The political economy of twin deficits and wage setting centralization

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Abstract

I provide a political economy model to explain why among developed countries the ones with more centralized wage bargaining system tend to have lower deficits in the external and fiscal balances (the twin-deficits). I demonstrate that more centralized wage bargaining reduces the government’s political incentive (cost) to deteriorate (reform) the external balance through the fiscal balance. The mechanism is as follows: an increase in the two balances leads to the Dutch disease symptoms: real appreciation of the currency, loss in competitiveness of tradable sector and an increase (a decline) in the real wage in the non-tradable (tradable) sector. The opposite happens if the government improves the two balances. Thus, N-sector workers relatively support (oppose) more a rise (reform) in the two deficits. Centralization of wage bargaining moderates the effects on the sectoral wages by reducing the responsiveness of sectoral wage with respect to sectoral prices. Thus, the more centralized is the wage determination, the less N-sector workers support (oppose) a rise (reform) in the two deficits. Relying on the majority rule, it will be argued that the policy maker follows the preferences of the N-sector workers (who constitute the majority in developed countries). Correspondingly, the government in an economy with relatively higher degree of wage centralization has less political incentive to widen the two deficits and more political support for improving the two balances.

Keywords: Wage bargaining Centralization, twin deficits, current account imbalances, Dutch disease, Search and Match, Real Exchange rate.

JEL-Classification: F32, E62, J31, J51, J6, F41.

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1 Introduction

Global current account imbalances have been the focal points of interest for policymakers during the last decade, especially after the financial crisis in 2007/2008. Since the boost in financial globalization in 90’s, the capital has been internationally flowing uphill from the emerging to the industrial economies (Prasad et al. (2007)). In other words, the negative current account in the industrial economies as a whole has been financed by the impressive current account surplus in the emerging economies, notably the fast growing East Asian economies and the oil-producing countries (saving glut).\textsuperscript{1} This is despite the fact that the latter group of countries have relatively less capital per worker (Lucas paradox). Researches in this area have tried to explain this paradox by some prominent features of the developed countries, e.g.: property right (Tornell and Velasco (1992)), institutional quality (Ca’Zorzi et al. (2009), Alfaro et al. (2008)) and technological and human capital level (Lucas (1990)).

However the pattern of current account (and the response to global saving glut) is not homogeneous among the developed countries. While some countries like U.S., U.K., Ireland and, to a lesser extend, France and Canada have long-term deficit in their current account, other countries such as Germany, Netherlands, Nordic countries and Belgium have experienced a surplus. In fact, while many papers have studied the external imbalances between developed and developing countries, there have been much less effort to shed light on the external imbalances among the industrial economies.

Contrasting developed economies with surplus in their external balances (Netherlands, Germany, Belgium and Nordic countries) against those with deficit (U.S., U.K., Australia, Canada and etc.), one can not distinguish significant difference between the two groups in terms of political stability, institutional arrangement, financial openness and etc. Some studies identify (i) GDP growth, (ii) demographic variables, (iii) initial net foreign asset to GDP ratio and (iv)fiscal balance as the main explanatory factors for external imbalances among the developed countries. Higher GDP growth implies higher consumption and investment which results in deficit in the current account (e.g. Obstfeld and Rogoff (2001)).\textsuperscript{2}

\textsuperscript{1}See Bernanke et al. (2007) and Clarida (2005)
\textsuperscript{2}Barnes et al. (2010) assert GDP growth does not seem to be explanatory for most of the developed countries. For example, inside the Euro-zone, some countries such as Portugal have continued to run high deficits but only achieved disappointing growth rates. Countries such as Spain and Ireland have experienced high growth and large deficits but only on the back of property and construction booms that proved unsustainable. Therefore, it remains a puzzle why investors should prefer to invest on these unsustainable booms rather than investing on other stable economies like Germany and Netherlands which run current account surpluses far above historical norms.
Demographic variables also proxies national savings, as a higher share of the economically inactive dependent population reduces national saving and decreases the current account balance (e.g., Higgins (1998)). Initial Net Foreign Assets (NFA) can have either positive or negative effect on the current account balance. It can deteriorate, as countries with relatively high NFA can afford to have trade deficits for extended periods, or it can improve, as economies with high NFA experience higher net foreign income flows. According to standard open economy macroeconomic models, the second effect usually dominates (e.g. Decressin and Stavrev (2009)). Finally, fiscal balance captures the effect of national savings: higher government budget balance increases the national saving and so the current account balance (Gruber and Kamin (2007); Salvatore (2006); Decressin and Stavrev (2009); Nickel and Vansteenkiste (2008)).

Among all these explanatory variables, the focus of this paper is on fiscal balance. Fiscal balance is perhaps one of the most direct instruments for the governments to manage the external balance (Chinn and Ito (2007)). The strong linkage between the two balances is known as the twin deficits. The twin deficits can be more important during a recession when governments implement fiscal policy to boost the economy. Expansion in government expenditure during a recession is not usually financed by tax, but by issuing public bonds. This leads to a rise in interest rate and, hence, to capital inflow and deficit in external balance.

The experience of US from 2001 to 2004 is a remarkable example of the twin deficits. Starting from 2001, Bush administration increased the government expenditure while decreasing the tax. These lead to a deficit in fiscal balance from -1.3 in 2000 to negative -4.1 (as percentage of GDP) in 2005. In the same period, the current account dropped from -3.7 to -5.7 (as percentage of GDP). Over half of the financing of the U.S. current account from 2001 to 2005 was accounted for by accumulation of dollars and U.S. Treasury securities by foreign central banks. This implies that "large proportion of capital flowing to the country takes place in the form of purchases of its government securities and not purchases of American stocks or direct investment in its factories" (Chinn (2005)).

The importance of the twin deficits in the pattern of current account imbalances among developed countries has been stressed in several theoretical and empirical literature. Nevertheless, there has been no attempt to explain why among developed countries, some countries manifest more symptoms of the twin deficits compared to the others. Data suggests that the developed economies with more centralized wage bargaining system tend to have relatively
lower deficits in the two balances. This paper provides a theoretical framework to explain this observation through a political economy point of view (majority rule) and by focusing on the Dutch disease phenomenon as a direct impact of the twin deficits. This theoretical framework incorporates three notions and mechanisms: (i) The Dutch disease impact of the twin deficits and its associated appreciation of the real exchange rate which lead to an inter-sectoral wage dispersion and, therefore, to different evaluations of the households who are affiliated to different sectors about the twin deficits (ii) Centralization of wage bargaining which changes the sectoral policy evaluation through its impact on the responsiveness of sectoral wages to sectoral prices. (iii) Political economy framework which aggregates the preferred policy of the households. In the following paragraphs, I will explain theses mechanisms more precisely.

While, the Dutch disease consequence of running the twin deficits has been mentioned in the literature, less attention has been paid to its political economy consequences through its associated re-distributional impact. Widening the deficit in fiscal and external balances leads to a real appreciation of the currency. i.e. an increase in the relative price of the non-tradable sector (henceforth the N-sector) to the tradable (henceforth the T-sector) products. If labor market is frictional, a real appreciation of currency results in a rise (decline) in real wage of workers in the N-sector (T-sector). Thus, fiscal expansion, when financed by external debt, provides workers in the N-sector with more public goods and higher wages. But, it provides the T-sector workers to enjoy higher provision of public goods only with the cost of a lower wage income (and so less private consumption). The contrary holds when the government attempts to correct the current account deficit by a contractionary fiscal policy. In this case, workers in the N-sector will suffer from a lower public good provision and, at the same time, from a lower wage (because of depreciation in the real exchange rate). The T-sector workers, however, will experience a decline in public good provision but, at the same time, they enjoy a higher private consumption. Consequently, affiliation to different sectors can induce the workers to have different evaluations about the twin deficits: Workers in N-sector relatively support more the twin deficits and they oppose more a reform in the two balances.

As explained in the last paragraph, the impact of the twin-deficit policy on the real exchange rate and, hence, on inter-sectoral relative wages initiates different policy preferences among the households in different sectors/industries. One of the structural characteristics of an economy that can influence the responsiveness of sectoral wages to a change in real exchange rate and, hence, the households policy preferences is the centralization of wage

\textsuperscript{3}Stylized facts are reported in section 2
bargaining. According to the existing literature, the wage disparity stems from two factors: (i) skill differentials among the workers (skill-based wage dispersion) and (ii) affiliation to different industries (industry-based wage dispersion). On the one hand, the workers in the same industry/firm may receive different wages due to their different individual efficiencies/skills. On the other hand, empirical papers have shown that after controlling for individual skills/efficiencies and job conditions, there is a persistent wage differential among the workers who are affiliated to different industries/sectors (Krueger and Summers (1988)). Centralization of wage bargaining tends to go hand-in-hand with lower overall wage dispersion in both senses. In this paper, I will show that centralization of wage bargaining can influence the preferences of the households belonging to different industries, by compressing the industry-based and skill-based wage dispersions.

Industry-based wage dispersion can be influenced by centralization of wage bargaining. Rycx (2002), Kahn (1998), Blau and Kahn (1999), Edin and Zetterberg (1992) show that among developed countries, the ones with more centralized wage bargaining system intend to have lower inter-sectoral wage dispersion (after controlling for workers skills and job conditions). Holmlund and Zetterberg (1991), Hartog et al. (2002) and Teulings and Hartog (1998) having the same result, conclude that industry wages in more decentralized countries are more responsive to sectoral prices and productivity changes. By contrast, industry wages in more wage-centralized economies (Nordic countries for example) are largely unaffected by sectoral conditions. In this sense, when a shock in external balance, and so in inter-sectoral relative prices (real exchange rate), is realized, the induced inter-sectoral wage dispersion is less if the wage setting system is more centralized. For example, if a government deteriorates the external balance by increasing its fiscal balance, the wage rise (decline) in relatively non-tradable (tradable) industries/sectors would be lower if the wage bargaining system is more centralized. This impact leads to the convergence of the policy preferences of the households from different sectors/industries.

Skill-based wage dispersion is also affected by centralization of wage bargaining. More precisely, centralization of wage bargaining tends to decline the wage gap between the workers with different individual efficiencies (See Cahuc and Zylberberg (2004)). Among different sources of heterogeneity in individual efficiencies what plays role in this framework is the heterogeneity arisen from job seniority. Job-specific human capital (Becker (2009) and Pissarides (1994)) leads to a positive correlation between job seniority and individual efficiency.
and so between the former and wage (see for example Topel (1990)). Centralization of wage bargaining leads to compression of wage gap between more efficient/experienced workers and inefficient/inexperienced ones. Compression of the wage gap in this sense can also lead to a convergence of policy preferences of the workers affiliated to different sectors. The mechanism is as follows: A shock in inter-sectoral relative prices (real exchange rate) leads to a reallocation of workers from booming sectors to disadvantaged ones: workers in disadvantaged sector will find job in booming sector. New matched workers in booming sector have relatively lower job-specific human capital and, so lower wage, compared to the incumbent workers. Centralization of wage bargaining can diminish this wage gap between the two types of workers in favor of new-matched workers. Therefore, centralization of wage bargaining can increase the expected forth-coming wage of the workers in disadvantaged sectors. This impact is specially more important if the decrease in wage gap is through reallocation of rent from efficient/incumbent workers to inefficient/new workers in the same sector.

In summary, centralization of wage bargaining can lead to a convergence between the policy preferences of workers belonging to different sectors by reducing the industry-based wage differentials and skill-based wage differentials. In other words, it makes a widening of (a reform in) the twin deficits less attractive (costly) for the N-sector workers. In an opposite way, centralization of wage bargaining makes a widening of (a reform in) the twin deficits more attractive (costly) for the T-sector workers.

The heterogeneous impact of the twin deficits on sectoral wages provides a room for political economy to play a role in the determination of the twin deficits. One characteristic of developed countries is that more and increasing numbers of workers are engaged in the N-sector: specifically services and construction. For example, in 2014 service sector and construction sector constituted respectively more than 118 millions and 9.8 millions of employments in U.S., while manufacturing sector included only around 15 millions of employments. This shows that the majority of workers and households enjoy higher wage induced by appreciation of currency and only the minority of population suffer from the loss in the competitiveness of the economy. Therefore, one can expect a democratic government in an industrialized economy to follow the preferences of the households in the N-sector: Anti-reform with respect to the balances and pro-twin deficits. If this is the case, central-

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5The importance of job-specific human capital in the existence of fictional labor market is studied by Acemoglu and Pischke (1998).

6This reallocation is due to an increase (decline) in job vacancy in booming (disadvantaged) sector and also due to the effort of the workers in disadvantaged sectors to look for a job in the booming sector. In this paper I exclude from the latter by assuming no on-the-job-search.
ization of wage bargaining can make the twin deficits less attractive to policy makers and makes the reforms in the two balances less costly (from political economic point of view) to them.

This paper provides a theoretical framework to establish such linkage between wage centralization and political economy of the twin deficits. This potential link has not been studied in the literature, although the available data from developed countries can support it. I will consider a two-sector economy in which labor market is characterized by search and match friction. Centralization of wage bargaining reduces the industry-based wage differentials and the skill-based wage differentials. I demonstrate that the N-sector workers always support (oppose) relatively more widening (reforming) the two deficits. Besides, I will show that centralization of wage bargaining reduces the attractiveness (repulsion) of widening (reforming) policies for the N-sector workers. In the next step, I assume that policy is decided by incumbent workers in N-sector (majority rule is applied). All these together will imply that in economies with more centralized wage bargaining system, policy makers have less incentive to run the twin deficits. On the contrary, reform in the twin deficits is politically less costly for the governments in the countries in which the wage bargaining is more centralized.

The rest of the paper is organized as follows: section 2 provides stylized facts to manifest the relationship between the two balances and wage centralization. Section 3 establishes the model which consists of two sector: T-sector and N-sector with search and match friction in labor market. The general equilibrium of the model will be defined in this section. Section 4 investigates the impact of a shock in the government expenditure when it is financed by foreign resources. I will demonstrate how centralization of wage bargaining can alter the impact of the shock on the inter-temporal utility of the households belonging to different sectors. In section 5, the policy will be defined and it will be shown that workers belonging to different sectors have different policy preferences. Then, the effect of wage centralization on the households’ preferred policy will be studied. Using a political economy framework, I will show that centralization of wage bargaining decreases the government’s political incentive (cost) to widen (improve) the twin deficits. Finally, section 6 will conclude and discuss the policy implications of the model.

\footnote{In section 2, I will provide some stylized facts even though this paper does not include very deep empirical study.}
2 Stylized facts

In this section, I present stylized facts from developed countries to show that the countries with more centralized wage bargaining system tend to have less deficits in their two balances compared to ones with less degree of wage centralization. This paper argues that the governments in the economies with more centralized wage bargaining system have less political incentive to deteriorate the external balance through the fiscal deficit and they face less political cost to improve their current account by improving their budget balance. The main mechanism, as it is shown in the paper, is through the impact of wage centralization on diminishing the responsiveness of sectoral wages with respect to sectoral prices.

Empirical papers suggest that the most important factors for reducing the sectoral wage response to sectoral price are the level of wage bargaining and, to a lesser extend, the share of labor force which are covered by the collective bargaining agreements (see for example Wallerstein (1999)). For this reason, I use the Iverson index to measure the centralization of wage bargaining. This index takes into the account both level of wage setting and enforceability of bargaining agreements (Iversen (1998)).

Unfortunately, this index has been reported only for a few countries in long period. I found the data for Iverson index from AIAS.\(^8\) This data base provides yearly Iverson index for several developed countries from 1970 to 2012. Table 2 in Appendix B reports the decade averaged of the Iverson index for these countries during the last four decades. The rank orderings of countries according to different indices of wage centralization are reported in table 3. These rankings are induced by the indices suggested by the following papers: (i) Calmfors and Drifill (1988), (ii) Schmitter (1981), (iii) Cameron (1984), (iv) Blyth (1979) and (v) Bruno and Sachs (1985). The differences between the ranking induced by Iverson index and the other rankings in table 3 are minor.

In the following subsection, I present the long-term effect of wage centralization on the two balances by comparing the decade-averaged current account and budget balance of the countries of our sample (the countries reported in table 2) for the last two decades. In subsection 2.2, I show how the fiscal balance and the current account of developed countries with different level of wage centralization have responded to the 2007-8 financial crisis.

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2.1 Long term effect of wage centralization

In this subsection, I provides some stylized facts to show the impact of wage centralization on the long term values of the external balance and the budget balance. Figure 1 shows the long term relationship between the current account and the public budget. The vertical and horizontal axes in figure 1 represent respectively the average of current account (%GDP) and the average of budget balance (%GDP) for two periods of time: from 1990-2002 and from 2003-2013. Each point in the graph, represents a country of our sample in one of the two period. This figure verifies the positive correlation between the two balances as implied by the twin deficits.

![Figure 1: Current account (% GDP) vs. budget balance (% GDP).](image)

Figure 2 shows the long term relationship between the budget deficit and the Iverson index. The vertical and horizontal axis represent the average of budget balance (%GDP) and the Iverson index in the same periods as before and for the same countries, respectively. The figure suggests that among developed countries, the ones with higher degree of wage centralization tend to have less deficit in their budget balance.

Figure 3 show the long term relation between the current account (%GDP) and the degree of wage centralization. The vertical and horizontal axis represent the average of the current account (as percentage of GDP) and the Iverson index for the same countries in the same periods, respectively. This figure suggests that in long term, the countries with higher degree of wage centralization have less deficit in the their external balances. Therefore, the available data from developed countries provides that centralization of wage bargaining tends to decrease the twin deficits. In this next subsection, I provide some facts to show how the two balances in developed countries with different levels of wage centralization react.
2.2 Short term effect of wage centralization

During 2008 crisis, the global economy experienced a convergences in global current account imbalances: less deficit in indebted countries and less surplus in lenders. In other words, the countries with more negative current account in the years leading to the crisis improve their external balances after the crisis, while the economies with initially more balanced external account have experienced a decline in their current account. Figure 4 represents this convergence pattern. In figure 4, the vertical axis represents the change in CA (% GDP): the average of CA (%GDP) between 2009 and 2011 minus the average of CA (%GDP) between
2004 and 2007. The horizontal axis is the current account (% GDP) in 2007. Each point refers to a country of our sample. The slope is negative which implies that the countries with more negative current account in 2007 improve their external balances while the economies with initially more balanced external account have shown a decline in their current account.

Figure 4: The convergence pattern of external balances among the developed economies during the financial crisis.

This might seem violating the prediction of this study since the main borrowers (countries with mode deficit in their external balances) in the years leading to the crisis are either very decentralized (US and UK), or less centralized (Australia and Spain) compared to the other countries in our sample. On the contrary, the lenders in that period of time are the ones with wage centralized system (Germany, Netherlands, Belgium, Nordic countries, Austria). But a deeper insight nullifies this doubt.

Following Alfaro et al. (2008), we decompose capital flows into public and private components. So doing, we can observe that all developed countries faced an increase in their budget deficits. However, the magnitude of widening in fiscal deficit has not been identical among these countries: the governments in indebted economies (which are more decentralized) have increased relatively more their budget deficit compared to their counterparts with less initial deficits in their both deficits (these are the the countries with more centralized wage bargaining system).

Consequently, the former group of countries have widened their public debt more than the latter group. We can observe this fact in figure 5. The vertical axis in figure 5 represents the change in the four-year average of budget balance (% GDP) just before and after
the financial crisis. In other words, the vertical axis is the average of the budget balance ($%GDP$) during the period of 2008-11 minus this average for the period between 2004 and 2007. The horizontal axis is the Iverson index. This figure suggests that the governments in relatively decentralized wage economies have widened their budget deficit more than their counterparts in relatively centralized wage economies. Consequently, as we can observe in figure 6, the public debt in the year following the financial crisis, has increased more in relatively decentralized wage economies. The vertical axis in figure 6 represents the change in public debt (in percentage of GDP) from 2007 to 2011. This result is also consistent with the predictions of this paper.
In these exercises, we have used the Iverson index to measure centralization of wage bargaining. Using Calmfors and Driffill index (Calmfors and Driffill (1988)) and Bruno and Sachs index (Bruno and Sachs (1985)) give the same conclusions. In the next sections, I introduce a political economy framework to explain these observations.

3 Model

In this section, I establish a dynamic general equilibrium model with two sectors: (i) tradable sector (henceforth, T-sector) and (ii) non-tradable sector (henceforth, N-sector). I assume an infinite number of households normalized to one. Each household supplies one unit of labor inelastically if he is employed. Labor is assumed to be the only factor of production in both sectors. The utility of the households depends on (i) private consumption \( (c_i) \) and (ii) public goods/services \( (G) \) provided by the government. The basket of private consumption and the provision of public good consist of final goods from the two sectors. Moreover, the government has commitment to pay unemployment benefit \( (b) \).

3.1 Labor market

In this subsection, I will present the labor market which is characterized by search and match friction. Each household is either unemployed or employed in one of the two sectors. If unemployed, he searches for a job in both sectors and he receives a constant and exogenous unemployment benefit \( (b) \). If employed, he earns the real wage of \( w_{\kappa,j} \) which depends on his individual efficiency \( (\kappa) \) and his sector affiliation \( (j) \). When vacant, the firms in each sector search for workers with real cost \( (c) \). When the job is active and matched with a worker, the firms produce final goods and enjoy the profit. The matching process in each sector is governed by Cobb-Douglas function and depends on the unemployment rate \( (u) \) and the
number of vacancies in that sector \( (\nu_j) \):

\[
M_j = \phi \nu_j^{1-\alpha} u^\alpha \quad : \quad \text{for } j \in \{T, N\} \quad (1)
\]

where \( \phi \) in equation (1) is the efficiency of matching function. Equation (1) gives the number of matches in each sector and in each unit of time. Therefore, the probability that a vacant firm in sector \( j \) matches with a worker, \( (q_j) \), and the probability that an unemployed household can find a job in sector \( j \), \( (\rho_j) \), can be found by the following equations:

\[
q_j = \phi \left( \frac{u}{\nu_j} \right)^\alpha, \quad \rho_j = \phi \left( \frac{\nu_j}{u} \right)^{1-\alpha} \quad : \quad \text{for } j \in \{T, N\} \quad (2)
\]

In this model, the only source of heterogeneity in individual efficiency is the job-specific human capital (Becker (2009)). The accumulation of the job-specific human capital depends on the job seniority (through learning-by-doing and adoption process) and the investment of the employer on the job-specific skills of the workers (Acemoglu and Pischke (1998)).

In this paper for the sake of simplicity, I assume that new matched workers are always inefficient. The inefficient workers can become efficient in the next period with exogenous probability of \( \delta (< 1) \). The inefficiency loss associated to the low skilled workers is represented by exogenous parameter \( \lambda \) which is in real term. Therefore, \( \lambda \) is the productivity gap between the inefficient workers and the efficient ones belonging to the same sector. Moreover, in each period of time, an active job can be destroyed with the exogenous probability of \( \chi \).

Therefore, the evolution of the numbers of efficient and inefficient workers in each sector can be written by the following equations:

\[
n'_{e,j} = (1 - \chi)(n_{e,j} + \delta n_{o,j}) \quad , \quad n'_{o,j} = \rho_j u + (1 - \chi)(1 - \delta)n_{o,j} \quad (3)
\]

In equation (3), \( n_{e,j} \) and \( n_{o,j} \) represent the number of efficient and inefficient workers in sector \( j \) respectively. To open a vacancy and search for workers, the firms must pay the real cost \( c \). Therefore, the value function of opening a vacancy in sector \( j \) is:

\[
V_j = -c + \beta (q_j J'_{o,j} + (1 - q_j) V'_j) \quad (4)
\]

In equation (4), \( J'_{o,j} \) is the next period value function of the employer in sector \( j \) with

9Pissarides (1994) uses similar formulation to capture the impact of job seniority on the job-specific human capital.

10\( \lambda \) can be interpreted as fixed investment by employers to improve the job-specific efficiency of inefficient workers.

11Hereafter subscripts \( o \) and \( e \) refer to inefficient and efficient workers respectively.
inefficient worker and $\beta$ is the subjective discount rate of the households. This equation implies that new matched workers are always inefficient in the first period of their jobs. The value function of employers in sector $j$ with efficient and inefficient workers can be represented by the following equations:

$$J_{o,j} = \left(\frac{a_{j}P_j}{\bar{P}} - \lambda\right) - \omega_{o,j} + \beta E \left[(1 - \chi)(1 - \delta)J'_{o,j} + (1 - \chi)\delta J'_{e,j} + \chi V_{j}'\right]$$  \hspace{1cm} (5)

$$J_{e,j} = \frac{a_{j}P_j}{\bar{P}} - \omega_{e,j} + \beta E \left[(1 - \chi)J'_{e,j} + \chi V_{j}'\right]$$  \hspace{1cm} (6)

In (5) and (6), $a_{j}$ can be interpreted as the sector-specific technology level which is assumed to be given and constant. $P_j$ and $\bar{P}$ represent the price of the final goods in sector $j$ and the domestic price level respectively. $\omega_{\kappa,j}$ is the income wage of a worker in sector $j$ and with the individual efficiency of $\kappa(\in \{e, o\})$. Accordingly, the value functions of the workers in sector $j$ with the individual efficiency of $e$ and $o$ can be respectively written as follows:

$$W_{o,j} = \omega_{o,j} - \tau + \beta E \left[(1 - \chi)(1 - \delta)W_{o,j}' + (1 - \chi)\delta W_{e,j}' + \chi W_{u}'\right]$$  \hspace{1cm} (7)

$$W_{e,j} = \omega_{e,j} - \tau + \beta E \left[(1 - \chi)W_{e,j}' + \chi W_{u}'\right]$$  \hspace{1cm} (8)

where $W_{u}'$ is the next period value function of being unemployed. This value function can be found by the following equation:

$$W_{u} = b + \beta E \left[\rho TW_{o,T}' + \rho NW_{o,N}' + (1 - \rho T - \rho N)W_{u}'\right]$$  \hspace{1cm} (9)

Free entry condition implies that the value function of vacancy creation is zero:

$$V_{j} = 0 \Rightarrow J'_{o,j} = \frac{c}{\beta q_{j}}$$  \hspace{1cm} (10)

Now we can clarify an important feature of our labor market: wage determination.

### 3.1.1 Decentralized wage

In the first step, we derive the hypothetical decentralized wages ($\omega_{\kappa,j}^{d}$): The wage that the worker in sector $j$ with individual efficiency $\kappa$ would earn if the wage bargaining system was decentralized. Similar to Mortensen and Pissarides (1999a), Mortensen and Pissarides (1999b), Mortensen and Pissarides (1999c) and Pissarides (2000), the hypothetical decentralized wage is determined according to Nash bargaining between individual employer and
worker. We assume the bargaining power of workers to be \( \eta \). Therefore:

\[
W_{\kappa,j}^d - W_u = \frac{\eta}{1 - \eta} J_{\kappa,j}^d \quad \kappa \in \{e, o\}, j \in \{T, N\}
\]  

(11)

This leads us to the determination of decentralized wage bargaining which is standard in literature:

\[
\omega_{\kappa,j}^d = \eta \left( \frac{a_j P_j}{P} - x \lambda \right) + (1 - \eta) \left( \tau + b \right) + \eta \beta E \left[ \rho_T (W'_{o,T} - W'_{u}) + \rho_N (W'_{o,N} - W'_{u}) \right]
\]

(12)

For: \( \kappa \in \{e, o\} \quad j \in \{T, N\} \).

Where \( x = \begin{cases} 
1 & \text{if } \kappa = o. \\
0 & \text{if } \kappa = e. 
\end{cases} \)

Equation (12) implies that the decentralized wage in each sector is an increasing function of the price in that sector.

### 3.1.2 Centralized Wage determination

The important feature of the labor market in this paper is the centralization of wage bargaining. Here, the main role of the wage bargaining centralization is to compress the wage gap (i) between the workers with the same individual productivity who belong to different sectors and (ii) between the workers in the same sector but with different individual productivity.\(^{12}\) The impact of wage centralization on reducing the intersectoral wage gap has been studied by many papers (see for example: Rycx (2002); Kahn (1998); Blau and Kahn (1999); Edin and Zetterberg (1992)). Holmlund and Zetterberg (1991), Hartog et al. (2002) and Teulings and Hartog (1998) having the same result, concludes that industry wages in more decentralized countries are more responsive to sectoral prices and productivity changes. By contrast, industry wages in more centralized economies (Nordic countries for example) are largely unaffected by the sectoral conditions.

Following Calmfors and Driffill (1988) and others, I assume that the centralized wage is set by the bargaining between a labor union, representing the workers, and one employer association, representing the employers/shareholders. Another assumption, I impose here, is that the aggregate wage compensation paid to the employees is the same as the total wage that the whole workers would earn if they were to bargain for their wage individually with employers (decentralized case):

\(^{12}\)I will show that the first impact has the major role.
In equation (13), \( \omega_{\kappa,j} \) is the market wage set by the union for a worker with individual efficiency \( \kappa \) in sector \( j \). This equation implies that the centralization of wage bargaining will not affect the share of workers as a whole from the total economic rent. In other words, the only task of the wage centralization in this model, is to diminish the wage dispersion by transferring some rents from the high paid to the low paid workers and not from/to the employers.\(^{13}\)

As it is clear from equation (12), there are two sources for the gap among the hypothetical decentralized wages: (i) individual inefficiency gap between the workers in the same sector (\( \lambda \)) (ii) rent gap across the sectors which originates from the varying prices and the technologies differentials between the sectors (\( \frac{a_j P_j}{P} \)). Centralization can decrease the wage dispersion coming from these two sources. The motivation of the union to compress the wage gaps can be based on its egalitarian criteria or insuring the workers against the volatility in inter-sectoral prices and against possible exogenous job separations which destroy the accumulated job-specific human capital of the efficient workers.

To investigate, theoretically, that the reduction in which type of wage dispersion matters more in our framework, we distinguish them by two different measures: Hereafter \( \sigma^S \) will represent the weight that the union impose on reducing the wage gap between the workers with different individual efficiency in the same sector and \( \sigma^N \) will represent the weight it puts for reducing the wage dispersion for the workers with the same individual productivity but affiliated to different sectors. This will be more clear in the following paragraphs.

Similar to Boeri and Burda (2009),\(^{14}\) the wage rate for a worker in sector \( j \) with efficiency \( \kappa \) depends, on one hand, on the productivity of his job (which depends on his individual efficiency and his sector productivity) and, on the other hand, on some egalitarian criteria enforced by the union. The job productivity is embodied in the hypothetical decentralized wage \( \omega_{\kappa,j}^d \). Egalitarian criteria is embodied in \( \sigma^N \) and \( \sigma^S \): The former is the share of the

\(^{13}\)Calmfors and Driffill (1988) show that there is a hump-shaped relationship between the aggregate level of wage and the degree of wage centralization: The countries where the wage is decided in industry/sector level have higher level of aggregate wage compared to the countries where the wage determination is decentralized or is centralized in national level. The focus of this paper is just the impact of wage centralization on reducing the wage dispersion among the workers. To capture that we exclude the possible impact of wage centralization on the aggregate level of wage.

\(^{14}\)This paper is the most similar to our model in terms of definition and model of wage centralization.
hypothetical decentralized wage of the workers which is pooled between the workers with the same individual efficiency possibly employed in different sectors. The latter is the share of the workers’ hypothetical wage which is pooled between the workers in the same sector and possibly with different individual efficiency. Therefore, the wage assigned by the union to a worker with individual efficiency \( \kappa \) in sector \( j \) will be:

\[
\omega_{\kappa,j} = (1 - \sigma_N - \sigma_S)\omega^d_{\kappa,j} + \omega^N_{\kappa} + \omega^S_j \quad \kappa \in \{e, o\}, j \in \{T, N\}
\]  

(14)

Note that if \( \sigma_N = \sigma_S = 0 \), the union has no interest to reduce the wage gaps. Thus, the model will be reduced to the one with decentralized wage bargaining system where \( \omega^N_{\kappa} = \omega^S_j = 0 \) and \( \omega_{\kappa,j} = \omega^d_{\kappa,j} \). If \( \sigma_N = 1 \) (so \( \sigma_S = 0 \)), the workers with the same individual efficiency will have the same wage independent from their sector affiliation. On the contrary, if \( \sigma_S = 1 \), the workers in the same sector will have the same wage independent from their individual efficiency. But the workers in different sectors may have different wages.

Note that, as long as the wage parity among the workers with different individual efficiencies in the same sector matters, the union will decrease the wage gap between the workers with different individual efficiencies only by redistributing some rents from the efficient workers to the inefficient workers in the same sector. Similarly, to reduce the wage gap between the workers with the same individual efficiencies but in different sectors, union transfers some rents from workers with efficiency \( \kappa \) from booming sector to the workers with the same efficiency in the other sector. Therefore:

\[
(\sigma_N)(n_{\kappa,T}\omega^d_{\kappa,T} + n_{\kappa,N}\omega^d_{\kappa,N}) = (n_{\kappa,T} + n_{\kappa,N})\omega^N_{\kappa} \quad \kappa \in \{e, o\}
\]  

(15)

\[
(\sigma_S)(n_{e,j}\omega^d_{e,j} + n_{o,j}\omega^d_{o,j}) = (n_{e,j} + n_{o,j})\omega^S_j \quad j \in \{T, N\}
\]  

(16)

The LHS of equation (15) represents the share of the hypothetical decentralized wage of all workers with individual productivity \( \kappa \) which goes to the inter-sectoral pooling system. The RHS of this equation is the egalitarian wage which all these workers will receive from the pool. Similarly, the LHS of equation (16) represents the share of the hypothetical decentralized wage of all workers in sector \( j \) which goes to the intra-sectoral pooling system; whereas the RHS of this equation is the egalitarian wage which all these workers will receive from the pool. We can rewrite equations (15) and (16) as:
\[ \bar{\omega}^N_\kappa = \frac{\sigma (n_{\kappa,T} \omega_{\kappa,T} + n_{\kappa,N} \omega_{\kappa,N})}{n_{\kappa,T} + n_{\kappa,N}} \quad \kappa \in \{e, o\} \] (17)

\[ \bar{\omega}_j^S = \frac{\sigma (n_{e,j} \omega_{e,j}^d + n_{o,j} \omega_{o,j}^d)}{n_{e,j} + n_{o,j}} \quad j \in \{T, N\} \] (18)

Substituting \(\bar{\omega}^N_\kappa\) and \(\bar{\omega}_j^S\) from equations (17) and (18) into equation (14), and substituting for decentralized wages from equation (12), we will have:

\[ \omega_{e,j} = \omega_{e,j}^d + \sigma^N \eta \frac{n_{e,-j}}{n_{e,j} + n_{e,-j}} \left( \frac{a_{-j} P_{-j}}{P} - \frac{a_{j} P_{j}}{P} \right) - \sigma^S \frac{n_{o,j}}{n_{e,j} + n_{o,j}} \eta \lambda \quad j \in \{T, N\} \] (19)

\[ \omega_{o,j} = \omega_{o,j}^d + \sigma^N \eta \frac{n_{o,-j}}{n_{o,j} + n_{o,-j}} \left( \frac{a_{-j} P_{-j}}{P} - \frac{a_{j} P_{j}}{P} \right) + \sigma^S \frac{n_{e,j}}{n_{e,j} + n_{o,j}} \eta \lambda \quad j \in \{T, N\} \] (20)

If \(\sigma^N = \sigma^S = 0\), the model will be reduced to the decentralized scenario. The more the union is interested or able to make the wage parity between the workers with the same individual efficiency in different sectors, the more would be the share of the worker’s hypothetical decentralized wage which will be pooled between him and other workers with the same individual efficiency. Consequently, for the workers in relatively productive sector, the higher is \(\sigma^N\), the lower would be the wage. The contrary holds for the workers affiliated to relatively less productive sectors. Similarly, if \(\sigma^S\) is higher, the wage for workers with less individual efficiency will be higher and the wage for the workers with higher individual efficiency will be lower.

3.1.3 Evolution of vacancies:

Using free entry condition, we can rewrite equation (5) as the following equation:

\[ J_{o,j} = \left( \frac{a_{j} P_{j}}{P} - \lambda \right) - \omega_{o,j} + \beta E \left[ (1 - \chi)(1 - \delta)J'_{o,j} + (1 - \chi)\delta J'_{e,j} \right] \] (21)

On the other hand, using equations (5) and (6) we can find the following relationship between value function of efficient and inefficient active jobs:

\[ J_{e,j} = \frac{a_{j} P_{j}}{P} - \lambda - \omega_{e,j} + \beta E \left[ (1 - \chi)(1 - \delta)J'_{e,j} + (1 - \chi)\delta J'_{o,j} \right] \]

See Appendix A.1 for the proof.
\[ J_{e,j} = J_{o,j} + \frac{\lambda(1 - \eta(1 - \sigma^S))}{1 - \beta(1 - \chi)(1 - \delta)} \] (22)

Substituting equation (22) into the equation (5), and using equation (10), we can find the evolution of vacancy in sector j as follows:

\[ \frac{c}{\beta q_j} = \left( \frac{a_j p_j^I}{P^I} - \lambda \right) - \omega'_{o,j} + \frac{c(1 - \chi)}{q_j^I} + \left( \beta \delta(1 - \chi) \frac{\lambda(1 - \eta(1 - \sigma^S))}{1 - \beta(1 - \chi)(1 - \delta)} \right) \] (23)

This equation implies that higher price and lower wage rate in one sector lead to more vacancies in that sector. Now we can focus on the general equilibrium of the model and show how the prices are determined in this model. We start by defining the utility and the decision of the households.

### 3.2 Households

The households' utility depends on their private consumption \((c_i)\) and public good provision \((G)\) provided by the government:

\[ u_i(c_i, G) = c_i + f(G) = c_i + z_1 G^{z_2} \] (24)

The dynamic framework of this model and having four different wage groups in each period of time, together with the possibility of moving from one wage group to the other group implies that allowing for individual saving leads to explosion of heterogeneity among the households. In this case, it would be very complicated (perhaps impossible) to solve the model, even numerically. Thus, for the sake of simplicity I rule out the possibility of individual saving both domestically and internationally.

I rule out domestically private saving by imposing linearity to the households’ utility function with respect to the private consumption. This strong assumption has indeed a quantitative impact on our result but not a qualitative one. Essentially, this model claims that widening the two deficits (an increase in capital inflow) leads to an increase (a decline) in the private consumption of the N-sector (T-sector) workers. The opposite holds if the government moderates the two deficits. If the household utility function is concave with respect to the private consumption, they will save and insure themselves against the fluctuations in the two balances. But the qualitative results will not change since the impact of the twin

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16See Appendix A.2 for proof.
deficits on the inter-sectoral wages and incomes of the workers remains the same.

Besides, I rule out the possibility of private saving/borrowing in international financial market by assuming that the individual households do not have access to international financial market. This is again very strong assumption which needs to be clarified. If the public goods and the private consumption are complementary, an increase in G backed by external resources allows the individual to increase their private consumption, hence, to borrow internationally. Therefore, the impact of the public balance on the external balance (and so on the wages) will be intensified. On the contrary, if G and C are substitutable, an increase in G motivates the households to save internationally, hence, the external balance and so the wages will be less sensitive to the public balance. In very extreme case, when \( z_1 = z_2 = 1 \), G and C are perfect substitute and Ricardian equivalence implies that, if the households have access to international financial market and they have complete information, they will save and accordingly, in this special case, budget balance has no impact on external balance. Empirical evidences show the existence of the twin deficits (positive impact of public balance on current account) which rules out the existence of \( z_1 = z_2 = 1 \) and perfect access of households to international financial market. Therefore, relaxing the strong assumption that households have no access to international financial market has no qualitative effect on our results as long as there is a positive relation between the two balances.

These assumptions simplify the model and imply that the households consume all their revenue in each period. Following the model in Dutch disease, I assume that the basket of private consumption consists of final goods from the two sectors:

\[
C_i(c_{i,T}, c_{i,N}) = c_{i,T}^\gamma c_{i,N}^{1-\gamma}
\]  

(25)

Given the sectoral prices, the household \( i \) decides about the optimal allocation of his consumption between the two sectors to minimize his cost for the given level of consumption:

\[
\max_P P_N c_{i,N} + P_T c_{i,T} \\
\text{s.t. } c_{i,T}^\gamma c_{i,N}^{1-\gamma} = C_i
\]

The household’s static cost minimization problem leads to the following relation between his consumption share of each sector and the real exchange rate (relative price of the N-sector to the T-sector):
An increase in the relative price of one sector makes the household to substitute their consumption toward the other sector. Since the private consumption is homogeneous of degree one with respect to the private consumption, equation (27) leads to the following relation between the aggregate private demands for each sector and the inter-sectoral relative prices:

\[ e = \frac{P_N}{P_T} = \frac{(1 - \gamma)c_{i,T}}{\gamma c_{i,N}} \]  

(26)

3.3 Government

Government expenditure consists of unemployment benefit (b) and provision of public good \((G_t)\). These expenditures can be financed by (i) lump-sum tax \((\tau_t)\) from employed households and/or (ii) gross return to foreign assets owned by the government \((S_t)\).\(^{17}\) \(\tau_t, G_t\) and \(b\) are in terms of the domestic price level while the foreign assets are in terms of the T-sector price. Therefore, we can write the government budget constraint as follows:

\[ G_t + bu_t + \frac{S_t}{P_t} = \tau_t \bar{n}_t + (1 + r) \frac{S_{t-1}}{P_t} \]  

(28)

\(S_t\) represents the government’s endowment of foreign assets. Thus, \(S_t - S_{t-1}\) is the government net saving or fiscal surplus. We define \(B_t = (1 + r)S_{t-1} - S_t\) as the **windfall expenditure**: the part of the government expenditure which is financed by foreign resources or the return to its foreign assets.\(^{18}\) In other words, the windfall expenditure is the public budget deficit plus the net return to its assets, i.e., the difference between the government expenditures and its revenue from lump-sum tax:

\[ G_t + bu_t = \tau_t \bar{n}_t + \frac{B_t}{P_t} \]  

(29)

Note that in steady state, \(B_{ss} = rS_{ss}\). This implies that in steady state government consumes all its revenue from tax revenue and the return to its international saving.

---

\(^{17}\) Assuming lump-sum tax instead of linear or progressive taxes makes the model simpler and, besides, rules out the distortionary impact of the other alternative tax forms.

\(^{18}\) Notice that if \(S_{t-1} > S_t\), the government finances its expenditure by borrowing.
Public good provision:

To produce public service/goods, government must buy tradable and non-tradable goods from the market and costlessly combine them. For the sake of simplicity, we assume that the share of T-sector and N-sector goods are the same in public good provision as their shares in the basket of private good ($\gamma$):¹⁹

$$G(g_T, g_N) = g_T^\gamma g_N^{1-\gamma}$$

Government cost minimization problem implies that:

$$\max P_N g_N + P_T g_T$$
$$\text{s.t. } g_T^\gamma g_N^{1-\gamma} = G_t$$

This minimization problem together with equation (27), lead the following relation between the sectoral aggregate demands and the real exchange rate:

$$e = \frac{P_N}{P_T} = \frac{(1-\gamma)(C_T + g_T)}{\gamma(C_N + g_N)}$$

We can also find the domestic price level in terms of the price of the T-sector (set as numeraire):

$$\bar{P} = \frac{1}{(1-\gamma)(1-\gamma)^\gamma P_N^{1-\gamma}}$$

³.4 Market clearing and equilibrium

Market clearing implies that the total expenditure (private and public) equals the total revenue (production rent and the net return to the government’s foreign assets) plus the national net borrowing ($S_{t-1} - S_t$), i.e. the budget deficit.²⁰

$$\bar{P}C_t + \bar{P}G_t = Y_{T,t} + P_{N,t}Y_{N,t} + ((1+r)S_{t-1} - S_t) = Y_{T,t} + P_{N,t}Y_{N,t} + B_t$$

¹⁹The higher is the $\gamma$, the lower would be the Dutch disease effect and real appreciation of currency as a response to windfall shock. In discussion section we will explain more what would be the effect of releasing this assumption.
²⁰Since households do not have access to the international financial market.
By definition, the aggregate consumption of N-sector final goods is equal to the production in this sector:

\[(c_N + g_N) = Y_N \Rightarrow c_{T,t} + g_{T,t} = Y_{T,t} + B_t\] (33)

Therefore, windfall expenditure \((B_t)\) represents the trade balance deficit. We can, equivalently, interpret \(B_t\) as current account deficit plus the net return to net foreign assets owned by the government.

**Definition 1.** We define the windfall expenditure as the variation of public foreign assets plus the net return to the public asset: \(B_t(= (1 + r)S_{t-1} - S_t)\). Since individual households do not have access to international financial market, we have:

\[\text{Current Account deficit} = \text{Budget deficit} = B_t - rS_{t-1} = S_{t-1} - S_t\]

Substituting equation (33) into equation (30), one can find the relative price of N-sector to T-sector (real exchange rate) as follows:

\[e_t = P_{N,t} = \frac{(1 - \gamma)(Y_{T,t} + B_t)}{\gamma(Y_{N,t})} = \frac{(1 - \gamma)\left(a_T(n_{e,T,t} + n_{o,T,t}) - n_{o,T,t}\lambda + B_t\right)}{\gamma\left(a_N(n_{e,N,t} + n_{o,N,t}) - n_{o,N,t}\lambda\right)}\] (34)

This equation expresses an important symptom of the Dutch disease: An increase in windfall expenditure \((B_t)\) leads to a real appreciation of the exchange rate. In other words, if the government increases its budget deficit by foreign resources, the real exchange rate will appreciate.\(^{21}\) Therefore, if a shock in windfall expenditure is realized, the inter-sectoral relative price, and so the inter-sectoral relative wages, will increase in favor of the N-sector. Note that if there was no friction in the labor market, the prices, and consequently the wages, would have stayed the same across the sectors since the labor market could immediately adjust itself as a response to the shock.

Now we can define the dynamic general equilibrium of the model. For given time profile of windfall expenditure \(B_t\) and the value of initial foreign assets, the dynamic general equilibrium can be defined such that:

- Households consume all their revenue from net wage (if employed) and unemployment benefit (if unemployed).

\(^{21}\) For a country with a positive (negative) net foreign assets, an increase (decrease) in international interest rate will have the same effect.
- Given relative prices, households and government allocate their expenditure between T-sector and N-sector.
- Free entry condition holds. (equation (23))
- Wages are determined as the outcome of wage bargaining between the union and the employer association. (equations (18) ad (19))
- Government budget constraint holds. (equation (29))
- Market clears. (equation (34))

Accordingly, the following set of equations determines the dynamic general equilibrium of the model for a given time profile of windfall expenditure \( \{B_t\} \): For \( j \in \{T, N\} \), this system leads to 18 equations with 18 unknowns: \( \{q_T, q_N, \rho_T, \rho_N, \nu_T, \nu_N, \omega_{e,T}, \omega_{o,T}, \omega_{e,N}, \omega_{o,N}, P_N, \bar{P}, n_{e,T}, n_{e,N}, n_{o,T}, n_{o,N}, u, \tau\} \).

### 3.5 Model calibration

In this subsection, I introduce the calibration of the model for numerical solution. The qualitative results of the paper are not sensitive to calibration. More precisely, In the followings sections, I demonstrate how a shock in windfall expenditure has distributive impact on workers in different sectors and with heterogeneous individual efficiency and I show how wage bargaining centralization affects this distributive impact. These results are not sensitive to the calibration of the model. The only variables which are sensitive to calibration are unemployment and tax. However, are not concerned with the variation of these variables and, moreover, the impact of the shock on these variables are in second order with respect to the variables of our interest. In the rest of this subsection, I will explain the calibration I use as baseline for the numerical solution of the model.

**Matching and the labor market**

*den Haan et al. (2000)* set the steady state separation rate \( \chi \) equal to 0.1. This calibration is based on *Hall et al. (1995)* conclusion that around 8 to 10 percent of workers separate from their jobs each quarter. *Merz (1995)* and *Andolfatto (1996)* find the quarter separation rate equal to 0.7 and 0.15 respectively. I set the *monthly* separation rate equal to 0.03 to correspond approximately to the average of these studies. As I explained before, I assume that wage centralization has no impact on the total economic share of workers. Thus, we set the bargaining power of unions equal to individual workers bargaining power which is set to 0.5 by *den Haan et al. (2000)* and others. Unemployment benefit \( b \) is set to be 13% of the
minimum steady state wage rate. The cost of opening a vacancy \( c \) is set to be equal to steady state minimum wage. To obtain the average unemployment rate of OECD country in 2014 (0.08), the level parameter of matching function \( \phi \) is set 0.077. The probability \( \delta \) that an inefficient worker becomes efficient in the next period is assumed to be (0.15). This assumption is made to have the share of inefficient worker around 20% of efficient workers. The inefficiency loss \( \lambda_0 \) is set as half of the minimum wage. The last two calibrations are arbitrary.

**Utility function**

As explained before, a shock in windfall expenditure affects the households utility through two different channels: (i) through the provision of public good and (ii) through the income effect induced by the change in real exchange rate. Given that the utility function is concave in public goods, the first channel is relatively more important if the steady state value of windfall income is low. To neutralize the effect of initial level of windfall income, I assume that the utility of households is linear in public good \( z_2 = 1 \). Yet, any choice of \( z_2 > 0 \) will not affect the qualitative results of this paper.

The windfall incomes received by developed countries \( B_{ss} = rS_{ss} \) are highly heterogeneous since accumulated level of foreign asset and the revenue from natural resource are highly heterogeneous among them. Since this value has only a symmetric impact on households utility and, thus has no impact on our result, we set it equal to 5% of steady state GDP. For baseline, I set \( z_1 = 0.1 \). In the following section, I discuss the impact of different levels of \( z_2 \) on the households value function. Again it is important to stress that our qualitative results do not depend on the choice of this variable. To capture the fact that the majority of workers are engaged to the N-sector, I assume the consumption share of the T-sector \( \gamma \) to be 0.3. The monthly discount rate is set as 0.9947.

**Production function**

I normalize the T-sectoral technology level to unity \( a_T = 1 \). Data from OECD finds that the averaged productivity ratio between industry industry sector and service sector is around 1.3. Accordingly I assume \( a_N = 1.3 \). The calibrated parameters are reported in table 1.

In the next section, having this dynamic general equilibrium, I explore the impact of a shock in the windfall expenditure on macro variables and especially on the households wage income. Then, I discuss how centralization of wage bargaining influences these impacts.
4 Effect of Shock in Windfall Expenditure

In this section, I investigate impacts of a shock in windfall expenditure. In the first subsection, I focus on the Dutch disease impact of that shock and I demonstrate how windfall shock affects the real exchange rate, sectoral employments and sectoral wages. In subsection 4.2, I concentrate on the impact of windfall shock on sectoral value functions. In both subsection, I start with the case of decentralized wage bargaining. Then, I investigate the effect of wage bargaining centralization.

4.1 Macroeconomic impact of windfall shock

4.1.1 Decentralized wage scenario

A positive shock in the windfall expenditure ($B_t$) leads to an increase in the public demand and, thus, in the aggregate demand for final goods in both sectors. More demand in the T-sector increases the import from the rest of the world and so it leads to deterioration of trade deficit (Thus, the twin deficits). However, By definition of the N-sector, the excess demand in the N-sector, cannot be fulfilled by import from the rest of the world. Consequently, the positive shock in the windfall expenditure leads to an appreciation in the real exchange rate: an increase in the relative prices of the N-sector to the T-sector. If the labor market is frictionless, the labors will be immediately reallocated and, thus, the prices and

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Table 1: Calibrated parameters

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Value</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\chi$</td>
<td>0.03</td>
<td>Exogenous separation rate</td>
</tr>
<tr>
<td>$\alpha$</td>
<td>0.5</td>
<td>Curvature parameter of matching function</td>
</tr>
<tr>
<td>$c$</td>
<td>0.25</td>
<td>Cost of opening a vacancy</td>
</tr>
<tr>
<td>$b$</td>
<td>0.03</td>
<td>Unemployment benefit</td>
</tr>
<tr>
<td>$\phi$</td>
<td>0.077</td>
<td>Level parameter of matching function</td>
</tr>
<tr>
<td>$\eta$</td>
<td>0.5</td>
<td>Union bargaining power</td>
</tr>
<tr>
<td>$\lambda_o$</td>
<td>0.1</td>
<td>Efficiency cost of new workers</td>
</tr>
<tr>
<td>$\delta$</td>
<td>0.15</td>
<td>Probability of skill acquisition</td>
</tr>
<tr>
<td>$\gamma$</td>
<td>0.3</td>
<td>Consumption Share of the T-sector</td>
</tr>
<tr>
<td>$\beta$</td>
<td>0.9947</td>
<td>Monthly discount rate</td>
</tr>
<tr>
<td>$z_1$</td>
<td>0.1</td>
<td>Weight of public good in utility</td>
</tr>
<tr>
<td>$z_2$</td>
<td>1</td>
<td>Concavity of utility with respect to public good</td>
</tr>
<tr>
<td>$a_T$</td>
<td>1</td>
<td>Technology level in the T-sector</td>
</tr>
<tr>
<td>$a_N$</td>
<td>1.3</td>
<td>Technology level in the N-sector</td>
</tr>
<tr>
<td>$B_{ss}$</td>
<td>0.1</td>
<td>Steady state Windfall income</td>
</tr>
</tbody>
</table>
wages will be immediately equalized across the sectors.

If the labor market is frictional, the sectoral transition of labors will last for a longer period. Real appreciation of currency increases (decreases) the economic surplus of matches in the N-sector (T-sector): More vacancy will be created in The N-sector (T-sector). Consequently, employment increases in the N-sector and decreases in the T-sector. During the transition period, N-sector workers, while enjoying a higher provision of public good, benefit from a higher wage. T-sectors workers, however benefit from a higher provision of public good only with the cost of decline in their wage and, thus, in their private consumption. The impact of the windfall income on unemployment rate, and so on tax rate, is ambiguous and relatively small. These impacts are depicted in figure 7. The impacts on sectoral employment rates and on sectoral wages are completely opposite if a negative shock in windfall expenditure is realized. In all the following figures of this section, the blue lines and the red lines represent the T-sector workers and the N-sector workers, respectively. Moreover, the efficient and inefficient workers are represented by solid lines and dashed lines, respectively.

4.1.2 Effect of inter-sectoral wage compression: $\sigma^N$

As discussed before, a higher of $\sigma^N$ reduces wage gap between the two sectors by transferring some rents from the sector with higher wages to the sector with lower wages. Consequently, $\sigma^N$ will decrease the sensitivity of sectoral wages with respect to variations of sectoral prices (variation of real exchange rate) induced by windfall shock. Therefore, both efficient and inefficient workers in N-sector will realize less rise in their wages as a response to a positive shock in windfall expenditure if $\sigma^N$ is high. Similarly, when a positive shock in windfall expenditure is realized, efficient and inefficient workers in N-sector will realize less decline in their wages if $\sigma^N$ is high. The opposite results will be obtained if a negative shock in windfall expenditure is realized. In a nutshell, an increase in $\sigma^N$ reduces the sensitivity of the wages with respect to variation in the sectoral prices. This result is consistent with empirical literature (see Holmlund and Zetterberg (1991); Teulings and Hartog (1998); Hartog et al. (2002); Rycz (2002)). Figure 8 demonstrates these results. As it is clear from the figure, when $\sigma^N = 1$, windfall shock induces no sectoral wage gap for workers with the same individual efficiency.

Besides, since the wage rise (loss) is lower for new matched workers in the booming (disadvantageous) sector when $\sigma^N$ is higher, the employers in this sector, will enjoy relatively more (less) profit from windfall shock if $\sigma^N$ is higher. Consequently, higher $\sigma^N$ strengthens
the rise (decline) in vacancy creation in the N-sector (T-sector) as a response to the windfall shock. As a result, when shock is realized, the expansion of the N-sector is faster if $\sigma^N$ is higher.

4.1.3 Effect of intra-sectoral wage compression: $\sigma^S$

Higher $\sigma^S$ reduces the wage gap between efficient and inefficient workers by redistributing some rents from the former to the latter. Therefore, if $\sigma^S$ is high, the employers of inefficient workers (including new matched jobs) must pay higher wage than what they would pay if the

Figure 7: Effect of a positive shock in windfall expenditure.
wage bargaining was decentralized. The opposite holds for the employers of efficient workers.

As explained before, when a positive shock in windfall expenditure is realized, more (less) vacancies and, hence, more (less) matches will be created in the N-sector (T-sector). Therefore, the share of inefficient workers in the N-sector (T-sector) increases (decreases). Consequently, more (less) rent from efficient workers of N-sector (T-sector) will be transferred to the inefficient workers in that sector. This effect mitigates the positive (negative) impact of the shock on the incumbent workers’ wage in the N-sector (T-sector). Therefore, as a response to positive shock in the windfall expenditure, the incumbent (efficient) workers in the N-sector (T-sector) realize a lower gain (loss) in their wage if $\sigma^S$ is high.

Another consequence of higher $\sigma^S$ is that it hinders the flow of labors from the T-sector to the N-sector. This impact results from the fact that higher $\sigma^S$ forces the new matched employers to pay relatively higher wage to their inefficient workers compared to the wages that they would pay if the wage bargaining was decentralized. This impact reduces the profitability of inefficient jobs which leads to a decline in the responsiveness of the job creation to prices. Consequently, the rise (decline) in vacancy creation in the N-sector (T-sector)

Figure 8: Effect of $\sigma^N$ in reducing the responsiveness of sectoral wages.
would be mitigated if $\sigma^S$ is high.

These results of this subsection are summarized in the following propositions 1 and 2:

**Proposition 1.** *If labor market is frictional, a positive shock in windfall expenditure increases (decreases) the wage in N-sector (T-sector).*

- An increase in $\sigma^N$ mitigates the wage dispersion across the sector.
- An increase in $\sigma^S$ mitigates (intensifies) this effect for incumbent (new) workers.

**Proposition 2.** *A positive shock in windfall expenditure leads to leakage of labors from T-sector to N-sector.*

- $\sigma^S$ hinders this transition and intensifies the appreciation of currency.
- $\sigma^N$ hastens this transition and lessens the appreciation of currency.

### 4.2 The impact of the shock on the households value functions

Using equation (24) and relying on the assumption that the households do not save, we can write the inter-temporal utility of efficient and inefficient households in sector $j$ as well as that of the unemployed households:

\[
V_{e,j} = (\omega_{e,j} - \tau + f(G)) + \beta E \left[(1 - \chi)V'_{e,j} + \chi V'_u\right] \quad (35)
\]

\[
V_{o,j} = (\omega_{o,j} - \tau + f(G)) + \beta E \left[(1 - \chi)(1 - \delta)V'_{o,j} + (1 - \chi)\delta V'_{e,j} + \chi V'_u\right] \quad (36)
\]

\[
V_{unemployed} = (b + f(G)) + \beta E \left[\rho_T V'_{o,T} + \rho_N V'_{o,N} + (1 - \rho_T - \rho_N) V'_u\right] \quad (37)
\]

A shock in the windfall expenditure affects the workers’ inter-temporal utility from two channels: *(i)* the provision of public good ($G$) and *(ii)* the impact on real wages $\omega_{\kappa,j}$. A positive shock in windfall expenditure affects positively the value function of the workers in the N-sector since they will enjoy, at the same time, a higher wage (and hence, a higher private consumption) and a higher provision of public goods. The impact on the value function of workers in the T-sector remains ambiguous since they enjoy a higher provision of public goods only at the cost of less wage and so less private consumption. The fact that which one dominates depends on the marginal rate of substitution between public good and
The higher is \( z_1 \), the more is the marginal utility of the public goods. Thus, the positive effect of windfall expenditure through the provision of public good dominates its negative impact through lower wage in the T-sector (see figure 9). These results are embodied in the following proposition:

**Proposition 3.** If the labor market is frictional,

- A positive shock in the windfall expenditure increases the welfare of the N-sector workers by providing them with higher public good provision and higher private consumption.

- The impact of the shock on the welfare of the T-sector workers is ambiguous since it provides them with higher public good only at the cost of less private consumption.

**Corollary 1.** If the labor market is frictional,

- A negative shock in the windfall expenditure decreases the welfare of the N-sector workers by providing them with a lower provision of public good and a lower private consumption.

- The impact of the shock on the welfare of the T-sector workers is ambiguous since it provides them with a lower public good but with more private consumption.

Now, we can analyze the role that wage centralization plays on the impact of the windfall shock on the expected inter-temporal utility of the households. As described in proposition

\[22\] The impact on the value function of the unemployed households is through public good provision and through the change in probability of finding job in the two sectors \((\rho_T\text{ and } \rho_N)\). The impact on the value function of the unemployed households is not the interest of this paper and I will not report it afterward.
1, wage centralization has influence on the responsiveness of the wages in the two sectors with respect to the shock in windfall income: It will decrease the sectoral wage gap raised by the shock. Therefore, one can expect that wage centralization (Higher $\sigma^N$ and $\sigma^S$) reduces the gap between inter-temporal utility of incumbent workers in the two sectors. This result is summarized in the following proposition:

**Proposition 4.** Assuming friction in the labor market,

- $\sigma^N$ mitigates (improves) the impact of a positive windfall shock on the welfare of the workers in the N-sector (T-sector).
- $\sigma^S$ depresses (improves) the impact of a positive windfall shock on the welfare of the incumbent workers’ in the N-sector (T-sector).

$\sigma^S$ has a second order impact compared to $\sigma^N$.

**Corollary 2.** Assuming friction in the labor market,

- $\sigma^N$ improves (deteriorates) the impact of the negative windfall shock on the welfare of the workers in the N-sector (T-sector).
- $\sigma^S$ improves (deteriorates) the impact of the negative windfall shock on the welfare of the incumbent workers’ in the N-sector (T-sector).

$\sigma^S$ has a second order impact compared to $\sigma^N$.

Figure 10 presents the impact of a shock in windfall expenditure on inter-temporal utility of incumbent workers for the case of $z_1 = 0.1$ and for the different levels of wage centralization. This figure shows that centralization of wage reduces the gap between the inter-temporal utility of the households affiliated to different sectors. As a matter of fact, the higher is the $\sigma^N$, the lower is the welfare gain (loss) for incumbent workers in N-sector (T-sector). In the same way, but in less extend, the higher is the $\sigma^S$, the less is the welfare gain (loss) for incumbent workers in N-sector (T-sector).

**5 Policy determination**

In this section, first, I define the policy; then, in subsection 5.2, I discuss the impact of the policy on households inter-temporal utility. I also evaluate the preferred policy of the households which will depend on their job status. In subsection 5.3, I discuss the effect of
wage centralization on households preferred policy. Finally, in subsection 5.4, I will explain the policy determination and the effect of wage centralization on endogenous policy determination.

5.1 Definition of the policy

At steady state, the windfall expenditure is equal to the net return to foreign assets. Thus, there is no deficit in the two balances at steady state:\textsuperscript{23}

\begin{equation}
B_{ss} = rS_{ss} \tag{38}
\end{equation}

If the government realizes a shock in its future assets with current amount of $\hat{S}$, it can decide about the time profile of expending this expected shock ($\{B_t\}$) such that the current amount of windfall expenditure and the current amount of asset shock correspond.\textsuperscript{24}

\textsuperscript{23}But deficit in trade balance if $S_{ss} > 0$.
\textsuperscript{24}The same occurs if the government realize a shock in its future natural resource revenue.
\[
\sum_{t=0}^{\tau} \left[ \frac{B_t}{(1+r)^t} \right] = \sum_{t=0}^{\tau} \left[ \frac{rS_{ss}}{(1+r)^t} \right] + \hat{S} = (1+r)S_{ss} + \hat{S}
\] 

(39)

Therefore, the policy can be interpreted as the optimal time allocation of the windfall expenditure \{B_t\} such that equation (39) is satisfied. This policy, as it will be clear in subsection 5.4, is chosen through a political economic framework which aggregates the households’ preferred policy. In this paper, I focus on the majority rule: policy is chosen according to the preference of the majority.

Since the model is non-linear and complex, we cannot find the households’ preferred policy analytically. Besides, since the model with nine value functions and five state variables is very complicated to be solved numerically, I will impose some restrictions on the policy rule: I will assume that the windfall expenditure will follow a Markov process with persistence \(\rho_B\) and magnitude \(\epsilon_{B,0}\):

\[
B_t = B_{ss} + \rho_B^t \epsilon_{B,0}
\]

(40)

Substituting from equation (40) into equation (39) we have:

\[
\sum_{t=0}^{\tau} \left[ \frac{\rho_B^t \epsilon_{B,0}}{(1+r)^t} \right] = \hat{S} \Rightarrow \epsilon_{B,0} = \frac{1+r-\rho_B \hat{S}}{1+r}
\]

(41)

Equation (41) which is resulted from the inter-temporal budget constraint of the government, implies that the policy is uni-dimensional. Once the government decides about the shock persistence of its windfall expenditure \(\rho_B\), its expenditure at time zero and, hence, in every period of time, will be determined accordingly. Once a positive shock is realized (\(\hat{S} > 0\)), the government can increase the provision of public good. In this case, the higher is \(\rho_B\), the more patient is the government to increase its expenditure (i.e. the provision of the public goods). Consequently, the two balances will be relatively more balanced (more surplus /less deficit). On the contrary, the lower is \(\rho_B\) as response to \(\hat{S} > 0\), the more impatient is the government: It provides more public goods today and less later. Therefore, once the positive shock in the value of the assets is realized, the more the policy chosen by the government is smoothing (the higher is \(\rho_B\)), the less (higher) would be the deficits.
(surpluses) in the two deficits and vice versa.

On the contrary, when a negative shock to the assets is realized $\hat{S} < 0$, the government must reduce its expenditure. In this case, the higher $\rho_B$ implies that the government postpones the reduction of its expenditure by borrowing from the international financial market. In the opposite way, the lower $\rho_B$ implies that the government adapts its expenditure to the shock more quickly. Therefore, when $\hat{S} < 0$, higher $\rho_B$ implies more (less) deficits (surplus) in the two balances. This leads us to the following lemma:

**Lemma 1.** a. If a positive shock in the value of the government’s assets is realized, then:

- An increase in $\rho_B$ (more smoothing policy / less accelerating policy) improves the two balances.
- An decline in $\rho_B$ (less smoothing policy / more accelerating policy) deteriorates the two balances.

b. If a negative shock in the value of the government’s assets is realized, then:

- An increase in $\rho_B$ (more smoothing policy / less accelerating policy) deteriorates the two balances.
- A decline in $\rho_B$ (less smoothing policy / more accelerating policy) improves the two balances.

![Figure 11](image)


**Figure 11:** Effect of smoothing policy.
In the following subsection, I will discuss the impact of these policies on the households’ welfare and then I will investigate the households’ preferred policy which will be shown to depend on the job status.

5.2 Effect of smoothing/accelerating policy on the household’s value function.

5.2.1 Case of frictionless labor market:

If there were no friction in the labor market, labor forces could have been immediately adjusted to the shock. Consequently, the windfall expenditure would have no effect on the wages or on the private consumption. Therefore, the only consequence of the windfall expenditure would have been to provide the households with higher provision of public good. Moreover, this impact would have been symmetric across the households. Therefore, in that case, the preferred policy would have been the same for all the households. The preferred policy, in this case, would have been the one that guarantees the highest present value of the public goods provision: \( \sum_{t=0}^{\infty} \left[ \beta^t f(G_s + \rho_B \frac{1+r}{1+r} B_t \hat{S}) \right] \). Note that in the case of perfect labor market, domestic price level \( \bar{P}_t \) would have been independent from \( B_t \). This implies that for the case of linear utility with respect to the public goods \( (z_2 = 1) \) the households, independent from their job status, will prefer pure smoothing policy \( (\rho_B = 1) \) if and only if \( r > \frac{1-\beta}{\beta} \) and they would prefer pure accelerating policy \( (\rho_B = 0) \) if and only if \( r < \frac{1-\beta}{\beta} \). We can summarize these results in the following proposition:

Proposition 5. If the labor market is frictionless, then:

a. The impact of a windfall shock on the households’ welfare is symmetric across the sectors and this impact is only through the provision of public good.

b. The symmetric preferred policy of the households would be the one which maximizes the current value of public good.

c. For special case of linear utility with respect to public good, households prefer pure smoothing policy \( (\rho_B = 1) \) if and only if \( r > \frac{1-\beta}{\beta} \) and they would prefer pure accelerating policy \( (\rho_B = 0) \) if and only if \( r < \frac{1-\beta}{\beta} \).

\(^{25}\)Neutrality of windfall expenditure with respect to the wage, in the case of the perfect labor market, is due to our assumption that the production is linear with respect to the labor factor. If a concave production function is considered, the wages, real exchange rate and the aggregate price level will increase with respect to the T-sector prices. But in any case, the windfall shock would create no gap between the sectoral wages.
5.2.2 Case of frictional labor market

The impact of the windfall shock and, consequently, that of the smoothing policy on the households welfare is more complicated if the labor market is frictional. On the one hand, friction in the labor market implies that windfall shock leads to a real appreciation of currency which can be interpreted as a decline in the value of windfall revenue in terms of domestic price level (since windfall expenditure is in terms of the T-sector price level). This effect implies that, the policy that maximizes the current value of the public goods is always greater in the case of a frictional labor market than in the case of a frictionless labor market. For example, for the case of linear utility with respect to public good provision, the policy which would maximize the current value of public good, would not be anymore the binary of $\rho_B = 1$ or $\rho_B = 0$. More precisely, in this case, even if the international interest rate is less than $\frac{1-\beta}{\beta}$, there would exist $\rho_B > 0$ which would maximize the current value of public good provision. The next proposition clarifies this result:

**Proposition 6.** If the labor market is frictional, then there exist $r_{\min} < r_{\max} < \frac{1-\beta}{\beta}$ such that:

- If $r > r_{\max}$, $\hat{\rho}_B = 1$ maximize current value of public good provision.
- If $r_{\min} < r < r_{\max}$, there exist $0 < \hat{\rho}_B < 1$ which maximizes current value of public good provision.
- If $r < r_{\min}$, $\hat{\rho}_B = 0$ maximizes current value of public good provision.

Figure 12 depicted the current value of public good provision as a function of smoothing policy ($\rho_B$) for $(z_2 = 1)$ and prevailing international interest rate of 2% (monthly net return of 0.16%). Note that for our calibration of $\beta = 0.9947$, $\rho_B = 0$ would have maximized the current value of the windfall expenditure if the labor market was frictionless. I define $\hat{\rho}_B$ as the policy which maximizes the current value of public good:

On the other hand, as discussed in section (4), a positive shock in windfall expenditure raises the wage income for the N-sector workers and reduces that for the T-sector workers. Therefore, it is clear that the impact of the the policy is not symmetric across the workers if labor market is frictional. If a positive shock in the government’s foreign asset is realized, smoothing policy decreases the rise in the current value of expected wage for the workers in the N-sector and it mitigates the loss in the current value of expected wage for the workers in the T-sector. The reason is that, on the one hand, higher smoothing policy leads to less
appreciation of real currency which implies less rise (decline) in the wage of the workers in the N-sector (T-sector). On the other hand, the higher is the $\rho_B$ the more likely it is for the workers in the N-sector (T-sector) to exist from (to enter to) the booming sector. Consequently, the workers in the N-sector prefer less smoothing policy than the workers in the T-sector. More precisely, the preferred policy of the workers in the N-sector is smaller than $\hat{\rho}_B$ and that of the T-sector workers is larger than $\hat{\rho}_B$.

Proposition 7. When a positive shock in the value of the government’s assets is realized, the workers in the N-sector support less smoothing policy than the workers in the T-sector. More precisely, if $\hat{\rho}_B$ represents the policy which maximizes the current value of public good provision, and $\rho^{*,j}_B$ is the preferred policy of the workers in sector $j$, then:

$$\rho^{*,N}_B < \hat{\rho}_B < \rho^{*,T}_B$$  \hspace{1cm} (42)

Corollary 3. When a negative shock in the value of the government’s assets is realized, the workers in the N-sector support more smoothing policy than the workers in the T-sector. More precisely, if $\hat{\rho}_B$ represents the policy which minimizes the current value of public good loss, and $\rho^{*,j}_B$ is the preferred policy of workers in sector $j$, then:

$$\rho^{*,T}_B < \hat{\rho}_B < \rho^{*,N}_B$$  \hspace{1cm} (43)
5.3 Effect of centralization on households’ preferred policy

Proposition (7) implies that the workers in the N-sector (T-sector) prefer a policy which implies more (less) twin deficits than the policy which would maximize the current value of public good provision would imply. This heterogeneity in the workers’ preferred policy is due to the asymmetric impacts of the windfall expenditure on the sectoral wages and, hence, on sectoral private consumption. On the other hand, proposition (4) implies that centralization of wage bargaining mitigates these divergent impacts of windfall expenditure.

Therefore, combining propositions (7) and (4) implies that when the wage is more centralized, the evaluation of workers in the two sectors converges to the policy that maximizes the current value of public good provision ($\hat{\rho}_B$). We summarize this result in the following proposition.

**Proposition 8.** The higher is the centralization of wage bargaining, the more (less) smoothing would be the preferred policy of the incumbent workers in the N-sector (T-sector) when a positive shock in the government’s assets is realized. More formally:

$$\frac{\partial \rho^*_B}{\partial \sigma^N} > \frac{\partial \rho^*_B}{\partial \sigma^S} > 0 \quad \frac{\partial \rho^*_T}{\partial \sigma^N} < \frac{\partial \rho^*_T}{\partial \sigma^S} < 0$$

**Corollary 4.** The higher is the centralization of wage bargaining, the less (more) smoothing would be the preferred policy of incumbent workers in N-sector (T-sector) when a negative shock in the government’s assets is realized. More formally:

$$\frac{\partial \rho^*_T}{\partial \sigma^N} > \frac{\partial \rho^*_T}{\partial \sigma^S} > 0 \quad \frac{\partial \rho^*_N}{\partial \sigma^N} < \frac{\partial \rho^*_N}{\partial \sigma^S} < 0$$

Figure 13 shows the impact of wage centralization on the N-sector workers’ preferred policy when a positive shock is realized. The higher is the degree of wage centralization, the more smoothing is the preferred policy of the workers in the N-sector. On the contrary, as one can see in figure 14, the higher is the degree of wage centralization, the less smoothing is the preferred policy of the workers in T-sector. In the case of ($\sigma^N = 1$), the impact of shock is the same for all the incumbent workers independent from the job status. Therefore, they would have an identical preferred policy which is the one that maximizes the current value of public good provision ($\hat{\rho}_B$).
Figure 13: Inter-temporal utility of N-sector workers as a function of policy for different levels of wage centralization.

5.4 Policy determination and impact on current account

From political economic point of view, the policy is determined by majority of households. According to the data from developed countries, majority of workers are affiliated to the N-sector. Therefore, the policy chosen by the government is likely to present the preferred policy of the workers in the N-sector.

According to proposition (8), centralization of wage bargaining pushes the preferred policy of the N-sector workers to be more smoothing. Consequently, this model suggests that in democratic countries where majority of households decide about the policy, the prevailing policy is more smoothing if the wage bargaining is more centralized. Next proposition leads to the last and the main conclusion of the model:

**Proposition 9.** If the policy is decided by majority rule and if the N-sector incumbent workers have the majority, then the higher centralization of wage bargaining leads to more
Corollary 5. If the policy is decided by majority rule and if the N-sector incumbent workers have the majority, then the higher centralization of wage bargaining leads to less smoothing policy as a response to a negative shock to the value of the government’s assets which can be translated to less deficits in the two balances.

6 Summary and conclusion

Current account imbalances has been one of the focal point of interest in macroeconomics, specially after the 2007/8 financial crisis. Empirical papers in this subject have shown that the fiscal balance position is one of the main explanatory variables specially when the current account imbalances among developed countries is concerned. The country with higher deficit in their fiscal balances tend to have higher deficit in their external balances. This positive correlation between the two balances is known as the twin deficits. In fact, controlling for
fiscal balance is one of the most direct tools for the governments to manage their external balances.

Even though the central role of the fiscal balance in the pattern of the current accounts of developed countries have been stressed by many empirical and theoretical papers, to the best of my knowledge, there has been no attempt to explain why among developed economies, some countries have less deficits in their two balances compared to the other ones. The available data from developed countries show that developed countries with a higher level of wage centralization tend to have less deficits in their two balances compared to their counterparts with lower degree of wage centralization. This paper provides a political economic framework to explain this observation by focusing on: (i) the Dutch disease effect of the twin deficits and its associated impacts on sectoral prices and, hence, on sectoral wages. (ii) wage bargaining centralization and its impact on reducing the responsiveness of sectoral wages to sectoral prices; And (iii) Political economy framework which aggregates the preferences of households regarding the twin deficit policy.

A deterioration in the twin deficits leads to some symptoms of the Dutch disease: (i) real appreciation of currency, (ii) Less competitiveness of the T-sector, (iii) a leakage of production factors from the T-sector to the N-sector and, finally and more importantly for the purpose of this paper, (iv) a wage dispersion in favor of N-sector workers if the labor market is frictional. The opposite holds if the government tries to reform the two balances. Using this Dutch disease impact of the twin deficits, I showed that the N-sector workers relatively support more the deterioration in the two deficits and oppose more the reforms in the twin deficits compared to T-sector workers. This divergent evaluations of the workers is due to inter-sectoral wage dispersion effect of a change in the two deficits.

Centralization of wage bargaining makes the sectoral wages less responsive to the variations in sectoral prices. Thus, the higher is the centralization of wage bargaining, the less would be the increase (decline) in the N-sector (T-sector) wage rate as a response to a real appreciation of currency induced by a deterioration in the twin deficits. Consequently, higher centralization of wage bargaining makes the deterioration of the two balances less (more) attractive for N-sector (T-sector) workers. On the contrary, and through the same mechanism, centralization of wage bargaining makes the reform in the two balances less (more) costly for the N-sector (T-sector) workers.

In the last step, I use a political economy framework. I argue that N-sector workers
construct the majority of the workers in developed economies. Thus, by using median voters theorem, it is assumed that the government, when deciding about the policy, follows the preferences of N-sector workers. Thus, from a political economy point of view, this paper predicts that the governments in the economies with higher level of wage centralization face less political support (opposition) to widen (improve) the twin deficits. This prediction is confirmed by the facts reported in the paper.

The construction of the model enables us to study separately two different channels through which wage centralization can decrease the responsiveness of sectoral wages with respect to sectoral prices (the real exchange rate). The first channel is through diminishing the inter-sectoral wage dispersion. The second channel is through moderating the wage gap between the workers in the same sector, but, with different level of job-specific human capital. The results suggest that both channels induce qualitatively the same consequence on the political incentive of the government for managing the two balances. But the former has more significant effect and, in fact, the impact of the former has a second order impact compared to the first one.
Appendix A

Appendix A1: Proof for equation (22)

Knowing that $V_j = 0$, we can rewrite equations (5) and (6) as:

$$J_{o,j} = \left(\frac{a_j P_j}{\bar{P}} - \lambda\right) - \omega_{o,j} + \beta E\left[(1 - \chi)(1 - \delta)J'_{o,j} + (1 - \chi)\delta J'_{e,j}\right]$$  \hspace{1cm} (A.1)

$$J_{e,j} = \frac{a_j P_j}{\bar{P}} - \omega_{e,j} + \beta E\left[(1 - \chi)J'_{e,j}\right]$$  \hspace{1cm} (A.2)

Therefore:

$$J_{e,j} - J_{o,j} = \lambda - (\omega_{e,j} - \omega_{o,j}) + \beta \left[(1 - \chi)(1 - \delta)(J'_{e,j} - J'_{o,j})\right]$$  \hspace{1cm} (A.3)

Since $\bar{\omega}_j^S$ is the same, from equations (19) and (20), we get:

$$\omega_{e,j} - \omega_{o,j} = \omega_{e,j}^d - \omega_{o,j}^d + \sigma^S \eta \lambda + \sigma^S \eta \left(\frac{a_j P_j}{P} - \frac{a_j P_j}{\bar{P}}\right)\left(\frac{n_{e,j} - n_{o,j}}{n_{e,j} + n_{e,-j} - n_{o,j} + n_{o,-j}}\right) \approx \omega_{e,j}^d - \omega_{o,j}^d + \sigma^S \eta \lambda$$  \hspace{1cm} (A.4)

Imposing the relation for decentralized wage from equation (12) to this equation, we will have:

$$\omega_{e,j} - \omega_{o,j} = \eta \lambda - \sigma^S \eta \lambda = (1 - \sigma^S)\eta \lambda$$  \hspace{1cm} (A.5)

By imposing equation (A.5) into equation (A.3):

$$J_{e,j} - J_{o,j} = (1 - (1 - \sigma^S)\eta)\lambda + \beta (1 - \chi)(1 - \delta)(J'_{e,j} - J'_{o,j})$$  \hspace{1cm} (A.6)

And therefore:

$$J_{e,j} - J_{o,j} = \frac{(1 - \eta(1 - \sigma^S))\lambda}{1 - \beta(1 - \chi)(1 - \delta)}$$  \hspace{1cm} (A.7)

Therefore:

$$J_{e,j} = J_{o,j} + \frac{(1 - \eta(1 - \sigma^S))\lambda}{1 - \beta(1 - \chi)(1 - \delta)}$$  \hspace{1cm} (A.8)

Appendix A2: Proof for equation (23)

Using equation (A.8), we can rewrite equation (A.1) as follows:

$$J_{o,j} = \left(\frac{a_j P_j}{P} - \lambda\right) - \omega_{o,j} + \beta\left[(1 - \chi)J'_{o,j} + ((1 - \chi)\beta \delta)\left(\frac{1 - \eta(1 - \sigma^S)}{1 - \beta(1 - \chi)(1 - \delta)}\right)\right]$$  \hspace{1cm} (A.9)
From equation (10) we can rewrite this equation:

\[ J_{o,j} = \left( \frac{a_j P_j}{P} - \lambda \right) - \omega_{o,j} + \frac{c}{\beta q_j} \left[ (1 - \chi) \frac{c}{\beta q_j} + ((1 - \chi) \delta) \frac{(1 - \eta(1 - \sigma)) \lambda}{1 - \beta(1 - \chi)(1 - \delta)} \right] \] (A.10)

Rewriteing this equation for the following period and, again, using equation (10), we can have:

\[ \frac{c}{\beta q_j} = \left( \frac{a_j P'_j}{P'_r} - \lambda \right) - \omega'_{o,j} + \frac{c(1 - \chi)}{q'_j} + ((1 - \chi) \beta \delta) \frac{(1 - \eta(1 - \sigma^S)) \lambda}{1 - \beta(1 - \chi)(1 - \delta)} \] (A.11)
### Appendix B

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(*) Sources for the Iverson indices: AIAS
### Table 3: Rank ordering of countries according to their degree of wage centralization

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<th>Schmitter&lt;sup&gt;b&lt;/sup&gt;</th>
<th>Cameron&lt;sup&gt;c&lt;/sup&gt;</th>
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<sup>a</sup> Source: Calmfors and Driffill (1988).  
<sup>b</sup> Source: Schmitter (1981).  
<sup>c</sup> Source: Cameron (1984).  
<sup>d</sup> Source: Blyth (1979).  
<sup>e</sup> Source: Bruno and Sachs (1985).
References


