

The political economy of twin deficits and wage setting centralization

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March 30, 2017

Abstract

This paper provides a political economy model, supported by an econometric analysis, which suggests a negative relation between wage centralization and the twin deficits (fiscal and the current account deficits) in industrial economies. An increase in the external deficit initiated by fiscal deficit favors non-traded sector workers through the real exchange rate appreciation and, hence, increasing the relative wages of this sector. Thus, non-traded sector workers relatively support (oppose) more a rise (reform) in the two deficits. Wage centralization mitigates this sectoral effect by reducing intersectoral wage gaps. Policy maker, following the preference of the median voter who belongs to the non-traded sector, has less political incentive (cost) to deteriorate (reform) the external balance through its budget balance, if the wage bargaining system is more centralized. This theoretical prediction is tested using a panel data that include 19 major industrial economies over the period of 1980-2012, confirming that wage centralization is associated with lower twin deficits.

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

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

I would like to thank Antoine d’Autume, David de la Croix, Bruno Decruse, Jean-Olivier Hairault, Xavier Ragot, Gonzague Vannoorenberghe, Romain Ranciere, Gilles Saint Paul, Francois Fontaine, Jean Imbs, David Margolis and Nuno Coimbra. This paper is indebted to their constructive suggestions and comments.

1 Introduction

Global current account imbalances have been focal points of interest in international macroeconomics, especially since the 2007-2008 financial crisis. Many authors argue that global imbalances and the global financial crisis are intimately connected.¹ The crucial importance of the subject in policy-oriented debates and the fear for re-emergence of another financial crisis have motivated a large body of theoretical and empirical research to identify fundamental determinants of global current account patterns. The related literature generally argues that saving glut in fast-growing emerging markets and in oil countries, as well as, financial, institutional and macro variables can, to a large extent, explain observed global current account imbalances.²

Nevertheless, less research has been devoted to study the role that the structure of the labor market can play in the determination of the current account position of a country. The present paper focuses on one aspect of the labor market, i.e. the degree of centralization of wage setting. The impact of wage centralization on macroeconomic performance has been studied in the literature. The consensus is that extremes work best for employment and growth. However, no research has been devoted to the role that wage centralization can play in the determination of external balances.

This paper provides a theoretical model, supported by an econometric analysis, which suggests a positive relation between wage centralization and current account. The empirical results of this paper demonstrate that higher wage centralization is significantly and positively associated with current account balances in the cross-section of advanced economies. Besides, the results suggest that this link is, to a great extent, through the positive relation between wage centralization and the budget balance. In other words, wage centralization is associated with a lower public deficit which can be translated to a lower external deficit (the twin deficit hypothesis).³

The mechanism introduced in this paper to explain this observation relies on a political economy framework which presumes that the government uses the fiscal balance and its external debt position as a tool for preserving its office. In this framework, it is assumed that the government, when managing its balance, follows the preference of median voter who belongs to the non-traded sector (notably construction and services), since this sector

¹See for example [Obstfeld and Rogoff \(2009\)](#) and [Caballero and Krishnamurthy \(2009\)](#).

²According to the existing literature, these variables include budget balance, financial development, demographic variables, stage of development, inequality, terms of trade volatility and previously accumulated foreign reserves.

³The twin deficit hypothesis has been studied by a large number of theoretical and empirical papers (see for example [Chinn et al. \(2014\)](#) and [Chinn and Ito \(2007\)](#)). Empirical studies generally suggest that 1% increase in the fiscal deficit leads to around 0.1% – 0.3% increase in the current account deficit.

construct the majority of society in all industrial economies. I argue that wage centralization reduces the median voter's thirst for widening the public external debt and their dismay for a reduction in public external debt. This affects the political incentive of the government in managing its balance.

The mechanism introduced in this paper is as follows: a rise in public spending, can improve the short-term aggregate welfare by increasing the provision of public goods. At the same time, it leads to deficit in current account and to an appreciation of the real exchange rate, i.e. an increase in the relative price of the N-sector products. That implies a reallocation of resources from the traded sector (henceforth, T-sector) to the N-sector.⁴ Frictions in the labor market severely constrain the between-sector labor mobility. As a result, the surge in the twin deficits induces an inter-sectoral wage dispersion in favor of the N-sector workers. Consequently, the median voter supports more such a twin deficits policy compared to workers in the T-sector, since the prices in the T-sector is fixed internationally and, hence, wages (in terms of aggregate price level) in this sector decreases. For the same reason, the workers in the N-sector relatively oppose more reforms in the twin deficits.

Centralization of wage bargaining decreases this distributional effect by reducing wage flexibility, i.e. the sensitivity of sectoral wages with respect to sectoral prices (and hence, to changes in real exchange rate).⁵ Thus, the gains and losses from the twin deficits are smaller. Consequently, wage centralization mitigates the median voter's support for the deterioration of the two balances and his oppositions to the reform in the two deficits. This theoretical prediction is tested and verified by an econometric analysis. More precisely, I find empirical evidence that wage centralization is associated with lower deficits in current account and in budget balance in a panel of industrial economies.

To the best of my knowledge, this paper is the first to study the relationship between wage centralization and the current account. The link proposed in this paper is through the twin deficits hypothesis. Nevertheless, some other candidate explanations can be put forward to explain this link. [Kumhof et al. \(2012\)](#), [Behringer and Van Treeck \(2013\)](#) and [Marzinotto \(2016\)](#) show that a rise in inequality reduces households savings and so the current account. Accordingly, wage centralization may improve households savings and current account by reducing inequality. Besides, wage centralization may affect current account through national investment. Wage centralization can influence the aggregate wage

⁴For sectoral impacts of the twin deficits and its effects on the real exchange rate see [Branson and Love \(1988\)](#), [Revenga \(1992\)](#).

⁵After controlling for labor-skills and job conditions, [Holmlund and Zetterberg \(1991\)](#), [Hartog et al. \(2002\)](#) and [Teulings and Hartog \(1998\)](#) have shown that between-sectors wage dispersions and the responsiveness of the sectoral wages to sectoral prices is lower in countries with more centralized wage bargaining system. This impact of wage centralization will be discussed more precisely later.

level. A rise in the aggregate wage level can reduce the trade balance by reducing the competitiveness of the economy. On the other hand, if the capital market is integrated, the rise in the aggregate wage level discourages foreign investments, which in turns, reduces current account deficits. Nevertheless, in the econometric analysis of the paper, I do not find any relationship between wage centralization and investment, on the one hand, and between the former and households savings, on the other hand.⁶

The rest of this paper is organized as follows: section 2 discusses the various strands of literature which are related to this paper. Section 3 reviews some historical facts related to the purpose of this paper. Section 4 establishes the theoretical model. In section 5, I run a numerical analysis to demonstrate the theoretical mechanism. Section 6 is devoted to an econometric analysis. Finally, section 7 concludes.

2 Literature review

Four strands of literature are relevant to this paper; the literature on (i) current account imbalances, (ii) wage centralization and finally, (iii) real exchange rate impact of public spending.

Literature on current account imbalances

The research on current account imbalances was firstly motivated by the large current account deficit in the US starting from the 1990's. [Bernanke et al. \(2005\)](#) and [Clarida \(2005\)](#) attribute this dramatic trend in the US external balance to saving glut in Asian emerging-market countries and the oil exporters, ranging from Persian gulf countries to Norway. Recently, empirical papers tried to identify the possible determinants of external balance using panel regressions (see for example, [Chinn and Prasad \(2003\)](#), [Cheung et al. \(2013\)](#) and [Gruber and Kamin \(2007\)](#)). Some empirical papers turned their focus to the imbalances in advanced economies ([Decressin and Stavrev \(2009\)](#), [Kumhof et al. \(2012\)](#) and [Barnes et al. \(2010\)](#)). According to the existing literature, the set of variables that explain the external positions of industrial economies includes the budget balance, initial net foreign asset, demographic variables, financial development, average GDP growth, terms of trade volatility and institutional variables. The empirical section of my paper is inspired by this literature.

Nevertheless, there has been no study on the role of the labor market. This paper focuses on one specific feature of the labor market, i.e. the centralization of wage bargaining.

⁶I find some evidence that wage centralization is associated with higher investment. This is consistent with the positive associations between wage centralization and budget balance, on one hand, and between the latter and investment, on the other hand. This will be explained more precisely in subsection 6.3.

The relationship between wage centralization and the current account as explained by this paper is through the twin deficits hypothesis. Most of the empirical literature on current account determinants finds robust evidence on the existence of the twin deficit hypothesis (see for example Chinn et al. (2014), Bluedorn and Leigh (2011), Chinn and Ito (2007) and Chinn and Ito (2008)).

Literature on the real exchange rate impact of public spending

The mechanism explained by this paper is based on the impact of public spending, and its associated twin deficits, on the real exchange rate and, hence, on the relative wages of the N-sector. These causality relationships are studied by the previous literature. For example, Ricci et al. (2008) find that an increase in the government consumption to GDP ratio of 1 percentage point is associated with an appreciation of the equilibrium real exchange rate of close to 3 percent. Other empirical studies find qualitatively the same effect of a shock in public spending and its associated twin deficits on the real exchange rate (see for example: Chinn (1999), Branson and Love (1988) and Corsetti et al. (2012)). Furthermore, the evidence for Europe from VAR analyses is that a discretionary negative shock to government spending is associated with real depreciation of exchange rate (Beetsma et al. (2008), Benetrix et al. (2009), Bénétrix et al. (2009)).

Besides, the implication of the change in the real exchange rate on sectoral wages is largely studied in the literature. For example, Revenga (1992) show that the dramatic increase in the US twin balances between 1980 and 1985, led to appreciation of the dollar which reduced the wages by 2% and employment by 4.5-7.5 on average in trade-impacted industries. Robertson (2003) also finds evidence that real exchange rate appreciation increases inter-sectoral wage gaps in favor of less traded sectors. Campa and Goldberg (2001) find evidence that the wages are more elastic than employment with respect to real exchange rate variations.

Literature on wage centralization

Macroeconomic impacts of wage centralization have been studied by a large number of papers. The literature mostly focuses on the impact of wage centralization on aggregate wage level, unemployment, inter-sectoral wage gaps and wage flexibility. For example, Calmfors and Driffill (1988) show that there is a hump-shaped relationship between the aggregate level of wage and the degree of wage centralization.⁷ The other strand of paper on wage central-

⁷They conclude that countries with high level of wage centralization and countries with very decentralized wage bargaining system have better economic performance and less unemployment rate compared with their counterparts with medium level of wage centralization, i.e. the countries in which the wage is set at industry level.

ization focuses on the impact of wage centralization on inter-sectoral wage gaps. De la Croix (1994) provides a survey on the sectoral wage interdependency arisen by sector/firm level unions. The general idea discussed in this strand of literature is that the centralization of wage bargaining, i.e. bargaining through sector-level/national-level unions tends to reduce inter-sectoral wage gaps.⁸ Related empirical literature such as Rycx (2002); Kahn (1998); Blau and Kahn (1999); Edin and Zetterberg (1992) show that, after controlling for workers skills and job conditions, the inter-sectoral wage gaps tends to be lower in countries with more centralized wage bargaining systems. Holmlund and Zetterberg (1991), Hartog et al. (2002) and Teulings and Hartog (1998) showing 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 centralized economies (Nordic countries for example) are largely unaffected by the sectoral conditions. In this paper, I focus on the impact of wage centralization on current account which has not been studied before. The mechanism explained in this paper relies on the impact of wage centralization on the responsiveness of sectoral wages with respect to sectoral prices.

3 Historical facts and general mechanism

The main hypothesis of this paper is that wage centralization reduces the current account through its negative impact on fiscal deficit. In this section, I focus on some historical facts which are related to this hypothesis. The mechanism explained by this paper incorporates the twin deficits hypothesis. Some empirical papers have found evidence that 1 percent of GDP decrease in fiscal deficits reduces the current account by 0.1-0.3 percent of GDP.⁹ Bluedorn and Leigh (2011) control for changes in fiscal policies that are motivated primarily by fiscal deficit reduction, and hence, are largely uncorrelated with other factors affecting current account. They find that 1 percent of GDP fiscal consolidation raises the current account-to-GDP ratio by about 0.6 percent. As a historical example, in Belgium, budget balance deficits started to decline from -16 (% GDP) in 1981 to a surplus of 0.2% in 2001. This led to a continuous improvement of the external balance from -4 (% GDP) in 1981 to +4,5 (% GDP) in 2001. The experience of the US in the beginning of 2000's is a well-known historical example of the link between the two deficits. The US budget balance (% GDP) fell

⁸It is argued that strategic complementarity among sector-specific unions lead to undesired inflation and unemployment, while coordination between these sector level unions, i.e. bargaining at national level, eliminates these undesired effects. This conclusion is similar to the one by Calmfors and Driffill (1988).

⁹See for example Alesina et al. (1991), Lee et al. (2008), Bussière et al. (2010), Chinn and Ito (2008), Beetsma et al. (2008) and Chinn et al. (2014).

continuously from 0.26% in 1999 to -4.7% and -4.3% in 2003 and 2004, respectively. In the same period, the current account (% GDP) dropped from -3% in 1999 to -5,2% and -5,7% in 2004 and 2005, respectively.

A standard implication of budget deficit and its associated deficit in current account is an appreciation of the real exchange rate. Ricci et al. (2008) finds that an increase in the government consumption to GDP ratio of 1 percentage point is associated with an appreciation of the equilibrium real exchange rate of close to 3 percent. An increase in the budget deficit, when the Ricardian effect fails to be complete, leads to an inflow of capital from the rest of the world. The inflow of capital increases the aggregate demand and deteriorates the trade balance. While the surge in the demand for traded goods can be satisfied by higher import, the supply of non-traded goods, such as non-traded services and construction, is limited to domestic productions which may not immediately adjust to the demand. Therefore, in short-term a rise in the twin deficits and its associated capital inflow increases the relative price of the N-sector (which represents real exchange rate).

An increase in the relative price of the N-sector results in a reallocation of production factors from the T-sector to the N-sector. Sector-specific labor skills and frictions in the labor market defer the factor adjustment between the two sectors. Consequently, the relative wage in the N-sector will increase. The US data confirms these links. Figure (1,b) represents the employment ratio between the N-sector (services and construction) and the T-sector (manufacturing sector). While the general trend is an increase in the employment share of the N-sector, this increase was accelerated between 1999 and 2008 and then the slowing in this trend for the period after the crisis when the current account improved. Figure (1,a) represents the ratio between the average wage unit costs of the N-sector and that of the T-sector with reference to the ratio in 2010 (i.e. the ratio in 2010 is normalized to unity). This figure shows that the general trend has been the increase in the ratio in favor of the N-sector unit wage cost.¹⁰ However, the trend was accelerated between 1999 and 2007 and then decelerates afterward. These two figures are consistent with the short-term impacts of the twin deficits on factors reallocation and on the inter-sectoral wage dispersion which are implied by the variation in real exchange rate resulted from the deterioration of the two balances: The workers affiliated to the N-sector enjoy the boost in that sector, while the workers in the T-sector lose from less competitiveness of their sector and from a decline in their wage (in terms of domestic price level).¹¹

The other feature, which is used in the mechanism explained by this paper, is political

¹⁰The increasing trends can be explained by productivity rise and also the upturn in capital insensitivity of the T-sector.

¹¹Workers who have more sector-specific skills are more touched by the policy.

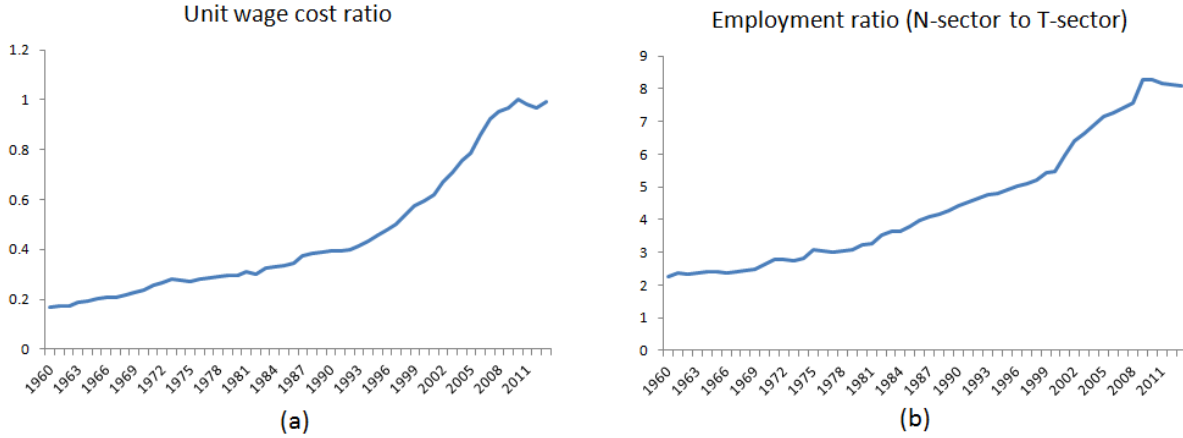


Figure 1: (a) US ratio between the average of unit wage cost in N-sector and T-sector with reference to 2010. (b) US employment ratio between N-sector and T-sector. (Source of data: AMECO)

economy framework. The government, trying to keep its office, is more concerned with the majority of the society. In all the industrial economies, a large and increasing majority of households are engaged in service and construction sectors. For example, in the US around 67% and 30% of employees were affiliated to the N-sector (construction and service) and T-sector (manufacturing), respectively, in 1960. These numbers changed to 88% and 11% in 2013. The same pattern can be found in other industrial economies. In 2013, the N-sector employment constituted about 88%, 90%, 82% and 78% of total employment in France, UK, Japan and Italy, respectively. Therefore, from a political economy point of view, one can expect that the government in industrial economies be mostly concerned with the impact of its policies on the N-sector workers and pay less attention to the consequences of its policies on the T-sector workers.

Wage centralization can play a role in this framework by moderating the impact of twin deficits policies and its associated changes in real exchange rate on sectoral wages. It is known from the literature that wage centralization tends to reduce the responsiveness of sectoral wages with respect to sectoral prices. For example, [Rycx \(2002\)](#); [Kahn \(1998\)](#); [Blau and Kahn \(1999\)](#); [Edin and Zetterberg \(1992\)](#)) using cross-sectional analysis show that inter-sectoral wage gaps, after controlling for individual workers' skills and job conditions, tend to be lower in countries with more centralized wage bargaining system. [Holmlund and Zetterberg \(1991\)](#), [Hartog et al. \(2002\)](#) and [Teulings and Hartog \(1998\)](#) obtain the same result and conclude that industry wages in more decentralized-wage-system countries are more responsive to sectoral prices and productivity changes. In the framework of this paper, wage centralization moderates benefits and losses from twin deficits policies and the changes

in real exchange rate. From this channel, wage centralization can influence the political incentives of governments in managing their fiscal balance through external debt/saving: governments in more centralized-wage countries find less political incentive for increasing their deficits through issuing foreign debts. They also face less political cost for improving their external debt position by reducing their fiscal deficits.

Hence, the prediction made by this mechanism is that countries with more centralized wage bargaining system tend to have lower budget deficits compared to their counterparts with more decentralized wage bargaining system. By the twin deficits hypothesis, this also implies more surplus in external balance for more centralized-wage economies if countries share the same characteristics in terms of other factors which may affect the current account. Figure (2,a) shows the relationship between non-overlapping 10-year averages of budget balance (%GDP) and wage centralization over the period of 1980-2010 for countries mentioned in table 3. This figure suggests a positive relationship between wage centralization and budget balance. Wage centralization is measured by the Iversen index. This index, providing yearly measurement of wage centralization, takes into account both level of wage setting and enforceability of bargaining agreements (Iversen (1998)).¹² The source of the data for the Iversen index is AIAS.¹³ This index is ranged from 0, representing a system in which wages are completely decentralized and set at individual level, to 1, representing completely centralized wage bargaining system where wages are set by coordination between a national union and an employer association.¹⁴ Table 3 in Appendix B indicates the 10-year averages of the Iversen index for these countries during the last four decades.¹⁵

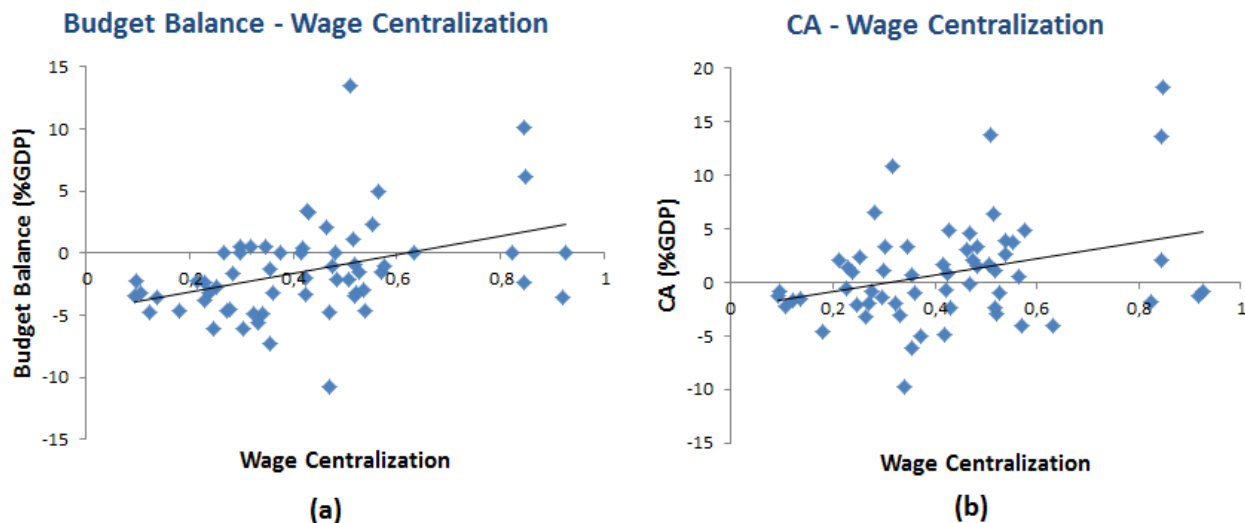
Figure (2,b) shows the relationship between non-overlapping 10-year averages of current account (%GDP) and wage centralization for the same countries and over the same period of time. This figure suggests that higher centralization of wage bargaining tends to go hand-in-hand with better external balance position in the cross section of industrial economies. As there are other candidate explanatory variables for the current account and the budget balance, in section 6, I perform an econometric analysis to show more rigorously how the two variables are associated with wage centralization.

¹²These two dimensions are recognized by empirical papers as main variables affecting sectoral wage-to-price responsiveness (see for example Wallerstein (1999)).

¹³Amsterdam Institute for Advanced Labor Studies.

¹⁴In the sample of industrial economies used in this paper, the Iversen index is ranged between 0.1 (USA and UK) to 0.6 (Nordic countries) with the exception for Austria for which the Iversen index is above 0.9 in most of the years.

¹⁵The rank orderings of countries according to different indices of wage centralization are reported in table 4. These rankings are induced by the indices suggested by the following papers: (i) Calmfors and Driffill (1988), (ii) Schmitter (1981), (iii) Cameron (1984), (iv) Blyth (1979) and (v) Bruno and Sachs (1985). As one can see in the table, the differences between the ranking induced by the Iversen index and the other rankings in table 4 are minor.



Wage centralization is measured by Iversen index. Each point in panels (a) and (b) represents, respectively, 10-year average of budget balance and current account for non-overlapping periods between 1980-2010.

Figure 2: (a) Budget balance (% GDP) vs. Iversen index, (b) Current account (% GDP) vs. Iversen index.

This paper focuses on the relationship between current account and wage centralization through the budget balance. There can be other possible channels through which wage centralization can affect current account. One of these possible channels is the impact of wage centralization on households savings through reducing income inequality. The impact of personal income inequality on private savings, and, hence on the current account, is recently studied by Kumhof et al. (2012) and Behringer and Van Treeck (2013). Given inequality-households savings relationship, wage centralization can improve the current account if it reduces personal income inequality. I investigate this channel in subsection 6.3. The results reject any robust relationship between wage centralization and the current account.

The other possible channel is through the impact of wage centralization on Investment. Low level of aggregate wages increases the international competitiveness of the economy and can improve trade balance, and hence, the current account. On the other hand, if the capital market is integrated, low aggregate wage level can encourage foreign investment which can, in turn, reduces current account. The impact of wage centralization on aggregate wage level was initiated by Calmfors and Driffill (1988). They find a hump shaped relationship between wage level and the degree of wage centralization. More precisely, they showed countries with high level of wage centralization (with dominant bargaining at national/inter-sectoral level) and the countries with very decentralized wage bargaining system (bargaining at firm/individual level) tend to have lower aggregate wage compared to their counterparts with medium level of wage centralization, i.e. the countries in which the wage is set at

industry/sector level. Considering the relationship between wage centralization and wage level, on the one hand, and between the former and investment, on the other hand, we can expect that wage centralization can influence current account through national capital formation. Related to this mechanism, the so called German miracle has been put forward by some literature to support the idea that the decentralization of wage bargaining can improve the external balance by restraining wage growth. This historical example is discussed in [Appendix A](#). The relationship between wage centralization and investment is empirically studied in subsection 6.3. There is weak evidence that wage centralization is associated with higher investment. Therefore, one cannot attribute the positive relation between current account and wage centralization through the relationship between the latter and investment. In the next section, I present a political economy framework to explain the relationship between wage centralization and the two balances.

4 Theoretical model

The model uses a political economy framework in which the policy maker follows preferences of N-sector workers which constitute the majority. It incorporates a small open economy with two sectors: T-sector and N-sector. The labor market is characterized by search and match friction. Wage centralization is introduced to the model. Centralization of wage bargaining reduces the responsive of sectoral wages with respect to seacroal prices. The government provides public goods financed through lumps-sum tax, external borrowing and return on foreign assets. The final consumption good and public good are built from a combination of the two goods. Private agents neither save nor borrow. Therefore, the budget deficit is equal to the current account and gives the magnitude of foreign capital inflows. To decide about its expenditure and so its deficit, the government follows the preferences of N-sector workers (median voter theorem).

4.1 Households

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

$$u(c_i, G) = c_i + f(G) = c_i + z_1 G^{z_2} \quad (1)$$

I assume that the households are risk neutral with respect to their private consumption. This assumption rules out the possibility of private saving and simplifies the model.¹⁶ Following the literature on the Dutch disease, I assume that the basket of private consumption consists of final goods from the T-sector and the N-sector.

$$C_i(c_{i,T}, c_{i,N}) = c_{i,T}^\gamma c_{i,N}^{1-\gamma} \quad (2)$$

Given the sectoral prices, the household i decides about the optimal allocation of its consumption between the two sectors to minimize its cost for a given level of consumption:

$$\begin{aligned} \min & P_N c_{i,N} + P_T c_{i,T} \\ \text{s.t.} & c_{i,T}^\gamma c_{i,N}^{1-\gamma} = C_i \end{aligned}$$

The traded sector price is set as numeraire ($P_T = 1$). The household's static cost minimization problem leads to the following relation between its consumption share of each sector and the real exchange rate (relative price of the N-sector to the T-sector):

$$e = \frac{P_N}{P_T} = \frac{(1-\gamma)c_{i,T}}{\gamma c_{i,N}} \quad (3)$$

where e represents the real exchange rate. An increase in the relative price of one sector makes the household to substitute its consumption toward the other sector. Since the private consumption is homogeneous of degree one with respect to sectoral consumption, equation (3) leads to the following relation between the aggregate private demand for each sector and the real exchange rate:

$$e = \frac{P_N}{P_T} = \frac{(1-\gamma)C_T}{\gamma C_N} \quad (4)$$

4.2 Government

Government provides public goods (G_t). Government finances its expenditure by (i) lump-sum tax (τ_t) levied on workers, (ii) gross return on its foreign assets and (iii) borrowing from the international financial market. τ_t , G_t and b are in terms of the domestic price level.¹⁷

¹⁶Private saving is, indeed, an important component of current account and accordingly, this assumption must be justified. In subsection A, I discuss the rationale and implications of this assumption.

¹⁷Assuming lump-sum tax instead of linear or progressive taxes simplifies the model and, besides, rules out the distortionary impact of other alternative tax forms.

Therefore, the government's budget constraint has the following form:

$$G_t = \tau_t \bar{n}_t + r \frac{A_{t-1}}{\bar{P}_t} + \frac{A_{t-1} - A_t}{\bar{P}_t} \quad (5)$$

A_t represents the initial net foreign assets owned by the government. This variable is in terms of the T-sector price level which is internationally fixed. $\frac{A_{t-1} - A_t}{\bar{P}_t}$ is the government net borrowing or fiscal deficit. $\frac{rA_{t-1}}{\bar{P}_t}$ is the net return on foreign assets.

I define $B_t (= (1+r)A_{t-1} - A_t)$ as **windfall expenditure**: the part of the government expenditure which is financed through borrowing or by the return on its foreign assets.¹⁸ In other words, windfall expenditure is public budget deficit plus the net return on its assets. Using this definition, we can rewrite the public budget constraint in the following form:

$$G_t = \tau_t \bar{n}_t + \frac{B_t}{\bar{P}_t} \quad (6)$$

Public good provision:

To produce public service/goods, the government must buy tradable and non-tradable final goods from the market and combine them with no cost. For the sake of simplicity, I assume that the share of T-sector goods in public goods is the same as in the basket of private good (γ):

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

The government minimizes its cost for a given level of public expenditure:

$$\begin{aligned} \min P_{N,t} g_{N,t} + P_{T,t} g_{T,t} \\ \text{s.t. } g_{T,t}^\gamma g_{N,t}^{1-\gamma} = G_t \end{aligned}$$

This minimization problem together with equation (4), lead to the following equations for the real exchange rate and aggregate price level (interms of T-sector price):

$$e = \frac{P_N}{P_T} = \frac{(1-\gamma)(C_T + g_T)}{\gamma(C_N + g_N)} \quad (7)$$

$$\bar{P} = \frac{1}{(1-\gamma)^{(1-\gamma)} \gamma^\gamma} P_N^{1-\gamma} \quad (8)$$

Equation (8) implies that appreciation of real exchange rate leads to an increase in the aggregate price level in terms of international price level.

¹⁸Notice that if $A_{t-1} > A_t$, the government finances partially its expenditure by borrowing.

4.3 Market clearing

Market clearing implies that the total expenditure (private and public) equals the total revenue (production rent and the net return on the government's foreign assets) plus the national net borrowing ($A_{t-1} - A_t$) which is the budget deficit.

$$\bar{P}_t C_t + \bar{P}_t G_t = Y_{T,t} + P_{N,t} Y_{N,t} + ((1+r)A_{t-1} - A_t) = Y_{T,t} + P_{N,t} Y_{N,t} + B_t \quad (9)$$

By definition, the aggregate consumption of N-sector final goods equals the production in that sector:

$$(c_N + g_N) = Y_N \quad (10)$$

Equations (9) and (10) imply that windfall expenditure corresponds to trade deficit:

$$B_t = Y_{T,t} - (c_{T,t} + g_{T,t}) \quad (11)$$

Therefore, we can, equivalently, interpret B_t as the current account deficit plus the net return on net foreign assets owned by the government.

Definition 1. Windfall expenditure is defined as the net borrowing plus the net return to foreign assets: $B_t (= (1+r)A_{t-1} - A_t)$. Since individual households do not have access to international financial market, we have:

$$\text{Current Account deficit} = \text{Budget deficit} = B_t - rA_{t-1} = A_{t-1} - A_t$$

Substituting equations (10) and (11) into equation (7), one can find the relative price of the N-sector (real exchange rate) as follows:

$$e_t = P_{N,t} = \frac{(1-\gamma)(Y_{T,t} + B_t)}{\gamma(Y_{N,t})} = \frac{(1-\gamma)(a_T n_{T,t} + B_t)}{\gamma a_N n_{N,t}} \quad (12)$$

This equation expresses an important symptom of the Dutch disease phenomenon: if production factors can not be immediately reallocated between the sectors, an increase in windfall expenditure leads to a real appreciation of currency. In other words, a positive shock in external borrowing, international interest rate (for the net creditors), or in the value of foreign asset brings about an appreciation of the real exchange rate in short term. In the next subsection, I introduce the production side of the economy which is characterized by search and match friction in the labor market.

4.4 Production side and the labor market

Production in any active firm depends linearly on labor. 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_j which depends on his sectoral affiliation (j). When vacant, firms in each sector search for workers with real cost (c). When the job is active and matched with a worker, firms produce final goods and enjoy the profit. Search is segmented: firms who search for jobs in one sector do not create congestion effect for the searching firms in the other sector. 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 (ν_j):

$$M_j = \phi \nu_j^{1-\alpha} u^\alpha \quad \text{for } j \in \{T, N\} \quad (13)$$

where ϕ is the efficiency of matching function. Equation (13) gives the number of matches in each sector and in each unit of time. Therefore, the probability that a vacant firm in sector j meets a worker, (p_j^f), and the probability that an unemployed household meets a vacancy in sector j , (p_j^w) are respectively:

$$p_j^f = \phi \left(\frac{u}{\nu_j}\right)^\alpha, \quad p_j^w = \phi \left(\frac{\nu_j}{u}\right)^{1-\alpha} \quad \text{for } j \in \{T, N\} \quad (14)$$

Since households can search for jobs in both sectors, there is the possibility of $p_T^w p_N^w$ that a worker finds a job in both sectors. In this case with probability of 0.5 he will be employed in one of the two sectors. 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 , (ρ_j), can be found by the following equations:

$$q_j = p_j^f - 0,5 p_{-j}^w, \quad \rho_j = p_j^w - 0,5 p_j^w p_{-j}^w \quad \text{for } j \in \{T, N\} \quad (15)$$

Moreover, in each period of time, an active job can be destroyed with the exogenous probability of χ . Therefore, the evolution of employment in each sector can be expressed by the following equations:

$$n_j' = \rho_j u + (1 - \chi) n_j \quad \text{for } j \in \{T, N\} \quad (16)$$

In equation (16), n_j represents the number of workers in sector j . 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:

$$V_j = -c + \beta(q_j J'_j + (1 - q_j)V'_j) \quad (17)$$

where $J'_{o,j}$ is the next period value function of the employer in sector j and β is the subjective discount rate of the households. The value function of active employers in sector j can be represented by the following equations:

$$J_j = \frac{a_j P_j}{\bar{P}} - \omega_{e,j} + \beta E \left[(1 - \chi) J'_j + \chi V'_j \right] \quad (18)$$

In (18), a_j and ω_j are sector-specific technology level, which is assumed to be given and constant, and wage in terms of domestic price level. P_j and \bar{P} represent the price of the final goods in sector j and the domestic price level, respectively. Accordingly, the value functions of the workers in sector j is:

$$W_j = \omega_{e,j} - \tau + \beta E \left[(1 - \chi) W'_j + \chi W'_u \right] \quad (19)$$

where W'_u is the next period value function of unemployed households. This value function can be expressed by the following equation:

$$W_u = \beta E \left[\rho_T W'_T + \rho_N W'_N + (1 - \rho_T - \rho_N) W'_u \right] \quad (20)$$

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

$$V_j = 0 \Rightarrow J'_j = \frac{c}{\beta q_j} \quad (21)$$

Using free entry condition and equation (18), we can write the evolution of vacancy as:

$$\frac{c}{\beta q_j} = \frac{a_j p'_j}{\bar{P}'} - \omega'_j + \frac{c(1 - \chi)}{q'_j} \quad (22)$$

This equation demonstrates another symptom of the Dutch disease phenomenon: the resource effect. Expecting a positive shock in real exchange rate increases (decreases) vacancy creation in the N-sector (T-sector). Consequently, the model implies that an increase in the windfall expenditure leads to a reallocation of resources from the T-sector to the N-sector.

4.4.1 Wage setting

As explained before, the main role of wage centralization in this model is reducing the inter-sectoral wage gap and hence, reducing the flexibility of real wages with respect to sector-prices.¹⁹ ²⁰ To capture this impact of wage centralization, I assume that there exist two wage bargaining levels in the economy: (i) bargaining at central level which is the outcome of the horizontal coordination between sector-level unions, and (ii) bargaining at firm level. The objective of the central-level bargaining is to set an egalitarian wage for all the workers ($\bar{\omega}$) independent from their sector affiliation.²¹ At the firm level, wage (ω_j^d) is set by bargaining between individual employee and firm. The market wages are the outcome of vertical coordination between these two levels of bargaining. This vertical coordination is directed at passing down the results obtained at a central level ($\bar{\omega}$) to firm level (Moene et al. (1993)). The ability of central organization to pass its bargaining result to firm level determines the level of wage centralization. More formally, market wages can be represented as:

$$\omega_j = (1 - \sigma^C)\omega_j^d + \sigma^C\bar{\omega} \quad j \in \{T, N\} \quad (23)$$

where σ^C , defined between zero and one, represents the level of wage centralization. If the central organizations have perfectly dominant positions ($\sigma^C = 1$) and can perfectly enforce their egalitarian objective the wage would be $\bar{\omega}$ for all the workers. Conversely, if the wage bargaining is completely decentralized ($\sigma^C = 0$), the market wages are be the outcome of firm-level bargaining (ω_j^d). This wage setting structure is similar to Boeri and Burda (2009),²² who argue that the wage depends, on the one hand, on the productivity of the job (here, his sectoral productivity) and, on the other hand, on some egalitarian criteria which is enforced by the unions.

I assume that wage centralization does not affect the aggregate share of workers from the total economic rent. In other words, central organizations attempt to reduce the inter-sectoral wage dispersion only by transferring some rents from high-paid to low-paid workers.²³

¹⁹In discussion, implications of the impact of wage centralization on reducing the intra-sectoral wage gap is discussed.

²⁰For the impact of wage centralization on reducing inter-sectoral wage gaps and reducing the responsiveness of sectoral wages to sectoral prices see: 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).

²¹The motivation of the union to compress the wage dispersion can be based on its egalitarian criteria or its objective for insuring the workers against the volatility in sectoral prices and productivity. See De la Croix (1994) for a survey on the impact of sector-national union wage bargaining on sectoral wage interdependency.

²²The model in this paper is the most similar to my model in terms of the definition and expression of wage centralization.

²³ The impact of wage centralization on current account through its impact on wage level can be an interesting subject for future studies. This channel is briefly discussed in section 3.

More formally:

$$\sum_j n_j \omega_j = \sum_j n_j \omega_j^d \quad (24)$$

Following Mortensen and Pissarides (1999a), Mortensen and Pissarides (1999b), Mortensen and Pissarides (1999c), decentralized wages (ω_j^d) are determined according to Nash bargaining between individual employer and worker. We assume the bargaining power of individual workers to be η . Therefore:

$$W_j^d - W_u = \frac{\eta}{1 - \eta} J_j^d \quad j \in \{T, N\} \quad (25)$$

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

$$\omega_j^d = \eta \frac{a_j P_j}{\bar{P}} + (1 - \eta)(\tau + b) + \eta \beta E \left[\rho_T (W_T' - W_u') + \rho_N (W_N' - W_u') \right] \quad \text{for: } j \in \{T, N\}. \quad (26)$$

Equation (26) demonstrates that the decentralized wage in each sector is an increasing function of the price in that sector. Moreover, it implies that, the only source of wage disparity in the model is sectoral prices (and sectoral technology level which is considered to be exogenous and constant). Recall that the aggregate price level \bar{P} is an increasing function of the real exchange rate (P_N). Hence, a positive shock in the N-sector price level induces an increase (a decrease) in the hypothetical decentralized wage of N-sector (T-sector) workers. Using equations (23) (26) and (24), one can show the market wage in the following form:

$$\omega_j = \omega_{e,j}^d - \eta \sigma^C \frac{n_{-j}}{n_j + n_{-j}} \left(\frac{a_j P_j}{\bar{P}} - \frac{a_{-j} P_{-j}}{\bar{P}} \right) \quad j \in \{T, N\} \quad (27)$$

This equation demonstrates that if wage is completely decentralized ($\sigma^C = 0$), workers earn their corresponding decentralized wage and if the wage is perfectly centralized ($\sigma^C = 1$), workers, regardless of their job affiliation earn the average wage of the economy. Finally, equation (27) implies that the higher is the degree of wage centralization, the lower is the responsiveness of wages with respect to the corresponding sector prices. Equations (12), (26) and (27) imply respectively that:

Proposition 1. *If the labor market is frictional, a positive shock in windfall expenditure (B_t) leads to:*

- *an increase the real exchange rate (by equation (12)).*
- *an increase (a decrease) in N-sector (T-sector) wages (by equation (26)).*

Centralization of wage bargaining reduces the sensitivity of sectoral wages with respect to variations in the windfall expenditure (by equation (27)).

4.5 Political economy and policy determination

The policy of the government is to choose its inter-temporal expenditure by borrowing/saving in the international financial market. I assume that it keeps its tax revenue constant. Moreover, the policy maker follows the median voter's preference, who is assumed to belong to the N-sector. In other words, the policy maker's objective is to maximize the value function of the representative worker in the N-sector. Using equation (1) and relying on the assumption that the households do not save, we can write the inter-temporal utility of workers and that of the unemployed households as follows:

$$V_j = (\omega_{e,j} - \tau + f(G)) + \beta E \left[(1 - \chi)V'_j + \chi V'_u \right] \quad (28)$$

$$V_u = (b + f(G)) + \beta E \left[\rho_T V'_T + \rho_N V'_N + (1 - \rho_T - \rho_N)V'_u \right] \quad (29)$$

Therefore, we can write the maximization problem of the policy maker as follows:

$$\begin{aligned} \max V_N &= (\omega_N - \tau + f(G)) + \beta E \left[(1 - \chi)V'_N + \chi V'_u \right] \\ \text{s.t. } G_t &= \tau_t \bar{n}_t + \frac{B_t}{\bar{P}_t} \quad \forall t \\ &\sum_{t=0} \left[\frac{B_t}{(1+r)^t} \right] = \sum_{t=0} \left[\frac{A_t}{(1+r)^t} \right] \end{aligned}$$

where r is the international interest rate. At steady state, the windfall expenditure is equal to the net return on foreign assets. Thus, there is no deficit in the two balances at steady state:²⁴

$$B_{ss} = rA_{ss} \quad (30)$$

If the government expects a positive shock in the future value of its foreign assets with the current amount of \hat{A} , it can decide about the time profile of expending this expected shock ($\{B_t\}$) such that the discounted amount of windfall expenditure equals the discounted amount of the asset shock:

$$\sum_{t=0} \left[\frac{B_t}{(1+r)^t} \right] = \sum_{t=0} \left[\frac{rA_{ss}}{(1+r)^t} \right] + \hat{A} = (1+r)A_{ss} + \hat{A} \quad (31)$$

²⁴Notice that $A_{ss} > (<)0$ implies a deficit (surplus) in trade balance.

Therefore, the policy can be interpreted as the optimal time allocation of the windfall expenditure $\{B_t\}$ such that equation (31) is satisfied. A shock in the windfall expenditure affects the workers' inter-temporal utility from two different channels: (i) the provision of public good (G) and (ii) the impact on real wages ω_j .²⁵ A positive shock in the windfall expenditure affects positively the value function of N-sector workers since they will enjoy an increase in wage (and hence, in private consumption) and, at the same time, a higher provision of public goods. Nevertheless, the impact on the value function of T-sector workers remains ambiguous since they enjoy a higher provision of public goods only with the cost of a decline in their wage. The fact that which effect dominates depends on the marginal rate of substitution between public goods and private goods (z_1).

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

- *A positive shock in the windfall expenditure increases the welfare of N-sector workers by providing them with higher public good provision and higher private consumption.*
- *The impact of the shock on the welfare of T-sector workers is ambiguous since it provides them with more public good provisions only with the cost of lower wages.*

Centralization of wage bargaining reduces wage responsiveness and, hence, it mitigates the gap induced by the windfall expenditure between the value functions of the two sectors. In the next subsection, a numerical example is performed to show how in this framework, wage centralization affects the political economy of the twin deficits when a shock in government's foreign assets is realized.

5 Numerical analysis

In this section, I perform a numerical example to illustrate the implication of this theoretical model on the political economy of the twin deficits. The interest is in qualitative implications of this model and not in quantitative ones. The qualitative implications are not sensitive to the calibration of the model. Nevertheless, the calibration methodology is explained in appendix A.3.

5.1 Effects of a shock in the windfall expenditure

Macroeconomic impacts of a shock in windfall expenditure.

Figure D.1 shows macroeconomic impacts of a positive temporary shock in windfall expen-

²⁵The 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 (ρ_T and ρ_N). The impact on the value function of jobless households is not the interest of this paper and I will not report it henceforth.

diture (B_t). A positive temporary shock leads to an increase in the aggregate demand for final goods in both sectors (equation (9)). More demand in the T-sector increases the import from abroad leading to deterioration of trade deficit (equation (11)). However, by definition, the supply of the N-sector final goods is restricted to the production in that sector (equation (10)). Consequently, the positive shock in the windfall expenditure leads to real exchange rate appreciation (equation (12)).

Appreciation of the real exchange rate increases (decreases) the economic surplus of matches in the N-sector (T-sector). Consequently, more vacancy will be created in the N-sector (T-sector) (equation (22)). Correspondingly, 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 a decline in their wages and, thus, in their private consumption (equation (26)).²⁶The impacts on sectoral employment rates and on sectoral wages are completely opposite if a negative shock in the windfall expenditure is realized.

As discussed before, a higher degree of wage centralization reduces wage dispersion between the two sectors by transferring some rents from the sector with higher wages to the sector with lower wages. Consequently, σ^C decreases the sensitivity of sectoral wages with respect to variations in the real exchange rate induced by the windfall shock. Figure D.2 demonstrates the response of sectoral wages to the same windfall shock for different levels of wage centralization. As it is clear from this figure, when $\sigma^C = 1$, windfall shock induces no inter-sectoral wage dispersion. Moreover, the wage rise for N-sector workers is smaller when the wage bargaining is more centralized.²⁷ Consequently, centralization of wage reduces the gap between the inter-temporal utility of households affiliated to different sectors (Figure D.3).

²⁶The impact of the windfall income on unemployment rate, and so on tax rate, depends on the initial employment shares. Our calibration tries to capture the fact that N-sector workers represent the majority. Since matching function is marginally diminishing in the number of vacancy, the windfall shock increases the unemployment. This result would be reversed if T-sector workers were the majority.

²⁷Besides, higher centralization of wage bargaining increases the profit of the booming sector employers by reducing the wage responses. Hence, the reallocation of labor to the booming sector is accelerated by wage centralization.

5.2 Policy determination and the twin balances

5.2.1 Definition of the policy

To be able to solve the model, I assume that the windfall expenditure follows a Markov process with persistence ρ_B and magnitude $\epsilon_{B,0}$:

$$B_t = B_{ss} + \rho_B^t \epsilon_{B,0} \quad (32)$$

Substituting from equation (32) into equation (31), we have:

$$\sum_{t=0}^{\infty} \left[\frac{\rho_B^t \epsilon_{B,0}}{(1+r)^t} \right] = \hat{A} \Rightarrow \epsilon_{B,0} = \frac{1+r-\rho_B}{1+r} \hat{A} \quad (33)$$

This equation implies that the policy is uni-dimensional. In other words, once the government decides about the shock persistence of its windfall expenditure (ρ_B), its expenditure at time zero and, hence, in every period of time, will be determined accordingly.

When a positive shock in the future value of government foreign assets is realized ($\hat{A} > 0$), the government can increase the provision of public good. In this case, the higher is ρ_B , the more tolerant is the government in increasing its expenditure and the smoother will be the provision of public goods (see figure D.4). Consequently, the two balances will be relatively more balanced (more surplus /less deficit). Conversely, the lower is ρ_B as a response to $\hat{A} > 0$, the less patient is the government in increasing its expenditure. The opposite holds if a negative shock in the expected value of foreign assets is realized. In that case, higher ρ_B implies more deficits and a lower ρ_B implies less deficits.

Fact 1. *If a shock in the value of the government's assets (\hat{A}) is realized, then:*

- *If $\hat{A} > 0$, higher ρ_B (smoothing policy) improves the two balances.*
- *If $\hat{A} < 0$, higher ρ_B (accelerating policy) deteriorates the two balances.*

5.2.2 Effect of smoothing/accelerating policy on the household's value function

The policy affects the inter-temporal utility of workers from two different channels: (i) the discounted value of public goods and (ii) the discounted value of wages. To understand better the impact of smoothing policy, I first consider an economy with perfect labor market.

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.²⁸ Therefore, the preferred policy would have been the same in both sectors: the policy that guarantees the highest present value of the public goods provision. Note that in the case of perfect labor market, domestic price level (\bar{P}_t) would have been independent of B_t . This implies that for the case of linear utility with respect to the public goods ($z_2 = 1$) the households, regardless of their job status, will prefer pure smoothing policy ($\rho_B = 1$) if and only if $r > \frac{1-\beta}{\beta}$ and they will prefer pure accelerating policy ($\rho_B = 0$) if and only if $r < \frac{1-\beta}{\beta}$.

Case of frictional labor market The impact of the policy on the households welfare is more complicated when the labor market is frictional. On the one hand, friction in the labor market implies that windfall shock leads to an appreciation of the real exchange rate which lead to 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 goods, 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:

Result 2. $\hat{\rho}_B$ is defined as the policy which maximizes the current value of public goods. If the labor market is frictional, then there exists $r_{min} < r_{max} < \frac{1-\beta}{\beta}$ such that:

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

Figure D.6 depicted the change in the current value of public good provision (resulted by the shock) as a function of smoothing policy (ρ_B) for ($z_2 = 1$) and prevailing annual international interest rate of 3% (monthly net return of 0.25%). Note that for the calibration

²⁸Neutrality 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.

of $\beta = 0,9947$ (annual discount rate of $\beta_y = 0,94$) , $\rho_B = 0$ would maximize the current value of the windfall expenditure if the labor market was frictionless.

On the other hand, as discussed in subsection (5.1), a positive shock in windfall expenditure increases the wage income of N-sector workers and reduces that of T-sector workers. Therefore, it is clear that the impact of the policy is not symmetric across the workers if the labor market is frictional. If a positive shock in government's foreign assets 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 exchange rate, implying less rise (decline) in the wage of the workers in the N-sector (T-sector). On the other hand, the higher is ρ_B the more likely it is for the workers in the N-sector (T-sector) to exit from (enter) the booming sector.

The preferred policy by households depends on the impact of policy on both public goods and wage/private consumption. Since the impact on private consumption is heterogeneous, the workers in the N-sector prefer less smoothing policy than the workers in the T-sector. This result is just due to the heterogeneous impact of the policy on sectoral wages. 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 $\hat{\rho}_B$.

Result 3. *When a positive shock in the value of the government's foreign 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 $\rho_B^{*,j}$ is the preferred policy of the workers in sector j , then:*

$$\rho_B^{*,N} < \hat{\rho}_B < \rho_B^{*,T} \quad (34)$$

The opposite holds if a negative shock is realized in the government's foreign assets.

5.2.3 Effect of centralization on households' preferred policy

The effect of smoothing policy on the discounted value of N-sector wages is monotonically negative as explained before. Moreover, wage centralization reduces the responsiveness of wages to sectoral prices. Figure 3 represents the effect of smoothing policy on the current value of changes in N-sector wages (relative to steady-state value of wage) for different level of wage centralization. While the wage effect of the shock is always decreasing with the policy, its magnitude is lower when wage is more centralized. Nevertheless, wage centralization has no significant impact on $\hat{\rho}$. When wage is decentralized and the wage impact is high, the

effect of policy on welfare is dominated by the effect of policy on wage. However, when wage is centralized, the impact on the provision of public goods dominates the impact of the policy on wages. As a result, the preferred policy of N-sector workers converges to $\hat{\rho}$ when wage centralization is high and so the impact on wage is small. These results are depicted in figure 4 which represents the impact of smoothing policy on the inter-temporal welfare of N-sector workers. When wage is completely decentralized, the effect of smoothing policy is similar to its policy on wage. However, when wage is strongly centralized the effect converges to the impact of the policy on public goods. Consequently, N-sector worker in a centralized wage economy prefers higher ρ_B which implies less twin deficits.

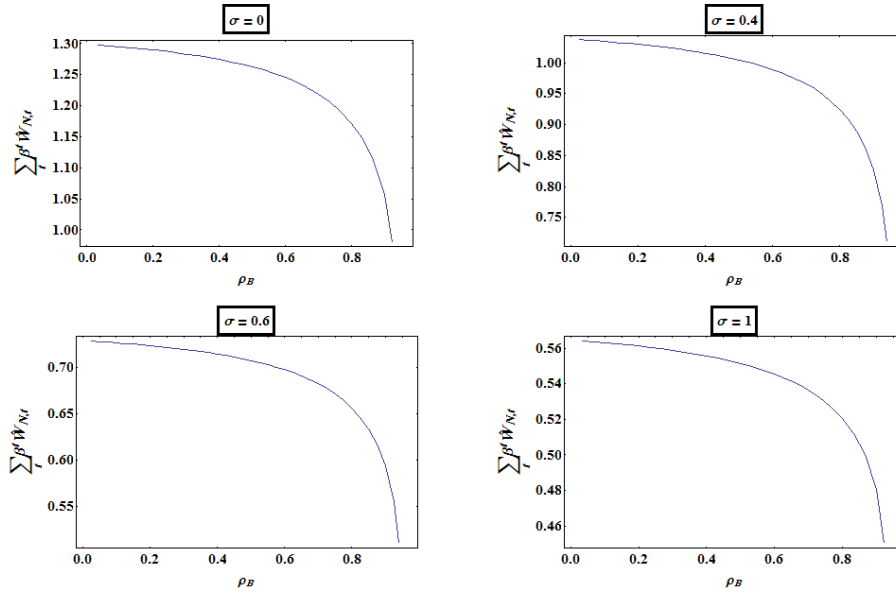


Figure 3: Discounted value of wage changes (% of steady state value) for N-sector workers as a function of smoothing policy for different levels of wage centralization.

Conversely, in decentralized-wage economies, the impact of smoothing policy on T-sector wage rate is positive (see figure D.7). This implies that T-sector workers' preferred policy is higher than $\hat{\rho}$. Again, the higher is the level of wage centralization, the lower is the impact of the shock on wages (figure D.7). It can be seen that T-sector workers' preferred policy converges to $\hat{\rho}$ when wage is highly centralized. This implies that T-sector workers in more centralized economies prefer less smoothing policy compared to T-sector workers in decentralized-wage economies (see figure D.8). When $\sigma = 1$, both groups of workers have the same evaluation of the policy.

Result 4. *The higher is the centralization of wage bargaining, the more (less) smoothing would be the preferred policy of workers in the N-sector (T-sector). The opposite holds if a negative shock is realized in the government's foreign asset. More formally:*

$$\begin{aligned}
\text{if: } \hat{A} > 0 : & \quad \frac{\partial \rho_B^{*,N}}{\partial \sigma^C} > 0 & \quad \frac{\partial \rho_B^{*,T}}{\partial \sigma^C} < 0 \\
\text{if: } \hat{A} < 0 : & \quad \frac{\partial \rho_B^{*,N}}{\partial \sigma^C} < 0 & \quad \frac{\partial \rho_B^{*,T}}{\partial \sigma^C} > 0
\end{aligned}$$

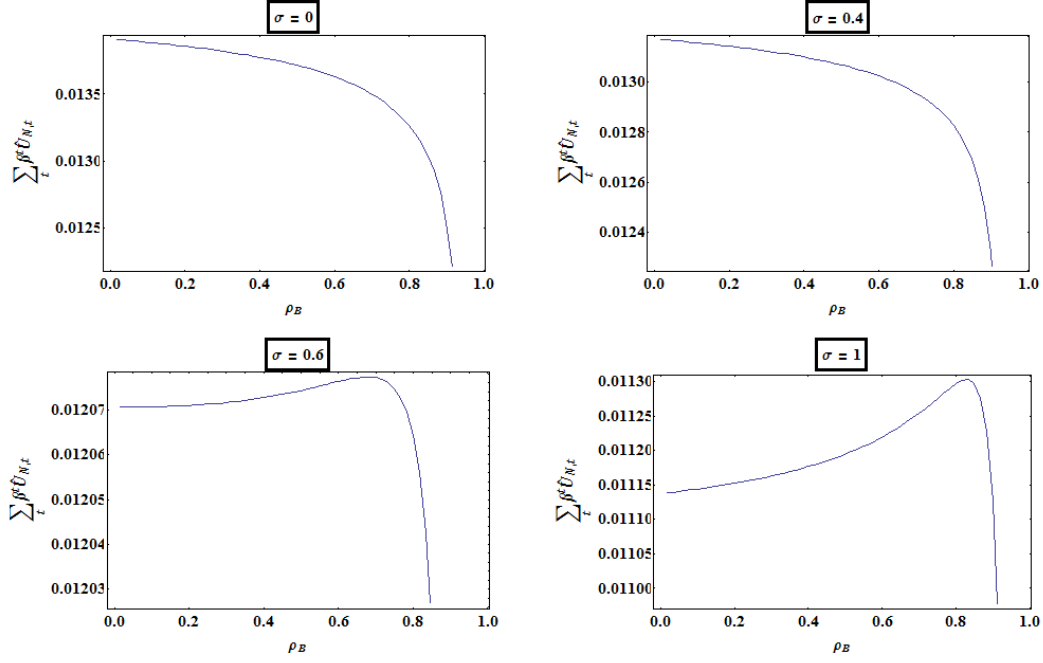


Figure 4: Inter-temporal utility of N-sector workers as a function of policy for different levels of wage centralization.

This setting implies that in economies with more centralized wage bargaining system, the policy maker who follows the preference of N-sector workers have less political support to increase its budget deficit, and consequently, the current account deficit compared to a policy maker in more decentralize wage economy.

5.2.4 Policy determination and impact on current account

From political economy point of view, the policy is determined by the 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 represent the preferred policy of the workers in the N-sector.

According to result (4), 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 the majority of households decide about the policy, the prevailing

policy is more smoothing if the wage bargaining is more centralized. In the next section, an econometric analysis is performed to test if this prediction is valid for the sample of industrial economies.

6 Econometric analysis

Our results in the previous section suggest that centralization of wage bargaining can reduce the twin deficit. In section 3, I document some stylized facts that support this relationship between wage centralization and the two balances. However, there are a number of other candidate explanations for the two balances, some of them likely to be correlated with wage centralization. To account for this issue, I perform a multivariate analysis of current account and budget balance determinants using a panel of 17 OECD countries over the period 1980-2012.²⁹ The sample of countries is mostly constrained by the availability of data on wage centralization index. In the first subsection, I test if wage centralization has an explanatory power for the budget balance. In subsection 6.2, I perform a regression for the current account to test (i) if wage centralization has any explanatory power for the current account and (ii) if the twin deficits hypothesis holds for the sample of countries. Besides, I will test if wage centralization can influence the current account through other channels, namely through households savings and investment.

6.1 Government budget balance and wage centralization

In this subsection, I test if wage centralization has explanatory power for the medium term budget balance of industrial economies. To test this hypothesis, I estimate the budget balance (as percentage of GDP) by controlling for the wage centralization and a set of some candidate explanatory variables which are likely to affect the budget balance. The estimations have the following form:

$$BB_{i,t} = \beta_0 + \zeta_C \text{ Wage Centralization}_{i,t} + \zeta Z_{i,t} + \epsilon_{i,t} \quad (35)$$

The dependent variable is the budget balance (%GDP). Wage centralization is measured by the Iversen index. $Z_{i,t}$ is the benchmark set of explanatory variables that include:

- Natural resource rent (%GDP) which is to a large extent, a windfall revenue for the government and expected to improve the budget balance. Alternatively, I substitute

²⁹The countries included in the econometric analysis are the ones reported in Table 3.

natural resource revenue by the variation of this variable. The rationale is that usually the government tends to adjust its expenditure to its natural resource revenue.

- Net government debt (%GDP) which can increase directly and indirectly the government revenue.
- Output gap. This variable is measured as the deviation of GDP per capita from its trend as a ratio to the actual GDP per capita. In recessions, the fiscal deficit is likely to increase due to a decline in tax base and the possibility of expansionary fiscal policy.
- Real GDP growth: higher GDP growth can increase the tax base and improves the budget balance.

The sources and descriptions of data used are reported in table 5. I estimate equation (35) using 3-year averages of data with the exception for net government's debt.³⁰ This is due to the fact that the main interest is in the medium term impact of wage centralization on budget balance.³¹ I control for time fixed effect in all the regressions. For robustness check, I control also for the lagged term of wage centralization. The results which are reported in table 1, confirm a positive and significant impact relationship between wage centralization on budget balance.³² The results for the estimation of budget balance with random effect is reported in table 7

6.2 Current account and wage centralization

In this subsection, I test whether wage centralization has explanatory power for medium-term current account positions of industrial economies. Besides, I test for the validity of the twin deficits hypothesis. The theoretical model of this paper claims that wage centralization improves current account by reducing fiscal deficits. To empirically account for this issue, I implement the following strategy: as a baseline model, I estimate current account (% GDP) using a benchmark set of explanatory variables which are used in the literature.³³ In the second step, I test whether wage centralization (represented by the Iversen index)

³⁰net government's debt is the accumulation of the past fiscal deficit. Hence, the value of this variable in the first year of each period is used to avoid capturing a reverse link from the fiscal deficit to government debt.

³¹This procedure has also the advantage of abstracting from cyclical effects and other high frequency noises in the data.

³²The impacts of per capita GDP deviation, natural resource rent and net foreign assets are significant and consistent with theory.

³³This benchmark set includes budget balance and I test whether the twin deficits hypothesis holds in the sample. Key references in this literature include Chinn and Prasad (2003), Gruber and Kamin (2007), Chinn et al. (2014) and Kumhof et al. (2012) and other papers mentioned in table 6.

Table 1: Estimation for Budget Balance (%GDP), with Country Fixed Effect

VARIABLES	(1) BB	(2) BB	(3) BB	(4) BB
Wage Centralization	16.920** (7.827)	19.432** (8.082)		
Lagged Wage Centralization			24.121*** (7.885)	17.378** (6.853)
Gov. net debt	-0.050*** (0.010)	-0.059*** (0.010)	-0.046*** (0.009)	-0.055*** (0.009)
Natural resource rent	0.430 (0.277)		0.794*** (0.301)	
Δ natural resource		0.801** (0.333)		0.802** (0.338)
Output gap	0.408*** (0.149)	0.461*** (0.156)	0.454*** (0.142)	0.474*** (0.145)
GDP growth	0.470*** (0.160)	0.471*** (0.163)	0.464*** (0.160)	0.489*** (0.160)
1992-1994	-3.002** (1.360)	-3.807*** (1.329)	-2.661** (1.314)	-3.408*** (1.279)
Constant	-7.486** (3.182)	-6.780** (2.959)	-10.500*** (3.333)	-6.145** (2.571)
Observations	137	132	141	141
R-squared	0.588	0.600	0.597	0.593
Number of Countries	19	19	20	20
Hausman test statistic	9.38 [0.8567]	7.29 [0.9229]	2.74 [0.9999]	13.33 [0.5005]

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

has a significant explanatory power for current account once it is substituted for the budget balance in the baseline model. Finally, I test a model in which both wage centralization and fiscal balance are included in the regression. Since, this model argues that the wage centralization can affect current account through the budget deficit, one can expect that once the two variables are included in the regression, wage centralization might not have any impact on current account. Therefore, the following three specifications are considered for different measurements of the variables:

$$CA_{i,t} = \beta_0 + \beta_{BB} \quad BB_{i,t} + \beta X_{i,t} + \epsilon_{i,t} \quad (36)$$

$$CA_{i,t} = \beta_0 + \beta_C \quad \text{Wage Centralization}_{i,t} + \beta X_{i,t} + \epsilon_{i,t} \quad (37)$$

$$CA_{i,t} = \beta_0 + \beta_{BB} \quad BB_{i,t} + \beta_{CB} \quad \text{Wage Centralization}_{i,t} + \beta X_{i,t} + \epsilon_{i,t} \quad (38)$$

The dependent variable is the current account. In order to control for scale effects, both budget balance and current account are measured as percentage of GDP. $X_{i,t}$ is the benchmark set of explanatory variables that, in line with the existing literature, includes: net foreign assets (%GDP), relative income (to the U.S.) and its quadratic term, financial development, young and old age dependencies, population growth, average GDP growth, inequality.³⁴

As before, I use alternatively non-overlapping 3-year averages of the data (with the exception of net foreign asset).³⁵ This is due to the fact that the main interest of this paper is the medium term impact of wage centralization on current account.³⁶

Following the literature, the explanatory variables (with the exception of net foreign assets and relative income) are converted into the deviations from their GDP-weighted sample mean prior to the calculation of 3 year averages. The rationale is to emphasize that current account balances are relative measures and their movements are influenced both by domestic and foreign economic conditions.³⁷ To remove omitted variables bias, I use country fixed

³⁴Sources and descriptions of data used are reported in table 5.

³⁵ Net foreign asset position is the accumulation of the past current account surpluses. Hence, the value of this variable in the first year of each period is used to avoid capturing a reverse link from the current account balance to net foreign asset.

³⁶For robustness check, I use also non-overlapping 4-year and 5-year averages of data. The differences are minor

³⁷For the wage centralization, both level data and deviated data are tested and the difference between the coefficient of the two in different specifications is minor. The coefficient of inequality is not significant if level data is used.

effect.³⁸

The summary of the results for the baseline model (equation 36) with and without country fixed effect are reported and compared with the literature in table 6. This table shows that our general results are consistent with the existing literature. The detailed results for this baseline specification are reported in columns (1) of tables 2. The results confirm the twin deficits hypothesis. The coefficient of budget balance is 0.228 implying a significant but not a complete Ricardian effect.

To test if wage centralization can affect the current account through the budget balance, I test a model in which wage centralization is substituted for budget balance (equation (37)). The results are reported in column (3) of table 2. The results suggest a significant and positive association of wage centralization and current account when wage centralization is substituted by the budget balance. As a robustness check, I add the other explanatory variables of the budget balance to the set of explanatory variables of the current account (columns (4) and (5) of table 2). The coefficient of wage centralization is more significant when these variables are included.

In the next step, I include both wage centralization index and fiscal balance in the regression (equation (38)). Column (2) of table 2 shows the result for this regression. The result shows that including both variables at the same time, wage centralization has no impact on the current account. This result can suggest that the budget balance is the only variable through which wage centralization affects the current account, or the other channels will cancel out each other in a way that beyond the impact through the twin deficit, the net impact of wage centralization on current account is not significant. The results with random effect are reported in table 8. The results are in line with the ones in table 2. First difference estimation of current account is also reported in table ???. These results also show a positive relation between wage centralization and current account for the sample of industrial economies.

6.3 Wage centralization, households savings and investment

As discussed in section 3, there are two other candidate explanations for the relationship between wage centralization and current account. One is that, wage centralization can improve households savings by reducing inequality. The second, is through the impact of wage centralization on wage share and investment. On the one hand, higher aggregate wage can deteriorate trade balance by decreasing international competitiveness of the economy.

³⁸As robustness check, I perform also the regression with random effect. The results for the coefficient of wage centralization wage centralization is qualitatively the same with and without country fixed effect. The results for random effect regression is reported in table 8.

Table 2: Estimation for CA, with country fixed effect

VARIABLES	(1) CA	(2) CA	(3) CA	(4) CA	(5) CA
Budget Balance	0.260*** (0.063)	0.252*** (0.067)			
Wage Centralization		3.874 (4.496)	6.365** (2.934)	18.830*** (5.292)	15.117*** (3.238)
Inequality	-0.446* (0.228)	-0.459* (0.231)	-0.497* (0.273)	0.149 (0.261)	-0.445** (0.200)
Financial development	-0.028** (0.012)	-0.027** (0.012)	-0.038** (0.016)	-0.010 (0.010)	-0.032** (0.014)
Net foreign assets	0.054*** (0.008)	0.054*** (0.008)	0.069*** (0.008)	0.079*** (0.020)	0.069*** (0.007)
Young dep.	0.509** (0.217)	0.482** (0.216)	0.496** (0.195)	0.353 (0.340)	0.580*** (0.190)
Old dep.	-0.455* (0.237)	-0.512* (0.248)	-0.708*** (0.194)	-0.364 (0.371)	-0.609** (0.257)
Population growth	-1.672* (0.956)	-1.631 (0.939)	-1.671** (0.783)	-2.092*** (0.619)	-1.321* (0.657)
Relative income	3.463 (5.748)	2.505 (5.921)	16.353* (7.876)	5.148 (11.691)	15.935* (8.535)
Quadratic relative income	-1.699 (2.621)	-1.318 (2.702)	-6.889* (3.783)	-1.140 (4.795)	-8.007* (3.969)
Natural resource rent				0.432 (0.385)	1.214** (0.438)
Gov. net debt				-0.022 (0.021)	
GDP growth				-0.002 (0.148)	
Output gap				-0.303 (0.221)	
Constant	-3.488 (2.898)	-4.338 (3.509)	-14.577*** (4.973)	-10.021 (6.487)	-18.618*** (5.913)
Time Fixed Effect	Yes	Yes	Yes	Yes	Yes
Observations	154	148	161	94	161
R-squared	0.680	0.683	0.728	0.801	0.767
Number of Countries	17	17	17	15	17

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

On the other hand, if financial market is integrated, it can lead to capital outflow. In this subsection, I test for these channels. To do so, I will regress households saving rate and capital formation by separately substituting these two dependent variables for CA in equations 36-38. I use both demeaned and non-demeaned measurements of data. The differences are minor.³⁹

Table 9 represents the regressions for households savings with and without country fixed effect. The results confirm some evidence for the existence of an incomplete Ricardian equivalence. Nevertheless, I find no evidence for the relationship between households savings and wage centralization (whether it is jointly with budget balance or separately included in the regression). Nevertheless, the coefficient of this variable is negative (which is consistent with the positive association of this variable with the budget balance). Therefore, there is no evidence that the positive association of wage centralization and current account is due to the positive impact of this variable on households savings.

Table 10 shows the results for the regression of national investment with and without country fixed effect. The results for the baseline models, columns (1) and (5), are consistent with the existing literature. With country fixed effect regression, the coefficient of wage centralization is always negative but highly insignificant. With random effect, the coefficient is always positive (significant only if substituted for budget balance). The positive coefficient is consistent with the positive association of budget balance and wage centralization (since the coefficient of budget balance is positive). This result also rejects the hypothesis that wage centralization can improve the current account by discouraging investment.

The econometric analysis of this paper, suggests that wage centralization is positively associated with budget balance and current account in a sample of industrialized economies. Besides, the results confirm the existence of the twin deficits hypothesis. Moreover, the results reject the two hypothesis that wage centralization may affect the current account by reducing inequality and discouraging investment.

7 Summary and conclusion

One new contribution of this paper is to introduce a relationship between wage centralization and the twin deficits. The empirical results of the paper demonstrate a positive and significant relationship between wage centralization and current account in the panel of industrial economies. Besides, the econometric findings suggest that this relation can, to a large extent, be explained by the impact of wage centralization on the budget balance. The paper presents a political economy framework to explain this observation which has not been studied by

³⁹Only the results for non-transformed data are reported.

the previous literature. The theoretical model incorporates a political economy framework in which policy maker follows the preference of the median voter who belongs to non-traded sector. An increase in public spending, and its associated twin deficits, induces appreciation of the real exchange rate, and hence, an increase in the relative price of the non-traded sector goods. AS labor market frictions severely constrain between-sector labor mobility, the relative wages of workers in the non-traded sector increases. Therefore, workers in this sector support relatively more such twin-deficits policies. The magnitude of these effects decreases with the degree of wage centralization: unions promote inter-sectoral wage equality and, consequently, the sensitivity of sector wages with respect to sectoral prices declines with more centralization of wage bargaining. Thus, the gains and losses from twin-deficit policies are smaller. This reduces the thirsts of the median voter for higher twin-deficits and his dismay for a reform in the two balances.

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A Appendix A: Discussion

Discussion on the assumptions for utility function

In the theoretical part of this paper, I rule out the possibility of private saving. This assumption considerably simplifies the model. Yet, private saving is an important component of current account and, therefore this assumption must be justified. The focus of the theoretical part of the paper, is the impact of wage centralization on current account through public saving/expenditure. As long as Ricardian equivalence is not complete, the impact of public saving on current account is not perfectly offset by private dissaving and, therefore, our theoretical results on the impact of wage centralization on current account remain valid qualitatively. The empirical results on current account, including our results in the previous section, point out an incomplete Ricardian equivalence which can justify qualitative results deduced by this assumption.

Moreover, I assume additive separable utility function with respect to private and public goods. Relaxing this assumption implies that, if public goods and private consumptions are complementary, an increase in G will increase private savings which intensifies current account deficit (if households have access to international financial markets). Conversely, if G and C are substitutable, an increase in G motivates the households to save internationally. Hence, the impact of the budget deficit on current account will be moderated.

A.1 Intra-sectoral wage compression

In the theoretical part of this paper, I argued that wage centralization affects the political incentive of the government in managing its budget balance, and so the current account, by reducing the inter-sectoral wage dispersion. Here, I discuss that wage centralization can have similar impact on the two balances if it reduces intra-sectoral wage dispersions as long as they are resulted by job-specific or sector-specific human capital. Job-specific human capital can be accumulated by workers through job seniority (Topel (1990), Becker (2009)) and by the investment of employers on the job-specific skills of the workers (Acemoglu and Pischke (1998)).⁴⁰ Therefore, job seniority can increase wages for workers with more job seniority. On the other hand, wage centralization can reduce the wage gap between the workers with different individual human capital/efficiency (See for example Cahuc and Zylberberg (2004) and Wallerstein (1999)). Combining these two impacts, one can deduce that wage centralization reduces the wage gap between the workers with different job seniority.

⁴⁰Pissarides (1994) uses similar formulation to capture the impact of job seniority on the job-specific human capital.

If a positive shock in the twin deficits is realized, workers will be reallocated from the T-sector to the N-sector. The new matched workers in the N-sector have relatively less job-seniority and, hence, less sector-specific human capital. Consequently, the proportion of low-skilled to high-skilled workers will increase in the N-sector. If wage centralization reduces the gap between high skilled and low skilled workers by rent sharing between the two groups of workers, incumbent workers in the N-sector will realize relatively less wage rise compared to the case where wages are less centralized. This reduces their thirst for such twin deficits policy. Correspondingly, the government following preferences of workers in the N-sector will find less political incentive to increase its expenditure financed by foreign debt. This channel is in second order compared to the channel explained in the theoretical part of the paper since its effect is only through rent sharing of the incumbent workers with reallocated workers who constitute a relatively small portion of the total employment.

A.2 Time inconsistency: from short-run to long-run

The numerical analysis of the paper obviously faces time-inconsistency problem since I have implicitly assumed that the government commits to its announced policy on ρ . When a positive shock in public foreign assets is realized, in the periods after the announcement of its policy ρ , the government which follows preferences of N-sector workers, has incentive to choose a lower ρ to postpone saving and to provide more public expenditure compared to its prior announcement. Similarly, when a negative shock in the foreign assets is realized, the government has always incentive to deviate to a higher ρ to postpone its fiscal consolidation. This can give us an intuition for better understanding of long-term implications of the model. The government in more decentralized-wage countries has more political incentive to deviate from its announced policy toward less fiscal consolidation and more fiscal expansion. The search&match feature of this model restrains a time-consistent analysis of the policy. One possible extension of this theoretical framework is to abstract from search&match labor market and assume sector-specific labor skills which perfectly prevents inter-sector labor mobility. Such framework can facilitate the analysis of time-consistent policy determination.

A.3 Wage centralization, wage level and current account: German Miracle

Decentralization of wage bargaining in Germany started from the mid 90's. In West Germany the proportion of employees subject to area-wide wage agreement fell from 72.2 percent in 1995 to 62.9 in 2002. In East Germany that number fell from, 56.3 percent in 1996 to 42.7

percent in 2002 (Ochel (2005)). The German current account, however, started to increase only after 2000, one year after the establishment of the Eurozone (see figure (A.1,a)). Between 1995 and 2000, when wage decentralization had been already in process, the German external balance was still in its steady deficit trend of around 1.5 percent of GDP. Moreover, the wage share continued its steady trend of after the German reunification till 2003. The decline in wage share started only after 2003: the wage share in manufacturing declined from 70 percent to 63.5 and 62 percent in 2006 and 2007 (see figure (A.1,b)) .⁴¹ The main and distinguishing labor market reform in 2003 was not decentralization of wage bargaining. Rather, the so-called Hartz labor market reforms in 2002 can better explain this decreasing trend in wage share in Germany. The Hartz committee focused on reducing unemployment duration by strengthening incentives to actively search for a job, and on improving job placement. Hartz labor market reforms shortened the period in which unemployment benefit was paid. It reduced the benefits for long-term unemployment and tightened the conditions for unemployed households to refuse a job and finally, it abolished the early-retirement options. All these reforms led to significant increase in labor market participation, to reduction in unemployment and, more related to this paper, to decline in wage level (see Jacobi and Kluge (2007) and Krebs and Scheffel (2013) for more details on the macroeconomic impacts of the Hartz labor market reforms). Therefore, it seems that it was mostly these later reforms that are responsible for the reduction in German aggregate wages and not the decentralization of wage bargaining.

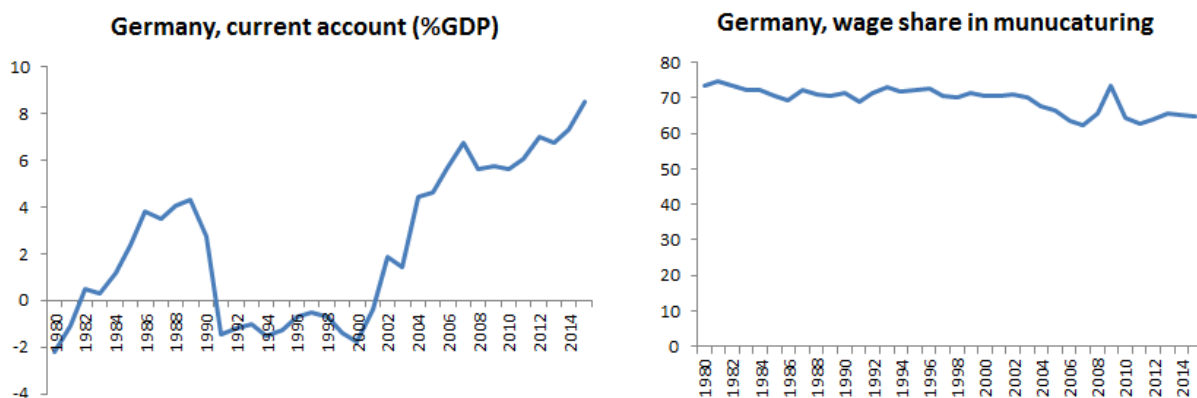


Figure A.1: (a) Current account (% GDP) (Data from IMF outlook, 2016) (b) Share of wage income in manufacturing sector (Data from AMECO).

Nevertheless, wage reduction and its associated increase in competitiveness was not the only source of the observed increase in the German current account which is realized after

⁴¹Similar to several industrial countries wage share in manufacturing increased in 2008 and 2009 to 66 and 73 percent in 2008 and 2009 (in Germany) and declined afterward to almost steady trend around 65 percent.

2000. [Kollmann et al. \(2015\)](#) attribute the steady rise in the German external balance to other factors such as: (i) the establishment of the Eurozone and its associated increase in financial integration in Europe which triggered capital flows from Germany to the rest of Europe. (ii) strong growth in emerging countries which boosted the demand for investment goods, given the German's specialization in those goods. (iii) the growth of outsourcing by German firms to low wage countries, notably in Eastern Europe. (iv) high saving rate in Germany that can be due to the demographic changes in that country. It is also worthwhile to mention that if the financial market is highly integrated, low wage share implies profitability of investment and inflow of foreign capital. Therefore, it is not theoretically clear if there is a negative relation between the aggregate wage level and the current account.

Appendix B: Tables

Table 3: Iversen index (*)

Country	80's	90's	2001-2012
US	0,12	0,14	0,18
UK	0,10	0,09	0,11
France	0,20	0,19	0,21
Japan	0,21	0,25	0,30
Canada	0,25	0,27	0,30
Portugal	0,26	0,34	0,35
Spain	0,31	0,34	0,35
Italy	0,31	0,35	0,34
Switzerland	0,34	0,28	0,32
Finland	0,40	0,39	0,40
Ireland	0,37	0,48	0,51
Australia	0,64	0,57	0,39
Belgium	0,45	0,45	0,46
Germany	0,41	0,42	0,48
Denmark	0,52	0,51	0,46
Sweden	0,53	0,52	0,51
Netherlands	0,54	0,54	0,57
Norway	0,56	0,55	0,51
Singapore	0,82	0,84	0,85
Austria	0,97	0,97	0,91

(*) Sources for the Iversen indices: AIAS

Table 4: Rank ordering of countries according to their degree of wage centralization

Ranking	Calmfors-Driffill ^a	Schmitter ^b	Cameron ^c	Blyth ^d	Bruno-Sachs ^e
1	Austria	Austria	Sweden	Austria	Austria
2	Norway	Norway	Norway	Norway	Germany
3	Sweden	Sweden	Austria	Sweden	Netherlands
4	Denmark	Denmark	Belgium	Denmark	Norway
5	Finland	Finland	Finland	Finland	Sweden
6	Germany	Netherlands	Denmark	New Zealand	Switzerland
7	Netherlands	Belgium	Netherlands	Australia	Denmark
8	Belgium	Germany	Germany	Germany	Finland
9	New Zealand	Switzerland	UK	Belgium	Belgium
10	Australia	US	Australia	Netherlands	Japan
11	France	Canada	Switzerland	Japan	New Zealand
12	UK	France	Italy	France	UK
13	Italy	UK	Canada	UK	France
14	Japan	Italy	US	Italy	Italy
15	Switzerland		France	US	Australia
16	US		Japan	Canada	Canada
17	Canada				US

^a Source: Calmfors and Driffill (1988). ^b Source: Schmitter (1981). ^c Source: Cameron (1984).

^d Source: Blyth (1979). ^eSource: Bruno and Sachs (1985).

Table 5: Variable Definitions & Sources for Panel Estimations

Current Account (CA)	Current account balance, ratio to GDP	IMF World Economic Outlook (2016)
Budget balance (BB)	Government budget balance, ratio to GDP	IMF World Economic Outlook (2016)
Wage centralization	Iversen index	Amsterdam Institute for Advanced Labor Studies (AIAS)
Financial development	Private credit by deposit banks and other financial institutions (%GDP)	World Bank Financial structure database (2011)
Growth	GDP per capita growth rate with fixed price	World Bank
Net foreign assets	Stock of Net Foreign Assets, ratio to GDP	Lane & Milesi-Ferretti
Relative income	Per capita GDP in PPP, measured relative to the U.S.	IMF World Economic Outlook (2016)
Output gap	actual GDP less potential GDP as a percent of potential GDP	IMF World Economic Outlook (2016)
Population growth	Annual population growth rate.	World bank
Young dep.	population under 15 relative to total population.	World Development Indicators (2010)
Old dep.	population over 65 relative to total population	World Development Indicators (2010)
Inequality	Top 1% income share	World wealth & income database (wid.world)
Gov. net debt	Gross government debt minus its financial assets (% of GDP).	WIMF World Economic Outlook (2016)
Natural resource rent	Sum of the rents from oil, natural gas, coal, mineral and forest (% of GDP).	World Bank
Households Savings (HHS)	Net households and NPISH savings (as % of net disposable income)	AMECO completed by OECD data
Investment	Gross capital formation (% of GDP)	World Bank
Trade openness	Openness indicator: ratio of exports plus imports of goods to GDP	OECD database

Panel consists of Australia, Belgium, Canada, Denmark, Finland, France, Germany, Italy, Ireland, Japan, Netherlands, Norway, Portugal, Singapore, Spain, Sweden, Switzerland, UK and the United States.

Table 6: Summary of selected studies of current account balance determinants

	Arabzadeh (Fixed Effect) (2017)	Arabzadeh (Random Effect) (2017)	Decressin &Starvev (2009)	Cheung C. et al (2013)	Barnes et al (2010)	Chinn &Prasad (2003)	Chinn et al. (2014)
Budget	+	+	+	x	+	x	+
Balance							
Financial	-	x	x	()	x	x	x
Development							
Initial net foreign	+	+	+	+	+	+	+
assets							
Young dep.	+	x	-	x	+	x	x
ratio							
Old dep.	-	-	-	x	x	x	x
ratio							
Population	-	-	-	()	()	()	()
growth							
Relative income	x	+	+	+	+	+	x
Quadratic relative	x	-	+	+	+	+	x
income							
Countries	17 indus.	17 indus.	11 Euro	30 OECD	25 OECD	18 indus.	23 indus.
Sample	1982-11	1980-12	1970-07	1973-08	1969-08	1971-95	1970-08

+ : Positive effect, significant at least at 10%.

- : Negative effect, significant at least at 10%.

x : Not significant at 10%.

() : Not included in the model.

Table 7: Estimation for Budget Balance, with Random Effect

VARIABLES	(1) BB	(2) BB	(3) BB	(4) BB
Wage Centralization	6.417** (2.497)	6.513** (2.801)		
Lagged Wage Centralization			5.607** (2.221)	5.527** (2.775)
Gov. net debt	-0.045*** (0.007)	-0.055*** (0.007)	-0.038*** (0.007)	-0.047*** (0.007)
Natural resource	0.421** (0.176)		0.509*** (0.161)	
Δ natural resource		0.647** (0.309)		0.559* (0.326)
Output gap	0.455*** (0.136)	0.491*** (0.147)	0.368*** (0.139)	0.396*** (0.142)
GDP growth	0.386*** (0.147)	0.401*** (0.152)	0.318** (0.155)	0.386** (0.156)
1992-1994	-2.781** (1.294)	-3.370*** (1.272)	-2.771** (1.361)	-3.285** (1.306)
Constant	-3.731** (1.545)	-2.409 (1.537)	-3.677** (1.488)	-2.330 (1.570)
Time Fixed Effect	Yes	Yes	Yes	Yes
Observations	137	132	141	141
Overall R-squared	0.7471	0.7180	0.7257	0.6840
Number of Countries	19	19	20	20
Hausman test statistic	9.38 [0.8567]	7.29 [0.9229]	2.74 [0.9999]	13.33 [0.5005]

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 8: Estimation for Current Account, with Random Effect

VARIABLES	(1) CA	(2) CA	(3) CA	(4) CA	(5) CA
Budget Balance	0.416*** (0.062)	0.335*** (0.081)			
Wage Centralization		4.446** (2.146)	6.491*** (1.935)	6.392*** (1.859)	8.125*** (1.507)
Inequality	-0.304*** (0.112)	-0.193 (0.119)	-0.192 (0.160)	-0.220 (0.151)	
Financial development	-0.007 (0.009)	-0.003 (0.009)	-0.010 (0.010)	-0.003 (0.006)	-0.009 (0.010)
Net Foreign Assets	0.078*** (0.006)	0.075*** (0.006)	0.081*** (0.006)	0.086*** (0.006)	0.072*** (0.008)
Young dep.	-0.030 (0.207)	0.066 (0.219)	0.139 (0.142)	0.105 (0.128)	0.042 (0.150)
Old dep.	-0.401** (0.201)	-0.278 (0.210)	-0.292 (0.202)	-0.259 (0.220)	-0.371* (0.213)
Population Growth	-1.950** (0.967)	-1.919* (1.017)	-1.866* (0.976)	-1.908* (1.043)	-2.453** (1.179)
Relative income	13.933*** (5.037)	10.401** (4.778)	14.133** (5.646)	12.030** (5.779)	5.760 (4.112)
Quadratic relative income	-7.318*** (2.619)	-5.294** (2.532)	-6.018* (3.217)	-5.775** (2.880)	-1.682 (2.409)
Natural resource rent				0.388* (0.232)	0.308 (0.228)
Constant	-7.291*** (2.535)	-7.188*** (2.430)	-12.233*** (3.114)	-11.192*** (3.264)	-9.607*** (2.203)
Time Fixed Effect	Yes	Yes	Yes	Yes	Yes
Observations	154	148	161	161	190
Overall R-Squared	0.843	0.849	0.802	0.815	0.746
Number of Countries	17	17	17	17	19

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 9: Estimation for Households Savings

VARIABLES	(1)		Country Fixed Effect		(3)		(4)		(5)		Random Effect		(8)	
	HHS	HHS	HHS	HHS	HHS	HHS	HHS	HHS	HHS	HHS	HHS	HHS	HHS	HHS
Budget Balance	-0.419** (0.153)	-0.426** (0.161)	-0.880 (7.520)	-1.977 (8.367)	-0.436 (0.276)	-0.350 (0.271)	-9.171 (7.308)	-8.083 (6.911)						
Wage Centralization			-0.880 (7.520)	-1.977 (8.367)			-9.171 (7.308)	-8.083 (6.911)						
Inequality	-0.242 (0.165)	-0.199 (0.178)	-0.396 (0.274)	-0.270 (0.320)	0.060 (0.148)	-0.076 (0.256)	-0.129 (0.266)	0.004 (0.264)						
Financial development	-0.047** (0.022)	-0.046* (0.022)	-0.040* (0.020)	-0.039 (0.024)	-0.030 (0.028)	-0.033 (0.030)	-0.034 (0.029)	-0.037 (0.030)						
Net foreign assets	0.049*** (0.015)	0.048*** (0.015)	0.039* (0.019)	0.031 (0.022)	0.080*** (0.025)	0.079*** (0.029)	0.081*** (0.029)	0.068* (0.037)						
Young dep.	-0.656 (0.579)	-0.770 (0.596)	-0.654 (0.723)	-0.661 (0.755)	-1.184** (0.529)	-1.282** (0.581)	-1.546** (0.645)	-1.564** (0.630)						
Old dep.	-2.032*** (0.482)	-2.118*** (0.482)	-2.066*** (0.607)	-1.958*** (0.652)	-1.247* (0.718)	-1.349* (0.786)	-1.609** (0.785)	-1.548* (0.807)						
Population growth	1.638 (1.192)	1.493 (1.256)	0.925 (1.280)	1.006 (1.277)	0.202 (2.391)	-0.085 (2.404)	-0.607 (2.565)	-0.223 (2.935)						
Relative income	22.316*** (6.606)	18.849** (7.972)	17.179* (9.402)	17.594 (11.251)	9.927 (7.059)	11.953* (7.070)	10.548 (10.684)	15.167 (12.087)						
Quadratic relative income	-8.623*** (2.353)	-7.572*** (2.565)	-8.047** (3.270)	-7.735 (4.892)	-5.488 (3.609)	-6.623* (3.545)	-7.575 (4.967)	-9.577 (6.651)						
GDP growth				-0.118 (0.289)				-0.446 (0.418)						
Output GAP				-0.190 (0.225)				-0.678** (0.277)						
Constant	-1.975 (3.962)	0.866 (6.786)	3.169 (7.585)	2.583 (8.251)	6.366 (5.103)	7.343 (5.175)	11.846* (6.979)	7.854 (7.246)						
Time Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes						
Observations	141	136	140	132	141	136	140	132						
R-squared	0.649	0.649	0.614	0.624										
Number of Countries	16	16	16	15	16	16	16	15						

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 10: Regression for National Investment

VARIABLES	Country Fixed Effect				Random Effect			
	(1) Investment	(2) Investment	(3) Investment	(4) Investment	(5) Investment	(6) Investment	(7) Investment	(8) Investment
Budget Balance	0.304*** (0.053)	0.316*** (0.058)	-1.147 (2.921)	-1.164 (2.132)	0.373*** (0.060)	0.360*** (0.076)	10.142** (4.096)	3.537 (3.407)
Wage Centralization		-1.986 (3.679)	-0.049 (0.206)	-0.442*** (0.146)		1.948 (2.897)		
Inequality	-0.262 (0.182)	-0.270 (0.185)	-0.049 (0.206)	-0.442*** (0.146)	-0.295* (0.163)	-0.236 (0.161)	-0.027 (0.198)	-0.336** (0.146)
Financial development	0.015 (0.009)	0.016 (0.009)	0.017 (0.011)	0.015** (0.007)	0.041*** (0.014)	0.045*** (0.014)	0.048*** (0.016)	0.039*** (0.015)
Initial net foreign assets	-0.029*** (0.007)	-0.029*** (0.007)	-0.048*** (0.013)	-0.009 (0.008)	-0.006 (0.006)	-0.005 (0.006)	-0.007 (0.011)	0.012 (0.012)
Young dep.	-0.379 (0.232)	-0.384 (0.254)	-0.335 (0.236)	-0.416** (0.161)	-0.639*** (0.190)	-0.584*** (0.179)	-0.402*** (0.153)	-0.424*** (0.136)
Old dep.	-0.206 (0.153)	-0.179 (0.153)	-0.126 (0.159)	-0.374* (0.211)	-0.202 (0.233)	-0.110 (0.204)	-0.002 (0.264)	0.094 (0.227)
Population growth	1.390*** (0.419)	1.363*** (0.426)	1.733** (0.625)	2.556*** (0.651)	2.585*** (0.620)	2.487*** (0.625)	3.066*** (0.710)	3.610*** (0.920)
Relative income	7.850* (4.303)	7.472 (4.782)	-2.488 (4.897)	-6.888 (5.694)	-14.228** (5.865)	-12.735** (5.211)	-20.564*** (6.846)	-17.308*** (6.045)
Quadratic relative income	-2.170 (1.449)	-2.181 (1.610)	3.655* (1.985)	3.175 (2.636)	6.687** (3.153)	5.788** (2.874)	10.869*** (3.786)	9.201*** (3.391)
Output gap				0.658*** (0.104)				0.495*** (0.111)
GDP growth				0.341*** (0.106)				0.544*** (0.174)
Constant	19.499*** (2.648)	20.501*** (3.539)	26.237*** (2.756)	28.989*** (2.749)	31.183*** (2.787)	30.077*** (2.355)	31.860*** (2.446)	32.220*** (2.828)
Time Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	154	148	161	139	154	148	161	139
R-squared	0.710	0.704	0.634	0.777	0.6681	0.6779	0.6678	0.6435
Number of Countries	17	17	17	15	17	17	17	15

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Appendix C: Calibration methodology for the numerical example

In this subsection, I introduce the calibration of the model for a numerical example which illustrates the mechanism of the model. It is worthwhile to mention that the only variables which are qualitatively sensitive to the calibration are unemployment and tax. However, these variables are not the main concerns of this paper and, moreover, the impact of the shock on these variables are in second order with respect to the variables of our interest.

Matching and the labor market

den Haan et al. (2000) set the steady state separation rate (χ) 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 7% and 15% respectively. I set the *monthly* separation rate equal to 0,03 to correspond approximately to the average of these studies. Following den Haan et al. (2000) and others, the bargaining power of workers is set to 0,5. Unemployment benefit (b) is set to be 13% of the steady state wage rate in the N-sector. 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 countries in 2014 (0.08), the level parameter of matching function (ϕ) is set to 0,077.

Utility function

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 $0 < z_2 < 1$ will not affect the qualitative results of this paper. Linearity of utility function with respect to its two components assures us that the steady state value of public expenditure has no impact on the results. I set steady state value of windfall income equal to around the average of the US trade deficit (relative to GDP) in the last 5 years before 2000. This value is 1.2% of steady state GDP. I assume that the government maximizes the utility of households when deciding about its expenditure. Therefore, marginal utility of private consumption and public good are the same, i.e. $z_1 = 1$. In the following section, I discuss the impact of different levels of z_1 on the households value function. To capture the fact that the majority of workers are engaged in the N-sector, I assume the consumption share of the T-sector (γ) to be 0.3. The monthly discount rate is set as 0.9947. Monthly interest rate is set equal to 0,042 % which corresponds to annual interest rate of 0.5 %.

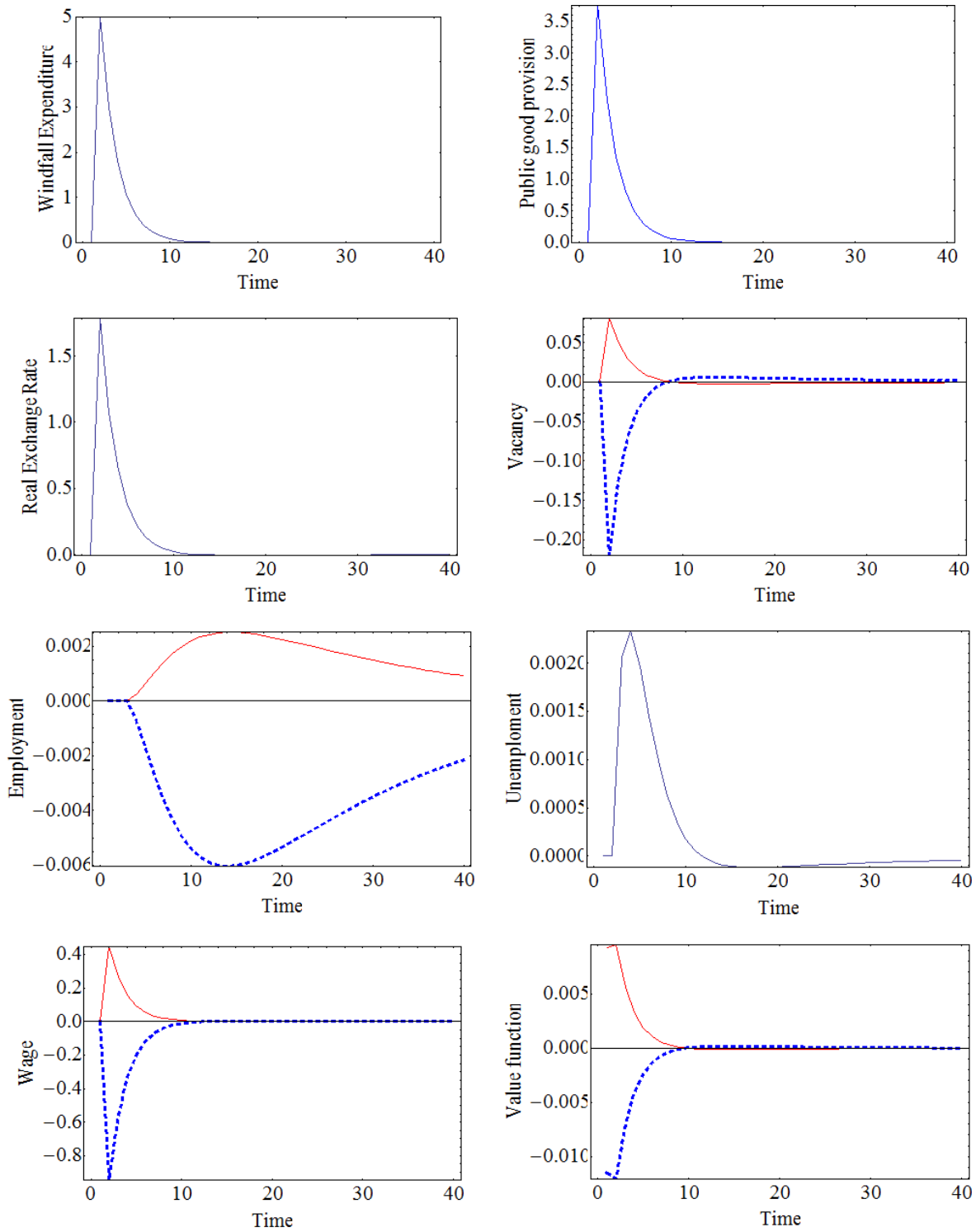
Production function

I normalize the T-sectoral technology level to unity ($a_T = 1$). Data from OECD shows that the averaged productivity ratio between industry sector and service sector is around 1,3. Accordingly I assume ($a_N = 1.3$). The calibrated parameters are reported in table 11.

Table 11: Calibrated parameters

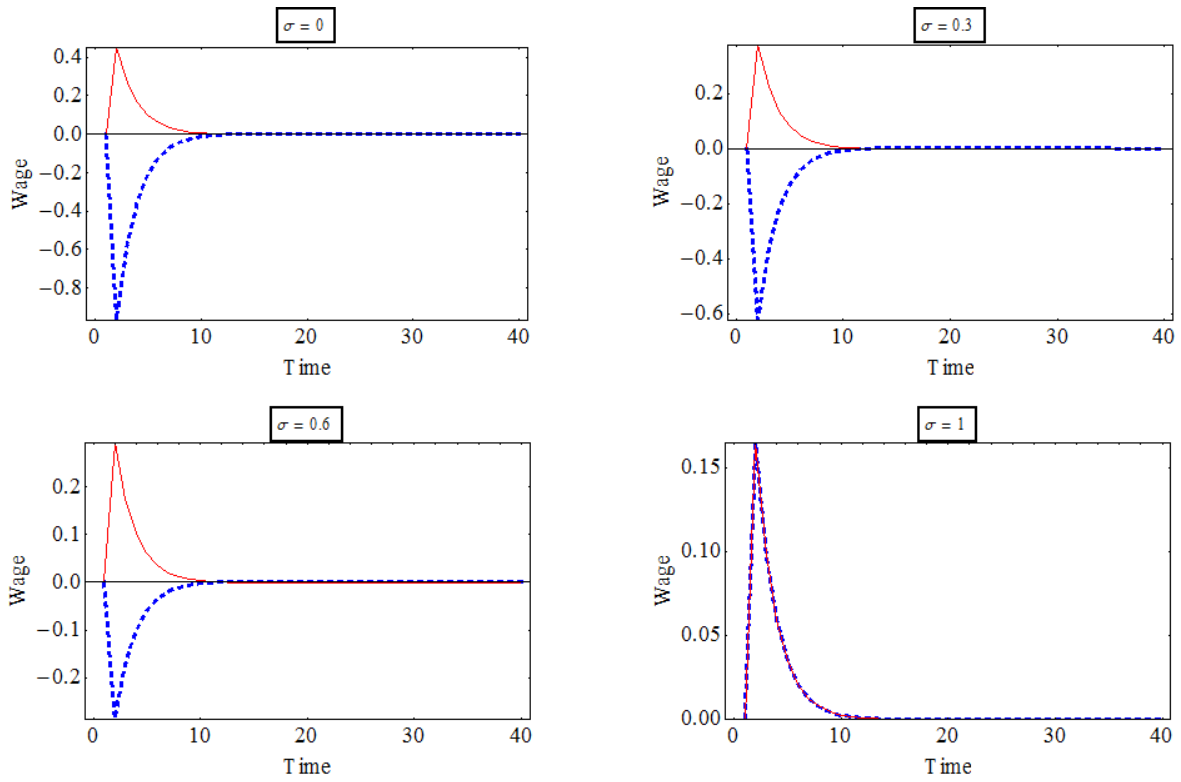
Symbol	Value	Interpretation	Source/Target
χ	0,03	Exogenous separation rate	To target approximate quarterly separation of 10-11 %
α	0,5	Curvature parameter of matching function	
c	0,25	Cost of vacancy	
ϕ	0,077	Level parameter of matching function	To obtain unemployment equal to 8%
η	0,5	Workers' bargaining power	Following den Haan et al. (2000) and others
γ	0,2	Consumption Share of the T-sector	To obtain N-sector empl. share equal to 0,85 (US in 2000)
β	0,9947	Monthly discount rate	standard
r	0,16 %	Monthly interest rate	U.S. 2015 (wold bank)
z_1	0,1	Weight of public good in utility	Same marginal utility for C and G
z_2	1	Concavity of utility with respect to public good	Linear utility with respect to G
a_T	1.3	Technology level in the T-sector	Av. productivity ratio between industry and service sector (OECD)
a_N	1	Technology level in the N-sector	Normalization
B_{ss}	0.05	Steady state Windfall expenditure	3.5% of S.S. GDP corresponding to 2012 trade deficit in US

Appendix D: Graphs



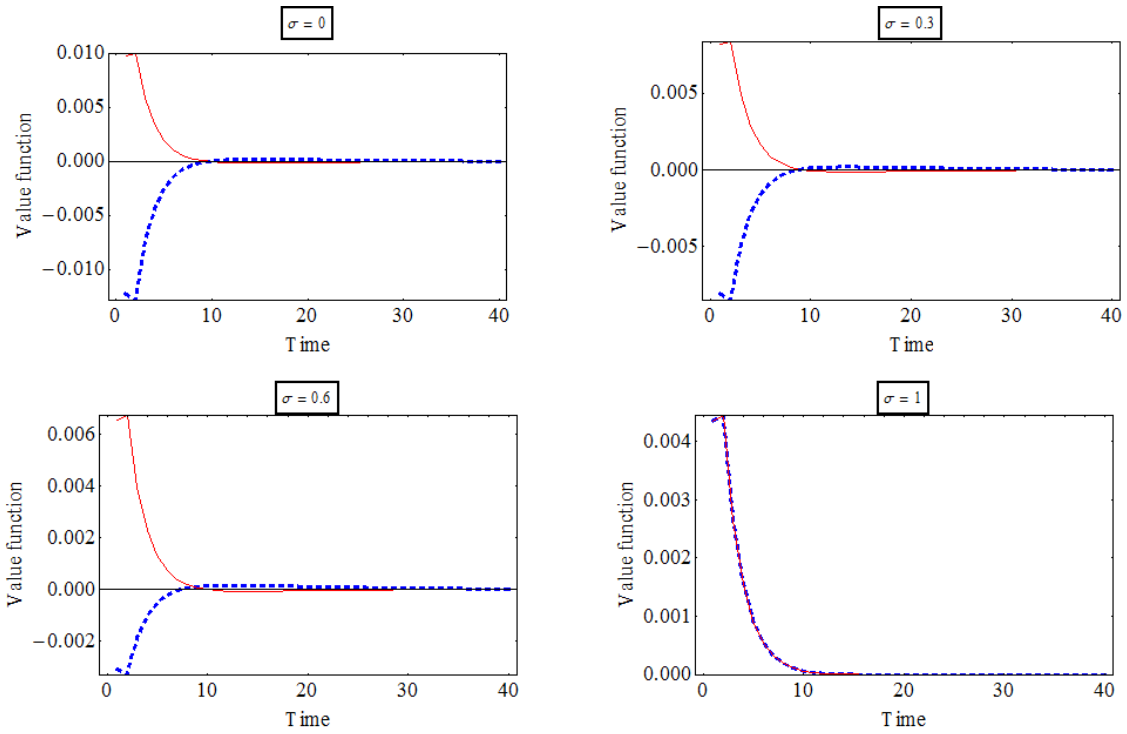
Solid line and dashed line correspond to N-sector and T-sector respectively.

Figure D.1: Macroeconomic impacts of a positive shock in windfall expenditure.



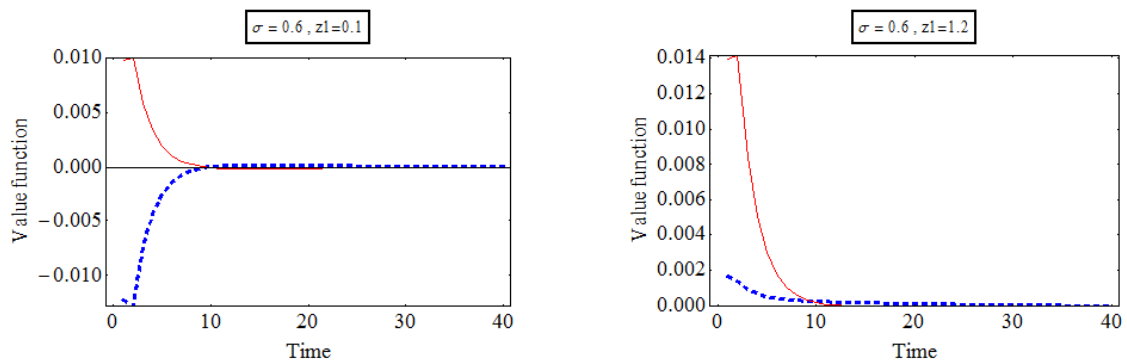
Solid and dashed lines correspond to N-sector and T-sector respectively.

Figure D.2: Effect of wage centralization on reducing the responsiveness of sectoral wages.



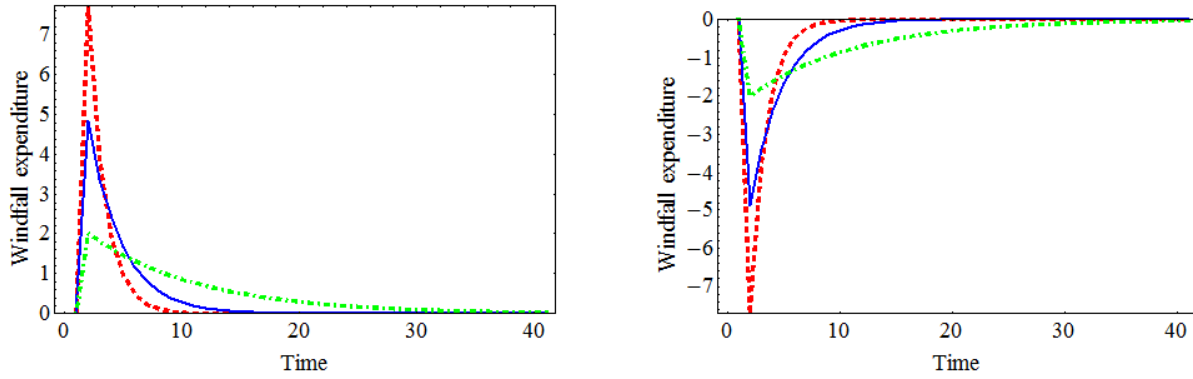
Solid line and dashed line correspond to N-sector and T-sector respectively.

Figure D.3: Effect of windfall expenditure on the household inter-temporal utility for the different levels of wage centralization.



Solid line and dashed line correspond to N-sector and T-sector respectively.

Figure D.4: Effect of Windfall expenditure on the household inter-temporal utility for different marginal rate of substitution between private and public goods.



Solid line (blue): Shock in windfall income. Dashed line (red): Windfall expenditure with accelerating policy. Dot-dashed line (green): Windfall expenditure with smoothing policy.

Figure D.5: Effect of smoothing policy.

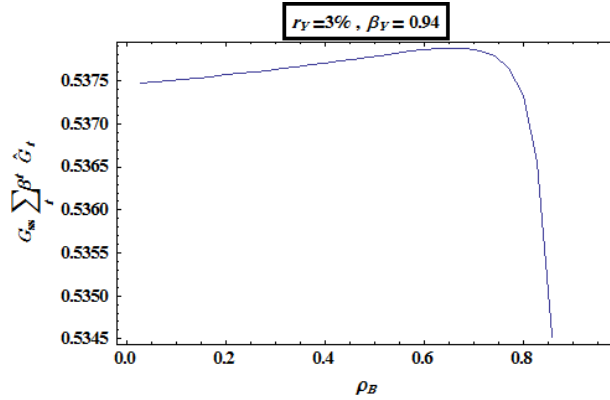


Figure D.6: Effect of smoothing policy on the current value of public good provision.

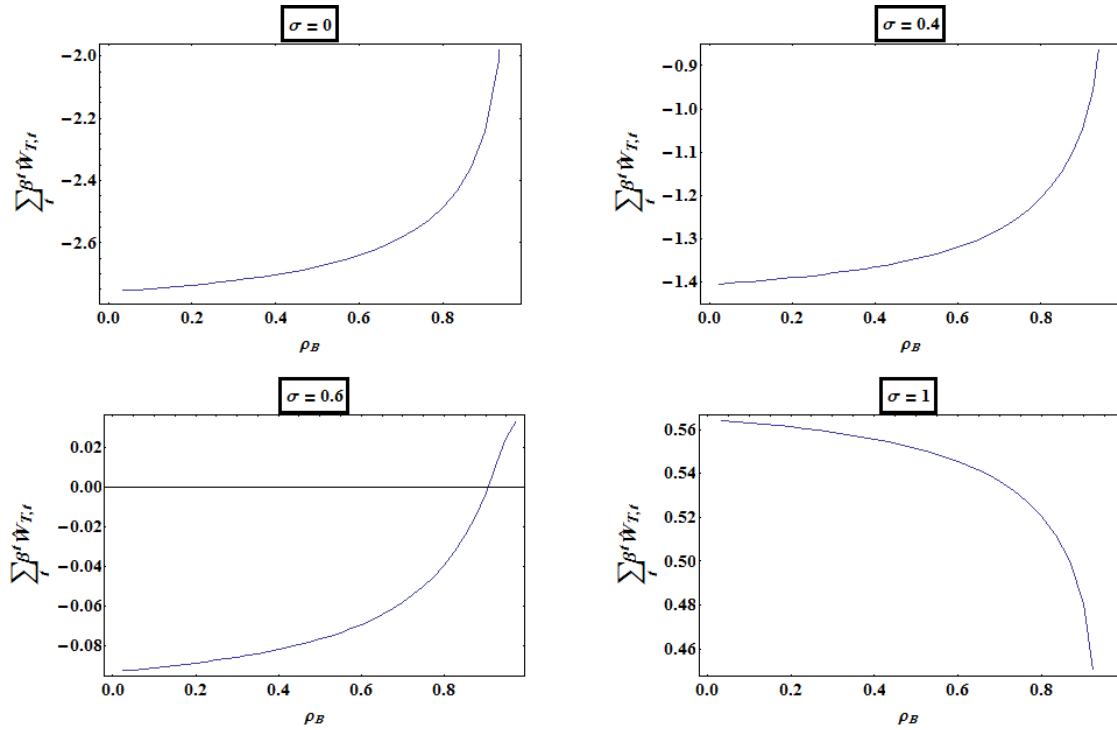


Figure D.7: Discounted value of wage changes (% of steady state value) for T-sector workers as a function of smoothing policy for different levels of wage centralization.

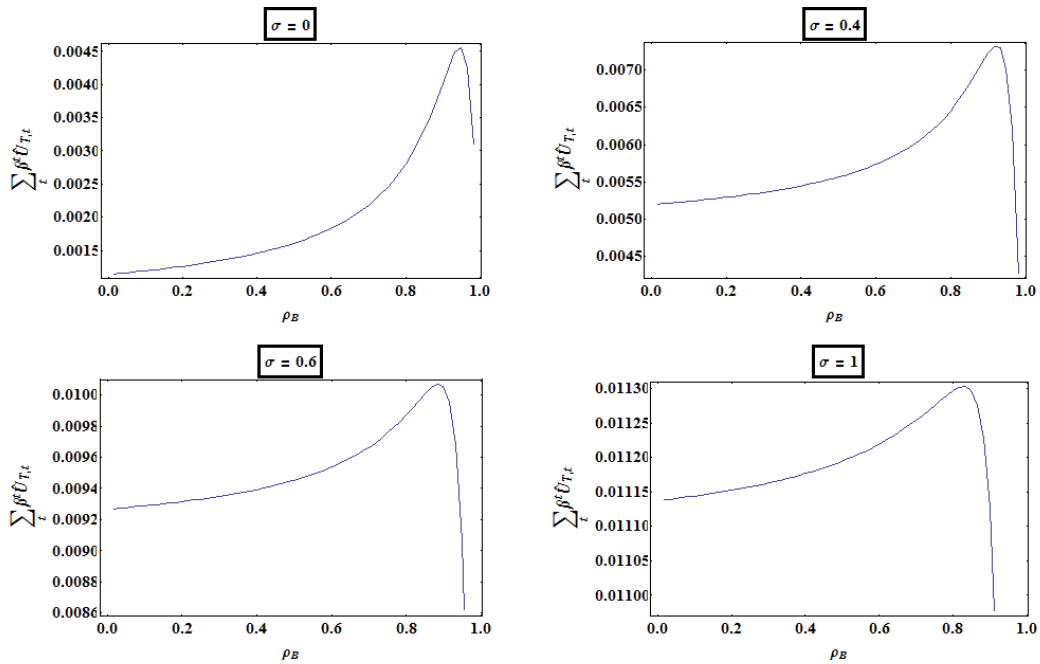


Figure D.8: Inter-temporal utility of T-sector workers as a function of policy for different levels of wage centralization.