece –at the exception of the GVA. The rise in relative prices and the growing share of the nontradable sector led to a strong rise in overall prices and wages.

However, strong heterogeneities remain among the periphery. As noted by Giavazzi and Spaventa (2010), relative GVA in Greece did not rise as much as employment over 1999/2007. The fast expansion of the non-traded sector relatively to the tradable sector in Greece was mainly led by

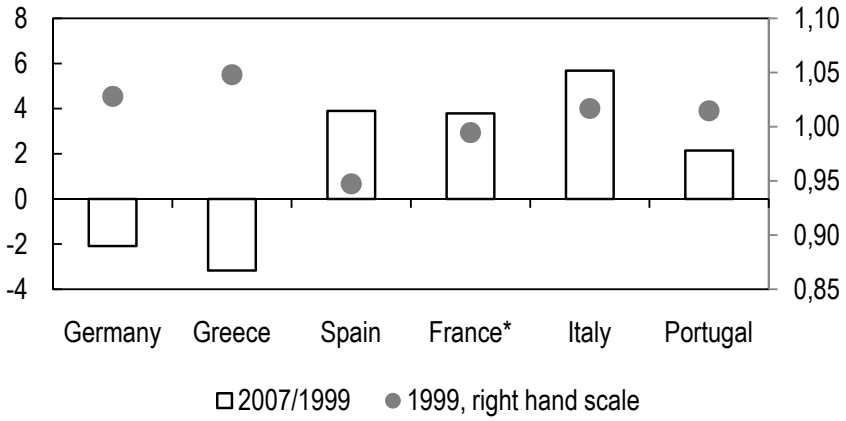
[6] In a Speech given at the Annual Hyman P. Minsky Conference on April 10, 2014, Peter Praet –Member of the Executive Board of the ECB– already stated that the incomplete market integration in goods and services, and a general lack of competitive processes in the nontradable sector, allowed some firms in so-called catching-up economies to extract excessive rents and distort capital allocation.

Figure 1 – Evolution of gross value added, employment and prices in the nontradable sector relative to the tradable sector, 2007/1999 and 2012/2008.



Source: author's calculations using Eurostat, BACI and IMF Balance of Payments and STAN data.*2011/2008 for Portugal

Figure 2 – Relative markups, level 1999 and growth rates 2007/1999.



*level in 2000 and growth rate 2007/2000 for France. Markups are proxied by net profit margins.
Source: author's calculations using Eurostat, BACI and IMF Balance of Payments and STAN data.

an increase in employment in real-estate activities (+173%) and education activities (+50%). In Portugal, the nontradable sector GVA expansion was led by the expansion of infrastructure activities (water supply, sewerage, waste management and remediation activities, +105%) and by the expansion of the finance and insurance sector (+85%). However, neither sector contributed

Table 2 – Long-term interest rates, 1992-1999 and 1999-2007.

	Average of nominal annual rates, 1992-1998, %	Average of nominal annual rates, 1999-2007, %	Variations, real, in terms of tradables, in p.p.	Variations, real, in terms of nontradables, in p.p.*
Germany	6.9	4.3	-2.5	-2.2
Ireland	7.8	4.4	-3.4	
Greece	16.8	4.8	-12.0	-13.0
Spain	9.9	4.4	-5.5	-7.7
France	7.3	4.4	-2.9	-4.0
Italy	10.6	4.6	-6.0	-7.6
Portugal	10.6	4.5	-6.1	-8.2

* Variations corrected by the GVA deflator of the nontradable sector relative to the tradable sector.
Source: author's calculations using AMECO, OECD, Eurostat, BACI and IMF Balance of Payments and STAN data.

to an increase in employment (resp. +1% and -7%), and employment was mainly driven by the tradable sector (and more particularly by administrative and support service activities, +34%). In Spain, the construction boom was the main contributor to rising imbalances: there was a strong increase in both GVA and employment in the construction sector (resp. +109% and +178%) and in real estate activities (resp. +70% and +135%). But the expansion of the nontradable sector was also fueled by a steep increase in the share of finance and insurance activities in total GVA, as well as health related activities. Italy and France seem to have some similarities with the three previous countries, but to a lesser extent. Indeed, both countries were concerned with an increase in both the GVA and employment in the housing sector (contruction and real estate activities) as well as the finance and insurance sector. Finally, in Germany, it is the tradable administrative and support service activities which met the strongest increase in both GVA and employment over the period. Employment fell in 7 out of 12 nontradable sectors, and GVA decreased in the construction sector over the period.

Few authors already suggested that the drift of the nontradable sector relative to the tradable sector between 1999-2007 was fostered by decreasing nominal long-term interest rates (Table 2). Spain, for example, saw its nominal interest rate fall by 5.5 p.p. while its (N/T) relative price increased by more than 20% and its relative GVA by more than 25% over 1999-2007. However, even though Greece faced a 12 p.p. fall in its nominal interest rate, its (N/T) relative GVA did not increase. Only relative employment increased steeply. Indeed, Greece was the only country in the periphery where the (N/T) relative markup fell between 1999 and 2007 (see Figure 2). The evolution of markups seem to play –with changes in nominal interest rate– a significant role in explaining heterogeneities in the behaviour of the nontradable sector relative to the tradable sector across EA countries.

The evolution of the nontradable sector relative to the tradable sector seems to be well correlated with current account deficits: countries facing the steepest increase in the relative price have the largest deficits over 1999-2007. Since capital inflows did not serve to expand the export sectors, deficits were then unsustainable (Kalantzis, 2015): they reflected a high private leverage with a

limited productive capacity of exportable goods and services. When facing sudden stops, countries were forced to adjust and reallocate their factors of production to the tradable sector in order to produce the export surpluses necessary to reimburse foreign liabilities. Relative prices decreased, and output and employment were reallocated to the tradable sector. These adjustments happened at a high social cost. In Spain, in particular, the bust of the housing bubble resulted in a steep increase in unemployment. Wages fell by 16% in Greece, 5% in Ireland, remained stable in Portugal and slowed down in Spain between 2008 and 2012. Only in Greece the GVA in the nontradable sector increased more than in the tradable sector during this period (see Figure 1).

3. The model: a three-period, two-sector, small open borrowing economy

I build on the framework by Obstfeld and Rogoff (1996), who formalized the benchmark model of the intertemporal approach to analyze the behavior of the current account. My goal is to study both the impact of monetary integration and market structures on the sectoral allocation of resources and on the behavior of the current account. I depart from the traditional model in several ways to adapt it to the questions I address.

As in Gregorio et al. (1994), and building on the literature formalized by Balassa (1964) and Samuelson (1964), I consider that the economy is composed of two sectors: the tradable sector (T), and the nontradable sector (N). However, I assume that, whereas the tradable sector is perfectly competitive and takes its price from the world market, the nontradable sector is characterized by a monopolistic competition similar to Dixit and Stiglitz (1977).

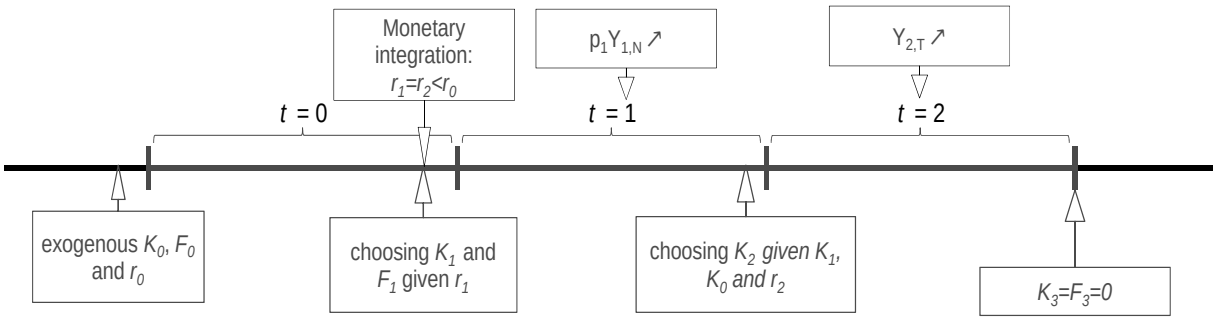
The economy is inhabited by a representative household who consumes, works, owns firms and borrows foreign assets. Production takes place using two inputs: capital and labor, so firms hire labor and make investment decisions. I assume that labor is mobile between sectors but not internationally, and capital is mobile between sectors and countries. Capital must be put in place on period in advance for production. Capital can be accumulated through investment, and output cannot be produced without capital. There is no economy-wide resource constraint for capital: resources can always be borrowed abroad and turned into domestic capital.

I consider a small borrowing economy, *i.e.* a country dependent on external financing like Giavazzi and Spaventa (2010). I make the simplifying assumption that the country's initial level of domestic capital K_0 is entirely financed by external debt F_0. Borrowing and lending take place *via* one period foreign risk-free bonds. Let F_t be the value of the bonds borrowed at the end of the period $t-1$ at the exogenous interest rate r_t (a negative F means a positive asset holding) and used for the production of goods in period t, $(1+r_t)F_t$ should be reimbursed at the end of period t.

In order to resolve the model analytically and give the main intuitions, I make the simplifying assumption that the economy lasts for three periods ($t = 0, 1, 2$), as in Blanchard (2007). It is obviously impossible to discuss borrowing in a two-period set-up: repayment would take place in the second period in any case. In period $t = 0$, the economy starts with an exogenous stock of domestic capital K_0 and foreign debt F_0 (with $K_0 = F_0$). Monetary integration happens in $t = 1$ and the interest rate decreases permanently, so $r_1 = r_2 < r_0$. This decrease is anticipated in the end of $t = 0$ so as to determine the new levels of capital and foreign liabilities for $t = 1, 2$. Following this monetary integration, the economy borrows more to finance an increase in nontradable production in $t = 1$. In $t = 2$, however, the country must produce the export surpluses necessary to reimburse foreign liabilities acquired previously. So as people do not wish to carry capital past the terminal

period and since the intertemporal current account must be balanced, in $t = 2$ the levels of domestic capital K_2 and foreign debt F_2 depend on their previous levels in periods $t = 0, 1$. The terminal period $t = 2$ is similar to an endowment economy since the levels of capital and debt are predetermined by their previous levels.

Figure 3 – Time frame



3.1. The setup

3.1.1. Households

The representative household derives utility in date t ($t = 0, 1, 2$) from the consumption of the tradable and nontradable goods, respectively $C_{t,T}$ and $C_{t,N}$:

$$\max_{\{C_{t,T},C_{t,N}\}_{t=0,1,2}} \bar{V} = \sum_{t=0}^{2} \beta^t In(C_{t,T}^{\gamma} C_{t,N}^{1-\gamma}) \tag{1}$$

Let the bar denote intertemporal variables. β is the time-preference factor ($\beta \in]0, 1[$) and γ the share of tradable goods in household's total consumption in each period ($\gamma \in]0, 1[$).

The consumer maximizes his utility subject to his budget constraint, expressed in terms of tradables:

$$\sum_{t=0}^{2} R_t \left(C_{t,T} + p_t C_{t,N}\right) = \bar{C}_T + \bar{C}_N = \bar{E} \tag{2}$$

where $\bar{E}$ represents the household intertemporal income in units of tradables, and p_t the price of nontradable goods in units of tradable goods at time t. R_t is the market discount factor for date t consumption. With r the interest rate in terms of the tradable good, we have:

$$R_t = \prod_{\upsilon=0}^{t} \frac{1 + r_0}{1 + r_\upsilon}$$

The representative household is endowed with a fixed supply of labor L_t, normalized to one unit in each period, which he sells at a competitive wage ω_t. He receives dividends from the firms

he owns, d_t. Dividends in time t consist in production minus labor costs and investment ($d_t = Y_t - \omega_t L_t - \Delta K_{t+1}$)[7]. Finally, the household borrows F_{t+1} at the end of the period t and must reimburse F_t borrowed previously at the exogenous interest rate r_t (a negative F means a positive asset holding). Therefore, his intertemporal income must equalize the present discounted value of his human and financial wealth:

$$\bar{E} = \sum_{t=0}^{2} R_t \left[\omega_s L_t + d_t + F_{t+1} - (1 + r_t)F_t\right] \tag{3}$$

We derive the first order conditions which yield the intratemporal allocation of real consumption:

$$\frac{C_{t,T}}{p_t C_{t,N}} = \frac{\gamma}{1-\gamma} \tag{4a}$$

and the intertemporal Euler condition on consumption:

$$\frac{C_{t+1,T}}{C_{t,T}} = \frac{p_{t+1}C_{t+1,N}}{p_t C_{t,N}} = \beta(1 + r_{t+1}) \tag{4b}$$

Using the first order conditions (4a) and (4a), and replacing in equation (2) we get that consumption in each sector is a fraction of total income:

$$C_{t,T} = \gamma C_t = \gamma \Omega_t \bar{E}, \quad p_t C_{t,N} = (1-\gamma)C_t = (1-\gamma)\Omega_t \bar{E} \tag{5}$$

with $\Omega_t = \frac{\beta^t}{(1+\beta+\beta^2)R_t}$.

Nontradable goods consumption In each period, all nontradable production is consumed so that: $Y_{s,N} = C_{s,N}$. Nontradable goods consist of differentiated varieties i, each being produced by a different monopolistically competitive local firm. There are m such firms. Denoting by $C_{i,t,N}$ the consumption of variety i in period t, the composite consumption of the non tradable good is:

$$C_{t,N} = \left(m^{\frac{-1}{\sigma}} \sum_{i=1}^{m} (C_{i,t,N})^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}} \tag{6}$$

with $\sigma > 1$, the elasticity of substitution between nontraded varieties. Given the level of nontradable consumption, we have:

$$p_t = \left(\frac{1}{m} \sum_{i=1}^{m} p_i^{1-\sigma} \right)^{\frac{1}{1-\sigma}} \tag{7}$$

where p_t is the aggregate price of the nontradable good and $p_{i,t}$ the price of variety i, each one relative to the tradable good, and given at time t. The consumption of each variety is given by:

$$C_{i,t,N} = (1-\gamma)\Omega_t \frac{\bar{E}}{m p_t} \left(\frac{p_{i_t}}{p_t} \right)^{-\sigma} \tag{8}$$

[7]Profits are different from dividends and consist in production minus labor and capital costs: $\pi_t = Y_t - \omega_t L_t - r_t K_t$.

3.1.2. Firms

As explained earlier, production takes place using two inputs: capital (mobile internationally and between sectors) and labor (mobile between sectors but not internationally). Labor mobility insures that workers earn the same wage in either sector. Because capital is internationally mobile, ressources can always be borrowed and turned into domestic capital. Whereas the economy does not face any borrowing limit, the supply of labor is constrained by the amount the representative household can provide:

$$L_{t,T} + L_{t,N} = L_t = 1 \tag{9}$$

$$K_{t,T} + K_{t,N} = K_t \tag{10}$$

I consider that the nontradable sector is more intensive in labor than the tradable sector[8]. The traded good acts a the numeraire, and nominal wages are determined by the equilibrium in the tradable sector. Prices are determined in the nontradable sector and depend on markups[9]. Markups are considered as exogenous and evolve according to product market regulations, as in Blanchard and Giavazzi (2003).

Tradable sector

I assume that the market for tradable goods is integrated and follows the law of one price so that the small country is a price taker. I postulate a single firm, with a Cobb Douglas production function of the form: $Y_T = A_T K_T^{\alpha_T} L_T^{(1-\alpha_T)}$, with $0 < \alpha_T < 1$. The firm maximises the dividends it will then redistribute to shareholders (production minus labor costs and investment):

$$\max_{\{K_{t,T}, L_{t,T}\}_{t=0,1,2}} \bar{d_T} = \sum_{t=0}^{2} R_t \Big(Y_{t,T} - \omega_t L_{t,T} - \Delta K_{t+1,T} \Big) \tag{11}$$

First order conditions equate marginal products of labor and capital to the current wage and interest rate respectively, and yield the capital-to-labor ratio as a function of the wage and the rate of interest:

$$\frac{K_{t,T}}{L_{t,T}} = \frac{\alpha_T}{1-\alpha_T} \frac{\omega_t}{r_t} \tag{12}$$

We can easily deduce the shares of capital and labor in the income generated in the sector, and we get:

$$Y_{t,T} = \omega_t L_{t,T} + r_t K_{t,T} \tag{13}$$

Plugging (13) into the expression for dividends (11), we get that the intertemporal value of the firm, the present discounted value of dividends, equates return on the initial investment:

$$\bar{d_T} = \sum_{t=0}^{2} R_t \Big(Y_{t,T} - \omega_t L_{t,T} - \Delta K_{t+1,T} \Big) = (1 + r_0) K_{0,T} \tag{14}$$

[8] ECB (2006) shows that services sectors are less capital intensive than the manufacturing sectors in the Euro area in the beggining of the 2000s. Moreover, Southern European countries tend to be characterized by an average firm size smaller than the Euro area aggregate, and have a larger share of self-employment in the services sectors, making this sector even more labor intensive than in the rest of the EA.

[9] This markup is relative (N/T) as the tradable sector acts as a numeraire.

Since r_t is exogenous (full capital mobility), combining first order conditions yields the equation for wages:

$$\omega_t = r_t^{-\frac{\alpha_T}{1-\alpha_T}} A_T^{\frac{1}{1-\alpha_T}} \alpha_T^{\frac{\alpha_T}{1-\alpha_T}} (1-\alpha_T) \tag{15}$$

Nontradable sector

In the nontradable sector, there are m varieties and firms under monopolistic competition. Each firm takes wages ω and the interest rate r as given and does not take into account the spillover effects on prices charged by other companies. Each firm i maximizes the present discounted value of its dividends:

$$\max_{\{K_{i,t,N}, L_{i,t,N}\}_{t=0,1,2}} \bar{d}_{i,N} = \sum_{t=0}^{2} R_t \Big(p_{i,t} Y_{i,t,N} - \omega_t L_{i,t,N} - \Delta K_{i,t+1,N} \Big) \tag{16}$$

subject to equation (8) and given that firm i faces a Cobb Douglas production function of the form: $Y_{i,t,N} = A_N K_{i,t,N}^{\alpha_N} L_{i,t,N}^{(1-\alpha_N)}$, with $0 < \alpha_N < 1$.

Given that all firms face the same profit-maximisation problem, we get that the capital-to-labor ratio depends on the wage-to-rental ratio and on the intensity of each factor in this sector as in the tradable sector:

$$\frac{K_{i,t,N}}{L_{i,t,N}} = \frac{\alpha_N}{1-\alpha_N} \frac{\omega_t}{r_t} \tag{17}$$

We can easily deduce the shares of capital and labor in the income generated in the sector, and we get:

$$p_t Y_{i,t,N} = \frac{\sigma}{\sigma - 1} (\omega_t L_{i,t,N} + r_t K_{i,t,N}) \tag{18}$$

Plugging (18) in the expression for dividends (16), we get that the intertemporal value of the firm, the present discounted value of dividends, equate return on the initial investment plus rents, with rents being a fraction $\frac{1}{\sigma}$ of nontradable intertemporal output:

$$\begin{aligned} \bar{d}_{i,N} &= \sum_{t=0}^{2} R_t \Big(p_t Y_{i,t,N} - \omega_t L_{i,t,N} - \Delta K_{i,t+1,N} \Big) \\ \bar{d}_{i,N} &= (1+r_0) K_{i,0,N} + \frac{1}{\sigma} \bar{Y_{i,N}} \end{aligned} \tag{19}$$

with $\bar{Y}_{i,N} = \sum_{t=0}^{2} R_t p_t Y_{i,t,N}$, intertemporal output produced by firm i in the nontradable sector.

As r_t is exogenous and ω_t is determined in the tradable sector, we deduce the common equilibrium price for each variety as a function of r_t and ω_t:

$$p_{i,t} = p_t = \frac{\sigma}{\sigma - 1} \frac{1}{A_N} \left(\frac{\omega_t}{1-\alpha_N} \right)^{(1-\alpha_N)} \left(\frac{r_t}{\alpha_N} \right)^{\alpha_N} \tag{20}$$

The relative price of nontradable goods depend on the markup applied in the nontraded sector, the sector's productivity, the interest rate and capital intensity of the nontradable sector, wages (determined in the tradable sector) and labor intensity in the non-traded sector.

3.1.3. Current account and capital accumulation

In each period, the nontradable market clearing requires that $C_{t,N} = Y_{t,N}$. The Current Account (CA) is thus composed of the excess of tradable output over consumption, investment and the interest the country must pay on foreign assets acquired previously:

$$CA_t = -(F_{t+1} - F_t) = Y_{t,T} - C_{t,T} - I_t - r_t F_t \tag{21}$$

The intertemporal current account must be balanced, and since $F_3 = 0$ and $K_3 = 0$, we get that:

$$\bar{Y_T} = \bar{C_T} + (1 + r_0)F_0 \tag{22}$$

Implying that intertemporal output of the tradable sector must cover intertemporal consumption of the tradable sector and the cost of the initial debt the country holds.

3.2. Equilibrium

In equilibrium, wages are determined in the tradable sector and depend on the interest rate and the tradable sector productivity and capital intensity:

$$\omega_t = r_t^{-\frac{\alpha_T}{1-\alpha_T}} A_T^{\frac{1}{1-\alpha_T}} \alpha_T^{\frac{\alpha_T}{1-\alpha_T}} (1 - \alpha_T) \tag{23}$$

Replacing wages using equation (15) in the pricing condition given in equation (20), we get:

$$\begin{aligned} p_t &= \frac{\sigma}{\sigma - 1} \frac{1}{A_N} \left(\frac{\omega_t}{1 - \alpha_N} \right)^{(1-\alpha_N)} \left(\frac{r_t}{\alpha_N} \right)^{\alpha_N} \\ &= r_t^{\frac{\alpha_N - \alpha_T}{1-\alpha_T}} \frac{\sigma}{\sigma - 1} \frac{A_T^{\frac{1-\alpha_N}{1-\alpha_T}}}{A_N} \left(\frac{1 - \alpha_T}{1 - \alpha_N} \right)^{1-\alpha_N} \alpha_T^{\frac{\alpha_T(1-\alpha_N)}{1-\alpha_T}} \alpha_N^{-\alpha_N} \end{aligned} \tag{24}$$

Nontradable relative prices depend on the rate of interest, on the tradable and nontradable sector productivities and capital intensities and on competition in the nontradable sector.

Using equation (3), we see that intertemporal income depend on the representative household labor income and on his financial wealth:

$$\bar{E} = \sum_{t=0}^{2} R_t \left(\omega_t L_t + d_t + \Delta F_{t+1} - r_t F_t \right)$$

The intertemporal foreign asset accumulation is constrained by the intertemporal current account constraint. Using equations (14) and (19), we get that the intertemporal value of the firm equates return on the initial investment plus the profit margin in the nontradable sector. Profit margin in the nontradable sector are a function of nontradable output, which depend on nontradable consumption and given (5), depend on intertemporal income ($\bar{Y_N} = \bar{C_N} = (1 - \gamma)\bar{E}$). Replacing in equation (3), we get:

$$\begin{aligned} \bar{E} &= \sum_{s=0}^{2} R_s \omega_s + \frac{1}{\sigma} \bar{Y_N} + (1 + r_0)(K_0 - F_0) \\ \bar{E} &= \frac{\sigma}{\sigma - (1 - \gamma)} \left[\sum_{s=0}^{2} R_s \omega_s(r_s) + (1 + r_0)(K_0 - F_0) \right] \end{aligned} \tag{25}$$

The intertemporal income thus depends on the elasticity of substitution within non-traded varieties and between tradable and nontradable goods, on wages and the initial level of domestic capital and debt.

The composition of nominal consumption remains stable over time:

$$\frac{C_{t,T}}{p_t(r_t)C_{t,N}} = \frac{\bar{C_T}}{\bar{C_N}} = \frac{\gamma}{1-\gamma} \tag{26}$$

Consumption evolves depending on β and the interest rate:

$$\frac{C_{t+1,T}}{C_{t,T}} = \frac{p_{t+1}C_{t+1,N}}{p_t C_{t,N}} = \beta(1+r_t) \tag{27}$$

Given that nontradable output is entirely consumed, and nontradable consumption depends on intertemporal income $\bar{Y_N} = \bar{C_N} = (1-\gamma)\bar{E}$, replacing $\bar{Y_T}$ using equation (22), we get the mix of intertemporal nominal output as a function of γ and the ratio of the cost of initial debt to intertemporal income:

$$\frac{\bar{Y_T}}{\bar{Y_N}} = \frac{\bar{C_T} + r_0 F_0}{\bar{C_N}} = \frac{\gamma}{1-\gamma} + \frac{r_0 F_0}{(1-\gamma)\bar{E}} \tag{28}$$

The bigger the cost of the initial debt $r_0 F_0$, the stronger the constraint on the intertemporal output mix and on the share of the traded intertemporal output.

The composition of nominal output changes over time, and depends on the allocation of capital:

$$\frac{Y_{t,T}}{p_t Y_{t,N}} = \frac{\sigma-1}{\sigma}\frac{\alpha_N}{\alpha_T}\frac{K_{t,T}}{K_{t,N}} \tag{29}$$

and the allocation of capital depends on the relative cost of factors of production and on consumption preferences (see Appendix 2 for a detailled resolution of the model):

$$\frac{K_{t,T}}{K_{t,N}} = \frac{\alpha_T}{\alpha_N(1-\alpha_T)}\left[\frac{\sigma}{\sigma-1}\underbrace{\frac{\omega_t}{p_t}}_{\text{cost effect}}\overbrace{\frac{1}{C_{t,N}}}^{\text{demand effect}} - (1-\alpha_N)\right] \tag{30}$$

3.3. Monetary integration and sectoral dynamics

I assume that, before $t = 0$, only goods markets are integrated and the country can import capital at a high rate of interest. The representative household optimizes his future behavior in beginning of $t = 0$ given the initial levels of K_0, financed by F_0 at the cost r_0. Financial integration happens in the end of $t = 0$ and leads to an exogenous decrease in r perceived as a permanent decrease ($r_1 = r_2 = r < r_0$).

Using equation (23), we can see that the interest rate fall is matched by a permanent wage increase ($\omega_1 = \omega_2 = \omega > \omega_0$). Because the nontradable sector is more intensive in labor than the tradable sector ($\alpha_N - \alpha_T < 0$), prices of nontradables relative to tradables also increase permanently ($p_1 = p_2 = p < p_0$).

The permanent fall in r results in an increase in the representative household intertemporal income expressed in terms of tradables. Indeed, equation (25) shows that this intertemporal income depends on the representative household labor income and on the country initial level of domestic capital and debt. As we have d that $K_0 = F_0$ for simplicity, we get that the representative household intertemporal income only depends on his labor income and on the elasticity within nontraded varieties and between nontradable and tradable goods. So as wages increase[10], the intertemporal income increases following a fall in r.

As intertemporal income rises, intertemporal consumption rises, and the composition of nominal consumption remains stable over time given the constant preferences. However, as stated already, the relative price of nontradable increase so the real consumption mix changes: tradable consumption increases more than nontradable consumption in real terms. The fall in r also increases the utility of present consumption so consumption will increase more in $t = 1$ than in $t = 2$.

The composition of intertemporal output expressed in terms of tradables depends on the burden the initial level of debt weights on the economy, as well as on consumption preferences (see equation 28). The increase in intertemporal income decreases the burden of initial debt weights on the mix of gross national income. The bigger the cost of the initial debt $r_0 F_0$, the stronger the constraint on the intertemporal output mix and on the share of the traded intertemporal output, the stronger the reallocation of intertemporal output towards the nontradable sector.

The dynamics of tradable to nontradable consumption and output is also sensitive to the fall in the interest rate, and the consumption and output mix vary in each period depending on how capital is allocated. Two mechanisms are at play (see equation 30):

- *a demand effect* stemming from the demand boom. Indeed, the demand boom results in a shift factors of production from the nontradable to the tradable sector since higher tradable goods consumption can be sustained through imports but nontradable goods must be produced domestically.
- *a cost effect* resulting from the fact that the increase in the relative price decreases the real cost of both capital and labor in the nontradable sector relatively to the tradable one. As a result, demand for capital in the nontradable sector increases, so does labor and output, at the expense of the tradable sector.

The decrease in the cost of capital leads firms to employ more capital relative to labor for production. Labor supply is normalized to one, and cannot decrease, so the country will use more capital for production in $t = 1$ and $t = 2$. The rise in domestic capital is financed by increasing imports of foreign assets. If domestic capital and foreign debt are predetermined, firms cannot use more capital for production at the time of the shock, even though its marginal price decreased. As a result, the marginal price of labor overshoots, and so does the relative price. The cost effect is thus more important if the shock is unticipated or if the capital mobility is imperfect.

In the second period, the country must produce enough tradables to reimburse foreign assets acquired previously. Therefore, output, labor and capital reallocate in the tradable sector to comply with the constraint on the intertemporal current account. The bigger the decrease in r, the stronger the reallocations in both periods, the most stringent the constraint on the current account in period $t = 2$.

[10] $\omega = \omega_1 = \omega_2 > \omega_0$ and $\sigma > (1 - \gamma)$ since $\sigma > 1$ and $\gamma \in]0, 1[$. As a result, $\frac{d\bar{E}}{dr}$ is negative.

To conclude, the decrease in the interest rate r leads to an increase in wages and, provided nontradables are relatively labor intensive, an increase in the relative prices of nontradables. As the interest rate in terms of nontradables decreases more than that of tradables, capital flows to the nontradable sector and labor follows as the nontradable sector is more labor intensive. This increase in wages drives the intertemporal income of the representative agent up, rising the consumption of nontradable output–and so its production– and rising also the consumption of tradable output. Thus, the relative output in the nontradable sector increases in the first period, the relative output of the tradable sector shrinks, and the current account deteriorates. However, in the second period, as the constraint on the intertemporal current account is binding, the economy must produce the excess of tradables sufficient to reimburse the excess of capital imported in the previous period. Therefore, factors flow back to the tradable sector, and the relative output of the nontradable sector shrinks.

3.4. Structural reforms and the sectoral allocation of resources

As in Blanchard and Giavazzi (2003), I consider that increases in σ may reflect any policy aiming at increasing competition in the nontradable sector (deregulations of real estate markets for example), and thus a growing substituability between nontraded goods.

Suppose the government increases competition in the nontradable sector, leading to an increase in σ. Relative nontradable markups decrease as a result, the profit margin redistributed to shareholders shrinks, and the representative household intertemporal income is reduced (see equation 25). The decrease in markup leads to a decrease in relative prices (see equation 24), and makes the nontradable sector less attractive to invest in. However, the decrease in the relative price of nontradable goods boosts the real consumption of nontraded varieties (see equation 26). Therefore, deregulations in the nontradable sector will increase the volume of the nontradable sector (labor and capital) but decrease its nominal output and relative price. The overall effect on the current account will thus be small.

If deregulations in the nontradable sector are driven simultaneoulsy to financial deregulation, the demand boom and output growth consecutive to lowered interest rates will be smaller. The hypertrophy of the nontradable sector will occur through an increase in employment and capital relative to the tradable sector, and less through an increase in its nominal output or relative price. Nominal output is more equally distributed between the tradable and nontradable sector, smoothing the structural change induced by monetary integration, and lowering the chance of putting the sustainability of the current account at risk.

4. Quantitative analysis

4.1. An extended version of the model

The previous section described the common dynamics of all peripheral economies after the Euro's inception with the analytical resolution of a simple three-period model. This section explores the model further in three ways: testing whether the equilibrium holds in a richer setup, detailing the role of the market structure of the nontradable sectors, and investigating whether the model can replicate the heterogeneity across peripheral countries (*work in progress*).

4.1.1. A more realistic setup

To do so, the model must be embedded in a richer set-up. First, I consider the model in infinite horizon. To ensure the stationarity of the model and the independence of its dynamics from the initial conditions, I consider that the interest rate the country faces is debt elastic as suggested in Schmitt-Grohe and Uribe (2003). The representative household programme is still modeled as in the simple set-up of Section 3. However, the interest rate x_t he now faces is increasing in the level of foreign debt he contracted. Specifically, x_t is given by:

$$x_t = r_t + \chi\left(e^{(F-\bar{F})} - 1\right)$$

where r_t denotes the exogenous world interest rate, and $\chi_t\left(e^{(F-\tilde{F})} - 1\right)$ is a country-specific interest rate premium, with χ_t being a parameter representing financial frictions and $\tilde{F}$ the steady state level of the country aggregate net foreign liabilities. This premium is null in steady state. I assume that firms in both sectors face convex capital adjustment costs, and capital depreciates at the rate δ. The capital adjustment costs are of the following form:

$$\frac{\phi}{2}K_{t,z}\left(\frac{I_{t,z}}{K_{t,z}} - \delta\right)^2$$

with ϕ being a constant parameter and $z = T, N$. This cost can be deducted from the dividend function of firms in each sector. A detailed description of this extended deterministic model is given in Appendix 3.

4.1.2. Calibration

The model is calibrated so as to reproduce best the evolutions in the Euro area between 1999 and 2007. Simulations are performed using Dynare. The time period is set to one year. The calibration of the model's parameters is reported in Table 3. Most of the parameters are standard in the business cycles' literature.

The two exogenous variables are the interest rate r and the markup in the nontradable sector. I set the initial interest rate such as to obtain an annualized nominal interest rate of 10% which matches the average nominal interest rate for peripheral countries over 1992-1998. I consider a relative markup of 1.25 as suggested by estimates of Christopoulou and Vermeulen (2012), corresponding to an elasticity of substitution within nontraded goods of $\sigma = 5$. I set $\beta = \frac{1}{1+r}$. I set the share of traded goods in aggregate consumption to 50% ($\gamma = 0.5$), and I set the capital intensity of the tradable sector at 43% and the capital intensity of the nontradable sector at 40%, in line with the estimates from my dataset. I consider that both sectors have the same productivity ($A_T = A_N$). I calibrate χ, a measure of financial frictions, so as to reproduce the average increase in net foreign assets observed in the EA between 1999 and 2007 after a 6p.p. decrease in the interest rate, it results in $\chi = 0.11$. Finally, the coefficient of installation costs ϕ is set to 1 following the discussion in Sim et al. (2010).

4.2. Simulations

Figure 4 illustrates the transitory dynamics after a permanent fall in the interest rate (black line), a permanent fall in markup (i.e. increase in σ, the elasticity of susbtitution within nontraded varieties,

Table 3 – Calibration

Parameter	Value
Financial frictions	$\chi = 0.11$
Discount factor	$\beta = \frac{1}{(1+\tilde{r})} \approx 91\%$
Share of T goods in consumption	$\gamma = 0.5$
Technology	$A = A_T = A_N$
Capital share in the T sector	$\alpha_T = 0.43$
Capital share in the N sector	$\alpha_N = 0.40$
Depreciation rate of capital	$\delta = 0.15$
Installation cost of capital	$\phi = 1$
Steady state investment (% of GDP)	$\tilde{I} = 23$
Steady state net foreign assets (% of GDP)	$\tilde{F} = 20$
Steady state current account (% of GDP)	$\tilde{CA} = 0$
Steady state interest rate	$\tilde{r} = 10\%$
Steady state relative markup	$\frac{\tilde{\sigma}}{\tilde{\sigma}-1} = 1.25$

black dashed line) and combined permanent shocks: a cut in the interest rate with an increased markup (green line); a cut in the interest rate with an increased markup (green dotted line). The figures confirm the analytical results demonstrated earlier.

A permanent decrease of 6 p.p. in the interest rate (black line) is matched by a 6% increase in the relative price, and a fall of more than 5% in the real interest rate in the nontradable sector relative to the tradable sector. As a result, capital flows to the nontradable sector, labor follows and relative employment increases of about 18% the first years of the shock. The current account deteriorates of less than 15 points of GDP, and GDP increases of about 3%. Before reaching back its steady state, the economy must produce the amount of tradables sufficient to reimburse the excess of foreign assets acquired previously (i.e. the net foreign assets in excess to their steady state level of 20% of GDP), and the relative nominal output decreases a little less than 5 years after the shock. The current account stabilizes around 10 years after the shock.

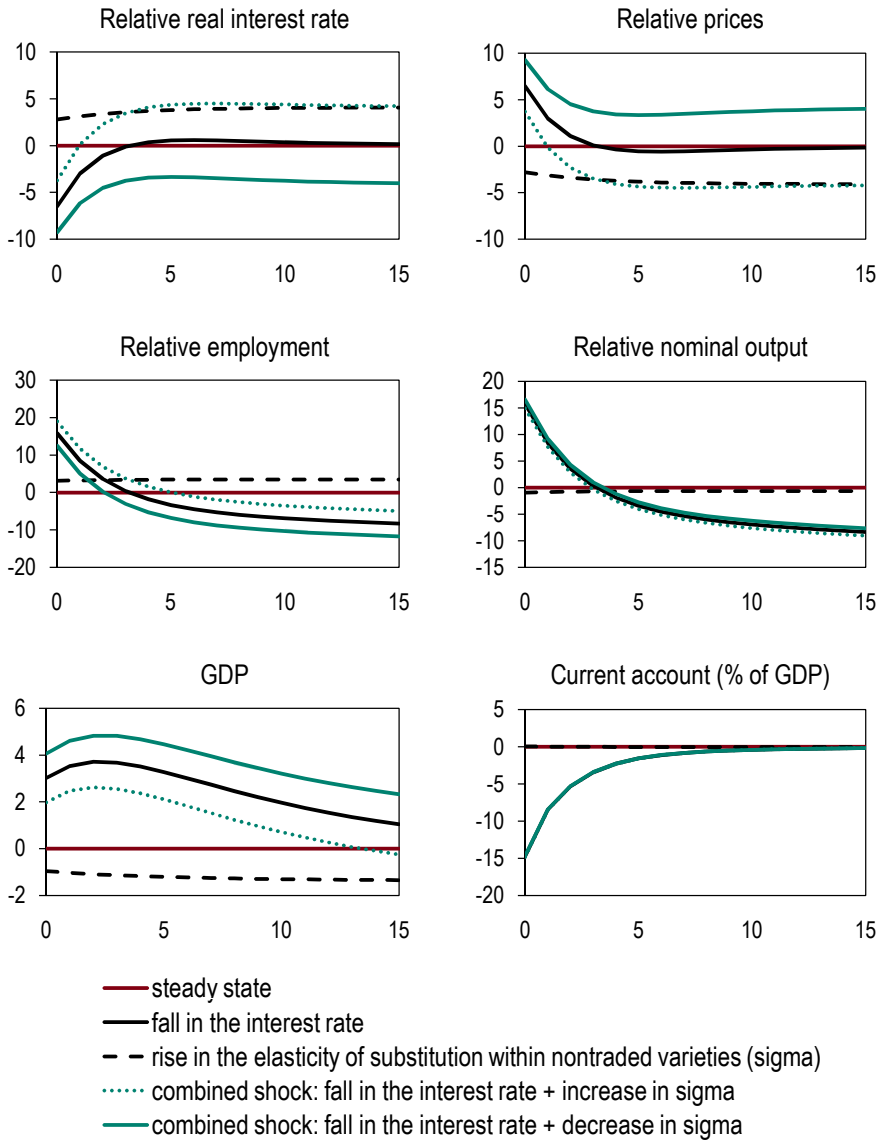
A permanent decrease of 4% in the markup in the nontradable sector (black dashed line) is matched by a 3% decrease in the relative price, and an increase of more than 3% in the real interest rate in the nontradable sector relative to the tradable sector. However, cheaper nontradable goods boosts their real consumption. As a result, employment increases in the nontradable sector, of about 2%, and nominal output as well as the current account remain stable. Profits redistributed to shareholders shrink, and the representative household intertemporal income (GDP) is reduced.

If deregulations in the nontradable sector are driven simultaneoulsy to financial deregulation (dotted green line), the demand boom and output growth consecutive to lowered interest rates will be smaller than if the markup had remained stable. The hypertrophy of the nontradable sector occurs more through an increase in employment and less through an increase in its nominal output or relative price than if only the interest rate had changed. Nominal output is more equally distributed between the tradable and nontradable sector, smoothing the structural change induced by monetary

integration. However, the current account still deteriorates by about 15 p.p.

Finally, if markups in the nontradable sector increase simultaneoulsy to financial deregulation (green line), the demand boom and output growth will be even bigger than if the markup had remained stable. The relative price will increase by around 10%, the real relative interest rate fall by more than 9%. The hypertrophy of the nontradable sector occurs more through an increase in prices and nominal output than through an increase in employment.

Figure 4 – Simulations: permanent cut in the interest rate, permanent change in markup, and combined shocks



Note: relative variables represent evolutions in the nontradable sector relative to the tradable sector. y-axis: deviations from steady state, in p.p. for the interest rate and the current account and in % for other variables. x-axis: number of years after the shock.
The change in sigma corresponds roughly to a change of 4% in the markup. The cut in the interest rate is of 6 p.p.

5. Conclusion

Wage and price divergence between the "core" and the "periphery" in the Euro area were pointed out as key factors of the macroeconomic divergence between both group of countries in the aftermath of the financial crisis of 2008. I suggest in this paper, using a simple model of an intertemporal current account, that the asymmetric shock facing the periphery was indeed caused by monetary and incomplete market integration. The hypertrophy of the nontradable sector resulted from: lowered nominal interest rate in the Euro area periphery, which attracted massive capital inflows and contributed to the real currency appreciation; incomplete market integration also contributed to distort the allocation of these capital inflows. Indeed, as European integration fostered market integration in the goods sector, strong differences in regulations in the services sectors remained. As a result, nontradable sectors enjoyed increasing markups and profit margins compared to the tradable sectors in the 2000s in the Euro area. I also show that it was lowered nominal interest rates which mostly contributed to the accumulation of current account deficits, and product market regulations have only a small impact on the current account. Thereby, since the 2008 financial crisis, in the EA periphery, increased interest rates seemed to be the major contributor to internal rebalancing. But labor reallocation happens at a high social cost as the nontradable sector is more labor intensive than the tradable sector.

These findings raise questions for future research, particularly to what extent variations in markups can explain the heterogeneity of the evolutions of the nontradable sectors across EA countries. One could also ask what is the cost of sectoral reallocations, and the welfare impact of monetary integration and product market regulations, would full labor mobility in the EA help to smooth the adjustments? Finally, these theoretical findings should be tested empirically, in particular, looking at whether variations in markups are a good determinant of capital misallocation using firm-level data.

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