Macroeconomic Impacts of Politics and Policy: Applications to Financial and Real Markets

by
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under supervision of
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... my Mother, my Brother and both my two Families,
for making me who I am...

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All those who, in any way and at any moment, contributed to the advancement of my work must take part in this achievement.
All I have has been given.

– *Rúben Branco*

Contents

Foreword

Economic policy impacts are at the heart of Macroeconomic research. Two major examples of intensely debated issues are the role of fiscal policy in countering business cycles and the intermediate variables policy must target in order to promote economic growth.

But the Macroeconomic impacts of policy do not depend exclusively on *what* the policymaker does. Those impacts depend also on *how* policy is implemented and on *who* implements it. The political party to which the policymaker belongs, the credibility associated to the policy action being implemented, or the political composition and strength of the future policymaker may crucially influence the way economic agents react to policy or to the policymaker.

Such reactions determine, in turn, important financial- and real-market decisions. This thesis explores three of them: the choice of the country to host an international capital investment, the entry into export market, and the evolution of stock market investments.

The first chapter theoretically explores and empirically tests the channels through which international capital flows react to economic policy and to governments' political profile. A game theoretical model is built, rationalizing the hypothesis that left-leaning cabinets implement higher taxes and higher public expenditures and that minoritarian or coalition cabinets react less actively to productivity shocks. The model predicts a negative reaction by capital flows to left-leaning cabinets and an uncertain reaction to both minorities and coalitions. These and other model predictions and features are tested on a set of 23 OECD democratic countries, in the period 1960-2008.

The second chapter performs a theoretical discussion on how the distinctive credibility and irreversibility associated to the introduction of the Euro may have led to an extraordinary export-market entry promotion. The real options approach is used to understand how exchange rate volatility may induce firms to wait before entering the export market – entry hysteresis. The model developed combines uncertainty around future exchange rates, sunk entry costs, entry decision preceding the realization of the future exchange rates, and irreversibility of the entry decision.

The third chapter applies a analyzes stock market volatility behavior around cabinet democratic elections. Three OECD countries are studied – Japan, U.K. and Germany – in the period

1960-2008. Potential volatility-regime changes are empirically identified using a regime-switching ARCH model (SWARCH).

The first and third chapters use a pioneer dataset characterizing the political profile of the democratic cabinets governing the countries studied. This dataset was built by the author, by gathering research literature, institutional sources and political encyclopedia.

Capital, cabinets and taxes: political and policy determinants of financial flows

Rúben Branco

Abstract:

International capital flows hold a notable economic relevance within OECD countries, showing clear reactions to economic policy and to governments' political profile. This study explores these impact channels and tests them empirically. A game theoretical model is built, rationalizing the hypothesis that (a) left-leaning cabinets implement higher taxes and higher public expenditures and that (b) minoritarian or coalition cabinets react less actively to productivity shocks. The model predicts, thus, a negative reaction by capital flows to left-leaning cabinets and an uncertain reaction to both minorities and coalitions, depending on how efficient their inaction is – trade-off between productivity-boosting and policy uncertainty/"noise". Model predictions are tested to on a set of 23 OECD democratic countries, in the period 1960-2008. The hypothesis that left-leaning cabinets set higher taxes finds empirical support. This policy divergence is more intense in the context of single-party cabinets, suggesting that coalitions may be associated to fiscal policy inaction/blending. Consistently, equity inflows react positively to single-party right cabinets. FDI net flows react negatively to majoritarian cabinets and positively to budget deficits, signaling sensitivity to environment stability and fiscal stimulus. Oppositely, equity inflows react positively to majoritarian cabinets (potentially more active in countering negative GDP shocks) and negatively to budget deficits and public expenditure (potentially anticipating higher taxes). The magnitude of the direct impacts of political profiles on capital flows range from 0.3 to 4.7 GDP percentage points (0.5–2.5 standard deviations of the respective sample flows). Reactions to fiscal policy are attenuated when *left* or *right* cabinets are in office.

1. Introduction

International capital flows hold a notable and increasing economic relevance throughout the world, especially within OECD countries. These flows show clear reactions to economic policy, which, in turn, is correlated with government's political profile. This study aims at understanding how this impact channel operates, testing the implied reactions by capital flows to cabinets' political profiles.

Since the late 80's, both Foreign Direct Investment (FDI) and Portfolio Equity (equity) net inflows show an increasing weight on each destination economy's GDP and on its domestic Gross Fixed Capital Formation (GFCF). FDI grew from a weight of 1–2% (2–9%) on GDP (GFCF) in 1977, to weights of 4–14% (15–75%) in 2010. In the same period, equity grew from weights of 0–0.1% on both GDP and GFCF to weights of 0–15% and 0–91%, respectively (see Figures A1–A4, in Appendix). Figures 1–4 show that this growing relevance by international capital flows is distinctively more intense within the OECD[1].

These capital flows react to intense political events. An example took place in Italy, 1998: on October 9, the Government headed by Romano Prodi collapsed after losing a confidence motion in Parliament by one vote. Prime-minister Prodi called this motion after the Communist Refoundation (CR) party had withdrawn its parliamentary support to the Government, due to disagreements over the 1999 Government budget. CR did not integrate the cabinet, but its support granted the cabinet a parliamentary majority. After a failed and turmoil-generating attempt by Prodi to form a new cabinet, a new Government was formed under Presidential invitation and Massimo D'Alema's leadership, gathering left-wing parties and a centrist party created a few months earlier. The early signs of inexperience by the new Government were followed by additional sources of political unrest: a continuing high level of party system instability – four new parties and one party merge –, the collapse of a constitutional reform, a referendum against proportionality in electoral law, the passing of three highly sensitive bills and the failure by a long-lasting parliamentary commission to reach highly expected institutional reforms.

[1] Data from the World Bank, World Development Indicators. Gross fixed capital formation includes land improvements; plant, machinery, and equipment purchases; and the construction of roads, railways, and the like, including schools, offices, hospitals, private residential dwellings, and commercial and industrial buildings. See Table A1 in Appendix for definitions of capital flows.

Figure 1. FDI net inflows in % of GDP (p.p.)

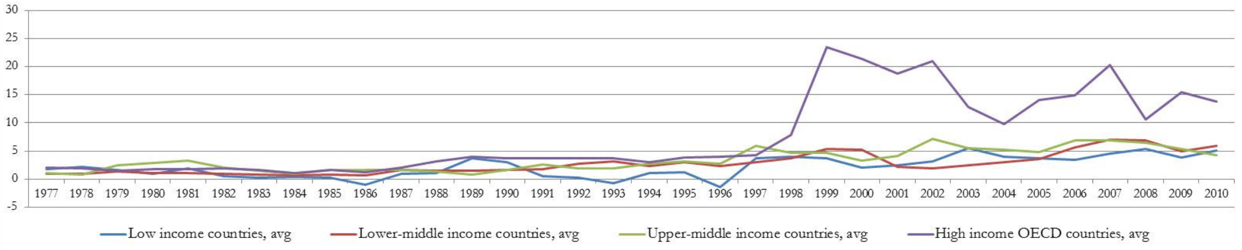


Figure 2. FDI net inflows in % of GFCF (p.p.)

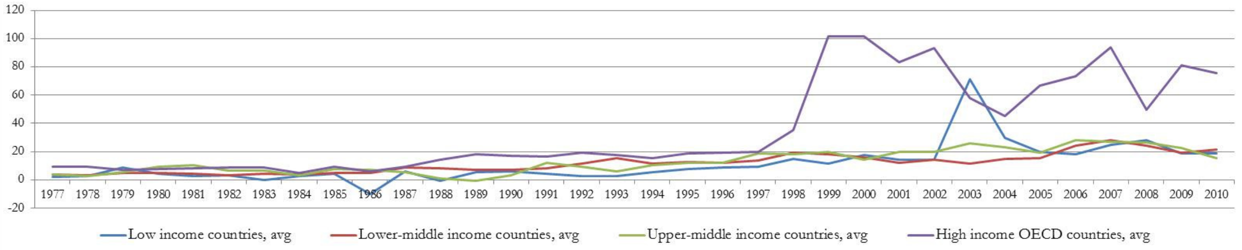


Figure 3. Equity net inflows in % of GDP (p.p.)

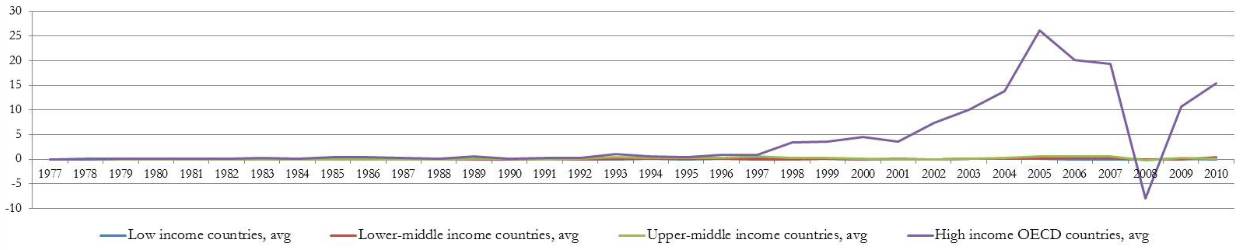
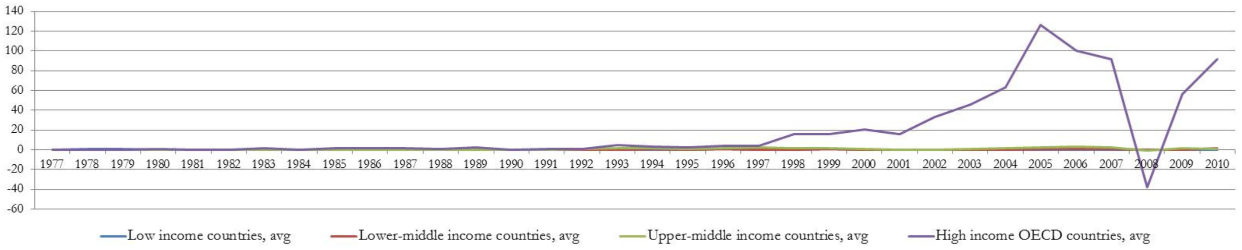


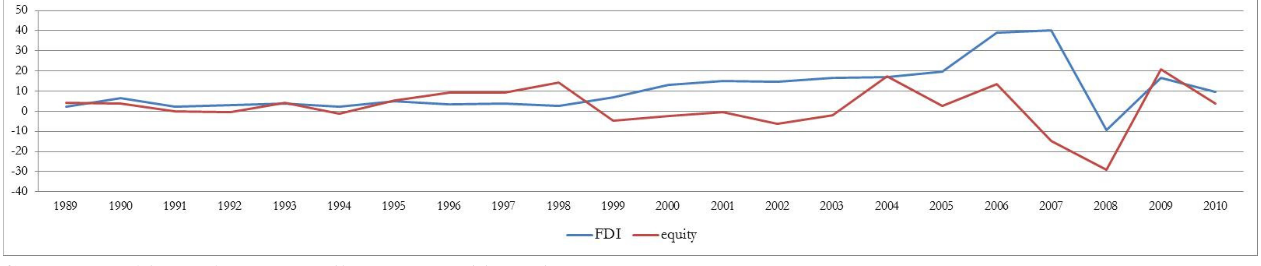
Figure 4. Equity net inflows in % of GFCF (p.p.)



Source: World Development Indicators, World Bank

Notes: Classes of countries defined by the World Bank. Simple averages by country group, in percentage points.

Figure 5. FDI and equity net inflows, Italy (1,000M€)



Source: World Development Indicators, World Bank

On the one hand, the fall of Prodi's Government made Italy transition from its "second-longest-serving government in the post World War II era" (Keesing's World News Archives) to more than three and a half years with (two) caretaker cabinets; on the other hand, this fall ended a coalition Government whose parliamentary majority was supported by an outside-cabinet agreement with the CR, giving rise to an executive that proved capable of effectively ending the budget deadlock.[2]

Figure 5 shows very diverse performances by FDI and equity inflows after this political event: FDI inflows grow 164% between 1998 and 1999, picking up to a positive trend terminated only in 2008, with an average yearly growth of 35%; equity inflows fall 131% between 1998 and 1999, starting a 5-year period of consecutive net outflows.

As the episode above also suggests, fiscal policy may be source or consequence of dramatic political events, (in)directly triggering capital flows' reactions. Consider now the case of Greece, 2007: on October 1, a new cabinet took office, headed by Prime-minister Karamanlis; in December, the IMF acknowledges the need for further challenging fiscal consolidation on the Greek public budget, in order to comply with the ongoing European Commission's excessive deficit procedure[3]; at the same instance, IMF classifies the 2008 revenue target set by the new Government as *ambitious*, due to the considerable efforts it required, expressing also *concern* that the quality of the 2008 expenditure adjustment falls short; in IMF's view, the 2010 balanced-budget target would require *further revenue enhancing measures* and *determined efforts to better control primary current spending*.

Figure 6 shows Greek tax revenue, public expenditure and budget balance in GDP percentage points. Greek fiscal policy in 2008 was characterized by tax revenue *decrease* (0.1 GDP p.p.), public expenditure *increase* (3.0 GDP p.p.) and budget balance *divergence* with respect to the balanced-budget target (decrease in 3.1 GDP p.p.). In May 2009, IMF explicitly states that "fiscal consolidation cannot be postponed", projecting a budget deficit widening and encouraging further deficit-reducing steps "without delay"[4]. More specifically, the IMF recommends "a coherent multiyear fiscal plan to place

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[2] Sources for political episodes described are Keesing's World News Archives (www.keesings.com) and the European Journal of Political Research 36: 317–325, 1999.

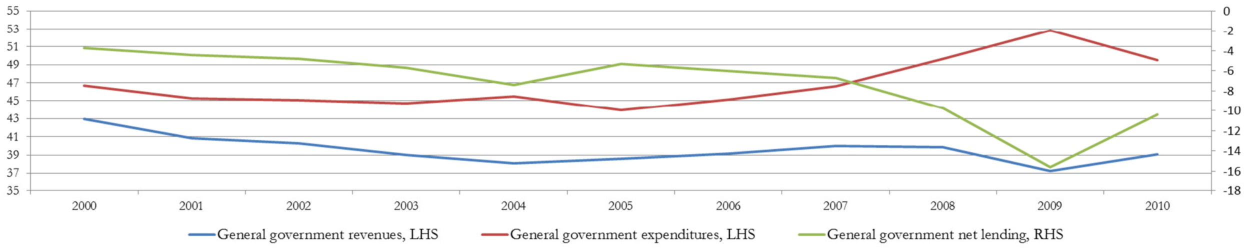
[3] Such considerations were made public through the Preliminary Conclusions of the IMF Mission to the 2007 Article IV Consultation; such consultations are made in the context of requests to use IMF resources, as part of discussions of staff monitored programs, and as part of other staff reviews of economic developments – see http://www.imf.org/external/np/ms/2007/121007a.htm for details on this particular report.

[4] Concluding Statement of the IMF Mission to the 2009 Article IV Consultation.

debt on a downward path" and "an annual adjustment of about 1.5 percent of GDP in permanent measures beginning in 2010". Confirming IMF's prospects, the year would end with an even larger deficit widening of 5.8 GDP p.p. driven by new revenue decrease and expenditure increase.

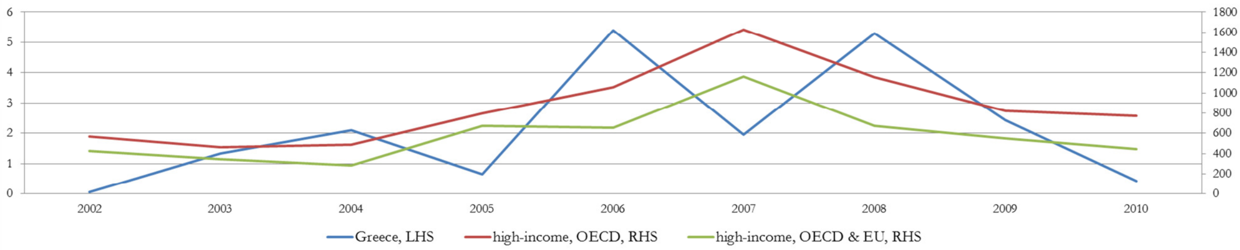
In this context of anticipated contractionary fiscal policy, FDI inflows to Greece fall by 92% between 2008 and 2010. As Figure 7 illustrates, this decrease is much more intense than the decrease observed, in the same period, in the sum of FDI inflows to the OECD high-income countries[5] (33%) or to the subset of these countries that belong to the EU (34%)[6].

Figure 6. Taxes, Public Expense and Budget Balance, Greece, in % of GDP (p.p.)



Source: OECD, Country Statistical Profiles
Notes: The net lending of the general government is the balancing item of the non-financial account for Government sector and is equal to the difference between total revenue and total expenditure. A negative figure indicates a deficit.

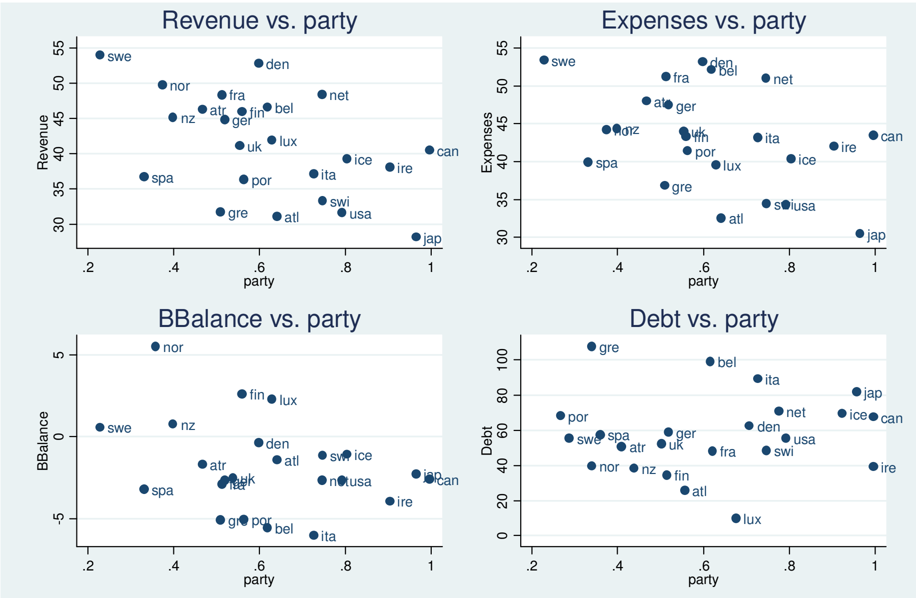
Figure 7. FDI net inflows (1,000M€)



Source: World Development Indicators, World Bank

[5] As defined by the World Bank (World Development Indicators).
[6] FDI inflows decrease more in 2008-2010 in Greece than in 2007-2010 in the OECD set (52%) or in the OECD-EU subset (62%).

Figure 8. Tax revenues, Public expenses, Budget balance and Public debt, in GDP percentage points, compared with Partisan ideology (country-averages, 1960–2008)



Source: Fiscal data from OECD Economic Outlook No. 86; political data collected by the author – see Section 3.1 for references and details.
Notes: *Party* is originally in daily frequency and each of the fiscal policy variables are originally in yearly frequency. All the variables are averaged country-wise, for the period 1960-2008. First the political variable is averaged to yearly frequency (into country-year observations) and, secondly, all the variables are averaged country-wise for the whole period, considering, for each plot, only the observations for which the respective political and fiscal variables are non-missing. Due to its outlying status, Norway is omitted in the graph comparing Budget balance to ideological index.

But politics may impact capital flows also in times of relative political stability, if the government's political profile determines the fiscal policy pursued. Figure 8 compares an index of cabinet ideology – *party* – ranging from zero (*left*) to 1 (*right*), to several fiscal policy variables – Tax revenues, Public expense, Budget balance and Public debt – measured in GDP percentage points[7]. All the variables are averaged for the period 1960–2008, for each of 23 OECD countries[8]. The figure suggests that countries with *party* closer (on average) to 1 – frequent right-leaning cabinets – hold lower public revenue, lower public expenses and lower budget balance. Regarding the corporate tax rate[9] (measured in percentage points), a similar correlation is suggested – see Figure 9 (variables built similarly to Figure 8).

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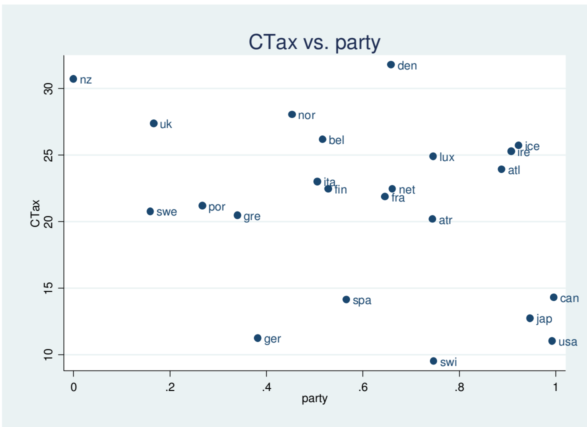
[7] Fiscal data definitions may be found in Section 3.1 below.
[8] These countries are Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, UK and USA.
[9] Basic combined central and sub-central (statutory) corporate income tax rate given by the adjusted central government rate plus the sub-central rate (OECD Tax Database).

Figure 10 repeats the exercise in Figure 9 restricting to the sub-sample of majoritarian single-party cabinets. Within this sub-sample, a much clearer correlation appears, associating countries where single-party cabinets are very frequently right-leaning to lower corporate tax rates.

Given all these interrelations between fiscal policy and cabinets' political profile, ordinary democratic politic/policy events, like elections or fiscal policy actions, may impact capital flows differently, depending on the policymaker's political profile. The heterogeneity amongst OECD countries, both in terms of policy and politics, accentuates the relevance of the impact channels discussed above. Figure 11 revisits the comparison between public expenses and the ideological index, already presented in Figure 8, but now with a visual distinction between two sets of countries: European (solid circle) and Asia-Pacific (hollow square). Except for New Zealand, Asia-Pacific OECD countries in the sample show more pronounced rightward ideological leaning and relatively low level of public expenses.

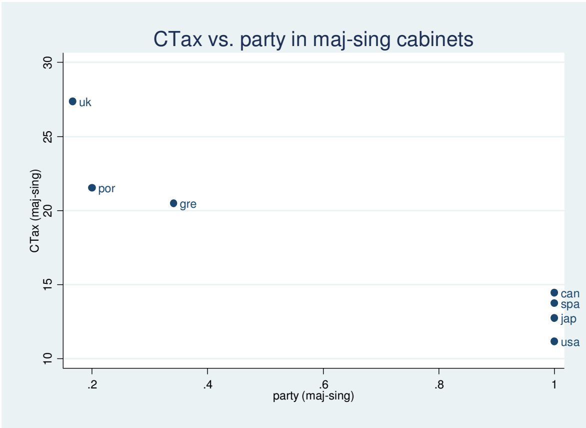
Figure 9. Corporate tax rate (in percentage points) compared with Partisan ideology (country-averages, 1960–2008)



Source: Fiscal data from OECD Tax Database; political data collected by the author – see Section 3.1 for references and details.

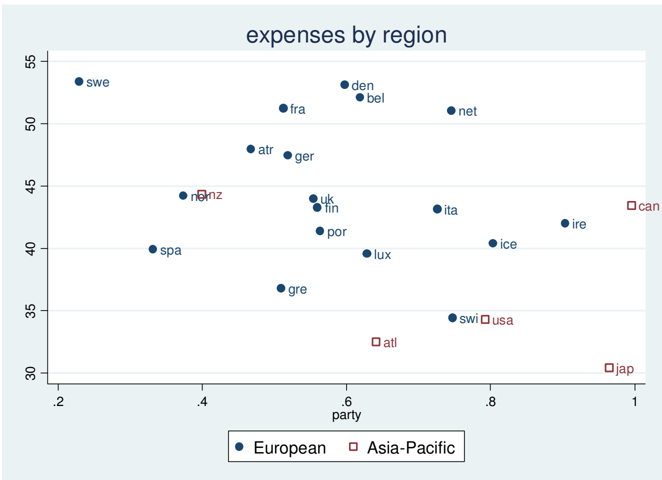
Notes: *Party* is originally in daily frequency and corporate tax rate is originally in yearly frequency. All the variables are averaged country-wise, for the period 1960-2008. First the political variables are averaged to yearly frequency (into country-year observations) and, secondly, all the variables are averaged country-wise for the whole period, considering only the observations for which the respective political and fiscal variables are non-missing.

Figure 10. Corporate tax rate (p.p.), compared with Partisan ideology (majoritarian single-party cabinets, country-averages, 1960–2008)



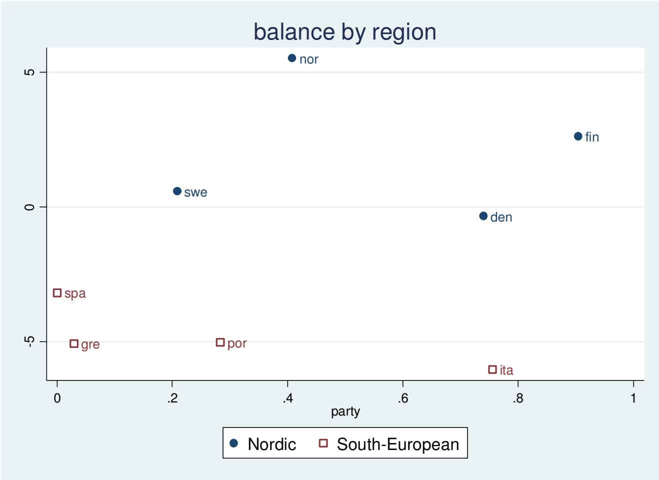
Source: Fiscal data from OECD Tax Database; political data collected by the author – see Section 3.1 for references and details.
Notes: *Majsing* is originally in daily frequency and fiscal policy variable is originally in yearly frequency. *Majsing* is a dummy variable signaling days with a majoritarian single-party cabinet in office. First the political variable is averaged to yearly frequency (into country-year observations) and, secondly, is averaged country-wise for the whole period, considering only the observations for which the political and fiscal variables are non-missing. Countries with few observations are excluded.

Figure 11. Public expenses in GDP percentage points, compared with Partisan ideology (country-averages, 1960–2008)



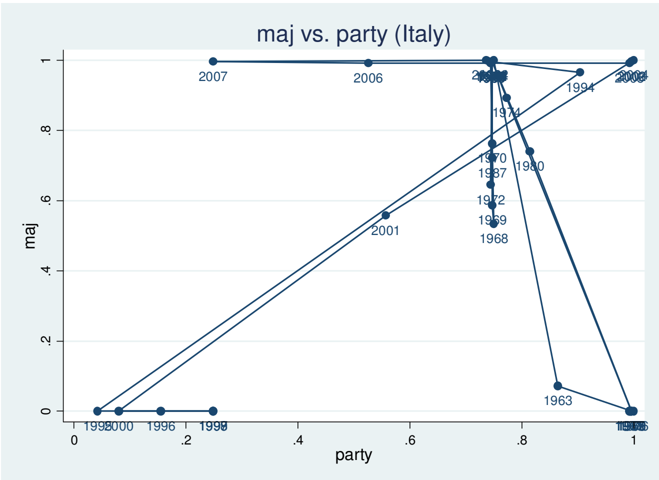
Source: Fiscal data from OECD Economic Outlook No. 86; political data collected by the author – see Section 3.1 for references and details.
Notes: *Party* is originally in daily frequency and public expense is originally in yearly frequency. All the variables are averaged country-wise, for the period 1960-2008. First the political variable is averaged to yearly frequency (into country-year observations) and, secondly, both variables are averaged country-wise for the whole period, considering only the observations for which both variables are non-missing.

Figure 12. Budget balance in GDP percentage points, compared with Coalition status (country-averages, 1960–2008)



Source: Fiscal data from OECD Economic Outlook No. 86; political data collected by the author – see Section 3.1 for references and details.
Notes: *Party* is originally in daily frequency and public expense is originally in yearly frequency. All the variables are averaged country-wise, for the period 1960-2008. First the political variable is averaged to yearly frequency (into country-year observations) and, secondly, both variables are averaged country-wise for the whole period, considering only the observations for which both variables are non-missing.

Figure 13. Majority status and Partisan ideology in Italy (yearly, 1960–2008)



Source: Political data collected by the author – see Section 3.1 for references and details.
Notes: Each political variable is averaged to yearly frequency (into country-year observations). Solid line follows chronological order.

Figure 12 presents the comparison between average public balance and average coalition status for two sets of countries, visually distinguished: Nordic European countries[10] (solid circle) and South European countries[11] (hollow square). Nordic countries hold clearly higher budget balances (almost all hold average surpluses), when compared to the average budget deficits by Southern countries; moreover, Nordic countries tend to have higher frequency of coalition cabinets than Southern countries.

OECD countries present political heterogeneity not only cross-section – note that country averages are widely spread along political axes in the plots above – but also over time, within each country. Figure 13 shows the example of Italy.

The aim of this study is to discuss and test the hypothesis that these cross-country and over-time shifts in political profiles generate reactions by capital flows and/or influence the way capital flows react to fiscal policy changes.

Cabinet's political profile may produce such impacts by inducing specific expectations about future policy. Oatley (1999) presents empirical support to the partisan-driven differences in fiscal deficits in the period 1970-1994. Under fixed exchange rates, leftist governments tend to produce higher deficits and lower surpluses than rightist ones.

Such expectations may, in turn, give rise to non-intuitive reactions to fiscal policy. Following the arguments in Bertola and Drazen (1993) and in Tavares (2004), contractionary policy may produce expansionary effects, if it induces sufficiently strong expectations of future policy shifts in the opposite direction. This way, decreases in permanent spending may induce decreases in the present discounted value of expected taxes, increasing private wealth and leading to a boom. Conversely, increases in taxes may lead to increases in output either because the path of taxes over time is smoothed or by solving uncertainty over the future course of fiscal policy. Moreover, deficit cuts can raise household wealth through a decrease in interest rates, by lowering the sovereign default risk. Therefore, either by solving uncertainty or by leading to a boom, budget cuts and tax increases may attract private capital – particularly in contexts of high public debt, in which private investors are particularly sensitive to public finance solvability.

[10] Norway, Denmark, Sweden and Finland.
[11] Portugal, Spain, Italy and Greece.

Section 2 develops a game theoretical model exploring (i) how the cabinet's political profile may determine the economic policy pursued and (ii) how the expectations over economic policy associated to each political profile may determine capital flows' reactions to electoral results, even before fiscal policy is implemented. The model rationalizes the hypothesis that (a) left-leaning cabinets implement higher taxes and higher public expenditures, and that (b) cabinets with parliamentary minoritarian support or composed by a coalition of parties react less actively to productivity shocks. Hypothesis (a) produces a predicted negative reaction by capital flows to left-leaning cabinets. Hypothesis (b) produces an uncertain reaction by capital flows to both majorities and coalitions. This hypothesis is in line with the theoretical results in Spolaore (2004): in a spectrum of promptness of action, a "cabinet" system, in which one agent autonomously chooses policy, produces more frequent and immediate action by policymakers than a "checks-and-balances" system, in which a "leading" agent is submitted to others' veto power, or a "consensus" system, in which all agents involved must agree before policy is chosen. Parliamentary minorities are associated to "checks-and-balances" and coalitions to "consensus". The impact of each of these political traits on capital flows depends on how efficient is the inaction they produce: veto powers may hamper productivity-boosting measures and generate policy uncertainty, but autonomous decision may lead to excessive policy "noise".

Section 3 describes the empirical test to assumptions and predictions of the model, both around elections and throughout political mandates. Results are presented and discussed.

2. The model

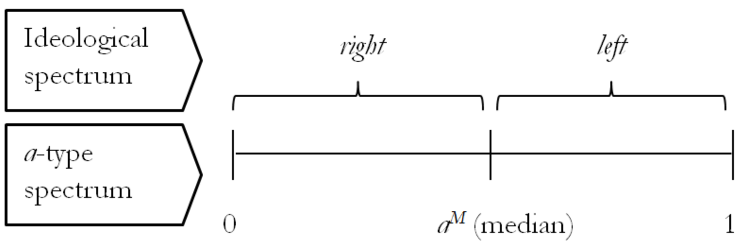
2.1. Game structure

Consider a two stage game with two players: Cabinet and Investors. In the beginning of the first stage, there is an inherited level of public debt $D_0 \in [0, +\infty)$ and an initial capital stock level $K_0 \in (0, +\infty)$ in the economy.

The first event is the election of the Cabinet, corresponding to a movement by Nature. After the election, Investors...

a) ... receive a signal $\hat{a} \in (0,1)$ about the new Cabinet's *ideological type* $a \in (0,1)$, which in turn identifies the ideological orientation of the recently elected Cabinet as illustrated in Figure 14.

Figure 14. Ideological type



b) ... are informed on the new Cabinet's (true) *composition type* $n \in [1,2, \dots [$, which indicates the number of political parties integrating the Cabinet[12], and on its (true) *parliamentary type* $p \in \{0,1\}$, where $p = 0$ if the Cabinet is minoritarian and $p = 1$ if the Cabinet is majoritarian.

The Cabinet knows exactly its true type.

Having received this information, Investors build a prior belief about the probability distribution of the (unknown) true type *a*: they assume $a \sim I(\hat{a}, \sigma(n,p))$. In this prior distribution *I*, expected value is the *ideological signal* $\hat{a}$ and the variance $\sigma(\cdot)$ is a function of Cabinet's types n and p.

[12] $n > 1$ indicates a coalition Cabinet.

In particular, $\frac{\partial\sigma}{\partial n} > 0$ and $\frac{\partial\sigma}{\partial p} < 0$, meaning that the uncertainty about the true *ideological type* of the Cabinet will be increasing in the number of agents (Cabinet parties and/or parliament) that need to be involved in policy-definition negotiations. Afterwards, Investors decide the new level of capital stock $K_1 \in (0, +\infty)$ they wish to hold in the domestic economy (*versus* abroad) and the first stage ends.

In the beginning of the second stage, Nature determines the value of $\mu \in (1, +\infty)$, the production function productivity level, according to $\mu \sim P(\mu_e, \nu)$, where P represents a probability distribution such that $\mathbb{E}(\mu) = \mu_e$ and $Var(\mu) = \nu$. After μ is known, capital level $K_2 \in (0, +\infty)$ is determined; K_2 represents the capital stock Investors will hold in the domestic economy at the end of the 2nd stage (consisting on a reassessment of K_1). With probability $0 < p_K < 1$, Nature allows Investors to freely choose the level of K_2; with probability $(1 - p_k)$, Nature sets $K_2 = K_1$[13]. After K_2 is determined, the Cabinet's true type a is revealed to Investors and the Cabinet chooses $\eta \in [0, +\infty)$, the strength of new *economic policy* measures to be taken in order to enhance μ, as well as the values of two *fiscal policy* instruments: the tax rate $\tau \in (0,1)$ – to be applied to the production output – and the weight of public expenditure on production, $\text{g} \in (0,1)$[14]. Note that $\eta = 0$ is equivalent to not adopting any new economic policy measure. Production function has the form $Y_2(K_2, \eta, \mu) = (1 + \eta).\mu.(K_2)^\beta$, where $\beta \in (0,1)$, but production is realized only after the Cabinet determines its policies. The fiscal policy instruments are subject to an *ex-ante* budget constraint $\tau Y_2 = D_0 + \text{g}.Y_2(K_2, 0, \mu_e)$; collected taxes must cover the inherited debt and the expenditure, without accounting for the impact of unexpected productivity shocks nor for the impact *economic* policy $(\mu_e = \mu \wedge \eta = 0)$[15]. Finally, production is realized, payoffs are assigned and the game ends.

Investors dislike fiscal policy uncertainty and economic policy volatility; their payoff consists of (a) the net return on the capital placed abroad, (b) output of domestic production net of taxes, (c) a

[13] $(1 - p_K)$ may be interpreted as a discount for the time during which the investment cannot be reversed/mobilized or, alternatively/complementarily, as a short-term-immobile portion of K_1.
[14] In the context of the model, economic policy comprises non-fiscal measures intended to boost productivity, like, for example, legislative action aiming at improving workstation organization, labor market dynamism, product market competition, business creation easiness...
[15] Note that, considering μ_e instead of μ, the budget constraint allows for the maintenance/accumulation of debt in the presence of negative productivity shocks, yielding public savings – or higher debt reduction, with re-parameterization – in the context of positive productivity shocks. Moreover, the null value of η represents the assumption that the public budget is defined before production takes place and without quantitative estimates of the potential impact from economic policy measures. All these assumptions are compatible with a scenario of ex-ante budget planning, in the context of which the budget constraint is assessed using production/productivity forecasts (μ_e) and abstracting from the impacts of (non-fiscal) economic policy.

disutility from the uncertainty linked to the signal â and (d) a disutility from the adoption of new economic policy measures by the Cabinet. Assuming (c) and (d) is proportional to the degree of Investors' exposure to the economy (measured by K_2), Investors' payoff is defined as follows:

$$R = r.(K - K_2) + (1 - \tau).Y_2(K_2, \eta, \mu) - \sigma(n, p).K_2 - \eta\varepsilon_I K_2,$$

where *K* represents total capital owned by Investors, $r \in (0,1)$ the exogenous foreign capital (net) return rate and ε_I the volatility-driven marginal cost from new policy strength. Cabinet's payoff (or utility) *W* has the following form:

$$W = a.\mathrm{g} - \frac{b}{2}\tau^2 - \mathbb{1}_{(1,\mu_e)}(\mu).\frac{[(1+\eta)\mu - \mu_e]^2}{\mu_e} - \mathbb{1}_{\{(n,p):n>1 \vee p=0\}}(n,p).[\eta + (n-1)\eta^2]\frac{\mu}{\mu_e}\varepsilon_N,$$

where (n, p) is a vector in $\mathbb{R}^{2+}$, $\varepsilon_N \in \mathbb{R}^+$ represents the cost of having to negotiate new economic policies within Cabinet or with the parliament and $b \in (1, +\infty)$. The first two terms of *W* refer to preferences with respect to fiscal policy instruments, with g yielding utility from its welfare applications (especially appealing to left-leaning Cabinets) and τ imposing disutility due to tax related inefficiencies. The third term of *W* reflects the negative utility extracted from negative productivity shocks[16] to μ, compared to its expected value – note that the marginal (dis)utility of μ is decreasing in μ (stronger negative shocks bring higher marginal utility losses). The last term in *W* represents the costs associated to the negotiations implied in economic policies adoption. These costs only appear in cases of coalitions or minorities[17] and are: (i) increasing in the strength of the policies assessed, given that stronger policies shall impose higher costs on coalition partners or parties represented in Parliament that do not agree on their direction, (ii) increasing in the number of parties in Cabinet – according to Spolaore (2004), within-coalition-Cabinet negotiations follow the "consensus system" mechanics, therefore the increase in policy strength originates a "war of attrition" before policy is adopted (this "war" represents an additional cost linked to coalitions and lasts longer for larger η – more costly

[16] $\mathbb{1}_{(1,\mu_e)}(\mu) = 1$, indicating $\mu < \mu_e$.

[17] $\mathbb{1}_{\{(n,p):n>1 \vee p=0\}}(n,p) = 1$, indicating $n > 1 \vee p = 0$.

measures – and larger n – more parties in Cabinet[18]) –, and (iii) decreasing in the magnitude of the shock, given that, the bigger the shock, the easier it shall be to reach an agreement on the measures to take[19].

In summary, the game structure is the following.

Figure 15. Time structure of the game

Stage 1	• â, n and p are revealed to the Investors • a, n and p are revealed to the Cabinet • Investors choose the level of K_1
Stage 2	• Nature determines μ • With probability p_K, Investors choose the level of K_2 and, with probability $(1 - p_K)$, Nature sets $K_2 = K_1$ • a is revealed to Investors • Cabinet chooses η, τ and g • Production Y_2 is realized • Payoffs R and W are assigned

2.2. Equilibrium

Equilibrium is presented by backward induction. Cabinet's optimization problem in stage 2 is as follows:

$$\max_{\tau,G,\eta} W = ag - \frac{b}{2}\tau^2 - \mathbb{1}_{(1,\mu_e)}(\mu)\,.\frac{[(1+\eta)\mu - \mu_e]^2}{\mu_e} - \mathbb{1}_{\{(n,p):n>1\vee p=0\}}(n,p)\,.\,[\eta + (n-1)\eta^2]\frac{\mu}{\mu_e}\varepsilon_N$$

$$\text{s.t. } \tau.Y_2(K_2,0,\mu_e) = D_0 + \text{g}.Y_2(K_2,0,\mu_e) \Leftrightarrow \text{g} = \tau - \frac{\text{D}_0}{Y_2(K_2,0,\mu_e)}$$

$$Y_2(K_2,\eta,\mu) = (1+\eta).\mu.(K_2)^{\beta}$$

[18] In of Spolaore (2004), the probability of measure adoption until a given time t, in the "consensus system", is decreasing in the cost of the measure and in the number of decision-makers.

[19] Note that this utility function replicates *the results* of the Spolaore (2004) framework, not *its mechanics*, given that is not the aim of this model to analyze the intra-Cabinet or the Cabinet-parliament negation dynamics, but instead replicate their output in terms of Cabinet preferences *vis-à-vis* economic policy choice.

From the F.O.C. on τ and g, we get

$$\frac{\partial W}{\partial \tau} = 0 \Leftrightarrow \tau^* = \frac{a}{b} \Rightarrow g^* = \frac{a}{b} - \frac{D_0}{Y_2(K_2, 0, \mu_e)}$$

For the case of $\mu \geq \mu_e \wedge n = p = 1$ (single-party-majority Cabinet without negative shock), *W* is independent from η, so there is no maximization with respect to this variable. If $\mu \geq \mu_e \wedge (n > 1 \vee p = 0)$, the optimum occurs at $\eta = 0$. In the case of $\mu < \mu_e \wedge n = p = 1$ (single-party-majority Cabinet with negative shock), we have:

$$\frac{\partial W}{\partial \eta} = 0 \Leftrightarrow -2\frac{\mu}{\mu_e}[(1+\eta)\mu - \mu_e] = 0 \Leftrightarrow \eta_s^* = \frac{\mu_e}{\mu} - 1$$

Note that the single-party-majority Cabinet will always act whenever a negative shock occurs, irrespective of its size ($\mu < \mu_e \Leftrightarrow \eta_s^* > 0$), fitting the Spolaore (2004) prediction of excessive action by "cabinet systems"[20]. Furthermore, this type of Cabinet will adjust completely to the shock: $(1+\eta_s^*)\mu = \mu_e$.

If $\mu < \mu_e \wedge (n > 1 \vee p = 0)$, the F.O.C. with respect to η yields:

$$\frac{\partial W}{\partial \eta} = 0 \Leftrightarrow -2\frac{\mu}{\mu_e}[(1+\eta)\mu - \mu_e] - [1 + 2(n-1)\eta]\frac{\mu}{\mu_e}\varepsilon_N = 0 \Leftrightarrow$$
$$\Leftrightarrow \eta_c^* = \frac{\mu_e - \mu - \frac{\varepsilon_N}{2}}{\mu + (n-1)\varepsilon_N}$$

Cabinets with coalition and/or minority in the parliament will act if and only if $\mu < \mu_e - \frac{\varepsilon_N}{2}$; there is, thus, an 'inaction band' $\left[\mu_e - \frac{\varepsilon_N}{2}, \mu_e\right)$, fitting the Spolaore (2004) prediction of greater shocks needed for "consensus" and "checks-and-balances systems" to act, compared to those demanded by "cabinet systems"[21]. Although having the same 'action threshold' $\left(\mu < \mu_e - \frac{\varepsilon_N}{2} \Leftrightarrow \eta_c^* > 0\right)$, coalition-Cabinets (regardless of *p*), will adopt less intense policies than single-party-minority Cabinets: $\eta_c^*|_{n>1} = \frac{\mu_e - \mu - \frac{\varepsilon_N}{2}}{\mu + (n-1)\varepsilon_N} < \frac{\mu_e - \mu - \frac{\varepsilon_N}{2}}{\mu} = \eta_c^*|_{n=1 \wedge p=0}$. This result fits Spolaore (2004) prediction of "action with

[20] For $\mu - \mu_e$ very small, $\eta^* > 0$ may be inefficient, concerning the costs imposed over the Investors.

[21] Note that, technically, we must have $\varepsilon_N < 2.(\mu_e - \mu)$, in order to have a non-empty action band for any type of cabinet.

delay" by "consensus systems", in the same 'action band' that triggers immediate action by the "checks-and-balances" system[22]. Note also that $\eta_s^* > \eta_c^*$.

Therefore, there is a theoretical correspondence in terms of reaction pattern *vis-à-vis* the shocks, linking single-party-majority Cabinets to Spolaore (2004) "cabinet systems", coalition Cabinets to Spolaore (2004) "consensus systems" and single-party-minority Cabinets to Spolaore (2004) "check-and-balances systems".

As shown in Figure A5, in Appendix, evidence does not support that this *action/inaction* argument applies to fiscal policy. Accordingly, the model channels this hypothesis through *other* economic policy, measured through η.

Proceeding with backward induction, Investors will, with probability p_K, choose K_2 according to:

$$(1 - E[\tau^*]).(1 + \eta^*).\mu\beta {K_2}^{\beta-1} - \sigma(n,p) - \eta^*\varepsilon_I = r \Leftrightarrow$$
$$\Leftrightarrow {K_2}^* = \left[\left(1 - \frac{\hat{a}}{b}\right)\frac{(1 + \eta^*)\mu\beta}{r + \sigma(n,p) + \eta^*\varepsilon_I}\right]^{\frac{1}{1-\beta}}$$

Finally, in stage 1 and before the productivity level is known, investors choose K_1 according to[23]

$$(1 - E[\tau^*]).E[(1 + \eta^*).\mu]\beta {K_1}^{\beta-1} - \sigma(n,p,\gamma) - E[\eta^*].\varepsilon_I = r \Leftrightarrow$$
$$\Leftrightarrow {K_1}^* = \left[\left(1 - \frac{\hat{a}}{b}\right)\frac{\beta.E[(1 + \eta^*)\mu]}{r + \sigma(n,p) + E[\eta^*]\varepsilon_I}\right]^{\frac{1}{1-\beta}}$$

Equilibrium outcome determines the following predictions:

a) $\frac{\partial K_t^*}{\partial \hat{a}} < 0, t \in \{1,2\}$; due to preference for high g and τ, left cabinets attract less capital, leading to lower capital inflow or higher capital outflow between the beginning and the end of the stage $1(K_1 - K_0)$; in particular, if we assume $K_0 = \left[\left(1 - \frac{a^M}{b}\right)\frac{\beta.E[(1+\eta^*)\mu]}{r+\sigma(n,p)+E[\eta^*]\varepsilon_I}\right]^{\frac{1}{1-\beta}}$, the election of a right (left) Cabinet will imply $K_1 - K_0 > (<)0$;

[22] Note that the intensity loss in the coalitions' intervention may be interpreted as time discount for its delay.
[23] Rigorously, the left hand side of the (initial) F.O.C. should be multiplied by $(1 - p_k)$; for the purpose of simplicity, this term is ignored, given it doesn't impact the relevant analysis.

b) $\frac{\partial K_t^*}{\partial n} \lesseqgtr 0, t \in \{1,2\}$; the effect of an additional party in cabinet or, more specifically, of having a coalition instead a single-party Cabinet is unpredictable. Note that, given single-party-majority Cabinets $(n = p = 1)$ always adjust completely to negative shocks,

$$E[(1+\eta_s^*)\mu] = \int_1^{\mu_e-\frac{\varepsilon_N}{2}}\left(1+\frac{\mu_e-\mu}{\mu}\right)\mu\, dP + \int_{\mu_e-\frac{\varepsilon_N}{2}}^{\mu_e}\mu_e\, dP + \int_{\mu_e}^{+\infty}\mu\, dP.$$

If$(n = 1 \wedge p = 0)$,

$$E\left[(1+\eta_c^*|_{n=1\wedge p=0})\mu\right] = \int_1^{\mu_e-\frac{\varepsilon_N}{2}}\left(1+\frac{\mu_e-\mu-\frac{\varepsilon_N}{2}}{\mu}\right)\mu dP + \int_{\mu_e-\frac{\varepsilon_N}{2}}^{\mu_e}\mu dP + \int_{\mu_e}^{+\infty}\mu\, dP.$$

For $n > 1$,

$$E[(1+\eta_c^*|_{n>1})\mu] = \int_1^{\mu_e-\frac{\varepsilon_N}{2}}\left(1+\frac{\mu_e-\mu-\frac{\varepsilon_N}{2}}{\mu+(n-1)\varepsilon_N}\right)\mu\, dP + \int_{\mu_e-\frac{\varepsilon_N}{2}}^{\mu_e}\mu\, dP + \int_{\mu_e}^{+\infty}\mu\, dP.$$

We can, therefore establish the relation

$$E[(1+\eta_s^*)\mu] > E\left[(1+\eta_c^*|_{n=1\wedge p=0})\mu\right] > E[(1+\eta_c^*|_{n>1})\mu],$$

indicating that the numerator of ${K_1}^*$ is decreasing in *n*. But, on the other hand,

$$E[\eta_s^*] = \int_1^{\mu_e-\frac{\varepsilon_N}{2}}\frac{\mu_e-\mu}{\mu}\, dP + \int_{\mu_e-\frac{\varepsilon_N}{2}}^{\mu_e}\frac{\mu_e-\mu}{\mu}\, dP > \int_1^{\mu_e-\frac{\varepsilon_N}{2}}\frac{\mu_e-\mu-\frac{\varepsilon_N}{2}}{\mu}dP =$$
$$E\left[\eta_c^*|_{n=1\wedge p=0}\right] > \int_1^{\mu_e-\frac{\varepsilon_N}{2}}\frac{\mu_e-\mu-\frac{\varepsilon_N}{2}}{\mu+(n-1)\varepsilon_N}\, dP = E[\eta_c^*|_{n>1}],$$

indicating that the denominator of ${K_1}^*$ also decreases in *n* due to the reduction of policy-volatility cost. Given $\frac{\partial\sigma}{\partial n} > 0$, the denominator increases in *n* due to the uncertainty cost, confirming the unpredictability of $\frac{\partial K_1^*}{\partial n}$. In ${K_2}^*$, the unpredictability is even greater, because, for $\mu \in \left(\mu_e - \frac{\varepsilon_N}{2}, \mu_e\right)$, $\eta_c^*|_{n=1\wedge p=0} = \eta_c^*|_{n>1} = 0$. For each remaining value of μ, the conclusions extracted for the numerator and denominator of ${K_1}^*$ may be extended to ${K_2}^*$.

c) $\frac{\partial K_t^*}{\partial p} \lesseqgtr 0, t \in \{1,2\}$; the inequalities exposed in (b) show that, from $p = 0$ to $p = 1$, it is impossible to predict the behavior of either the numerator or the denominator of ${K_1}^*$ and ${K_2}^*$, because it crucially depends on the value of *n*. The only clear monotonicity is $\frac{\partial\sigma}{\partial p} > 0$.

d) $\frac{\partial K_2^*}{\partial \mu} > 0$; capital will be attracted/repelled by positive/negative productivity shocks.

The unpredictability with respect to Investors' reaction to *n* and *p* is due to the trade-off between the impact of these types (i) on the uncertainty about the Cabinet's ideology – larger *n* repels capital and larger *p* attracts it – and (ii) on the efficiency of the reaction to the productivity negative shocks – single-party-majority Cabinets may react too frequently if, for $\mu \in \left(\mu_e - \frac{\varepsilon_N}{2}, \mu_e\right)$, the positive impact of $\eta > 0$ through μ is more than compensated by the negative impact through ε_I; single-party-minority Cabinets and coalition Cabinets may react too infrequently if, otherwise, the net impact of $\eta > 0$ is positive for $\mu \in \left(\mu_e - \frac{\varepsilon_N}{2}, \mu_e\right)$; finally, single-party-minority Cabinets and, especially, coalition cabinets may react with inefficiently low intensity if $\frac{\partial R}{\partial \eta} > 0$ for $\mu \in \left(1, \mu_e - \frac{\varepsilon_N}{2}\right)$ – the particularly low intensity of reaction by coalition cabinets may be interpreted as "action with delay" (the lack of intensity being attributed to time discount of delayed actions). In other words, single-party and majoritarian cabinets are more prompt in adjusting productivity shocks and induce higher certainty around expected policy, but, on the other hand, generate, in consequence, more policy "noise" and potential excessive-action inefficiencies.

3. Empirical test

In order to test assumptions and predictions of the model, as well as broader interrelations between politics, policy and capital flows, four distinct impact channels are assessed:

A) capital flows' reaction to electoral outcomes – testing predictions (a)–(d) in Section 2.2;

B) capital flows' reaction to the political profile of the cabinet in office, 1998–2008 – testing for non-immediate reactions;

C) impact of cabinet's political profile on fiscal policy followed, 1998–2008 – testing the ideological impacts implied in equilibrium outcomes $\tau^* = \frac{a}{b}$ and $g^* = \frac{a}{b} - \frac{D_0}{Y_2(K_2, 0, \mu_e)}$, Section 2.2;

D) capital flows' reaction to fiscal policy, both unconditionally and conditional on the political profile of the cabinet in office, 1998–2008.

Note that assessments (B) and (D) outreach the limits of the model, exploring potential spill-overs of its assumptions and predictions to the political mandate. The following sections detail the data used and the methodology adopted.

3.1. Data

An innovative political dataset is built by the author, starting from Woldendorp et al (1998) and extending the time span (to include the period from mid 90's to 2008), the set of countries covered (to include Portugal, Spain, Greece and USA) and the set of variables (to include dates of elections). Other references used in this empirical endeavour are the *Political Data* Yearbooks (1995-2009) – published by the European Journal of Political Research[24] –, the Keesing's Contemporary Archives[25], the Comparative Political Data Set (CPDS), 1960-2006[26], and several institutional and research websites[27]. The data in Woldendorp et al (1998) was in "cabinet-wise" format – each observation was a cabinet –

[24] See EJPR Vol. 48, no. 7-8 (2009), Vol. 47, no. 7-8 (2008) and Vol. 46, no. 7-8 (2007) for examples.
[25] www.keesings.com
[26] See Armingeon et al (2008).
[27] Examples are the US House of Representatives (Office of the Clerk), US Senate (archives), Parties and elections in Europe (www.parties-and-elections.de), Zaraté's Political Collections.

and is transformed into daily format, using the stock markets business days from Datastream, aggregating it afterwards into yearly format, in order to match the capital flows data.

The political dataset covers the period 1960-2008 for 23 OECD democracies – Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, UK and USA –, characterizing, namely: cabinet party's/parties' ideology, cabinet party composition, cabinet parliamentary support, prime minister identification, cabinet duration, reason for cabinet termination, day of new cabinet 'office taking', election days. The underlying specific variables characterize, in the daily format, the *status quo* or the transition occurred in each day, for each country. With the yearly aggregation, many ways of transforming the data were pursued. In order to perform the empirical test to the model, two types of political variables are used:

(i) *state variables*, reporting the 'dominant political profile in office' in each country/year, measured through the number of days in office; these variables also characterize the 'dominant' cabinet with respect to ideology – left, center, right (e.g. $right_{mode}$= 0 if the ideology most days 'in office' in a given country/year *was not right-leaning*)[28] –, parliamentary support – majority/minority (e.g. $majority_{mode}$= 1 if the cabinet support most days 'in office' in a given country/year was majoritarian, $majority_{mode}$= 0 otherwise)[29] – and (quantitative) party composition – coalition/single-party (e.g. $coalition_{mode}$= 0 if the cabinet composition most days 'in office' in a given country/year was *single-party*). Note that the 'dominant profile' need not have been possessed by the same cabinet, but by several distinct cabinets sharing one or more characteristics[30].

(ii) *transition variables*, reporting transitions occurred in years with election(s) and/or cabinet change(s) due to other reasons[31]; these variables discriminate between transitions occurred

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[28] In the case of the U.S.A., cabinet ideology fluctuates between *center*, for Democrat administrations, and *right*, for Republican administrations.

[29] In the case of the U.S.A., parliamentary support is classified through the composition of the Congress; in case of divergence between the status of the two chambers, the composition of the House of Representatives is used.

[30] Although it is possible to ensure the dominance by one exact cabinet by selecting country/year observations with a maximum of one change/election.

[31] Several events may occur in each year; for the country/year pairs with more than one event, all transitions occurred are reported.

in an election day and those occurred in an 'office taking' day – named as *change day* from now on –, even if the change was due to an election[32]. They characterize cabinet transition in terms of ideology (e.g. $left\text{-}right_{election}$ = 1 if there was one election in a given country/year giving origin to a transition from a left leaning cabinet to a right leaning one), parliamentary support (e.g. $majority\text{-}nmajority_{election}$ = 1 if there was one election in a given country/year giving origin to a transition from a majoritarian cabinet to a minoritarian one) and (quantitative) party composition (e.g. $ncoalition\text{-}coalition_{change}$ = 1 if there was a coalition cabinet taking office from a single-party one, in a given country/year).

Ideological classification follows the criteria observed by the data sources mentioned above. The CPDS, in particular, cites Schmidt and Beyer (1992) and Schmidt (1996) as source of the party ideological classification criteria producing the cabinet ideological labeling[33]. *Left* denotes social democratic parties and political parties left of social democracy, *right* denotes liberal and conservative parties and *center* denotes center parties, in particular Christian Democratic or Catholic parties.

Data on capital flows and controls – *per capita* real GDP growth and inflation rate – is extracted from the World Development Indicators & Global Development Finance database (World Bank Group). Capital flows used are:

(i) *FDI (net) inflows*, flows of long-term-oriented investment in the domestic economy by foreign investors, net of disinvestment (original source is the International Monetary Fund, Balance of Payments (BoP) database, supplemented by data from the United Nations Conference on Trade and Development and official national sources);
(ii) *FDI (net) outflows*, flows of long-term-oriented investment in foreign economies by domestic investors, net of disinvestment (original sources are the International Monetary

[32] In a country/year pair with one election and respective change, the same transition is reported by two variables – one devoted to elections and other to changes. The distinction is particularly relevant, for instance, in the cases of changes not due to elections and elections to which the respective change occurs in the following year.
[33] Other sources are mentioned in the CPDS and in Woldendorp et al (1998): Schmidt and Beyer (1992), Ismayr (2003), European Journal of Political Research, Neue Zürcher Zeitung, People in Power (http://www.circa-uk.demon.co.uk/pip.html) and the Parline database (http://www.ipu.org/parline-e/parlinesearch.asp). Where all these criteria couldn't help, the authors assigned the classifications by themselves.

Fund, International Financial Statistics and Balance of Payments databases, World Bank, Global Development Finance, and World Bank and OECD GDP estimates);

(iii) *FDI net flows*, which consist of *FDI (net) inflows* subtracted of *FDI (net) outflows* (original source is the International Monetary Fund, Balance of Payments Statistics Yearbook and data files); positive (negative) sign denotes net capital *entry* (*exit*) in the domestic economy;

(iv) *Equity net inflows*, net inflows of investment in domestic equity securities other than those recorded as FDI, by foreign investors (original sources are the International Monetary Fund, Balance of Payments database, and World Bank, Global Development Finance);

(v) *Capital account net flow*, net balance of the Balance of Payments Capital and Financial Account (original source is the International Monetary Fund, Balance of Payments Statistics Yearbook and data files); positive (negative) sign represents net *entry* (*exit*) of capital in the domestic economy.

All the capital flows series used are measured in percentage of domestic nominal GDP. Fiscal policy is measured through the following variables:

(i) *Corporate Tax Rate*, in percentage points (OECD Tax Database, Corporate and Capital income taxes, basic (non-targeted) corporate income tax rates)[34];

(ii) *Public Expenses* in percentage of domestic nominal GDP, in percentage points – *expp* in regressions tables – (OECD Economic Outlook No. 86, December 2009);

(iii) *Public Revenue* in percentage of domestic nominal GDP, in percentage points – *revp* in regressions tables – (OECD Economic Outlook No. 86, December 2009);

(iv) *Public Budget Balance* in percentage of domestic nominal GDP, in percentage points – *balp* in regressions tables – (OECD Economic Outlook No. 86, December 2009); this variable represents *Government Net Lending* and corresponds to the subtraction of *Public Expenses* to *Public Revenue* (*balp* = *revp* – *expp*); positive (negative) sign denotes budget *surplus* (*deficit*);

[34] Data available at http://www.oecd.org/tax/taxpolicyanalysis/oecdtaxdatabase.htm#C_CorporateCaptial.

(v) *Public Gross Debt* in percentage of domestic nominal GDP, in percentage points – *debtp* in regressions tables – (OECD Economic Outlook No. 86, December 2009).

Control variables used are:

(i) *Real* per capita *GDP growth*, annual growth rate of the gross domestic product in constant 2000 US dollars, divided by midyear population (original source are the World Bank national accounts data, and OECD National Accounts data files);

(ii) *Inflation rate*, annual percentage change of the Consumer Price Index (original source is the International Monetary Fund, International Financial Statistics and data files).

(iii) *Unemployment rate*, in percentage points, first difference – *dunempp* in regressions tables – (OECD Economic Outlook No. 86, December 2009)

(iv) *Short-term interest rate*, in percentage points, first difference – *dsinterestp* in regressions tables – (OECD Economic Outlook No. 86, December 2009)

(v) *Productivity growth*, in percentage points; annual percentage growth of real GDP per employed person – *dproductivityp* in regressions tables – (OECD Economic Outlook No. 86, Dec. 2009)

(vi) *Trade* over domestic nominal GDP ([exports+imports]/GDP), in percentage points – *tradep* in regressions tables – (original source are the World Bank national accounts data, and OECD National Accounts data files)

(vii) *BoP Current Account Balance* over domestic nominal GDP, in percentage points – *curr-accp* in regressions tables – (OECD Economic Outlook No. 86, December 2009)

(viii) *Exchange rate appreciation/depreciation*, in percentage points; percentage growth of the amount of local currency units per U.S. dollar; amount of dollars per Deutsche Mark, for the USA – Eurozone currencies were retrospectively converted to Euros for the entire sample, using the adhesion conversion rates – (original source are the World Bank national accounts data, and OECD National Accounts data files; Euro conversion rates from the European Central Bank)

See Table A1 and Table A2, in Appendix, for specific description and summary statistics of each variable used (respectively).

3.2. Methodology

This section details the methodology followed to test each of the impact channels exposed at the beginning of Section 3. In all regressions, fixed and random effects are successively used. Time dummies are included in all specifications, in order to filter trends over time and abnormal spikes specific to some years – see Figure A8 in Appendix.

A) Capital flows' reaction to electoral outcomes

The sample is restricted to years with no election following a year with one election only. Mid-term elections in the U.S.A. are not considered[35], nor are elections involving incumbent or elected caretaker cabinets[36].

Capital flows are regressed on the last period's transition variables, following the specification:

$$f_{i,t_2} = \alpha + \alpha_i + \alpha_{t_2} + \beta_{ll}.(left \cdot left)_{i,t_1} + \beta_{lc}.(left \cdot center)_{i,t_1} + \beta_{lr}.(left \cdot right)_{i,t_1} + \\ +\beta_{cl}.(center \cdot left)_{i,t_1} + \beta_{cr}.(center \cdot right)_{i,t_1} + \beta_{rl}.(right \cdot left)_{i,t_1} + \\ +\beta_{rc}.(right \cdot center)_{i,t_1} + \beta_{rr}.(right \cdot right)_{i,t_1} + \omega_{mm}.(maj \cdot maj)_{i,t_1} + \\ +\omega_{mn}.(maj \cdot nmaj)_{i,t_1} + \omega_{nm}.(nmaj \cdot maj)_{i,t_1} + \upsilon_{cc}.(coal \cdot coal)_{i,t_1} + \upsilon_{cn}.(coal \cdot ncoal)_{i,t_1} + \\ +\upsilon_{nc}.(ncoal \cdot coal)_{i,t_1} + \lambda_g.g_{i,t_2} + \lambda_\pi.\pi_{i,t_2} + \varepsilon_{i,t_2},$$

where: t_1 represents the election year and t_2 the following year; f_{i,t_2} represents a specific capital flow (FDI, equity, or capital account) divided by nominal GDP, for country *i*, in period t_2; α_i and α_{t_2} represent the country-effect and the time dummy, respectively; g_{i,t_2} and π_{i,t_2} represent, respectively,

[35] U.S.A. mid-term elections aim at selecting part of the Congress members, but not the President or his/her cabinet. Therefore, these elections may lead to changes in cabinet's parliamentary support, but not in its ideology (center/right) or in the number of parties in cabinet (always one).

[36] Such cabinets are often not associated to specific ideologies or parties and may assume a technocratic stance, often with the specific goal of overcoming economic or political crises. Examples of caretaker cabinets are those headed by Prime-minister Dini in Itlay, 1995–1996.

real *per capita* GDP growth and CPI inflation rate for country *i*, in period t_2, and the remaining variables stand for the political *transition* dummies referring to the election(s) occurred in country *i*, in period t_1. Note that, from now on, indices denoting the type of event (election/change) the transitions refer to will be dropped, given the analysis shall focus only on elections. *Center-center*, *nmaj-nmaj* and *ncoal-ncoal* are left out in the 'complete specification', in order to avoid replicating the constant term.

Capital flows are also regressed on the same period's state variables (characterizing the elected cabinet[37]), following the specification:

$$f_{i,t_2} = \alpha + \alpha_i + \alpha_{t_2} + \beta_l.(left)_{i,t_2} + \beta_r.(right)_{i,t_2} + \omega_m.(maj)_{i,t_2} + v_c.(coal)_{i,t_2} + \lambda_g.g_{i,t_2} + \lambda_\pi.\pi_{i,t_2} + \varepsilon_{i,t_2},$$

where the political variables represent now the political *state* dummies characterizing the 'dominant' political profile in country *i*, in period t_2. '*Mode*' indices will also be dropped from now on for these variables. *Center* cabinets are left out, in order to avoid replicating the constant term.

A final alternative specification is implemented, using interactions of the political state variables across the three political dimensions – ideology, parliamentary support and party composition (e.g. *left-nmaj-coal* = 1 denotes that the cabinet most days in office was a left-leaning minoritarian coalition). Such approach follows the specification:

$$f_{i,t_2} = \alpha_i + \sum_{\substack{i\in\{left,right\}\\ s\in\{maj,nmaj\}\\ c\in\{coal,ncoal\}}} [\beta_{isc}.(i\cdot s\cdot c)_{i,t_2}] + \lambda_g.g_{i,t_2} + \lambda_\pi.\pi_{i,t_2} + \varepsilon_{i,t},$$

where the political variables $(i\cdot s\cdot c)_{i,t}$ represent the interacted *state* dummies – *i*deology, *s*upport and *c*omposition – characterizing the 'dominant' political profile in country *i*, period t_2. *Center-maj-ncoal* and *center-nmaj-ncoal* are left out, in order to avoid replicating the constant term.

Note that, differently from the model, the impact of productivity shocks on flows is assessed contemporaneously to the impact of political news. Both for transition and state variables, several 'sub-specifications' are attempted, containing only subsets of the explanatory political variables exposed.

[37] Absence of elections in t_2 is imposed with the purpose of capturing the profile of the elected cabinet through the 'dominant' state political variables.

Two distinct robustness tests are performed to all specifications above: (1) the additional control variables described in Section 3.1 – unemployment, short-term interest, productivity growth, trade, current account and exchange rate – are added to the specification; (2) years with 2 elections (or, more precisely, the years following them) are included in the analysis, political transition variables are redefined in order to report the transition occurred between the beginning and the end of the electoral year (instead of reporting each transition occurred in each election) and, for years with election(s) occurring only in the period January–March, the capital flows, control variables and political state variables used in the regressions respect to the electoral year, t_1 (instead of those from the subsequent year, t_2)[38].

B) Capital flows' reaction to the political profile of the cabinet in office, 1998–2008

In order to capture clearer reactions, this analysis focus on the sample period during which capital flows become distinctively more active within the OECD – see Figures 1–4.

All years in 1998–2008 are considered and each year's capital flows are regressed on the same period's political state variables, following the specification:

$$f_{i,t} = \alpha + \alpha_i + \alpha_{t_2} + \beta_l.(left)_{i,t} + \beta_r.(right)_{i,t} + \omega_m.(maj)_{i,t} + \upsilon_c.(coal)_{i,t} + \lambda_g.g_{i,t} + \lambda_\pi.\pi_{i,t} + \varepsilon_{i,t},$$

where the political variables represent the political *state* dummies characterizing the 'dominant' political profile in country *i*, in period *t*. *Center* cabinets are left out, in order to avoid replicating the constant term.

Capital flows are also regressed on the interactions of the political state variables across the three political dimensions, using the specification:

$$f_{i,t} = \alpha_i + \sum_{\substack{i\in\{left,right\}\\ s\in\{maj,nmaj\}\\ c\in\{coal,ncoal\}}} \left[\beta_{isc}.(i\cdot s\cdot c)_{i,t}\right] + \lambda_g.g_{i,t} + \lambda_\pi.\pi_{i,t} + \varepsilon_{i,t},$$

[38] In the sample used, there are 328 years with at least one election; in 3 of those years, 2 elections occurred (in the same year). With the redefinition of the political transition variables, years with two elections hold only one transition per political dimension (ideology, parliamentary support and party composition) – the one resulting from the direct comparison of the cabinets in office in the beginning and in the end of the year. Using the original definition for the transition variables, each of these years would have several transitions reported in each political dimension – see the maximum value of *righ-right* in Table A2 (Appendix) for an example.

where the political variables $(i \cdot s \cdot c)_{i,t}$ represent the interacted *state* dummies – on *i*deology, *s*upport and *c*omposition – characterizing the 'dominant' political profile in country *i*, period *t*. *Center-maj-ncoal* and *center-nmaj-ncoal* are left out, in order to avoid replicating the constant term.

Similarly to (A), 'sub-specifications' containing subsets of political regressors are run, and the additional control variables described in Section 3.1 – unemployment, short-term interest, productivity growth, trade, current account and exchange rate – are added to each specification.

C) Impact of cabinet's political profile on fiscal policy followed, 1998–2008

In order to ensure comparability and consistency, this analysis focus on the same period as (B), testing the existence of distinct fiscal policy patterns associated to specific political traits; the specification used is:

$$p_{i,t} = \alpha + \alpha_i + \alpha_{t_2} + \beta_l.(left)_{i,t} + \beta_r.(right)_{i,t} + \omega_m.(maj)_{i,t} + \upsilon_c.(coal)_{i,t} + \lambda_g.g_{i,t} + \lambda_\pi.\pi_{i,t} + \varepsilon_{i,t},$$

and

$$p_{i,t} = \alpha_i + \sum_{\substack{i \in \{left,right\} \\ s \in \{maj,nmaj\} \\ c \in \{coal,ncoal\}}} \left[\beta_{isc}.(i \cdot s \cdot c)_{i,t}\right] + \lambda_g.g_{i,t} + \lambda_\pi.\pi_{i,t} + \varepsilon_{i,t},$$

where $p_{i,t}$ represents a specific fiscal policy measure (corporate tax rate, public expenses, public revenue, or public budget balance[39]), for country *i*, in period *t*. *Center*, *center-maj-ncoal* and *center-nmaj-ncoal* cabinets are left out, in order to avoid replicating the constant term. Similarly to (A) and (B), 'sub-specifications' containing subsets of political regressors are run.

[39] Public debt is not assessed at this instance.

D) Capital flows' reaction to fiscal policy, both unconditionally and conditional on the political profile of the cabinet in office, 1998–2008

This represents an indirect potential impact channel: the political profile of the cabinet in office may influence the way capital flows react to its fiscal policy, by inducing expectations over future policy. This hypothesis is tested through the specifications:

$$f_{i,t} = \alpha + \alpha_i + \alpha_{t_2} + \lambda_g . g_{i,t} + \lambda_\pi . \pi_{i,t} +$$

$$+ \sum_{p \in \{ctax,exp,rev,debt\}} \left[\beta_p . p_{i,t} + \beta_{pl} . (p \times left)_{i,t} + \beta_{pr} . (p \times right)_{i,t} + \omega_{pm} . (p \times maj)_{i,t} + \upsilon_{pc} . (p \times coal)_{i,t}\right] + \varepsilon_{i,t},$$

and

$$f_{i,t} = \alpha + \alpha_i + \alpha_{t_2} + \beta_{bal} . bal_{i,t} + \beta_{ball} . (bal \times left)_{i,t} + \beta_{balr} . (bal \times right)_{i,t} +$$

$$+ \omega_{balm} . (bal \times maj)_{i,t} + \upsilon_{balc} . (bal \times coal)_{i,t} + \lambda_g . g_{i,t} + \lambda_\pi . \pi_{i,t} + \varepsilon_{i,t}.$$

Budget balance is isolated in a distinct specification, in order to avoid the multi-colinearity with revenues and expenses. *Center* cabinets are left out, in order to avoid replicating the fiscal policy measure. For both regressions above, 'sub-specifications' are run, restricting the set of regressions only to the fiscal policy measure(s) isolated from political variables and, additionally, in the case of the first specification, addressing one fiscal policy at a time (either isolated or interacted with the political variables).

3.3. Results

This section presents and discusses the results from the empirical test to impact channels (A)–(D), focusing on the results attained using fixed effects (FE), given that this technique always produces consistent estimators, even when not the most efficient. Moreover, the use of fixed effects implies the possibility of arbitrary correlation between the unobserved country-specific effects and the observed political/control variables. Such hypothesis seems plausible, given the homogeneous cabinets' political profile in some countries[40], and implies, namely, that the country-specific constant term (representing a ***1960-2008 country-specific average capital flow***) may be correlated with the country-specific 1960-2008 profile in terms of growth, inflation, politics, fiscal policy... This would mean that investors take into account a country's macroeconomic/political track record or structural profile, when considering investing in its economy.

Only the significant results holding under the robustness tests detailed in Section 3.2 and under error clustering[41] are reported, highlighted and discussed. In case a given coefficient assumes different (rounded) values across regressions and unless otherwise stated, the coefficient from the most complete specification is used for discussion.

A) Capital flows' reaction to electoral outcomes.

Tables 1–4 report the significant and robust results from this empirical test. Tables A5–A8 (Appendix) report the results of those same specifications, under the robustness test (2) described in Section 3.2.A. – redefining political transitions and considering contemporaneous flows for elections held in January–March. Only FDI and equity flows show significant and robust reaction to some electoral outcomes.

Table 1 shows that FDI flows react negatively to elections from which majority cabinets are formed: net flows are lower in about 1.5 GDP percentage points (p.p.), when compared to years after elections of minoritarian cabinets. Table 2 shows that this impact originates exclusively from elections in which the cabinet majoritarian status is *maintained*[42]. The renewal of the majoritarian status is associated with lower FDI net flows in 1.8 GDP (p.p.), when compared to any other electoral result – an impact representing more than 50% of the standard deviation of FDI net flows in years after elections[43].

Regarding prediction (c) in the end of Section 2.2, this performance by FDI implies the negative derivative $\left.\frac{\partial K_t^*}{\partial p}\right|_{p_0=1} < 0$, where p_0 denotes the majoritarian status of the incumbent cabinet

[40] Note that some countries are very close to the political axes' extremes in Figures 8–12, indicating very homogeneous political profiles. A clear example is Canada, for which *right* = 1 in all years in sample.
[41] Variance estimation technique preventing the hypothesis of error correlation within sub-sample groups ("clusters"). In this study, countries are considered the potential clusters.
[42] Note that this does not imply the maintenance of the *exact* same cabinet.
[43] See Table A3 (Appendix), summary statistics excluding Luxembourg, for non-election years following years with election(s).

before the election. Such evidence supports that, after exposure to a majoritarian government, inefficiently excessive action by this type of cabinets dominates over the higher certainty around their expected ideology.

Table 3 reveals that, contrary to FDI, equity inflows react positively to the election of majoritarian cabinets (regardless of incumbent's type), in 0.9 GDP p.p. – about 50% of these flows' standard deviation in years after elections[44].

Regarding the same model prediction, this evidence supports $\frac{\partial K_t^*}{\partial p} > 0$. Such an opposite behaviour by FDI and equity flows is consistent with their distinct purposes: contrary to equity, FDI has a long-term lasting management interest in an enterprise located at the destination economy[45], being, thus, more sensitive to context volatility – harmful to business stability – implied in excessive action by the cabinet; more focused in the short-term and more indifferent to business environment, equity flows react positively to more active cabinets, more committed to neutralize shocks to productivity – and, thus, to stock returns.

On the other hand, Table 4 shows that equity flows react negatively to electoral transitions from right to center cabinets, partially supporting the negative derivative in model prediction (a), Section 2.2: $\left.\frac{\partial K_t^*}{\partial \hat{a}}\right|_{a_0=0 \wedge \hat{a}\in(0,a^M)} < 0$. This impact reaches a magnitude of 4.7 GDP p.p., equivalent to more than 2.5 standard deviations of equity inflows in years after elections[46].

[44] See Table A3 (Appendix), summary statistics excluding Luxembourg, Belgium and Ireland, for non-election years following years with election(s).
[45] See Section 3.1 and Table A1 (Appendix) for definitions.
[46] See Table A3 (Appendix), summary statistics excluding Luxembourg, Belgium and Ireland, for non-election years following years with election(s).

Table 1. FDI net flows after elections and political profile variables characterizing the elected cabinet

Dependent variable: FDI net flows, in percentage of GDP (percentage points), in years without any election, following a year with election(s)

Independent variables	(1) FE, maj, excl. Lux	(2) FE, maj, excl. Lux	(3) FE, coal, excl. Lux	(4) FE, coal, excl. Lux	(5) FE, all excl. Lux	(6) FE, all excl. Lux
real per capita GDP	0.025	0.416	0.026	0.401	0.073	0.373
growth	(0.238)	(0.461)	(0.241)	(0.456)	(0.235)	(0.454)
inflation (CPI)	0.013	0.205	0.013	0.211	0.004	0.164
	(0.098)	(0.163)	(0.100)	(0.164)	(0.098)	(0.159)
dunempp		0.053		0.037		-0.042
		(0.587)		(0.589)		(0.584)
dsinterestp		-0.394*		-0.400*		-0.398*
		(0.213)		(0.216)		(0.214)
dproductivityp		-0.232		-0.227		-0.201
		(0.396)		(0.396)		(0.393)
tradep		0.054		0.053		0.055
		(0.036)		(0.036)		(0.037)
curr-accp		-0.405**		-0.407**		-0.393**
		(0.176)		(0.177)		(0.170)
dexchangep		0.155		0.156		0.154*
		(0.097)		(0.097)		(0.093)
left					-1.937	-1.265
					(1.958)	(1.288)
right					-2.442	-1.692
					(2.149)	(1.275)
majority	-1.476**	-1.551*	-1.482**	-1.479*	-1.498*	-1.519*
	(0.706)	(0.853)	(0.741)	(0.860)	(0.766)	(0.889)
coalition			0.025	-0.346	0.034	-0.366
			(0.676)	(0.770)	(0.903)	(0.951)
Constant	-0.473	-6.258	-0.486	-1.725	4.629	0.353
	(2.271)	(4.043)	(2.246)	(3.327)	(3.183)	(3.844)
Observations	199	182	199	182	199	182
R-squared	0.094	0.320	0.094	0.320	0.128	0.335
Number of countries	22	22	22	22	22	22

Notes. Robust standard errors in parenthesis. * Significant at 10% level ** Significant at 5% level. *** Significant at 1% level. All political variables refer to the cabinet's political profile most frequent in the year of the capital flow. Control variables always refer to the year of the capital flow. All regressions performed using fixed effects and robust variance estimates. *Center* left out to avoid multi-colinearity with constant. All controls are measured in percentage points. Luxembourg excluded due to outlying status – see Table A2 (Appendix). All the significant coefficients shaded are robust to error clustering by countries.

Table 2. FDI net flows after elections and political transition variables reflecting electoral outcome from each election

Dependent variable: FDI net flows, in percentage of GDP (percentage points), in years without any election, following a year with election(s)				
Independent variables	(1) FE, str&comp, excl. Lux	(2) FE, str&comp, excl. Lux	(3) FE, all, excl. Lux	(4) FE, all, excl. Lux
real per capita GDP	0.047	0.322	0.126	0.381
growth	(0.240)	(0.436)	(0.249)	(0.474)
inflation (CPI)	-0.003	0.234	-0.029	0.120
	(0.106)	(0.163)	(0.115)	(0.180)
dunempp		-0.295		-0.186
		(0.632)		(0.634)
dsinterestp		-0.528**		-0.587**
		(0.257)		(0.265)
dproductivityp		-0.094		-0.127
		(0.416)		(0.416)
tradep		0.059		0.067*
		(0.036)		(0.038)
curr-accp		-0.426**		-0.442***
		(0.176)		(0.152)
dexchangep		0.176*		0.165*
		(0.102)		(0.088)
left-left			-0.980	-1.210
			(1.429)	(1.571)
left-center			-1.120	0.061
			(2.023)	(1.844)
left-right			-1.837	-1.923
			(1.411)	(2.082)
center-left			-0.931	-0.251
			(1.714)	(2.195)
center-right			-0.684	1.743
			(2.250)	(1.548)
right-left			-1.689	-0.286
			(1.611)	(1.801)
right-center			4.730	5.101*
			(3.680)	(2.580)
right-right			-1.487	-1.188
			(1.437)	(1.406)
maj-maj	-1.961**	-1.702*	-1.904**	-1.846*
	(0.798)	(0.917)	(0.878)	(0.943)
maj-nmaj	-0.624	0.022	-0.939	-0.947
	(0.814)	(1.327)	(1.020)	(1.308)
nmaj-maj	-0.676	0.392	-0.837	-0.484
	(0.870)	(0.978)	(1.049)	(0.978)
coal-coal	0.031	-1.009	-0.496	-1.946
	(0.871)	(1.078)	(1.210)	(1.448)
coal-ncoal	-0.605	-1.281	-0.517	-2.183
	(1.154)	(1.502)	(1.227)	(1.774)
ncoal-coal	-0.124	0.207	0.053	-0.212
	(1.037)	(1.101)	(1.296)	(1.219)
Constant	-0.660	-4.190	2.660	-6.621
	(2.588)	(3.641)	(3.438)	(4.319)
Observations	199	182	199	182
R-squared	0.100	0.351	0.198	0.429
Number of countries	22	22	22	22

Notes. Robust standard errors in parenthesis. * Significant at 10% level ** Significant at 5% level. *** Significant at 1% level. All political variables refer to each election-driven transition occurred in the election of the year (t–1) preceding the year of the capital flow (t). Control variables always refer to the year of the capital flow. All regressions performed using fixed effects and robust variance estimates. *Center-center*, *nmaj-nmaj* and *ncoal-ncoal* left out to avoid multi-colinearity with constant. All controls are measured in percentage points. Luxembourg excluded due to outlying status – see Table A2 (Appendix). All the significant coefficients shaded are robust to error clustering by countries.

Table 3. Equity inflows after elections and political variables characterizing the elected cabinet

Dependent variable: Equity inflows, in percentage of GDP (percentage points), in years without any election, following a year with election(s)

Independent variables	(1) FE, maj, excl. Lux, Bel & Ire	(2) FE, maj, excl. Lux, Bel & Ire	(3) FE, coal, excl. Lux, Bel & Ire	(4) FE, coal, excl. Lux, Bel & Ire	(5) FE, all excl. Lux, Bel & Ire	(6) FE, all excl. Lux, Bel & Ire
real per capita	**0.073**	**0.154**	**0.080**	**0.182**	**0.065**	**0.172**
GDP growth	**(0.091)**	**(0.201)**	**(0.087)**	**(0.206)**	**(0.085)**	**(0.215)**
inflation (CPI)	**0.029**	**-0.062**	**0.028**	**-0.069**	**0.030**	**-0.061**
	(0.036)	**(0.065)**	**(0.037)**	**(0.066)**	**(0.037)**	**(0.064)**
dunempp		**0.321**		**0.357**		**0.347**
		(0.321)		**(0.334)**		**(0.346)**
dsinterestp		**0.113**		**0.119**		**0.123**
		(0.072)		**(0.074)**		**(0.075)**
dproductivityp		**-0.109**		**-0.125**		**-0.127**
		(0.172)		**(0.177)**		**(0.182)**
tradep		**-0.034**		**-0.030**		**-0.034**
		(0.032)		**(0.032)**		**(0.035)**
curr-accp		**0.143****		**0.141***		**0.139***
		(0.072)		**(0.072)**		**(0.072)**
dexchangep		**-0.053**		**-0.055***		**-0.054***
		(0.032)		**(0.032)**		**(0.031)**
left					**0.567**	**0.043**
					(0.880)	**(0.729)**
right					**0.759**	**0.390**
					(0.841)	**(0.617)**
majority	**0.849****	**1.016****	**0.804****	**0.928****	**0.783****	**0.893****
	(0.366)	**(0.432)**	**(0.359)**	**(0.418)**	**(0.349)**	**(0.406)**
coalition			**0.193**	**0.517**	**0.155**	**0.349**
			(0.365)	**(0.447)**	**(0.481)**	**(0.564)**
Constant	**-1.443**	**-0.046**	**-1.113**	**-0.029**	**-1.313**	**-0.097**
	(0.892)	**(1.896)**	**(0.748)**	**(1.887)**	**(1.355)**	**(2.218)**
Observations	**179**	**167**	**179**	**167**	**179**	**167**
R-squared	**0.256**	**0.372**	**0.257**	**0.377**	**0.268**	**0.382**
N. of countries	**20**	**20**	**20**	**20**	**20**	**20**

Notes. Robust standard errors in parenthesis. * Significant at 10% level ** Significant at 5% level. *** Significant at 1% level. All political variables refer to the cabinet's political profile most frequent in the year of the capital flow. Control variables always refer to the year of the capital flow. All regressions performed using fixed effects and robust variance estimates. *Center* left out to avoid multi-colinearity with constant. All controls are measured in percentage points. Luxembourg, Belgium and Ireland excluded due to outlying status – see Figure A6 (Appendix). All the significant coefficients shaded are robust to error clustering by countries.

Table 4. Equity inflows after elections and political transition variables reflecting electoral outcome from each election

Dependent variable: Equity inflows, in percentage of GDP (percentage points), in years without any election, following a year with election(s)

Independent variables	(1) FE, ideol, excl.Lux, Bel & Ire	(2) FE, ideol, excl. Lux, Bel & Ire	(3) FE, all, excl. Lux,Bel & Ire	(4) FE, all, excl. Lux, Bel & Ire
real per capita GDP	0.048	0.116	0.068	0.149
growth	(0.097)	(0.211)	(0.096)	(0.227)
inflation (CPI)	0.037	0.015	0.041	0.009
	(0.039)	(0.078)	(0.041)	(0.077)
dunempp		0.113		0.247
		(0.318)		(0.337)
dsinterestp		0.181**		0.199**
		(0.082)		(0.096)
dproductivityp		-0.026		-0.041
		(0.177)		(0.187)
tradep		-0.054*		-0.058*
		(0.030)		(0.034)
curr-accp		0.160**		0.163**
		(0.066)		(0.063)
dexchangep		-0.042		-0.049*
		(0.028)		(0.029)
left-left	-1.144	-1.453	-0.626	-0.798
	(0.841)	(0.938)	(0.835)	(1.023)
left-center	-1.143	-1.251	-0.669	-0.670
	(1.172)	(1.110)	(1.118)	(1.215)
left-right	0.182	0.527	0.592	1.057
	(0.801)	(0.932)	(0.811)	(1.104)
center-left	-0.372	-0.535	-0.332	-0.275
	(0.879)	(1.424)	(1.035)	(1.544)
center-right	-1.069	-2.083**	-1.297	-2.347**
	(0.961)	(1.015)	(1.008)	(0.981)
right-left	-0.463	-0.897	-0.243	-0.641
	(0.915)	(0.990)	(0.895)	(0.974)
right-center	-4.013**	-4.510**	-4.220**	-4.673***
	(1.917)	(1.859)	(1.914)	(1.740)
right-right	-0.943	-1.076	-0.900	-0.892
	(0.865)	(0.964)	(0.878)	(1.032)
maj-maj			0.978**	1.169*
			(0.491)	(0.597)
maj-nmaj			1.059	1.177
			(0.658)	(0.800)
nmaj-maj			0.770	0.638
			(0.472)	(0.514)
coal-coal			0.773	1.000
			(0.564)	(0.699)
coal-ncoal			0.280	0.678
			(0.702)	(0.956)
ncoal-coal			0.055	0.171
			(0.590)	(0.651)
Constant	1.232	1.403	0.223	4.062
	(1.067)	(1.953)	(1.055)	(2.558)
Observations	179	167	179	167
R-squared	0.378	0.502	0.411	0.546
Number of countries	20	20	20	20

Notes. Robust standard errors in parenthesis. * Significant at 10% level ** Significant at 5% level. *** Significant at 1% level. All political variables refer to each election-driven transition occurred in the election of the year (t–1) preceding the year of the capital flow (t). Control variables always refer to the year of the capital flow. All regressions performed using fixed effects and robust variance estimates. *Center-center*, *nmaj-nmaj* and *ncoal-ncoal* left out to avoid multi-colinearity with constant. All controls are measured in percentage points. Luxembourg, Belgium and Ireland excluded due to outlying status – see Figure A6 (Appendix). All the significant coefficients shaded are robust to error clustering by countries.

B) Capital flows' reaction to the political profile of the cabinet in office, 1998–2008.

This empirical test searches for non-immediate reactions by capital flows to the political profile of elected cabinets. More specifically, it tests the existence of capital reactions during cabinets' mandates. The same model hypotheses and predictions hold, except now they are assumed to apply on a continuous fashion, instead of around a discrete event. Only equity and capital account net balance show significant and robust reactions to some cabinet profiles; Tables 5–7 report the results.

Table 5 shows that equity inflows react positively to right-leaning cabinets; during these cabinets' mandates, equity inflows are higher in 1.4 GDP p.p., when compared to any other cabinet's mandates. Table 7 shows that the only robust source of this impact are single-party right-leaning majoritarian cabinets, which are associated to higher equity flows in 1.6 GDP p.p. – impact equivalent to about 65% of the equity flows standard deviation during the decade under analysis[47].

This evidence supports model prediction (a) in Section 2.2, conditional on a context of low uncertainty around cabinet ideology and minimum negotiation costs preventing the cabinet from reacting to productivity shocks: $\left.\frac{\partial K_t^*}{\partial \hat{a}}\right|_{p=1 \wedge n=1} < 0$. The preference for cabinets (hypothetically) associated to lower taxes is, thus, expressed only in the context of low barriers to action and less uncertainty around the link between ideology and fiscal policy pursued.

Capital account net flows show a positive reaction to coalition cabinets in 0.3 GDP p.p. – Table 6 –, specifically associated to right-leaning minoritarian coalitions (0.7 GDP p.p.), left-leaning minoritarian coalitions (0.6 GDP p.p.) and left-leaning majoritarian coalitions (0.5 GDP p.p.) – Table 7. These impacts compare with a standard deviation of 0.7 GDP p.p. by capital account net flows in 1998–2008[48].

Such performance by the capital account partially supports a positive derivative in model prediction (b): $\left.\frac{\partial K_t^*}{\partial n}\right|_{\hat{a}\in(0,a^M+\xi)\vee p=0} > 0$, for some $\xi \geq 0$. The order of preference within coalitions suggests also: $\frac{\partial}{\partial p}\left(\frac{\partial K_t^*}{\partial n}\right) < 0$.

[47] See Table A3 (Appendix), summary statistics excluding Luxembourg, Belgium and Ireland, for all years in 1998–2008. In this paragraph, the regressions coefficients chosen for discussion are those from the less complete regressions, due to the lack of significance by the potential additional regressors.

[48] See Table A3 (Appendix), summary statistics excluding Luxembourg, for all years in 1998–2008. In this paragraph, the regressions coefficients chosen for discussion are those from the less complete regressions, due to the lack of significance by the potential additional regressors.

Table 5. Equity inflows and political profile variables characterizing the cabinet most days in office, 1998–2008

Dependent variable: Equity inflows, in percentage of GDP (percentage points), yearly						
Independent variables	(1) FE, right, excl. Lux, Bel & Ire	(2) FE, right, excl. Lux, Bel & Ire	(3) FE, ideol, excl. Lux, Bel & Ire	(4) FE, ideol, excl. Lux, Bel & Ire	(5) FE, all, excl. Lux, Bel & Ire	(6) FE, all, excl. Lux, Bel & Ire
real per capita	0.098	0.256	0.112	0.234	0.133	0.276
GDP growth	(0.134)	(0.314)	(0.133)	(0.313)	(0.129)	(0.317)
inflation (CPI)	-0.310	-0.199	-0.274	-0.171	-0.277	-0.116
	(0.405)	(0.334)	(0.399)	(0.332)	(0.401)	(0.336)
dunempp		0.213		0.158		0.160
		(0.459)		(0.458)		(0.469)
dsinterestp		-0.032		-0.023		-0.138
		(0.184)		(0.183)		(0.198)
dproductivityp		-0.093		-0.077		-0.027
		(0.330)		(0.326)		(0.337)
tradep		-0.024		-0.019		-0.030
		(0.042)		(0.042)		(0.044)
curr-accp		0.011		0.003		-0.004
		(0.104)		(0.105)		(0.107)
dexchangep		-0.027		-0.031		-0.038
		(0.028)		(0.029)		(0.029)
left			0.618	0.615	0.918	0.852
			(0.813)	(0.857)	(0.845)	(0.890)
right	1.402***	1.431***	1.805**	1.827**	1.717*	1.668*
	(0.448)	(0.465)	(0.852)	(0.891)	(0.873)	(0.912)
majority					0.560	0.909*
					(0.426)	(0.546)
coalition					0.927	0.858
					(0.706)	(0.735)
Constant	1.218	4.300	0.774	3.415	-0.198	3.045
	(0.803)	(3.259)	(0.965)	(3.364)	(1.033)	(3.442)
Observations	214	214	214	214	214	214
R-squared	0.178	0.187	0.181	0.189	0.192	0.206
Number of countries	20	20	20	20	20	20

Notes. Robust standard errors in parenthesis. * Significant at 10% level ** Significant at 5% level. *** Significant at 1% level. All political variables refer to the cabinet's political profile most frequent in the year of the capital flow. Control variables always refer to the year of the capital flow. All regressions performed using fixed effects and robust variance estimates. *Center* left out to avoid multi-colinearity with constant. All controls are measured in percentage points. Luxembourg, Belgium and Ireland excluded due to outlying status – see Figure A6 (Appendix). All the significant coefficients shaded are robust to error clustering by countries.

Table 6. Capital account net flows and political profile variables characterizing the cabinet most days in office, 1998–2008

Dependent variable: Capital account net flows, in percentage of GDP (percentage points), yearly				
	(1)	(1)	(3)	(4)
Independent variables	FE, coal, excl. Lux	FE, coal, excl. Lux	FE, all, excl. Lux	FE, all, excl. Lux
real per capita	0.048**	0.025	0.046**	0.021
GDP growth	(0.023)	(0.039)	(0.022)	(0.039)
inflation (CPI)	-0.002	-0.000	-0.002	-0.004
	(0.028)	(0.033)	(0.028)	(0.033)
dunempp		-0.076		-0.074
		(0.053)		(0.055)
dsinterestp		-0.039		-0.028
		(0.029)		(0.032)
dproductivityp		-0.003		-0.004
		(0.033)		(0.034)
tradep		0.003		0.004
		(0.004)		(0.004)
curr-accp		-0.002		-0.002
		(0.009)		(0.009)
dexchangep		0.001		0.002
		(0.003)		(0.003)
left			0.032	0.051
			(0.093)	(0.096)
right			0.041	0.039
			(0.082)	(0.083)
majority			-0.100	-0.094
			(0.067)	(0.072)
coalition	0.253***	0.232**	0.293***	0.275***
	(0.086)	(0.090)	(0.094)	(0.100)
Constant	0.022	-0.375	0.034	-0.350
	(0.140)	(0.386)	(0.154)	(0.330)
Observations	235	235	235	235
R-squared	0.099	0.119	0.104	0.124
N. of countries	22	22	22	22

Notes. Robust standard errors in parenthesis. * Significant at 10% level ** Significant at 5% level. *** Significant at 1% level. All political variables refer to the cabinet's political profile most frequent in the year of the capital flow. Control variables always refer to the year of the capital flow. All regressions performed using fixed effects and robust variance estimates. *Center* left out to avoid multi-colinearity with constant. All controls are measured in percentage points. Luxembourg excluded due to outlying status – see Figure A7 (Appendix). All the significant coefficients shaded are robust to error clustering by countries.

Table 7. Capital flows and political profile variables characterizing the cabinet most days in office, ideology-strength-composition interactions, 1998–2008

Independent variables	Dependent variable, in percentage of GDP (percentage points), yearly: Equity inflows (1) FE, excl. Lux, Bel & Ire	Equity inflows (2) FE, excl. Lux, Bel & Ire	Capital account net flows (3) FE, excl. Lux	Capital account net flows (4) FE, excl. Lux
real per capita GDP	0.118	0.249	0.032	0.011
growth	(0.134)	(0.318)	(0.021)	(0.040)
inflation (CPI)	-0.273	-0.141	-0.005	-0.001
	(0.423)	(0.349)	(0.027)	(0.034)
dunempp		0.136		-0.071
		(0.492)		(0.057)
dsinterestp		-0.092		-0.022
		(0.202)		(0.034)
dproductivityp		-0.032		0.002
		(0.348)		(0.035)
tradep		-0.031		0.001
		(0.049)		(0.005)
curr-accp		-0.012		0.001
		(0.125)		(0.010)
dexchangep		-0.036		0.000
		(0.033)		(0.003)
left-maj-coal	1.412	2.158	0.466**	0.411*
	(1.355)	(1.671)	(0.191)	(0.210)
left-maj-sing	1.107	1.804	0.059	0.028
	(1.241)	(1.541)	(0.213)	(0.235)
left-min-coal	1.743	2.110	0.601***	0.556**
	(1.240)	(1.782)	(0.194)	(0.214)
left-min-sing	0.131	0.643	0.190	0.170
	(1.020)	(1.514)	(0.166)	(0.179)
center-maj-coal	0.786	1.642	0.394**	0.327
	(1.629)	(2.003)	(0.196)	(0.222)
center-min-coal	-0.798	-0.335	0.343*	0.339
	(1.327)	(2.403)	(0.183)	(0.243)
right-maj-coal	2.554**[a]	3.284**	0.329*	0.276
	(1.267)	(1.648)	(0.184)	(0.201)
right-maj-sing	1.602**	2.330**	0.202**	0.175
	(0.638)	(1.107)	(0.095)	(0.106)
right-min-coal	2.135	2.657	0.747***	0.653***
	(1.469)	(1.864)	(0.212)	(0.242)
right-min-sing	0.957	1.365	0.185*	0.141
	(0.939)	(1.362)	(0.101)	(0.131)
Constant	0.462	3.280	-0.090	-0.276
	(1.174)	(3.714)	(0.172)	(0.402)
Observations	214	214	235	235
R-squared	0.197	0.208	0.139	0.149
Number of countries	20	20	22	22

Notes. Robust standard errors in parenthesis. * Signif. at 10% level ** Signif. at 5% level. *** Signif. at 1% level. All political variables refer to cabinet's political profile most frequent in the year of the capital flow. Control variables always refer to the year of the capital flow. All regressions performed using FE and robust variance estimates. *Min* and *sing* denote minoritarian and single-party cabinets, respectively. *Center-maj-sing* and *center-min-sing* left out to avoid multi-colinearity with constant. All controls measured in percentage points. [a] Not robust to error clustering by countries. Luxemb., Belgium and Ireland excluded from equity flows regressions, due to outlying status – Figure A6 (Appendix). Luxemb. excluded from capital-account flows regressions, due to outlying status – Figure A7 (Appendix). All the significant coefficients shaded are robust to error clustering by countries.

C) Impact of cabinet's political profile on fiscal policy followed, 1998–2008.

This empirical assessment tests ideological impacts on fiscal policy, implied in equilibrium outcomes $\tau^* = \frac{a}{b}$ and $g^* = \frac{a}{b} - \frac{D_0}{Y_2(K_2,0,\mu_e)}$ (Section 2.2), as well as the assumed impacts of cabinet majoritarian/coalition status on expected ideology uncertainty: $\frac{\partial\sigma}{\partial n} > 0$, $\frac{\partial\sigma}{\partial p} < 0$. Table 8 reports the results.

Left-leaning cabinets are indeed associated to higher corporate tax rates: 3.9 p.p. higher with respect to center cabinets and 1.0 p.p. higher with respect to right-leaning cabinets (these impacts compare with a standard deviation of 6.8 p.p. by the corporate tax rate in the period analyzed[49]). This relative ranking of ideologies with respect to the corporate tax rate is common to all combinations of parliamentary support and party composition, except for minoritarian coalitions, in which case right-leaning cabinets hold the highest tax rates. Within single-party cabinets, the distance from tax revenues of left ideology to that implemented by other ideologies (either right or center) is larger. Such pattern is consistent with the hypothesis that coalitions hamper the correlation between cabinet ideology and implemented fiscal policy, casting higher uncertainty over expected fiscal policy. This may be seen as support for the assumption of higher ideology uncertainty under coalitions: $\frac{\partial\sigma}{\partial n} > 0$. It would also contribute to explain the focused reaction of equity flows to *single-party majoritarian* right-leaning cabinets, discussed in 3.3.B – those cabinets shall implement more freely their (assumed) low-tax proneness – if right cabinets did set lower taxes than cabinets of *any* other ideological type. More specifically, the evidence that right cabinets hold higher corporate taxes than center cabinets is not consistent with the negative reaction by equity inflows to right-center electoral transitions.

Coalitions also show higher corporate tax rates than single-party cabinets and that pattern is consistent throughout the interactions between political dimensions, within each ideology.

Regarding the weight of public revenues on GDP, left cabinets are again associated to higher levels: 1.2 GDP p.p. (comparing with a standard deviation of 7.4 GDP p.p.[50]). Such fact originates from the lower tax revenues collected by right-leaning single-party cabinets and by center minoritarian coalitions. The absence of coalitions enables, thus, right cabinets to lower taxes, contributing to explain

[49] See Table A2, for the summary statistics of fiscal policy measures in 1998–2008.
[50] See Table A2, for the summary statistics of fiscal policy measures in 1998–2008.

the negative reaction by equity inflows to right-center electoral transitions and, more clearly, the positive reaction by equity inflows to single-party right cabinet mandates.

Simultaneously, these same cabinets – right single-party cabinets and center minoritarian coalitions – exhibit, together with left single-party majorities, higher public expenses and, in consequence, lower budget balances (higher deficits and/or lower surpluses). As an additional consequence, coalitions show lower public expenses in 1.4 GDP p.p. (s.d. of 6.6 GDP p.p.[51]) and higher budget balances in 2.0 GDP p.p. (s.d. of 4.6 GDP p.p.[52]). This evidence suggests that coalitions may cause some inaction also with respect to public expenses.

[51] See Table A2, for the summary statistics of fiscal policy measures in 1998–2008.
[52] See Table A2, for the summary statistics of fiscal policy measures in 1998–2008.

Table 8. Fiscal policy measures and political profile variables characterizing the cabinet most days in office, isolated traits and ideology-strength-composition interactions, 1998–2008

	Dependent variable, in percentage points, yearly							
	Corporate tax rate		Public Revenue, % of GDP		Public Expense, % of GDP		Public Budget Balance, % of GDP	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Independent variables	FE, isolated	FE, interact.	FE, isolated	FE, interactions	FE, isolated	FE, interactions	FE, isolated	FE, interactions
real per capita GDP growth	0.182	0.033	-0.000	-0.061	-0.497***	-0.520***	0.497***	0.459***
	(0.159)	(0.138)	(0.080)	(0.085)	(0.131)	(0.141)	(0.143)	(0.152)
inflation (CPI)	0.359*	0.329	-0.044	-0.021	0.457	0.420	-0.501	-0.441
	(0.199)	(0.209)	(0.117)	(0.116)	(0.428)	(0.456)	(0.403)	(0.439)
left	3.938***		1.246***		-0.439		1.685**[a]	
	(0.823)		(0.458)		(0.630)		(0.824)	
right	2.975***		0.227		-0.373		0.600	
	(0.722)		(0.412)		(0.533)		(0.675)	
majority	-0.677		0.558*[a]		-0.105		0.663	
	(0.601)		(0.323)		(0.484)		(0.526)	
coalition	2.505***		0.615		-1.382**		1.997***	
	(0.819)		(0.459)		(0.633)		(0.684)	
left-maj-coal		9.392***		0.396		-0.185		0.581
		(1.830)		(0.772)		(1.147)		(1.151)
left-maj-sing		8.145***		0.336		1.981*		-1.644*
		(1.556)		(0.672)		(1.084)		(0.855)
left-min-coal		9.494***		-0.342		1.289		-1.630
		(1.611)		(0.715)		(1.125)		(1.233)
left-min-sing		7.912***		-0.443		0.965		-1.408
		(1.314)		(0.701)		(0.890)		(0.874)
center-maj-coal		6.165***		-0.398		-0.005		-0.393
		(1.644)		(0.836)		(1.101)		(0.998)
center-min-coal		4.810***		-5.256***		3.718***		-8.975***
		(1.654)		(0.765)		(1.334)		(1.626)
right-maj-coal		8.485***		-0.214		-0.543		0.329
		(1.658)		(0.816)		(1.096)		(0.934)
right-maj-sing		5.397***		-1.167***		1.933***		-3.101***
		(0.891)		(0.448)		(0.516)		(0.509)
right-min-coal		12.175***		-0.179		0.933		-1.112
		(1.900)		(0.774)		(1.183)		(1.202)
right-min-sing		4.676***		-2.418***		2.041***		-4.459***
		(1.124)		(0.522)		(0.714)		(0.637)
Constant	30.234***	27.180***	42.572***	44.174***	43.983***	42.299***	-1.411	1.875
	(1.023)	(1.386)	(0.717)	(0.791)	(1.354)	(1.710)	(1.342)	(1.548)
Observations	247	247	251	251	251	251	251	251
R-squared	0.561	0.605	0.158	0.258	0.280	0.329	0.366	0.495
N. of countries	23	23	23	23	23	23	23	23

Notes. Robust standard errors in parenthesis. * Significant at 10% level ** Significant at 5% level. *** Significant at 1% level. All control and political variables refer to the cabinet's political profile most frequent in the respective year. All regressions performed using fixed effects and robust variance estimates. *Min* and *sing* denote minoritarian and single-party cabinets, respectively. *Center-maj-sing* and *center-min-sing* left out to avoid multi-colinearity with constant. All controls are measured in percentage points. [a] Not robust to error clustering by countries. All the significant coefficients shaded are robust to error clustering by countries.

D) Capital flows' reaction to fiscal policy, both unconditionally and conditional on the political profile of the cabinet in office, 1998–2008.

This analysis tests an indirect impact channel linking the cabinet's political profile to capital flows, through the fiscal policy implemented. Expected policy patterns associated to specific political profiles may induce, on capital flows, distinct reactions to the same observed fiscal policy, depending on the policymaker's political profile. Tables 9 and 10 report the results[53].

FDI net flows react positively to budget deficits and negatively to surpluses by center cabinets: 1.4 GDP p.p. of additional net flows per GDP percentage point of additional deficit (or lower surplus) – a decrease in budget balance in one standard deviation is associated to an increase in FDI net flows in 1.2 standard deviations. For left and right cabinets, this reaction is 92% and 70% lower in magnitude, respectively.

Oppositely, equity inflows react negatively to budget deficits and positively to surpluses by center cabinets: 0.8 GDP p.p. of less inflows per GDP percentage point of additional deficit (or lower surplus) – a decrease in budget balance in one standard deviation is associated to a decrease in equity inflows in 2.5 standard deviations. This reaction is lower in magnitude for left and right cabinets, by 56–57%. Equity flows react negatively also to public expenditure by center and right cabinets, although with less magnitude for the latter.

Being more sensitive to economic activity, due to the business management aim, FDI responds positively to expansionary fiscal policy. On the contrary, equity investments react negatively to higher expenditure and lower budget balance, possibly anticipating future budget consolidation, namely through higher taxes.

[53] See Table A4 in Appendix for the results of specifications in Table 10 without controls.

Table 9. FDI net flows, Public Budget Balance and political profile variables characterizing the cabinet most days in office, 1998–2008

Dependent variable: FDI net flows, in percentage of GDP (percentage points), yearly				
	(1)	(2)	(3)	(4)
Independent variables	FE, isolated, excl. Lux	FE, isolated, excl. Lux	FE, interactions, excl. Lux	FE, interactions, excl. Lux
real per capita	0.475**	0.364	0.768**	0.972*
GDP growth	(0.190)	(0.575)	(0.360)	(0.569)
inflation (CPI)	0.501	0.504	0.990**	1.236**
	(0.669)	(0.614)	(0.499)	(0.584)
dunempp		-0.652		-0.002
		(0.878)		(0.767)
dsinterestp		-0.680		-1.088**
		(0.466)		(0.453)
dproductivityp		0.181		-0.066
		(0.591)		(0.629)
tradep		0.027		0.034
		(0.056)		(0.050)
curr-accp		-0.175		-0.096
		(0.203)		(0.135)
dexchangep		0.016		0.017
		(0.043)		(0.037)
balp	-0.560*	-0.469*	-1.612***	-1.405***
	(0.292)	(0.262)	(0.344)	(0.389)
balp × left			1.353***	1.288***
			(0.316)	(0.342)
balp × right			1.176***	0.984**
			(0.341)	(0.383)
balp × maj			-0.329	-0.422*
			(0.220)	(0.235)
balp × coal			0.080	0.193
			(0.186)	(0.227)
Constant	-3.199**	-5.669	-5.101***	-9.027*
	(1.620)	(5.763)	(1.874)	(4.858)
Observations	255	255	235	235
R-squared	0.081	0.104	0.267	0.309
N. of countries	22	22	22	22

Notes. Robust standard errors in parenthesis. * Significant at 10% level ** Significant at 5% level. *** Significant at 1% level. All political variables refer to the cabinet's political profile most frequent in the year of the capital flow. Control variables always refer to the year of the capital flow. All regressions performed using fixed effects and robust variance estimates. *Balp* denotes Public Budget Balance in percentage of GDP and is expressed in percentage points. *Center* left out to avoid multi-colinearity with constant. All controls are measured in percentage points. All the significant coefficients shaded are robust to error clustering by countries. Luxembourg excluded due to outlying status – see Table A2 (Appendix).

Table 10. Equity inflows, fiscal policy and political profile variables characterizing the cabinet most days in office, 1998–2008

Dependent variable: Equity inflows, in percentage of GDP (percentage points), yearly. All regressions performed excluding Luxembourg, Belgium and Ireland.

Independent Var.	(1) FE, isol.	(2) FE, interact.	(3) FE, isol.	(4) FE, interact.	(5) FE, isol.	(6) FE, interact.
real per capita GDP	0.053	0.167	-0.096	0.075	0.040	-0.028
growth	(0.261)	(0.280)	(0.282)	(0.264)	(0.251)	(0.269)
inflation (CPI)	-0.197	-0.057	-0.157	0.044	-0.160	0.041
	(0.208)	(0.284)	(0.267)	(0.195)	(0.212)	(0.249)
additional controls[a]	Yes	Yes	Yes	Yes	Yes	Yes
expp	-0.349**[b]	-0.452***	-0.518***	-1.472***		
	(0.145)	(0.161)	(0.182)	(0.410)		
expp × left		0.012		0.972**		
		(0.017)		(0.374)		
expp × right		0.031*		0.955**		
		(0.018)		(0.380)		
expp × majority		0.017		-0.021		
		(0.014)		(0.160)		
expp × coalition		0.002		0.260		
		(0.016)		(0.169)		
revp			0.172	0.930***[c]		
			(0.113)	(0.221)		
revp × left				-0.796***[c]		
				(0.269)		
revp × right				-0.770***[c]		
				(0.265)		
revp × majority				0.017		
				(0.142)		
revp × coalition				-0.196		
				(0.140)		
debtp			0.029	0.173*		
			(0.027)	(0.102)		
debtp × left				-0.116		
				(0.089)		
debtp × right				-0.111		
				(0.095)		
debtp × maj.				0.015		
				(0.032)		
debtp × coal.				-0.039		
				(0.035)		
balp					0.286**[b]	0.787***
					(0.122)	(0.188)
balp × left						-0.443***
						(0.150)
balp × right						-0.448***
						(0.152)
balp × majority						-0.016
						(0.112)
balp × coalition						-0.046
						(0.115)
Constant	20.465***	24.381***	19.949**	16.292*	4.904**	4.810**
	(7.866)	(8.439)	(8.639)	(8.714)	(2.363)	(2.410)
Observations	232	214	214	214	232	214
R-squared	0.139	0.212	0.191	0.304	0.133	0.203
N. of countries	20	20	20	20	20	20

Notes. Robust standard errors in parenthesis. * Signif. at 10% level ** Signif. at 5% level. *** Signif. at 1% level. All political variables refer to cabinet's political profile most frequent in the year of the capital flow. Control variables always refer to year of capital flow. All regressions performed using FE and robust variance estimates. *Center* kept out to avoid replicating the constant. [a] These are: *dunempp, dsinterestp, dproductivityp, tradep, curr-accp* and *dexchangep.* [b] Not robust to absence of additional controls. [c] Not robust to absence of other fiscal policy measures. All controls measured in percentage points. All significant coefficients shaded are robust to error clustering by countries. Luxembourg, Belgium and Ireland excluded due to outlying status – see Figure A6 (Appendix).

Conclusion

International capital flows hold a notable and increasing economic relevance within OECD countries, showing clear reactions to economic policy and to governments' political profile. This study explores the channels through which these impacts operate, testing their empirical support.

A game theoretical model is built, exploring (i) how the cabinet's political profile may determine the economic policy pursued and (ii) how the expectations over economic policy associated to each political profile may determine capital flows' reactions to electoral results. The model rationalizes the hypothesis that (a) left-leaning cabinets implement higher taxes and higher public expenditures, and that (b) cabinets with parliamentary minoritarian support or composed by a coalition of parties react less actively to productivity shocks. Hypothesis (a) produces a predicted negative reaction by capital flows to left-leaning cabinets. Hypothesis (b) produces an uncertain reaction by capital flows to both minorities and coalitions; the impact of each of these political traits on capital flows depends on how efficient is the inaction they produce: veto powers may hamper productivity-boosting measures and generate policy uncertainty, but autonomous decision may lead to excessive policy "noise".

Four types of impacts are empirically tested: (A) capital flows' reaction to electoral outcomes; (B) capital flows' reaction to the political profile of the cabinet in office; (C) impact of cabinet's political profile on fiscal policy followed and (D) capital flows' reaction to fiscal policy, both unconditionally and conditional on the political profile of the cabinet in office.

Starting by (C), left-leaning cabinets are indeed associated to higher corporate tax rates. Right cabinets set higher corporate tax rates than center cabinets and *single-party* right-leaning cabinets set lower public revenues than all other cabinets, except minoritarian center coalitions. Coalitions, in turn, show higher corporate tax rates, lower public expenses and higher budget balances (lower deficits and/or higher surpluses) than single-party cabinets, suggesting that coalitions may produce some inaction with respect to public expenses and corporate tax exemptions/reductions.

Concerning impacts (A), FDI net flows react negatively to elections in which cabinet majorities are renewed (1.8 GDP percentage points). Contrary to FDI, equity inflows react positively to the election of majoritarian cabinets (0.9 GDP p.p.). Such an opposite behaviour is consistent with these flows' distinct purposes: contrary to equity, FDI has a long-term lasting management interest in an enterprise located at the destination economy, being, thus, more sensitive to context volatility implied in excessive action by the cabinet; being more focused in the short-term, equity flows react positively to more active cabinets, more committed to neutralize shocks to productivity.

Equity inflows react negatively to electoral transitions from right to center cabinets (4.7 GDP p.p.) – impacts (A) – and positively during the mandates of single-party right-leaning majoritarian cabinets (1.6 GDP p.p.) – impacts (B). This latter preference for right-leaning cabinets is, thus, expressed only in the context of low barriers to action and less uncertainty around the link between ideology and fiscal policy pursued. The positive reaction to single-party right cabinets is consistent with the lower public revenues associated to this political profile.

Capital account net flows show a positive reaction to coalition cabinets (0.3 GDP p.p.)[54].

Finally, concerning impacts (D), FDI net flows react positively to budget deficits and negatively to surpluses by center cabinets. With left and right cabinets, this reaction is 92% and 70% lower in magnitude, respectively. Oppositely, equity inflows react negatively to budget deficits and positively to surpluses by center cabinets, being the reaction also lower in magnitude for left and right cabinets, by 56–57%. Equity flows react negatively also to public expenditure by center and right cabinets, although with less magnitude for the latter. Being sensitive to economic activity, due to the business management aim, FDI responds positively to expansionary fiscal policy. On the contrary, equity investments react negatively to higher expenditure and lower budget balance, possibly anticipating future budget consolidation, namely through higher taxes.

The magnitude of the direct impacts of political profiles on capital flows range from 0.3 to 4.7 GDP percentage points, representing from 0.5 to 2.5 standard deviations of the respective flows in the relevant sample.

In sum, the hypothesis that left-leaning cabinets set higher taxes finds empirical support. This ideology-driven policy divergence occurs more intensely in the context of single-party cabinets, suggesting that coalitions may be associated to fiscal policy inaction, hampering the link between ideology and policy. All this evidence is consistent with the observed positive reaction of equity inflows to single-party right cabinets. The heterogeneous nature and purposes of the several types of capital

[54] This positive reaction could be grounded on a preference by this type of flows for higher budget balances (to which coalitions are associated), but such preference does not appear in (D).

flows determine very distinct reactions to other political profiles and policies. FDI is more sensitive to business environment stability and economic activity fiscal promotion, reacting negatively to majoritarian cabinets and positively to budget deficits. Equity inflows are particularly focused on short-term gains and on taxes, reacting positively to majoritarian cabinets (potentially more active in countering negative GDP shocks) and negatively to budget deficits (potentially anticipating higher taxes).

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APPENDIX

Table A1. Variables description

Financial & Controls	
FDI net (p.p.)	Foreign direct investment represents net inflows of investment to acquire a lasting management interest (10 percent or more of voting stock) in an enterprise operating in an economy other than that of the investor. It is the sum of equity capital, reinvestment of earnings, other long-term capital, and short-term capital as shown in the balance of payments. This series shows total net flows, that is, net FDI in the reporting economy from foreign sources less net FDI by the reporting economy to the rest of the world, divided by current GDP and expressed in percentage points.
FDI in (p.p)	Foreign direct investment represents the net inflows of investment to acquire a lasting management interest (10 percent or more of voting stock) in an enterprise operating in an economy other than that of the investor. It is the sum of equity capital, reinvestment of earnings, other long-term capital, and short-term capital as shown in the balance of payments. This series shows net inflows (new investment inflows less disinvestment) in the reporting economy from foreign investors, is divided by nominal GDP and expressed in percentage points.
FDI out (p.p)	Foreign direct investment represents the net inflows of investment to acquire a lasting management interest (10 percent or more of voting stock) in an enterprise operating in an economy other than that of the investor. It is the sum of equity capital, reinvestment of earnings, other long-term capital, and short-term capital as shown in the balance of payments. This series shows net outflows of investment from the reporting economy to the rest of the world, is divided by nominal GDP and expressed in percentage points.
Capital account (p.p.)	Net capital account includes government debt forgiveness, investment grants in cash or in kind by a government entity, and taxes on capital transfers. Also included are migrants' capital transfers and debt forgiveness and investment grants by nongovernmental entities. Data is divided by nominal GDP and expressed in percentage points.
Equity net inflows (p.p.)	Portfolio equity includes net inflows from equity securities other than those recorded as direct investment and including shares, stocks, depository receipts (American or global), and direct purchases of shares in local stock markets by foreign investors. Data is divided by nominal GDP and expressed in percentage points.
Real per capita GDP growth (p.p.)	Annual growth of the gross domestic product divided by midyear population. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in percentage points.
Inflation CPI (p.p.)	Inflation as measured by the consumer price index reflects the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals, such as yearly. The Laspeyres formula is generally used. Data are in percentage points.
Unemployment rate 1st diff. (p.p.)	First difference of the Harmonised unemployment rate, which is based on the definition recommended by the International Labour Organisation (ILO), ensuring comparability over time.
Short-term interest rate 1st diff. (p.p.)	The short-term interest rates are based on three-month money market rates where available, or rates on similar financial instruments. First difference.
Productivity growth (p.p.)	Annual growth rate of the real GDP per employed person, accounted for in the national accounts.
Trade (p.p.)	Trade is the sum of exports and imports of goods and services measured as a share of gross domestic product.
Current account (p.p.)	Current account balance (% of GDP). Current account balance is the sum of net exports of goods, services, net income, and net current transfers.
Exchange rate variation (p.p.)	Variation of the official exchange rate (% variation of LCU per USD; % variation of USD per DEM, in the case of the U.S.A.)

Political	
left-left	No. of elections originating left to left cabinet transitions, in a given country/year observation.
left-center	No. of elections originating left to center cabinet transitions, in a given country/year observation.
left-right	No. of elections originating left to right cabinet transitions, in a given country/year observation.
center-left	No. of elections originating center to left cabinet transitions, in a given country/year observation.
center-center	No. of elections originating center to center cabinet transitions, in a given country/year observation.
center-right	No. of elections originating center to right cabinet transitions, in a given country/year observation.
right-left	No. of elections originating right to left cabinet transitions, in a given country/year observation.
right-center	No. of elections originating right to center cabinet transitions, in a given country/year observation.
right-right	No. of elections originating right to right cabinet transitions, in a given country/year observation.
maj-maj	No. of elections originating majority to majority cabinet transitions, in a given country/year observation.
maj-nmaj	No. of elections originating majority to minority cabinet transitions, in a given country/year observation.
nmaj-maj	No. of elections originating minority to majority cabinet transitions, in a given country/year observation.
nmaj-nmaj	No. of elections originating minority to minority cabinet transitions, in a given country/year observation.
coal-coal	No. of elections originating coalition to coalition cabinet transitions, in a given country/year observation.
coal-ncoal	No. of elections originating coalition to single-party cabinet transitions, in a given country/year observation.
ncoal-coal	No. of elections originating single-party to coalition cabinet transitions, in a given country/year observation.
ncoal-ncoal	No. of elections originating single-party to single-party cabinet transitions, in a given country/year observation.
left	Dummy variable identifying country/year pairs in which the cabinet ideology most days "in office" is left, in a given country/year observation.
center	Dummy variable identifying country/year pairs in which the cabinet ideology most days "in office" is center, in a given country/year observation.
right	Dummy variable identifying country/year pairs in which the cabinet ideology most days "in office" is right, in a given country/year observation.
majority	Dummy variable identifying country/year pairs in which the cabinet parliamentary most days "in office" is majority, in a given country/year observation.
coalition	Dummy variable identifying country/year pairs in which the cabinet quantitative party composition most days "in office" is coalition, in a given country/year observation.
Fiscal	
Corporate tax rate (p.p.)	Combined corporate income tax rate: basic combined central and sub-central (statutory) corporate income tax rate given by the adjusted central government rate plus the sub-central rate.
Public Revenue, % of GDP (p.p.)	Total receipts, general government, as a percentage of GDP
Public Expense, % of GDP (p.p.)	Total disbursements, general government, as a percentage of GDP
Public Budget Balance, % of GDP (p.p.)	Government net lending , general government, as percentage of GDP
Public Debt, % of GDP (p.p.)	General government gross financial liabilities, as a percentage of GDP

Table A2. Summary statistics (1960-2008)

Financial & Controls					
Variable	Non missing observations	Mean	St. Dev.	Min.	Max.
FDI net (p.p.)	784	-0.662	6.843	-147.168[55]	33.421
FDI in (p.p)	860	7.769	42.111	-15.048	564.916[56]
FDI out (p.p)	784	5.501	35.850	-22.560	570.398[57]
Equity net (p.p.)	775	4.583	42.334	-229.411[58]	731.780[59]
Capital account (p.p.)	790	0.093	0.530	-3.910	6.986
Real per capita GDP growth (p.p.)	1077	2.610	2.609	-7.914	13.273
Inflation CPI (p.p.)	1071	6.030	6.703	-0.895	84.222
Unemployment rate 1st diff. (p.p.)	1043	0.110	0.922	-3.189	6.758
Short-term interest rate 1st diff. (p.p.)	899	-0.187	2.034	-13.050	8.283
Productivity growth (p.p.)	1070	2.172	2.497	-8.608	12.706
Trade (p.p.)	839	74.641	62.613	11.224	667.568
Current account (p.p.)	820	-0.525	4.860	-26.619	17.572
Exchange rate variation (p.p.)	1126	1.239	10.803	-29.352	101.131

Political					
Variable	Non missing obs.[60]	Mean	St. Dev.	Min.	Max.
left-left	283	0.155	0.363	0	1
left-center	283	0.011	0.103	0	1
left-right	283	0.081	0.274	0	1
center-left	283	0.021	0.144	0	1
center-center	283	0.106	0.308	0	1
center-right	283	0.060	0.238	0	1
right-left	283	0.078	0.268	0	1
right-center	283	0.067	0.251	0	1
right-right	283	0.428	0.503	0	2
maj-nmaj	283	0.102	0.304	0	1
maj-maj	283	0.534	0.500	0	1
nmaj-maj	283	0.173	0.379	0	1
nmaj-nmaj	283	0.194	0.396	0	1
coal-ncoal	283	0.078	0.268	0	1
coal-coal	283	0.403	0.491	0	1
ncoal-coal	283	0.138	0.345	0	1
ncoal-ncoal	283	0.385	0.495	0	2
left	1087	0.238	0.426	0	1
center	1087	0.203	0.403	0	1
right	1087	0.558	0.497	0	1
majority	1088	0.750	0.433	0	1
coalition	1088	0.568	0.496	0	1

[55] Luxembourg has the only observation below -100% (in the year 2007).
[56] Luxembourg has the only (12) observations above 100%.
[57] Luxembourg has the only (8) observations above 100%.
[58] Luxembourg has the only observation below -100% (in the year 2008).
[59] Luxembourg has the only (7) observations above 100%.
[60] In the case of political transitions, observations respect only to years with elections that didn't involve caretaker cabinets, followed by years without any elections. Years of U.S. mid-term elections are also not considered.

Fiscal					
Variable	Non missing obs.	Mean	St. Dev.	Min.	Max.
Corporate tax rate (p.p.)	597	38.151	9.715	12.500	61.750
Public Revenue, % of GDP (p.p.)	922	40.806	9.271	20.199	63.471
Public Expense, % of GDP (p.p.)	922	42.725	9.549	18.169	70.928
Public Budget Balance, % of GDP (p.p.)	943	-1.886	4.355	-16.009	18.768
Public Debt, % of GDP (p.p.)	697	60.340	28.527	7.647	175.274

Fiscal, 1998–2008					
Variable	Non missing obs.	Mean	St. Dev.	Min.	Max.
Corporate tax rate (p.p.)	249	31.859	6.800	12.500	56.046
Public Revenue, % of GDP (p.p.)	276	43.817	7.411	30.332	62.861
Public Expense, % of GDP (p.p.)	276	44.323	6.628	31.333	61.182
Public Budget Balance, % of GDP (p.p.)	276	-0.506	4.607	-15.658	18.768
Public Debt, % of GDP (p.p.)	253	65.000	32.556	7.647	175.274

Table A3. Summary statistics, excluding outliers (1960-2008)

Financial							
Outlier(s) excluded	(Sub)sample	Variable	Non missing observations	Mean (p.p.)	St. Dev. (p.p.)	Min. (p.p.)	Max. (p.p.)
Luxembourg	Non-election years, after year with election(s)	FDI net	222	-0.085	3.441	-13.832	29.747
		Equity net	220	1.191	5.949	-12.853	54.440
		Capital account	223	0.081	0.467	-2.581	1.853
	All years in 1998–2008	FDI net	258	-1.062	5.235	-24.477	29.747
		Equity net	259	3.856	12.058	-12.853	75.836
		Capital account	258	0.110	0.650	-2.581	2.088
Luxembourg, Belgium and Ireland	Non-election years, after year with election(s)	FDI net	211	-0.133	3.266	-13.832	29.747
		Equity net	201	0.408	1.801	-12.853	8.310
		Capital account	212	0.072	0.451	-2.581	1.853
	All years in 1998–2008	FDI net	238	-1.278	4.505	-24.477	29.747
		Equity net	235	1.139	2.455	-12.853	12.989
		Capital account	238	0.120	0.643	-2.581	2.088

Table A4. Equity inflows, fiscal policy and political profile variables characterizing the cabinet most days in office, 1998–2008

Dependent variable: Equity inflows, in percentage of GDP (percentage points), yearly. All regressions performed excluding Luxembourg, Belgium and Ireland.

Independent Var.	(1) FE, isol.	(2) FE, interact.	(3) FE, isol.	(4) FE, interact.	(5) FE, isol.	(6) FE, interact.
real per capita GDP	**0.037**	**0.301****	**0.117**	**0.227***	**0.030**	**0.177**
growth	(0.081)	(0.123)	(0.135)	(0.117)	(0.081)	(0.117)
inflation (CPI)	**-0.301**	**-0.173**	**-0.310**	**0.026**	**-0.302**	**-0.124**
	(0.209)	(0.260)	(0.263)	(0.182)	(0.220)	(0.182)
additional controls[a]	No	No	No	No	No	No
expp	**-0.193**	**-0.249****	**-0.314****	**-1.172*****		
	(0.120)	(0.118)	(0.131)	(0.330)		
expp × left		**0.024**		**0.842****		
		(0.018)		(0.381)		
expp × right		**0.035***		**0.806****		
		(0.019)		(0.393)		
expp × majority		**0.004**		**-0.056**		
		(0.011)		(0.165)		
expp × coalition		**0.009**		**0.345***		
		(0.014)		(0.181)		
revp			**0.149**	**0.917***[b]**		
			(0.121)	(0.223)		
revp × left				**-0.697**[b]**		
				(0.269)		
revp × right				**-0.681**[b]**		
				(0.276)		
revp × majority				**0.018**		
				(0.142)		
revp × coalition				**-0.241***		
				(0.142)		
debtp			**0.023**	**0.131**		
			(0.024)	(0.099)		
debtp × left				**-0.081**		
				(0.092)		
debtp × right				**-0.064**		
				(0.094)		
debtp × maj.				**0.027**		
				(0.035)		
debtp × coal.				**-0.057**		
				(0.037)		
balp					**0.166**	**0.720*****
					(0.104)	(0.180)
balp × left						**-0.448*****
						(0.159)
balp × right						**-0.471*****
						(0.157)
balp × majority						**-0.017**
						(0.115)
balp × coalition						**-0.104**
						(0.118)
Constant	**10.373***	**10.459***	**7.387**	**1.540**	**1.847*****	**1.071***
	(5.705)	(5.445)	(6.105)	(5.725)	(0.532)	(0.584)
Observations	232	214	214	214	232	214
R-squared	**0.072**	**0.136**	**0.119**	**0.231**	**0.070**	**0.153**
N. of countries	20	20	20	20	20	20

Notes. Robust standard errors in parenthesis. * Signif. at 10% level ** Signif. at 5% level. *** Signif. at 1% level. All political variables refer to cabinet's political profile most frequent in the year of the capital flow. Control variables always refer to the year of the capital flow. All regressions performed using fixed effects and robust variance estimates. *Center* left out to avoid multi-colinearity with constant. [a] These are: *dunempp, dsinterestp, dproductivityp, tradep, curr-accp* and *dexchangep*. [b] Not robust to absence of other fiscal policy measures. All controls are measured in percentage points. All the significant coefficients shaded are robust to error clustering by countries. Luxembourg, Belgium and Ireland excluded due to outlying status – see Figure A6 (Appendix).

Table A5. FDI net flows after elections and political profile variables characterizing the elected cabinet

Dependent variable: FDI net flows, in percentage of GDP (percentage points), in (i) years without any election, following a year with election(s) taking place in April–December, and in (ii) years with election(s) taking place in January–March

Independent variables	(1) FE, maj, excl. Lux	(2) FE, maj, excl. Lux	(3) FE, coal, excl. Lux	(4) FE, coal, excl. Lux	(5) FE, all excl. Lux	(6) FE, all excl. Lux
real per capita	0.050	0.435	0.053	0.442	0.107	0.427
GDP growth	(0.196)	(0.423)	(0.199)	(0.430)	(0.192)	(0.414)
inflation (CPI)	0.012	0.184	0.012	0.183	-0.004	0.127
	(0.085)	(0.137)	(0.087)	(0.137)	(0.087)	(0.129)
dunempp		0.295		0.302		0.260
		(0.542)		(0.541)		(0.533)
dsinterestp		-0.327		-0.328		-0.317
		(0.198)		(0.201)		(0.194)
dproductivityp		-0.232		-0.235		-0.199
		(0.428)		(0.429)		(0.416)
tradep		0.052		0.053		0.054
		(0.035)		(0.035)		(0.035)
curr-accp		-0.392**		-0.393**		-0.381**
		(0.184)		(0.185)		(0.176)
dexchangep		0.139		0.138		0.141
		(0.091)		(0.091)		(0.088)
left					-2.223	-1.770
					(1.971)	(1.435)
right					-2.524	-2.076
					(1.951)	(1.312)
majority	-1.370**	-1.838**	-1.389**	-1.857**	-1.421**	-1.908**
	(0.667)	(0.901)	(0.679)	(0.928)	(0.702)	(0.958)
coalition			0.087	0.137	-0.123	-0.085
			(0.645)	(0.777)	(0.788)	(0.874)
Constant	0.582	-1.154	1.172	-1.150	2.438	1.627
	(1.159)	(2.885)	(1.521)	(2.897)	(2.400)	(3.483)
Observations	196	181	196	181	196	181
R-squared	0.088	0.311	0.088	0.312	0.125	0.334
N. of countries	22	22	22	22	22	22

Notes. Robust standard errors in parenthesis. * Significant at 10% level ** Significant at 5% level. *** Significant at 1% level. All political variables refer to the cabinet's political profile most frequent in the year of the capital flow. Control variables always refer to the year of the capital flow. All regressions performed using fixed effects and robust variance estimates. *Center* left out to avoid multi-colinearity with constant. All controls are measured in percentage points. Luxembourg excluded due to outlying status – see Table A2 (Appendix). All the significant coefficients shaded are robust to error clustering by countries.

Table A6. FDI net flows after elections and political transition variables reflecting electoral outcome from each election

Dependent variable: FDI net flows, in percentage of GDP (percentage points), in (i) years without any election, following a year with election(s) taking place in April–December, and in (ii) years with election(s) taking place in January–March				
	(1)	(2)	(3)	(4)
Independent variables	FE, str&comp, excl. Lux	FE, str&comp, excl. Lux	FE, all, excl. Lux	FE, all, excl. Lux
real per capita GDP	0.055	0.385	0.140	0.511
growth	(0.204)	(0.424)	(0.202)	(0.415)
inflation (CPI)	0.003	0.215	-0.018	0.124
	(0.093)	(0.142)	(0.104)	(0.143)
dunempp		0.055		0.268
		(0.622)		(0.556)
dsinterestp		-0.418*		-0.437*
		(0.241)		(0.235)
dproductivityp		-0.178		-0.199
		(0.471)		(0.442)
tradep		0.067*		0.080**
		(0.036)		(0.038)
curr-accp		-0.424**		-0.422***
		(0.188)		(0.153)
dexchangep		0.140		0.138*
		(0.092)		(0.081)
left-left			-0.168	-0.741
			(1.141)	(1.746)
left-center			-0.512	-0.657
			(1.696)	(1.981)
left-right			-0.509	-0.926
			(1.339)	(1.542)
center-left			-0.893	-1.339
			(1.730)	(1.866)
center-right			0.382	1.893
			(1.661)	(1.568)
right-left			-1.136	0.129
			(1.209)	(1.313)
right-center			5.337	5.600**
			(4.195)	(2.800)
right-right			-1.056	-1.346
			(1.149)	(1.430)
maj-maj	-1.840**	-2.382**	-1.560*	-2.394**
	(0.881)	(1.090)	(0.920)	(1.041)
maj-nmaj	-0.694	-1.350	-0.922	-2.254**
	(0.744)	(1.006)	(0.961)	(1.069)
nmaj-maj	-0.685	-0.559	-0.821	-1.540
	(0.778)	(0.977)	(0.957)	(1.200)
coal-coal	0.154	-0.471	-0.461	-1.254
	(0.911)	(1.136)	(1.206)	(1.505)
coal-ncoal	-0.627	-0.779	-0.668	-2.108
	(1.291)	(1.447)	(1.364)	(1.935)
ncoal-coal	-0.113	0.701	-0.117	0.308
	(1.066)	(1.206)	(1.237)	(1.162)
Constant	0.240	-3.702	0.572	-2.831
	(1.447)	(3.344)	(1.910)	(3.671)
Observations	196	181	196	181
R-squared	0.091	0.333	0.200	0.435
Number of countries	22	22	22	22

Notes. Robust standard errors in parenthesis. * Signif. at 10% level ** Signif. at 5% level. *** Signif. at 1% level. All political variables refer to cabinet transition occurred between the first and last days of the election year (direct comparison between the cabinet in office on the first business day and the cabinet in office on the last business day). Control variables always refer to the year of the capital flow. All regressions performed using FE and robust variance estimates. *Center-center*, *nmaj-nmaj* and *ncoal-ncoal* left out to avoid multi-colinearity with constant. All controls are measured in percentage points. Luxembourg excluded due to outlying status – see Table A2 (Appendix). All the significant coefficients shaded are robust to error clustering by countries.

Table A7. Equity inflows after elections and political profile variables characterizing the elected cabinet

Dependent variable: Equity inflows, in percentage of GDP (percentage points), in (i) years without any election, following a year with election(s) taking place in April–December, and in (ii) years with election(s) taking place in January–March

Independent variables	(1) FE, maj, excl. Lux, Bel & Ire	(2) FE, maj, excl. Lux, Bel & Ire	(3) FE, coal, excl. Lux, Bel & Ire	(4) FE, coal, excl. Lux, Bel & Ire	(5) FE, all excl. Lux, Bel & Ire	(6) FE, all excl. Lux, Bel & Ire
real per capita GDP	0.066	0.274**	0.069	0.287**	0.042	0.282**
growth	(0.068)	(0.138)	(0.066)	(0.141)	(0.066)	(0.139)
inflation (CPI)	0.019	-0.043	0.018	-0.045	0.024	-0.022
	(0.033)	(0.051)	(0.034)	(0.051)	(0.032)	(0.052)
dunempp		0.439*		0.450*		0.440*
		(0.250)		(0.254)		(0.256)
dsinterestp		0.074		0.071		0.069
		(0.071)		(0.072)		(0.070)
dproductivityp		-0.233		-0.238		-0.255
		(0.150)		(0.151)		(0.154)
tradep		-0.040		-0.039		-0.034
		(0.032)		(0.032)		(0.032)
curr-accp		0.142*		0.141*		0.130*
		(0.078)		(0.078)		(0.076)
dexchangep		-0.056*		-0.057*		-0.060*
		(0.033)		(0.033)		(0.032)
left					1.169	0.885
					(0.938)	(0.783)
right					1.270	1.086
					(0.864)	(0.736)
majority	0.748**	1.095**	0.723**	1.064**	0.726**	1.057**
	(0.330)	(0.448)	(0.312)	(0.440)	(0.316)	(0.420)
coalition			0.108	0.242	0.251	0.361
			(0.347)	(0.388)	(0.424)	(0.471)
Constant	-1.528**	0.833	-0.458	0.660	-2.981*	-1.736
	(0.706)	(1.573)	(0.826)	(1.601)	(1.523)	(1.831)
Observations	177	166	177	166	177	166
R-squared	0.260	0.394	0.260	0.395	0.291	0.415
Number of countries	20	20	20	20	20	20

Notes. Robust standard errors in parenthesis. * Significant at 10% level ** Significant at 5% level. *** Significant at 1% level. All political variables refer to the cabinet's political profile most frequent in the year of the capital flow. Control variables always refer to the year of the capital flow. All regressions performed using fixed effects and robust variance estimates. *Center* left out to avoid multi-colinearity with constant. All controls are measured in percentage points. Luxembourg, Belgium and Ireland excluded due to outlying status – see Figure A6 (Appendix). All the significant coefficients shaded are robust to error clustering by countries.

Table A8. Equity inflows after elections and political transition variables reflecting electoral outcome from each election

Dependent variable: Equity inflows, in percentage of GDP (percent. points), in (i) years without any election, following a year with election(s) taking place in April–Dec., and in (ii) years with election(s) taking place in Jan.–March

Independent variables	(1) FE, ideol, excl.Lux, Bel & Ire	(2) FE, ideol, excl. Lux, Bel & Ire	(3) FE, all, excl. Lux,Bel & Ire	(4) FE, all, excl. Lux, Bel & Ire
real per capita GDP	0.035	0.171	0.057	0.220
growth	(0.075)	(0.143)	(0.076)	(0.175)
inflation (CPI)	0.030	0.004	0.030	-0.003
	(0.032)	(0.066)	(0.036)	(0.069)
dunempp		0.168		0.342
		(0.272)		(0.296)
dsinterestp		0.123		0.143
		(0.084)		(0.095)
dproductivityp		-0.152		-0.163
		(0.155)		(0.173)
tradep		-0.051		-0.055
		(0.032)		(0.034)
curr-accp		0.131*		0.140**
		(0.070)		(0.066)
dexchangep		-0.045		-0.055*
		(0.030)		(0.031)
left-left	-0.960	-1.159	-0.593	-0.641
	(0.697)	(0.872)	(0.674)	(0.824)
left-center	-0.956	-0.803	-0.590	-0.237
	(1.074)	(1.083)	(1.012)	(1.018)
left-right	-0.095	0.207	0.341	0.712
	(0.755)	(0.910)	(0.885)	(0.993)
center-left	-0.404	0.167	-0.508	0.209
	(0.955)	(1.492)	(1.035)	(1.575)
center-right	-0.035	-0.615	-0.264	-0.970
	(0.987)	(1.139)	(1.072)	(1.201)
right-left	-0.145	-0.406	-0.031	-0.309
	(0.781)	(0.863)	(0.791)	(0.866)
right-center	-3.561*	-3.802**	-3.782**	-3.940**
	(1.829)	(1.786)	(1.859)	(1.629)
right-right	-0.467	-0.383	-0.502	-0.298
	(0.737)	(0.920)	(0.749)	(0.884)
maj-maj			0.787	1.330**
			(0.492)	(0.643)
maj-nmaj			0.736	1.119
			(0.656)	(0.759)
nmaj-maj			0.634	0.831
			(0.458)	(0.572)
coal-coal			0.852	1.000*
			(0.571)	(0.580)
coal-ncoal			0.396	0.750
			(0.657)	(0.837)
ncoal-coal			-0.090	-0.076
			(0.564)	(0.613)
Constant	0.099	1.921	-0.735	0.995
	(0.989)	(1.734)	(1.092)	(2.005)
Observations	177	166	177	166
R-squared	0.373	0.482	0.405	0.537
Number of countries	20	20	20	20

Notes. Robust standard errors in parenthesis. *Sign. at 10% level **Sign. at 5% level. ***Sign. at 1% level. Political variables refer to cabinet transition occurred between the first and last days of the election year (direct comparison between cabinet in office on the first business day and the cabinet in office on the last business day). Control variables measured in percentage points and refering to same year as capital flow. All regressions performed using FE. *Center-center*, *nmaj-nmaj* and *ncoal-ncoal* left out to avoid replicating the constant. Luxemb., Belgium and Ireland excluded due to outlying status – see Figure A6 (Appendix). Significant coefficients shaded are robust to error clustering by countries.

Figure A1. FDI net inflows in % of GDP (p.p.)

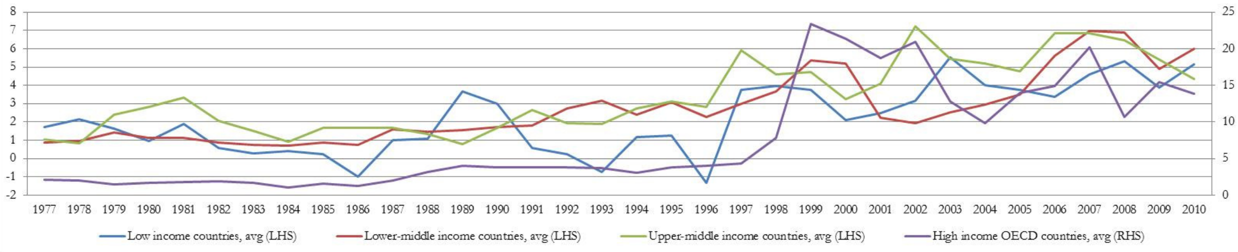


Figure A2. FDI net inflows in % of GFCF (p.p.)

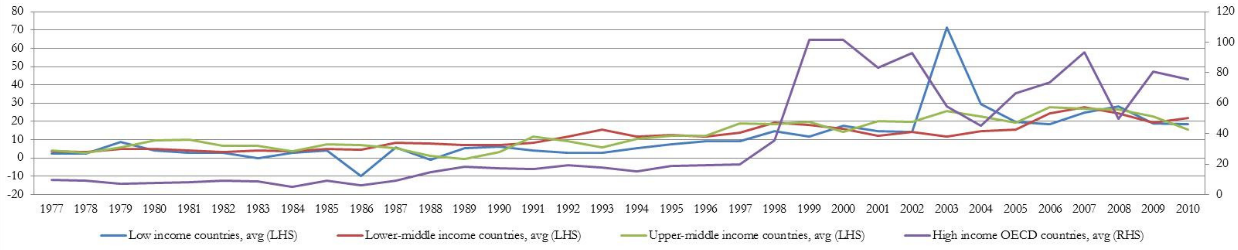


Figure A3. Equity net inflows in % of GDP (p.p.)

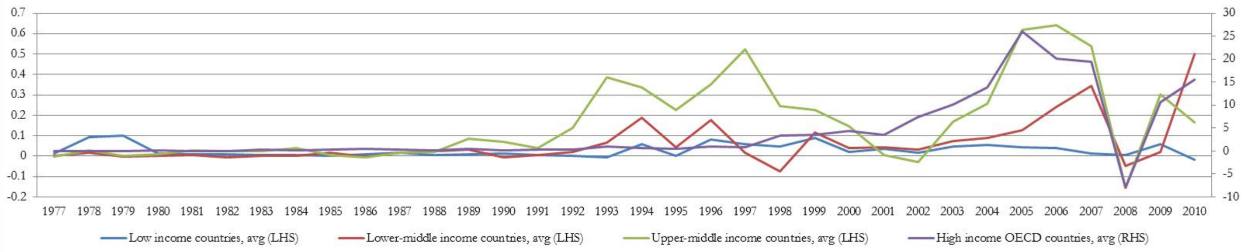
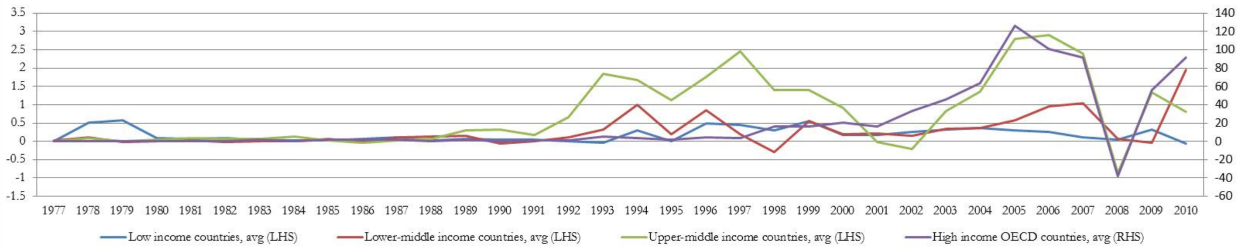


Figure A4. Equity net inflows in % of GFCF (p.p.)



Source: World Development Indicators, World Bank
Notes: Classes of countries defined by the World Bank. Simple averages by country group, in percentage points.

Figure A5. Policy volatility, parliamentary support and party composition

Figure A5.A shows the comparison between an index of single-party majoritarian status – *singmaj*, ranging from zero (minority or coalition) to 1 (single-party majority) – and a measure for the volatility of each fiscal policy variable, consisting of its 1960-2008 country-wise standard deviation. The plots show that countries with more frequent majoritarian single-party cabinets hold less volatile fiscal policy, suggesting that the action/inaction argument in Spolaore (2004) is not valid for fiscal policy.

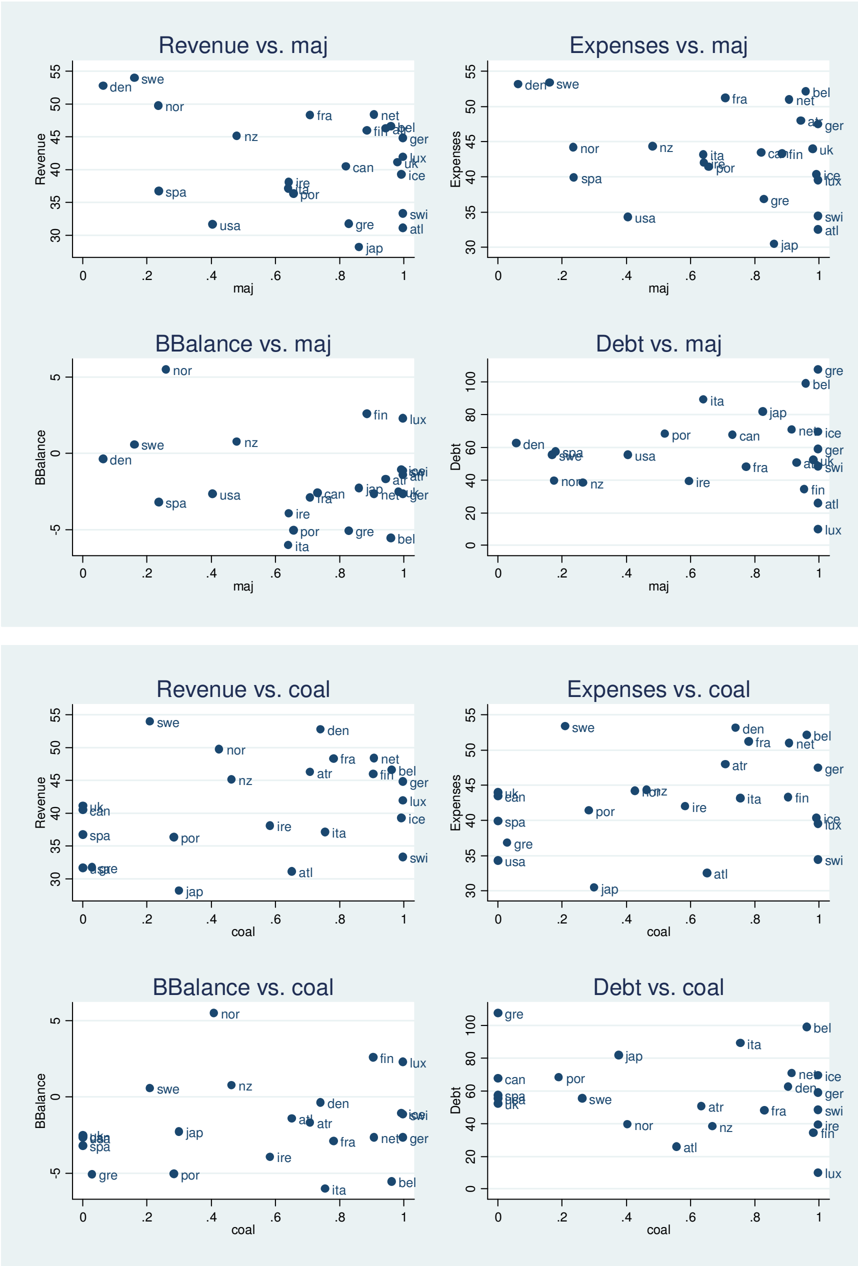
Figure A5.A. Standard-deviation of Public Revenue, Public Expense, Budget balance and Public debt (all in GDP p.p.), compared with cabinet majoritarian-single-party status (country-averages, 1960–2008)

Source: Fiscal data from OECD Economic Outlook No. 86; political data collected by the author – see Section 3.1 for references and details.

Notes: *Majsing* is originally in daily frequency and fiscal policy variables are originally in yearly frequency. *Majsing* is a dummy variable signaling days with a majoritarian single-party cabinet in office. First the political variable is averaged to yearly frequency (into country-year observations) and, secondly, is averaged country-wise for the whole period, considering, for each plot, only the observations for which the respective political and fiscal variables are non-missing. Country-wise standard-deviation is computed for each fiscal policy variable (for 1960-2008).

Figure A5.B performs a similar exercise, replacing *majsing* with its two underlying political indexes – *maj*, ranging from zero (minoritarian cabinet) to 1 (majoritarian), and *coal*, ranging from zero (single-party cabinet) to 1 (coalition). In line with Figure A5.A, there seems to be no clear evidence supporting the hypothesis that majority or single-party cabinets hold more volatile fiscal policy.

Figure A5.B. Standard-deviation of Public Revenue, Public Expense, Budget balance and Public debt (all in GDP p.p.), compared with cabinet majoritarian and coalition statuses (country-averages, 1960–2008)



Source: Fiscal data from OECD Economic Outlook No. 86; political data collected by the author – see Section 3.1 for references and details.

Notes: *Maj* and *coal* are originally in daily frequency and fiscal policy variables are originally in yearly frequency. *Maj* (*coal*) is a dummy variable signaling days with a majoritarian (coalition) cabinet in office. First the political variables are averaged to yearly frequency (into country-year observations) and, secondly, these variables are averaged country-wise for the whole period, considering, for each plot, only the observations for which the respective political and fiscal variables are non-missing. Country-wise standard-deviation is computed for each fiscal policy variable (for 1960-2008).

Figure A6. Outlying character of Luxembourg, Belgium and Ireland with respect to Equity inflows

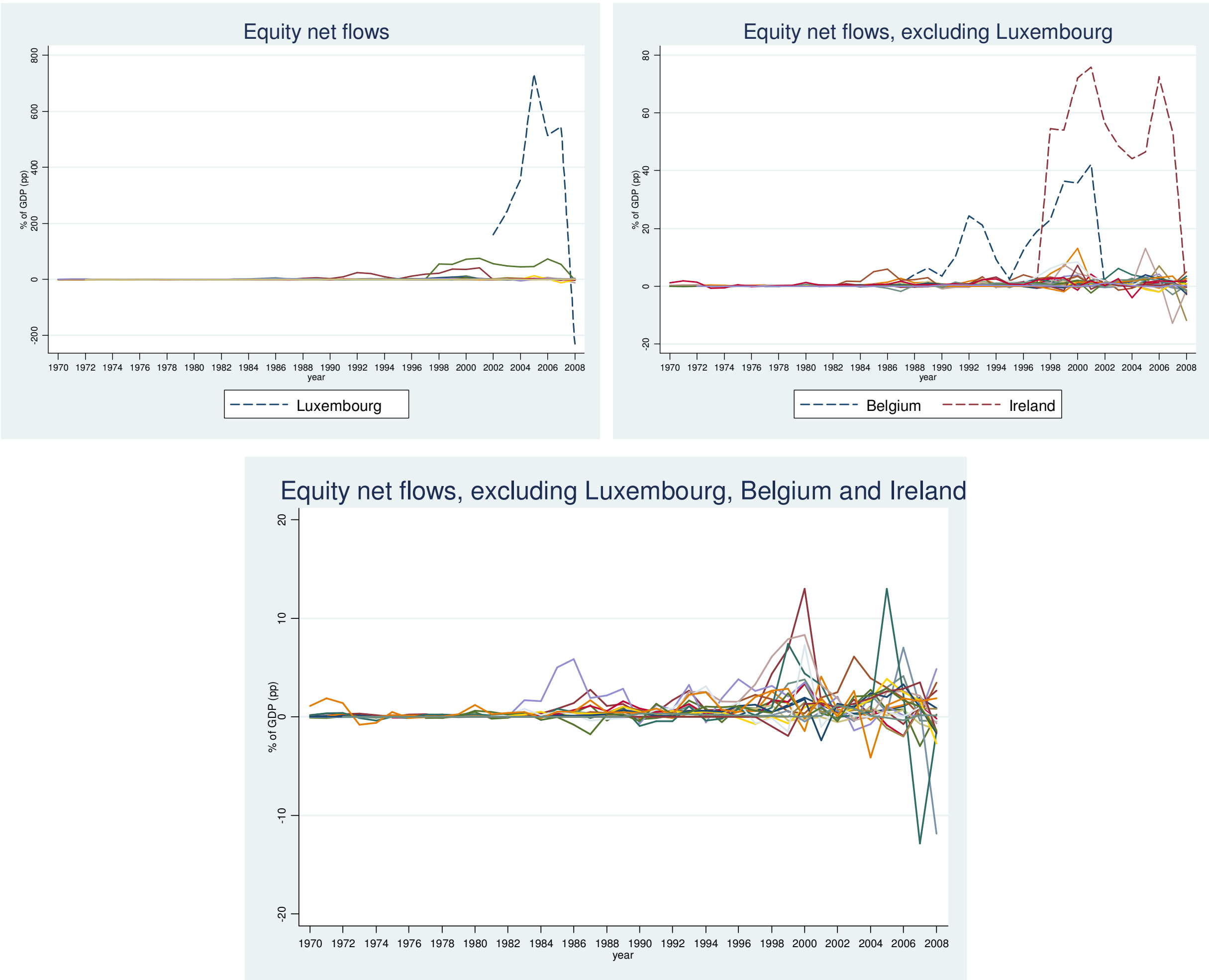


Figure A7. Outlying character of Luxembourg with respect to Capital Account net flows

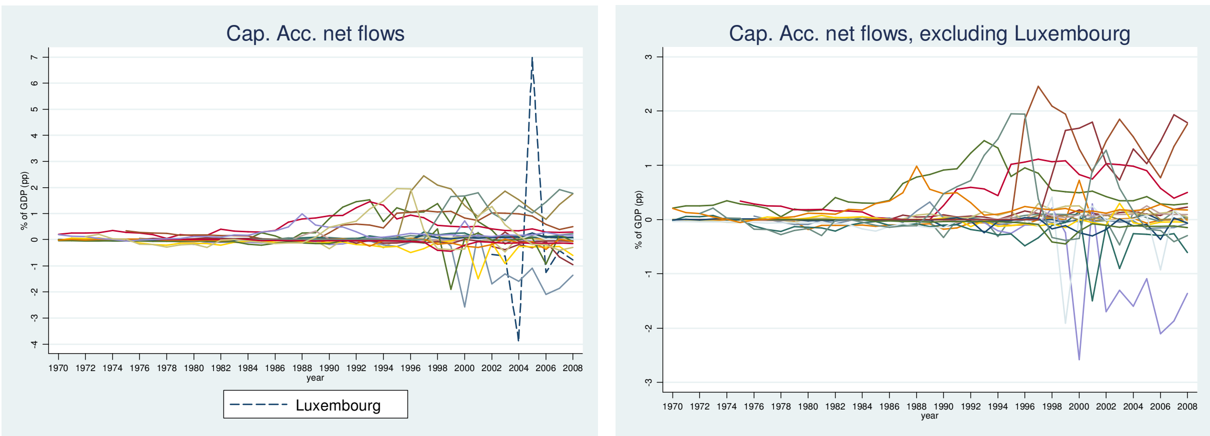
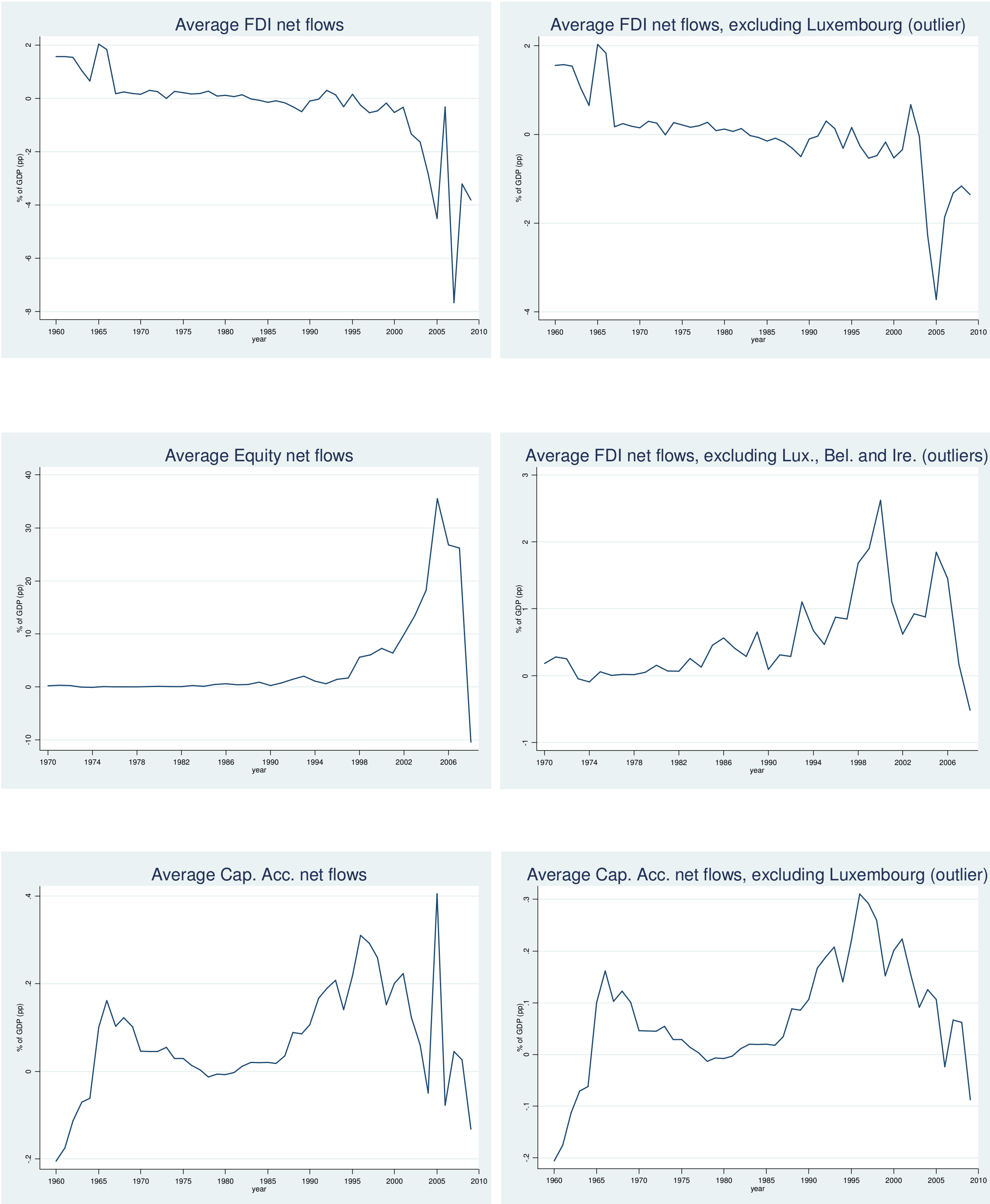


Figure A8. Cross-country yearly average of FDI, Equity and Capital Account net flows



Euro And International Trade: The Role Of Exchange Rate Uncertainty And Policy Credibility On Export Market Entry

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Abstract

Exchange rate risk is central to discussions about international economic policy. The elimination of that risk is one of the benefits attributed to the European currency union project. The introduction of the Euro represents a distinctive experiment of exchange uncertainty reduction, given the extraordinary credibility associated to such policy action. This study presents a theoretical model using the real options approach to understand how exchange rate volatility may induce firms to wait before entering the export market - entry hysteresis. The model combines (i) uncertainty around future exchange rates, (ii) sunk entry costs, (iii) entry decision preceding the realization of the future exchange rates, and (iv) irreversibility of the entry decision. According to the model, by eliminating exchange rate uncertainty within the Eurozone, the Euro contributed to export market entry by firms that would, otherwise, remain as non-exporters. The model produces a closed-form market-entry threshold, with a clear relation with exchange rate volatility, allowing for objective empirically-testable hypotheses.

1 Introduction

The risk associated to exchange rates is crucial to international economic policy. The elimination of that risk is one of the benefits attributed to the European currency union project. The introduction of the European single currency represents a distinctive experiment of exchange uncertainty reduction, given the extraordinary credibility associated to this policy action. This study presents a theoretical model using the real options approach to understand how exchange rate volatility may induce firms to wait before entering the export market. According to the model, by eliminating exchange rate uncertainty within the Eurozone, the Euro contributed to export market entry by firms that would, otherwise, remain as non-exporters. The model produces a closed-form market-entry threshold, with a clear relation with exchange rate volatility, allowing for objective empirically-testable hypotheses.

As noted in Obstfeld and Rogoff (1998), exchange risk is central to discussions about international economic policy – dollar safe-haven appreciations after crises external to the USA and risk-aversion-based arguments driving the European common currency project are examples. The "Delors Report" on the European Monetary Union (Delors, 1989) explicitly states that "the creation of a single currency area would add to the potential benefits of an enlarged economic area because it would remove intra-Community exchange rate uncertainties and reduce transaction costs, eliminate exchange rate variability and reduce the susceptibility of the Community to external shocks." This European single currency - the Euro - aggregates 11 countries accounting for 20% of world's output, 30% of world's trade and 300 million people (Baldwin, 2006), integrating an economic and monetary union process ultimately aiming at price stability, balanced growth, living standards convergence, high employment and external equilibrium (Delors, 1989). Baldwin (2006) considers it the world's largest economic policy experiment. Along the process, the Euro produces an uncertainty reduction with high potential impact on international trade.

But this uncertainty-reduction effect is especially powerful due the distinctive credibility associated to the policy: "a single currency would clearly demonstrate the irreversibility of the move to monetary union (...)" (Delors, 1989). *Irreversibility* is key. The extraordinary commitment credibility around the Euro is compared by Zingales (2012) to a legendary strategy by the Spanish explorer Hernán Cortés[1]. According to the legend, Cortés, in his quest to conquer Mexico, ordered the burn of the ships that transported the army from Spain. *Irreversibility* motivated the army towards victory, by inducing unquestionable commitment.

Baldwin et al (2008) test the impact of the European currency union on international trade, replicating the exercise in Rose (2000)[2] for the EU-15 in the 1996-2006 period, with several methodological improvements[3]. Their results point a significant positive impact of the Euro on the level of exports from Eurozone (EZ) countries to both EZ and non-EZ countries, qualitatively confirming the "Rose effect"[4], although with much smaller magnitude. These results appear in a context of no clear or solid evidence supporting the impact of exchange rate volatility on international trade. Many studies had found significant (and, sometimes, very large) impacts of either exchange volatility or currency unions on trade[5]; nevertheless, Tenreyro (2007) identifies and implements a set of methodological improvements to the empirical framework used in several of those (successful) studies - the gravity equation - finding no significant impact[6].

In any case, Baldwin (2006) acknowledges (in it concluding remarks) the long way still to be covered in order to understand the impact of the Euro on trade. Moreover, a theoretical discussion on *how* this impact may occur is pointed as the next step to take. According to the author, "it is now time to move beyond studies of how big is the magic."

Our study intends to take this step, contributing to end the absence of clear-cut conclusions on the effect of exchange rate volatility on trade (see IMF, 2004, for a review). More specifically, we explore a possibility already discussed in Baldwin (1988) but – to the best of our knowledge – not yet directly assessed in the literature: "(. . .) it seems likely that real exchange rate shocks

[1]This legend is not historically accurate and is used by the author in an essay on the fiscal policy constraints associated to the Euro adhesion.

[2]Rose (2000) finds significant positive impacts of currency unions and significant negative impacts of exchange rate volatility on international trade.

[3]Some of them proposed in Santos Silva and Tenreyro (2006).

[4]"(...) two countries sharing the same currency trade three times as much as they would with different currencies."

[5]Examples are Kenen and Rodrik (1986), De Grauwe (1987), Koray and Lastrapes (1989), Bini-Smaghi (1991), Arize (1998), Dell'Ariccia (1999), Fountas and Aristotelous (1999), Rose (2000), Rose and Wincoop (2001), Anderton and Skudelny (2001), Rose and Engel (2002), Glick and Rose (2002), Bun and Klaassen (2002), Nitsch (2002, 2004), De Nardis and Vicarelli (2003), Micco et al. (2003), Barr et al (2003), Broda and Romalis (2003) and Koren and Szeidl (2003). See Baldwin et al (2005) for a review. In IMF (2004), a panel data empirical analysis is performed, finding some negative impacts of exchange volatility on trade, but those impacts are also not robust, mainly to the introduction of country time-varying effects.

[6]More recently, Berthou and Fontagné (2008), Esteve-Pérez et al (2008) and Fontagné et al (2009) use firm-level data to find significant trade effects from the introduction of the Euro.

could (...) have hysteretic effects. Additional research is needed to explore this conjecture"[7]. We design a theoretical model that answers this call by analyzing the role of exchange rate volatility in enhancing the value of a specific strategic option, available to any potential exporter: waiting one more period before entering the export market. This represents an application of the real options approach developed in Dixit (1989) to the interaction between exchange rate volatility and export market entry. Some pivotal components in this framework are (i) the uncertainty around future exchange rates, (ii) the existence of sunk entry costs, (iii) the entry decision timing, previous to the realization of the future exchange rates, and (iv) the irreversibility of the entry decision. Under such conditions, firms become vulnerable to unfavorable exchange rate realizations after entry. This vulnerability, associated to the sunk cost of entry, produces a theoretical rationale for entry hysteresis, by enhancing the value of *waiting* as defensive strategy. Broll and Eckwert (1999) build a theoretical model close to this approach, abstracting away from components (ii)-(iv) and considering instead that there are no entry costs, that the firm decides if to enter after observing the exchange rate and that she may exit the export market at any time. This alternative context produces, instead, a theoretical argument in favor of a positive impact of exchange risk on the value of *entering* the export market[8].

Baldwin and Krugman (1989) also build a theoretical framework assessing the real options of entering and exiting the export market[9]. In their model, hysteresis is driven by the gap between the export-market entry cost and the ongoing maintenance costs associated to that market. We wish, instead, to underline, isolate and understand the role of exchange rate volatility in the entry hysteresis. Moreover, our model uses a realistic stochastic process to represent exchange rate motion and aims at producing an empirically testable closed form rule guiding the entry decision. These two features answer two improvement needs made explicit in Baldwin and Krugman (1989): to abandon the (unrealistic) i.i.d. assumption in the conditional distribution of the future exchange rate and to assess the empirical importance of the effects at hand.

[7]Baldwin (1988) explores the role of hysteresis in the impact of exchange rate shocks on market entry/exit, *after* the shocks take place. Differently, our study assesses the role of potential future exchange rate variations in determining current entry hysteresis, *before* those variations occur.

[8]Examples of other studies exploring positive impacts of exchange rate volatility on the value of the real option of exporting are Franke (1991) and Sercu and Vanhulle (1992).

[9]Firms, in this model, are foreign and face the decision of entering a domestic market to sell their products.

Our model follows closely the theoretical framework in Handley and Limão (2012). Sections 2 and 3 replicate its monopolistic competition setting and the zero-profit condition determining market entry under certainty; differently, trade tariffs and wages are not considered, exchange rate is made explicit instead, and new forms of heterogeneity across production sectors are added. Firm productivity remains the pivotal dimension with respect to which export market entry is determined[10]. Section 4 designs a stochastic path for the relevant policy variable, similar to the one in Handley and Limão (2012) in its shock-driven dynamics and in its focus on the potential worst-case scenario for future policy. The specific policy motion process, though, is distinct, in order to effectively represent the specific dynamics of our policy variable: the exchange rate. This motion process distinction translates into a distinct set of conditions determining market entry under uncertainty, in Section 5. Nevertheless, these conditions follow the real options approach taken in Handley and Limão (2012), leading to a similar interrelation between the entry thresholds with and without uncertainty. The channel through which policy credibility operates is also the same - the probability of policy shocks -, although now designed (in Section 6) under a framework specific to the policy experiment at hand: the European currency union. Given the clear role of exchange volatility in the closed-form entry threshold under uncertainty, Section 6 derives objective hypotheses concerning the Euro impact on export market entry. Such hypotheses pave the way for promising empirical research.

The model predicts that, by reducing exchange volatility, the Euro reduces hysteresis and lowers the export-market entry threshold, promoting firm entry. The framework we design does not account for potential general equilibrium effects associated to the simultaneous introduction of the Euro in a broad set of countries. One example of such effects is the enhanced competition in intra-Eurozone trade, produced by the additional firm entry (e.g. if more French firms start exporting to Italy after the Euro is introduced, the same happens with German firms, meaning that French exporters will face additional competition in the Italian market after the Euro). Such competition increase could induce export price decline, countering and potentially off-setting the direct entry promotion from the Euro introduction. Baldwin et al (2008) and Fontagné et al (2009)

[10] As in Melitz (2003), firms face a fixed cost to enter the foreign market, and, as an output of the framework, only a range of the most competitive firms will find it profitable to export.

present evidence supporting this competition-driven price reduction[11]. Even in the presence of this general equilibrium effect, our model remains adequate to analyze the accession to a currency union by an isolated country (the Eurozone enlargements provide recent experiences of the kind; see Flandreau and Maurel, 2005, for an example of monetary union involving two countries only, the Austro-Hungarian union).

As mentioned above, the next sections describe the theoretical model. Appendix B generically provides details on its mechanics. Any other specific Appendix section providing additional details shall be explicitly mentioned.

[11] Baldwin et al (2008) extract this conclusion from (i) the absence of empirical support for trade diversion by EZ exports towards EZ markets – which would concomitantly result from transaction costs reduction –, (ii) the presence of evidence supporting a broad price reduction in EZ imports, regardless the origin country, (iii) the presence of evidence supporting the trend towards the usage of pricing-to-market strategy by non-EZ exporters when assessing the EZ, (iv) the empirical evidence pointing the absence of product-type portfolio expansion in non-EZ exports to EZ – one of the arguments pointed in earlier studies to explain the empirical invisibility of trade diversion towards the EZ – (this evidence confirms (i)) and (indirectly) from (v) the presence of evidence supporting the increasing convergence of exports prices within the EZ.

2 Demand, Supply and Pricing

The model operates on a monopolistic competition setting. Consumers in importing country i face price p_{iv} (denoted in country i's currency) for each unit of product v. Their optimal demand for product v, q_{iv}, is given by

$$q_{iv} = \frac{\mu_s Y_i}{P_{is}} \left(\frac{p_{iv}}{P_{is}}\right)^{-\sigma_s},$$

where $P_{is} = \left[\int_{v\in\Omega_s} (p_{iv})^{1-\sigma_s}\, dv\right]^{1/1-\sigma_s}$ represents the constant-elasticity-of-substitution (CES) price index of sector s, Y_i the aggregate income of country i, μ_s the income share devoted to goods from sector s, and $\sigma_s > 1$ the constant elasticity of substitution, heterogeneous across sectors $s \in S$. Note that p_{iv} includes any existing trade costs[12]. Each product v belongs to a given sector s, which corresponds to a set of products Ω_s, a sub-sector of Ω ($v \in \Omega_s \subseteq \Omega$).[13]

Firm j, located in country x and exporting v to country i, receives $p_{xiv} = \frac{p_{iv}}{e^{x,i}}$ per unit sold, where p_{xiv} is measured in country x's currency and $e^{x,i}$ represents the exchange rate between countries x and i, measuring the amount of i currency units per x currency unit. Firm j's marginal cost for producing product v, c_j, is heterogeneous across firms, is constant for each firm, and has the form

$$c_j = \frac{c}{a_j},$$

where a_j represents a measure of firm j's productivity, c represents the the unitary price of inputs originating from country x – measured in country x's currency, heterogeneous in x, and constant for all firms and products within x.[14]

[12] Including dealer costs, transportation and advertising.

[13] Note that S denotes the set of sectors, while each sector s and the "universe" of varieties, Ω, are sets of products. Optimal demand function q_{iv} may be obtained from standard optimization of the representative consumer's utility function associated to consumption of goods from sector s, $U = Q_s^{\mu_s} q_0^{1-\mu_s}$, where $Q_s = \left[\int_{v\in\Omega_s} q_v^{\rho_s} dv\right]^{1/\rho_s}$ and $\rho_s = 1 - \frac{1}{\sigma_s}$.

[14] We omit the index x for simplicity, given we focus on a same and unique origin country. Marginal cost $c_j = \frac{c}{a_j}$ may be rationalized by a firm j's production function of the form $Q_j = C_j^{\alpha} L_j^{1-\alpha} m$, where C_j and L_j represent, respectively, the capital and labor stocks used by firm j and m represents the quantity of intermediate inputs used. Assuming the capital and labor stocks are constant (short term), the total cost function $T_j = cm(Q_j) + wL_j + rK_j$ (where c, w and r represent unitary prices of intermediate inputs, labor and capital, respectively) only depends on Q_j through the quantities of intermediate inputs used: $Q_j = C_j^{\alpha} L_j^{1-\alpha} m \Leftrightarrow m(Q_j) = \frac{Q_j}{C_j^{\alpha} L_j^{1-\alpha}}$. Under such a setting, marginal cost associated to Q_j will be $c_j = \frac{\partial T_j}{\partial Q_j} = c\frac{\partial m(Q_j)}{\partial Q_j} = \frac{c}{C_j^{\alpha} L_j^{1-\alpha}}$, where $C_j^{\alpha} L_j^{1-\alpha} \equiv a_j$. Under such a setting, productivity is increasing in labor and capital stocks.

Firms maximize profit ${}_{xjis} = \left(\frac{p_{iv}}{e^{x,i}} - c_j\right) q_{iv}$, reaching the mark-up rule[15]

$$p^*_{xiv} = \frac{c}{\rho_s a_j},$$

where $0 < \rho_s = 1 - \frac{1}{\sigma_s} < 1$.

Using this optimal pricing strategy and the optimal demand function in the profit function we obtain (after simplification) optimal profits

$${}^*_{xjis} = A_{is} \frac{a_j^{\sigma_s - 1}}{(e^{x,i})^{\sigma_s}},$$

where $A_{is} \equiv \left(\frac{\rho_s^{\sigma_s}}{\sigma_s - 1}\right) \mu_s Y_i (P_{is})^{\sigma_S - 1} c^{1-\sigma_S}$. Note that optimal profits (expressed in x's currency) are decreasing in $e^{x,i}$, but this sensitivity is heterogeneous across sectors[16].

15 $\frac{\partial}{\partial p_{iv}} \left[\left(\frac{p_{iv}}{e^{x,i}} - c_j\right) q_{iv}\right] = 0 \Leftrightarrow \frac{\partial}{\partial p_{iv}} \left[\left(\frac{p_{iv}}{e^{x,i}} - c_j\right) \frac{\mu_s Y_i}{P_{is}} \left(\frac{p_{iv}}{P_{is}}\right)^{-\sigma_s}\right] = 0 \Leftrightarrow p_{iv} = \frac{c_j}{\rho_s} e^{x,i} \Leftrightarrow p_{xiv} = \frac{c_j}{\rho_s}$

16 $\frac{\partial \ln {}^*_{jis}}{\partial \ln e^{x,i}} = -\sigma_s$

3 Deterministic entry setup

This section discusses export market entry in the absence of uncertainty. Firm j enters the foreign market of country i if the present discounted value of the exporting profits exceeds the sunk cost of entry K_{xi} (expressed in x's currency)

$$\frac{{}^{*}_{xjis}}{1-\beta} \geq K_{xi},$$

where β represents the inter-temporal discount factor. The condition above defines, in equality $\left({}^{*}_{xjis} = [1-\beta]\, K_{xi}\right)$, the *deterministic productivity threshold*

$$a_{is}^{D} = \left[\frac{K_{xi}\,(1-\beta)}{A_{is}}\right]^{\frac{1}{\sigma_s - 1}} \left(e^{x,i}\right)^{\frac{\sigma_s}{\sigma_s - 1}}.$$

All firms with productivity above a_{is}^{D} enter the export market. Note that, given $\sigma_s > 1$, a currency x appreciation (depreciation) $e^{x,i} \uparrow (\downarrow)$ induces exit (entry)[17]. The underlying intuition is simple: a currency x appreciation (depreciation) produces an increase (decrease) in the optimum foreign output price $p_{iv}^{*} = p_{xiv}^{*} e^{x,i}$, which, in turn, leads to a decrease (increase) in demand q_{iv} and a consequent decrease (increase) in optimum profits ${}^{*}_{xjiv} = \left(p_{xiv}^{*} - c_j\right) q_{iv}$, making the profits' present discounted value smaller, relative the constant sunk cost K_{xi}, for any firm j with a given productivity a_j. The magnitude of this exchange rate impact on the entry threshold is also sector-specific, as shown by the elasticity of the threshold to a definitive change in $e^{x,i}$ is

$$\frac{\partial \ln a_{is}^{D}}{\partial \ln e^{x,i}} = \frac{\sigma_s}{\sigma_s - 1}.$$

The deterministic productivity entry-threshold is the same for all firms exporting a product from the same sector to the same foreign market – it's value is sector- and market-specific. The marginal entrant is the least productive exporting firm[18].

[17] Detailed proof in Appendix B, "Appreciation-/depreciation-induced entry/exit".

[18] If one assumes a_{is}^{D} is positively correlated with capital and labor stocks it is also the *smallest* exporting firm.

4 Exchange rate motion

To introduce exchange rate dynamics, we consider a process according to which $E^i_{t+1} := \ln e^{x,i}_{t+1}$ will remain fixed at the current level $E^i_t := \ln e^{x,i}_t$ with some probability $(1-\gamma)$, $0 < \gamma < 1$; with probability γ, $E^i_{t+1} \neq E^i_t$ and E^i_T, $T > t$, follows a discrete Markov process, characterized by two states, Low (L) and High (H), and the following transition probabilities p^i_{IJ}, $I, J \in \{L, H\}$:

		E^i_{T+1}	
		E^i_L	E^i_H
E^i_T	E^i_L	p^i_{LL}	p^i_{LH}
	E^i_H	p^i_{HL}	p^i_{HH}

where $E^i_H > E^i_L$ and $\sum_{J=L,H} p^i_{IJ} = 1,\ I = L, H.$[19] Once having switched to this discrete Markov process, E^i_T never returns to E^i_t.

As shown by Kopecky and Suen (2010), the Rouwenhorst method (distinctively) allows this type of discrete processes to approximate the AR(1) continuous stochastic process, often pointed as the best framework to model the behavior of the (logarithm of the) exchange rate - see Meese and Rogoff (1983a, 1983b), Balke et al (2011) and Bekaert and Gray (1998) (the latter regarding target-zone regimes)[20]. In order to attain clear comparative statics and closed form solutions, we consider the simple 2-state discrete process above.

Under a fixed-exchange regime, $\gamma < 1$ represents the probability of regime change (towards a free-float or a target-zone) and, under a free-float or a target-zone, $\gamma = 1$ and the exchange rate follows the Markov process above[21].

For the transition towards the Markov process, we define the probabilities

$$p^i_{E_t I} = Pr\left(E^i_{t+1} = E^i_I | E^i_t \neq E^i_L, E^i_t \neq E^i_H\right),\ I = L, H.$$

[19] For simplicity, we abandon the superscript x. In its absence, all the analysis refers to the same source country x.

[20] More specifically, Kopecky and Suen (2010) prove that the Rouwenhorst method matches the conditional and unconditional mean and variance and the first-order autocorrelation of any stationary AR(1) process, showing also that this method is distinctively accurate in replicating the parameters/observations of that continuous process and is distinctively robust with respect to variation in the persistence of the process, the number of points used in the discrete approximation and the procedure used to generate model statistics.

[21] Note that the assumption of $\gamma = 1$ under a free-float/target-zone implies the allocation of probability zero to the event of returning to a fixed-exchange regime.

5 Entry setup with uncertainty

This section describes the entry setup, under the uncertainty originated by the exchange-rate motion process described in the previous section. Define $V_o(.)$, $o = e, w$, as the value of an exporting ($o = e$) or a non-exporting ($o = w$) firm - for a non-exporting firm, these value functions may be interpreted as the value of the real options of entering and waiting in the next period, respectively. Assuming $V_o(.)$ to be continuous in the exchange rate, $\exists E_j^{iU}$ (*exchange rate threshold*) such that firm j is indifferent between exporting and non-exporting:

$$V_e(E_j^{iU}, a_j) - K_{xi} = V_w(E_j^{iU}, a_j).$$

By definition, the firm that is indifferent between exporting and non-exporting given the current (log) exchange rate E_t^i - the *cutoff firm* -, is that for which $E_j^{iU} = E_t^i$. We shall assume $E_L^i < E_t^i < E_H^i$, $\forall t$, and, thus, the *cutoff firm* enters (waits) whenever $E_T = E_L^i$ ($E_T = E_H^i$).

The *productivity threshold under uncertainty* a_{ist}^U (separating exporters from non-exporters) shall be precisely the productivity held by the *cutoff firm*. In order to determine it's value, we consider the following system of value functions describing the *cutoff firm*, still out of the export market at the beginning of period t and (alternatively) facing a (log) exchange rate of E_t^i (the current exchange rate), E_L^i or E_H^i:[22]

[22] $E_t^i \neq E_L^i$ and $E_t^i \neq E_H^i$. The exit option is not analyzed nor modeled.

$$V_e(E_t^i, a_{ist}^U) = {}_{xjis}(E_t^i, a_{ist}^U) + (1-\gamma)\,\beta V_e(E_t^i, a_{ist}^U) + \gamma\beta \left[\Sigma_{I=L,H} \left\{ p_{E_t I}^i . \tilde{V}_e(E_I^i, a_{ist}^U) \right\}\right] \tag{5.1}$$

$$V_w(E_t^i, a_{ist}^U) = (1-\gamma)\,\beta V_w(E_t^i, a_{ist}^U) + \gamma\beta \left[p_{E_t L}^i \left(\tilde{V}_e(E_L^i, a_{ist}^U) - K_{xi} \right) + p_{E_t H}^i . \tilde{V}_w(E_H^i, a_{ist}^U) \right] \tag{5.2}$$

$$\tilde{V}_e(E_I^i, a_{ist}^U) = \pi_{xjis}(E_I^i, a_{ist}^U) + \beta \left[\Sigma_{J=L,H} \left\{ p_{IJ}^i . \tilde{V}_e(E_J^i, a_{ist}^U) \right\}\right], \quad I = L, H \tag{5.3}$$

$$\tilde{V}_w(E_I^i, a_{ist}^U) = \beta \left[p_{IL}^i . \left(\tilde{V}_e(E_L^i, a_{ist}^U) - K_{xi} \right) + p_{IH}^i . \tilde{V}_w(E_H^i, a_{ist}^U) \right], \quad I = L, H \quad , \tag{5.4}$$

$$V_e(E_t^i, a_{ist}^U) - K_{xi} = V_w(E_t^i, a_{ist}^U), \tag{5.5}$$

where ${}_{xjis}(.)$ represents the optimal profit function[23] and $\tilde{V}_o(.)$ describe the value of the firm when the exchange rate follows the Markov process described in Section 4. Note that, in the sub-problem defined by this discrete Markov process, we assume that firms enter if $E_{t+1}^i = E_L^i$ and wait if $E_{t+1}^i = E_H^i$ - see equations (5.2) and (5.4). The optimality of such strategy is ensured by the conditions $E_j^{iU} = E_t^i$, $E_L^i < E_t^i < E_H^i$ and $\gamma p_{E_t H}^i > p_{LH}^i$, which we take henceforth as assumptions (see Appendix C for details on the determination of these sufficient conditions).

Using (5.1)-(5.5), we attain the uncertainty threshold[24]

$$a_{ist}^U = a_{ist}^D \left[\frac{1 - \beta p_{HH}^i + \beta\gamma p_{E_t H}^i}{1 - \beta p_{HH}^i + \beta\gamma p_{E_t H}^i . \exp\left\{ \sigma_s \left[E_t^i - E_H^i \right] \right\}} \right]^{\frac{1}{\sigma_s - 1}} . \tag{5.6}$$

[23] Asterisk is dropped for notation simplicity.

[24] See Appendix A for further details on this threshold determination.

This *productivity threshold under uncertainty* consists of a transformation of the *deterministic threshold*[25]. Note that

$$1 - \exp\left\{\sigma_s \left[E_t^i - E_H^i\right]\right\} = 1 - \frac{_{xjis}\left(E_H^i\right)}{_{xjis}\left(E_t^i\right)}$$

represents the percentage loss in profits from a potential jump from the current exchange rate E_t^i to the *worst case scenario* E_H^i. By assumption, E_H^i (E_L^i) may assume any value higher (lower) than E_t^i, implying that $E_t^i - E_H^i < 0$ and $a_{ist}^U > a_{ist}^D$: the profit loss from a jump to the exchange rate *worst scenario* produces an *hysteresis gap* between the deterministic and the uncertainty thresholds, and this gap is increasing in that profit loss. In spite of the optimal-profit function convexity in the exchange rate (lowering risk aversion), uncertainty induces an increase in the productivity threshold the firms must overcome in order to rationally decide entering the export market - due to uncertainty, some firms that would otherwise enter, now choose to wait[26]:

$$a_{ist}^D = a_{ist}^U \mid_{\gamma=0},\ a_{ist}^D < a_{ist}^U \mid_{\gamma\neq 0},\ \frac{\partial a_{ist}^U}{\partial \gamma} > 0.$$

Moreover, the sensitivity of the ratio $\frac{a_{ist}^U}{a_{ist}^D}$ with respect to the *worst-scenario* potential shock, $E_t^i - E_H^i$, depends on σ_s, meaning that this uncertainty-driven threshold amplification is heterogeneous across sectors.

[25]Note that $a_{ist}^U = a_{ist}^D$ when $\gamma = 0$.

[26]Note that only "bad news" impact the decision.

6 Exchange rate policy

We define as exchange rate policy *intervention* an isolated change in the value of the exchange rate, induced by the monetary authority (e.g. an isolated depreciation), and as exchange rate policy *regime* an intended exchange rate agenda to be pursued by the monetary authority (e.g. fixed exchange rate).

We assume that a policy intervention induces a change in the current (log) exchange rate E_t^i and that the introduction of a new exchange rate policy regime induces both a change in E_t^i and a change in the probability of regime shift, as follows

$$\gamma_{it} = \gamma_{free} + (\gamma_{euro} - \gamma_{free})\, euro_{it} + (\gamma_{fix} - \gamma_{free})\, fix_{it} + (\gamma_{target} - \gamma_{free})\, target_{it},$$

where $euro_{it}$ represents a dummy signaling the Eurozone membership by both countries x and i (at period t), fix_{it} represents a dummy signaling the presence, in period t, of a fixed-exchange regime (other than the Euro) between the currencies of those two countries, and $target_{it}$ represents the presence in t of a target zone constraining the exchange rate between x and i.

Although the Euro may be considered a special case of a fixed-exchange regime, the extremely low reversibility associated to a currency unification may grant this policy a distinctively higher commitment credibility than that of any fixed-exchange regime.

In the context of a free-float regime ($euro_{it} = fix_{it} = target_{it} = 0$), the probability of regime shift is γ_{free}, but, with the introduction of an exchange-rate-constraining policy regime, this probability shifts to: (a) γ_{euro} if both countries belong to the Eurozone, (b) γ_{fix} if a fixed-exchange regime different than the Euro is implemented in the exchange between x and i, or (c) γ_{target} if a target zone is implemented between x and i.

An empirical test to the model may use a set of exporting and non-exporting firms and the uncertainty-threshold specification (5.6) to test hypotheses (i) $\gamma_{euro} < \gamma_{fix} < \gamma_{target} < \gamma_{free}$, (ii) $\gamma_{euro} = 0$ and (iii) $\gamma_{free} = 1$. Note that, under a fixed-exchange or the Euro, we interpret γ exactly as the probability of regime shift; under a target-zone, this parameter may be interpreted instead as a moderator of transition probabilities towards E_H^i and E_L^i ($\gamma p_{E_tH}^i$ and $\gamma p_{E_tH}^i$, respectively).

Conclusion

Exchange rate risk is crucial to international economic policy and its elimination is one of the benefits attributed to the European currency union project. The introduction of the Euro produced a distinctive exchange uncertainty reduction, due to the extraordinary credibility associated to such policy action.

This study presents a theoretical model using the real options approach to understand how exchange rate volatility may induce hysteresis in export-market entry. The model combines (i) uncertainty around future exchange rates, (ii) sunk entry costs, (iii) entry decision preceding the realization of the future exchange rates, and (iv) irreversibility of the entry decision. Its monopolistic competition setting and the productivity-driven firm heterogeneity produce a market entry threshold representing the productivity level below which firms rationally decide not to enter the export market. The sunk cost of entry and the vulnerability of firms to potential unfavorable exchange rate scenarios assign value to the real option of *waiting before entering*, as defensive strategy. Therefore, the market entry threshold is multiplied under uncertainty, raising the productivity level that firms must overcome before benefiting from entry.

The stochastic process designed to represent exchange rate motion mimics empirically observed exchange rate dynamics and isolates the probability of exchange rate change over time. The entry threshold under uncertainty is increasing in this exchange rate change probability. Moreover, the closed form derived for the entry threshold allows the empirical estimation of this probability and, more specifically, allows to test its reduction after the introduction of target-zone, fixed or common-currency exchange rate regimes. A negative impact by such regimes on the probability of exchange rate change is equivalent to threshold reduction and, thus, export-market entry.

The impact of the Euro on entry via uncertainty reduction may, thus, be tested by analyzing the evolution of the estimated probability of exchange rate change around the introduction of the European common currency. Data on the number of exporting and non-exporting firms in any Eurozone economy may allow this empirical assessment. Destination country identification shall allow the use of non-Eurozone economies as an important comparison group; business sector identification may be used to test the impact heterogeneity predicted in the entry threshold closed form. There are general equilibrium effects not acknowledged by our model - e.g. the enhanced competition in intra-Euro international trade, due to simultaneous adhesion by several countries - which could counter and potentially offset the entry-promotion impact through reduced uncertainty. One way to overcome such caveat is to assess the adhesion to the Euro by an isolated country or by a limited set of countries.

The distinctive power of the Euro, associated to its credibility and to its irreversibility stance, may also be tested by replicating that probability estimation around other exchange rate regimes. A post-Euro especially intense decline in the probability of exchange rate change (compared to the probability decline after a target-zone or a fixed-exchange regime) shall provide empirical support for the extraordinary uncertainty-reduction impact by the European currency union. More specifically, a null probability of exchange rate change after the Euro introduction represents evidence of exchange uncertainty *elimination*.

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APPENDIX

A. Uncertainty threshold determination in detail

For notation simplicity, define $\pi(.)$ as the optimal profit function, $E_k = E_k^i$, $k = L, t, H$, and $p_{mn} \equiv p_{mn}^i$, $m = E_L, E_t, E_H$ and $n = E_L, E_H$. Using equations (5.3) and (5.4) we attain

$$V_e(E_I, a_{ist}^U) = \frac{(1-\beta p_{JJ})\,\pi(E_I, a_{ist}^U) + \beta p_{IJ}\pi(E_J, a_{ist}^U)}{(1-\beta p_{HH})(1-\beta p_{LL}) - \beta^2 p_{LH}.p_{HL}}, \qquad I \neq J, \quad I, J \in \{L, H\} \tag{6.1}$$

$$V_w(E_H, a_{ist}^U) = \frac{\beta p_{HL}}{(1-\beta p_{HH})(1-\beta p_{LL}) - \beta^2 p_{LH}.p_{HL}}\pi(E_L, a_{ist}^U) + \\ + \frac{\beta^2 p_{LH}.p_{HL}}{(1-\beta p_{HH})\left[(1-\beta p_{HH})(1-\beta p_{LL}) - \beta^2 p_{LH}.p_{HL}\right]}\pi(E_H, a_{ist}^U) - \frac{\beta p_{HL}}{1-\beta p_{HH}}K \tag{6.2}$$

Using (5.1), (5.2), (6.1) and (6.2), we attain

$$V_e(E_t, a_{ist}^U) = \frac{1}{1-(1-\gamma)\beta}\pi(E_t, a_{ist}^U) + \\ + \frac{\gamma\beta}{1-(1-\gamma)\beta}\frac{1}{(1-\beta p_{HH})(1-\beta p_{LL}) - \beta^2 p_{LH}.p_{HL}}. \\ .\left[\sum_{\substack{I, J \in \{L, H\} \\ I \neq J}} \left\{p_{E_t I}\left[(1-\beta p_{JJ})\,\pi(E_I, a_{ist}^U) + \beta p_{IJ}\pi(E_J, a_{ist}^U)\right]\right\}\right] \tag{6.3}$$

$$V_w(E_t, a_{ist}^U) = \frac{\gamma\beta}{1-(1-\gamma)\beta}\frac{(1-\beta)\,p_{E_tL}+\beta p_{HL}}{(1-\beta p_{HH})(1-\beta p_{LL})-\beta^2 p_{LH}.p_{HL}}.$$
$$\left[\pi(E_L, a_{ist}^U)+\frac{\beta p_{LH}}{1-\beta p_{HH}}\pi(E_H, a_{ist}^U)\right]-$$
$$-\frac{\gamma\beta}{1-(1-\gamma)\beta}\left(p_{E_tL}+\frac{\beta p_{E_tH}p_{HL}}{1-\beta p_{HH}}\right)K \quad (6.4)$$

We then determine the *productivity threshold under uncertainty* a_{ist}^U by applying (6.3) and (6.4) to (5.5).

B. Derivations and proofs

Maximizing profits to reach optimal pricing strategy

$$\frac{\partial_{jiv}^*}{\partial p_{iv}} = 0 \Leftrightarrow \frac{\partial}{\partial p_{iv}}\left(\frac{p_{iv}}{e^{x,i}}-c_j\right)q_{iv} = 0 \Leftrightarrow$$
$$\Leftrightarrow \frac{\partial}{\partial p_{iv}}\left(\frac{p_{iv}}{e^{x,i}}-c_j\right)\frac{\mu_s Y_i}{P_{is}}\left(\frac{p_{iv}}{P_{is}}\right)^{-\sigma_s} = 0 \Leftrightarrow$$
$$\Leftrightarrow \frac{1}{e^{x,i}}\frac{\mu_s Y_i}{P_{is}}\left(\frac{p_{iv}}{P_{is}}\right)^{-\sigma_s} - \sigma_s\left(\frac{p_{iv}}{e^{x,i}}-c_j\right)\frac{\mu_s Y_i}{P_{is}^{1-\sigma_s}}p_{iv}^{-\sigma_s-1} = 0 \Leftrightarrow$$
$$\Leftrightarrow \frac{1-\sigma_s}{e^{x,i}}\frac{\mu_s Y_i}{P_{is}^{1-\sigma_s}}p_{iv}^{-\sigma_s} + \sigma_s c_j\frac{\mu_s Y_i}{P_{is}^{1-\sigma_s}}p_{iv}^{-\sigma_s-1} = 0 \underset{p_{iv}\neq 0}{\Leftrightarrow}$$
$$\underset{p_{iv}\neq 0}{\Leftrightarrow} \frac{1-\sigma_s}{e^{x,i}}p_{iv} = -\sigma_s c_j \Leftrightarrow$$
$$\Leftrightarrow p_{iv} = -\frac{\sigma_s c_j e^{x,i}}{1-\sigma_s} \underset{\rho_s = 1-\frac{1}{\sigma_s}}{\Leftrightarrow} p_{iv}^* = \frac{c_j e^{x,i}}{\rho_s}$$

Optimal profits

$$
{}^{*}_{xjiv} = \left(\frac{p^*_{iv}}{e^{x,i}} - c_j\right) q_{iv} = \left(\frac{c_j}{\rho_s} - c_j\right) \frac{\mu_s Y_i}{P_{is}} \left(\frac{p^*_{iv}}{P_{is}}\right)^{-\sigma_s} =
$$

$$
= \left(\frac{\sigma_s}{\sigma_s - 1} - 1\right) c_j \frac{\mu_s Y_i}{P_{is}} \left(\frac{c_j}{\rho_s}\frac{e^{x,i}}{P_{is}}\right)^{-\sigma_s} =
$$

$$
= \underbrace{\left(\frac{\rho_s^{\sigma_s}}{\sigma_s - 1}\right) \mu_s Y_i (P_{is})^{\sigma_S - 1} c^{1-\sigma_S}}_{\equiv A_{is}} \frac{a_j^{\sigma_s - 1}}{(e^{x,i})^{\sigma_s}}
$$

Deterministic entry threshold

$$
\frac{{}^{*}_{xjis}}{1-\beta} = K_{xi} \Leftrightarrow A_{is}\frac{a_j^{\sigma_s-1}}{(e^{x,i})^{\sigma_s}} = (1-\beta)\, K_{xi} \Leftrightarrow a_j = \left[\frac{(1-\beta)\, K_{xi}}{A_{is}}\right]^{1/\sigma_s - 1} \left(e^{x,i}\right)^{\frac{\sigma_s}{\sigma_s - 1}}
$$

Appreciation-/depreciation-induced entry/exit

$\frac{\partial a^D_{is}}{\partial e^{x,i}} = \frac{\sigma_s}{\sigma_s - 1}\left[\frac{K_{xi}(1-\beta)}{A_{is}}\right]^{1/\sigma_s - 1} (e^{x,i})^{\frac{1}{\sigma_s - 1}} > 0$. Thus, an increase (decrease) in $e^{x,i}$ produces an increase (decrease) in a^D_{is} and a consequent decrease (increase) in the number of firms that export (firms with productivity a_j such that $a_j > a^D_{is}$) - firm exit (entry).

Elasticity of the threshold w.r.t. $e^{x,i}$

$$
\frac{\partial \ln a^D_{is}}{\partial \ln e^{x,i}} = \frac{\partial}{\partial \ln e^{x,i}} \left\{\frac{1}{\sigma_s - 1} \ln\left[\frac{K_{xi}\,(1-\beta)}{A_{is}}\right]\right\} + \frac{\sigma_s}{\sigma_s - 1}\frac{\partial}{\partial \ln e^{x,i}} \ln e^{x,i} = \frac{\sigma_s}{\sigma_s - 1}
$$

Profit loss under E^i_H

$$
1 - \frac{{}_{xjis}(E^i_H)}{{}_{xjis}(E^i_t)} = 1 - \frac{A_{is} a_j^{\sigma_s - 1} (\exp\{E^i_H\})^{-\sigma_s}}{A_{is} a_j^{\sigma_s - 1} (\exp\{E^i_t\})^{-\sigma_s}} = 1 - \frac{(\exp\{E^i_t\})^{\sigma_s}}{(\exp\{E^i_H\})^{\sigma_s}} = 1 - (\exp\{E^i_t - E^i_H\})^{\sigma_s} = 1 - \exp\{\sigma_S\,[E^i_t - E^i_H]\}
$$

Uncertainty impact: $\frac{\partial a_{ist}^{U}}{\partial \gamma} > 0$

$$\frac{\partial a_{ist}^{U}}{\partial \gamma} = \frac{a_{ist}^{D}}{\sigma_s - 1}\frac{\partial}{\partial \gamma}\left[\frac{1 - \beta p_{HH}^{i} + \beta\gamma p_{E_t H}^{i}}{1 - \beta p_{HH}^{i} + \beta\gamma p_{E_t H}^{i}.\exp\left\{\sigma_s\left[E_t^i - E_H^i\right]\right\}}\right] =$$

$$= \frac{a_{ist}^{D}}{\sigma_s - 1}\left[\frac{\beta p_{E_t H}^{i}\left(1 - \beta p_{HH}^{i} + \beta\gamma p_{E_t H}^{i}.\exp\left\{\sigma_s\left[E_t^i - E_H^i\right]\right\}\right)}{\left(1 - \beta p_{HH}^{i} + \beta\gamma p_{E_t H}^{i}.\exp\left\{\sigma_s\left[E_t^i - E_H^i\right]\right\}\right)^2}\right] -$$

$$- \frac{a_{ist}^{D}}{\sigma_s - 1}\left[\frac{\left(1 - \beta p_{HH}^{i} + \beta\gamma p_{E_t H}^{i}\right)\beta p_{E_t H}^{i}.\exp\left\{\sigma_s\left[E_t^i - E_H^i\right]\right\}}{\left(1 - \beta p_{HH}^{i} + \beta\gamma p_{E_t H}^{i}.\exp\left\{\sigma_s\left[E_t^i - E_H^i\right]\right\}\right)^2}\right] =$$

$$= \frac{a_{ist}^{D}}{\sigma_s - 1}\left[\frac{\left(1 - \beta p_{HH}^{i}\right)\beta p_{E_t H}^{i}.\left(1 - \exp\left\{\sigma_s\left[E_t^i - E_H^i\right]\right\}\right)}{\left(1 - \beta p_{HH}^{i} + \beta\gamma p_{E_t H}^{i}.\exp\left\{\sigma_s\left[E_t^i - E_H^i\right]\right\}\right)^2}\right] > 0$$

C. Sub-problem optimality consistency

Below we determine the conditions under which we can consistently focus on the decision strategy assumed in Section 5 for the sub-problem originated by the event $E_{t+1}^i \neq E_t^i$ (exchange rate starts following a discrete Markov process). Note that, for this sub-problem, we assume, in equations (5.2) and (5.4), that a firm waiting in period t shall, in period $t+1$, enter if $E_{t+1}^i = E_L^i$ and wait if $E_{t+1}^i = E_H^i$. Below, we show that, if $E_L^i < E_t^i < E_H^i$ and $\gamma p_{E_t H}^i > p_{LH}^i$, firms to which that strategy is sub-optimal have trivial solutions for the full-problem characterized by equations (5.1)-(5.4) (firms that always enter in the sub-problem will always enter in the full-problem and firms that never enter in the sub-problem never enter in the full-problem). Thus, under those conditions, the only set of firms to which the *productivity threshold under uncertainty* a_{is}^U is relevant is the set of firms to which that sub-problem strategy is optimal.

In this exercise, we follow Dixit (1989), using a slightly different notation[27]. $\tilde{V}_{w(e)}(.)$ and $V_{w(e)}(.)$ shall now denote "the value of a firm that was outside (inside) the export market before the current period started". This value will already be the outcome of the optimal decision between entering and waiting in the current period, whereas in equations (5.1)-(5.4), $\tilde{V}_{w(e)}(.)$ and $V_{w(e)}(.)$ represent the "value of a firm, should it wait (enter) during the current period" - the value of each specific option, instead of the value of the optimal choice. The results are the same to those

[27] See the appendixes of this study, available at
http://www4.ncsu.edu/~jjseater/PDF/Classes/784Dixit_Entry&Exit_Appendices_JPE_Jun1989.pdf

attained through the setup used in (5.1)-(5.4), as shown, for instance, by the full match between the uncertainty threshold obtained in (5.6) and that attained in the very last result of this section. Other notation changes are adopted, for simplicity (e.g. $E^i \equiv E^i_t$ and $p^i_H \equiv p^i_{E_t H}$).

We start by exploring the sub-problem setup and determine the thresholds delimiting the sets of firms that have distinct optimal strategies; afterwards, we move to the full-problem and determine the *productivity threshold under uncertainty* a^U_{is} for each of those types of firms, determining also the conditions under which a^U_{is} becomes irrelevant to the firms that never (always) enter in the sub-problem.

Sub-Problem Setup

The exchange rate can only assume one of two possible values, E^i_L and E^i_H. The transition probabilities are p_{LL}, p_{LH}, p_{HH}, and p_{HL}. There are two state variables, the exchange rate and a discrete variable equal to w when the firm is not exporting and to e when the firm is exporting. Becoming an exporter entails the payment of a sunk cost K_{xi} and a flow of profits $\pi_e\left(a_{is}, E^i_L\right)$ or $\pi_e\left(a_{is}, E^i_H\right)$, where a_{is} is the productivity of the firm. Not exporting implies a flow of profits $\pi_w\left(a_{is}\right)$. The decision problem consists of optimally choosing the trade status; the resulting value functions are $\tilde{V}_w(.)$ and $\tilde{V}_e(.)$. If the firm is not exporting and chooses to start exporting, it acquires the value corresponding to the exporting status (and *vice-versa*). The value function in each status, net of the switching cost, is the terminal payoff function for the other status. Note that, in the absence of per-period costs of exporting: (i) there is no reason to stop exporting once you have started, (ii) the only reason why a firm might not start exporting is that the associated expected profits flow, once the discount rate β has been taken into account, is not sufficient to cover the export sunk entry cost K_{xi}. Note that (ii) bites less for more productive firms.

The intuition is that very productive firms $(a > a^g_{is})$ will prefer to start exporting both at E^i_L and at E^i_H, firms with an intermediate productivity level $\left(a^b_{is} < a < a^g_{is}\right)$ prefer to start exporting at E^i_L but not at E^i_H, and less productive firms $\left(a < a^b_{is}\right)$ will never choose to start exporting. We can define three productivity intervals, described by the two cutoffs a^b_{is} and a^g_{is}, with $a^b_{is} \leq a^g_{is}$. Next, we determine these cutoffs.

The Problem of a Non-exporter

Consider a non-exporting firm with productivity a_{is} and facing the current exchange rate E_L^i. The value of the firm is $\tilde{V}_w(E_L^i, a_{is})$. The firm optimally chooses if to become an exporter or not as follows. If the firm enters into the export market its value switches to $\tilde{V}_e(E_L^i, a_{is})$ but the firm has to pay K_{xi}. Alternatively, the firm could stay out of the export market for one more period, get π_{wxis} in the current period, and start the new period with the exchange rate E_H^i with probability p_{LH} or E_L^i with probability p_{LL}. The expected continuation value is

$$E\left[\tilde{V}_w(E_L^i + dE_L^i, a_{is})\right] = p_{LL}^i \tilde{V}_w(E_L^i, a_{is}) + p_{LH}^i \tilde{V}_w(E_H^i, a_{is}).$$

By Bellman's Principle of Optimality, $\tilde{V}_w(E_L^i, a_{is})$ must be the better of the two alternatives, that is,

$$\tilde{V}_w(E_L^i, a_{is}) = max\left\{\tilde{V}_e(E_L^i, a_{is}) - K_{xi}, \pi_{wxis}(a_{is}) + \beta\left[p_{LL}^i \tilde{V}_w(E_L^i, a_{is}) + p_{LH}^i \tilde{V}_w(E_H^i, a_{is})\right]\right\}.$$

Following similar steps, the Bellman equation when the current exchange rate is E_H^i is,

$$\tilde{V}_w(E_H^i, a_{is}) = max\left\{\tilde{V}_e(E_H^i, a_{is}) - K_{xi}, \pi_{wxis}(a_{is}) + \beta\left[p_{HL}^i \tilde{V}_w(E_L^i, a_{is}) + p_{HH}^i \tilde{V}_w(E_H^i, a_{is})\right]\right\}.$$

Such equations produce the following conditions.

1. $\forall a_{is} \leq a_{is}^b$

$$\tilde{V}_w(E_L^i, a_{is}) = \pi_{wxis}(a_{is}) + \beta\left[p_{LL}^i \tilde{V}_w(E_L^i, a_{is}) + p_{LH}^i \tilde{V}_w(E_H^i, a_{is})\right] \quad (6.5)$$

$$\tilde{V}_w(E_H^i, a_{is}) = \pi_{wxis}(a_{is}) + \beta\left[p_{HL}^i \tilde{V}_w(E_L^i, a_{is}) + p_{HH}^i \tilde{V}_w(E_H^i, a_{is})\right] \quad (6.6)$$

$$\tilde{V}_w(E_L^i, a_{is}) \geq \tilde{V}_e(E_L^i, a_{is}) - K_{xi}$$

$$\tilde{V}_w(E_H^i, a_{is}) \geq \tilde{V}_e(E_H^i, a_{is}) - K_{xi}$$

2. $\forall a_{is} \geq a_{is}^{g}$

$$\tilde{V}_w(E_L^i, a_{is}) = \tilde{V}_e(E_L^i, a_{is}) - K_{xi}$$

$$\tilde{V}_w(E_H^i, a_{is}) = \tilde{V}_e(E_H^i, a_{is}) - K_{xi} \tag{6.7}$$

$$\tilde{V}_w(E_L^i, a_{is}) \geq \pi_{wxis}(a_{is}) + \beta \left[p_{LL}^i \tilde{V}_w(E_L^i, a_{is}) + p_{LH}^i \tilde{V}_w(E_H^i, a_{is}) \right]$$

$$\tilde{V}_w(E_H^i, a_{is}) \geq \pi_{wxis}(a_{is}) + \beta \left[p_{HL}^i \tilde{V}_w(E_L^i, a_{is}) + p_{HH}^i \tilde{V}_w(E_H^i, a_{is}) \right]$$

3. $\forall a_{is} \in \left(a_{is}^{b}, a_{is}^{g}\right)$

$$\tilde{V}_w(E_L^i, a_{is}) = \tilde{V}_e(E_L^i, a_{is}) - K_{xi} \tag{6.8}$$

$$\tilde{V}_w(E_H^i, a_{is}) = \pi_{wxis}(a_{is}) + \beta \left[p_{HL}^i \tilde{V}_w(E_L^i, a_{is}) + p_{HH}^i \tilde{V}_w(E_H^i, a_{is}) \right] \tag{6.9}$$

$$\tilde{V}_w(E_L^i, a_{is}) \geq \pi_{wxis}(a_{is}) + \beta \left[p_{LL}^i \tilde{V}_w(E_L^i, a_{is}) + p_{LH}^i \tilde{V}_w(E_H^i, a_{is}) \right]$$

$$\tilde{V}_w(E_H^i, a_{is}) \geq \tilde{V}_e(E_H^i, a_{is}) - K_{xi}$$

The Problem of an Exporter

In the case of an exporting firm we do not need to distinguish between the three cases above. Consider an exporting firm with productivity a_{is} when the current exchange rate is E_L^i. The value of the firm is $\tilde{V}_e(E_L^i, a_{is})$. The firm has no reason to choose to stop exporting. Its value is equal to the cash flow from selling in the domestic and foreign markets plus the expected continuation value, i.e.

$$\tilde{V}_e(E_L^i, a_{is}) = \pi_{wxis}(a_{is}) + \pi_{exis}\left(a_{is}, E_L^i\right) + \beta \left[p_{LL}^i \tilde{V}_e(E_L^i, a_{is}) + p_{LH}^i \tilde{V}_e(E_H^i, a_{is}) \right], \tag{6.10}$$

and

$$\tilde{V}_e(E_L^i, a_{is}) \geq \tilde{V}_w(E_L^i, a_{is}).$$

If the current exchange rate is E_H^i instead,

$$\tilde{V}_e(E_H^i, a_{is}) = \pi_{wxis}(a_{is}) + \pi_{exis}\left(a_{is}, E_H^i\right) + \beta \left[p_{HL}^i \tilde{V}_e(E_L^i, a_{is}) + p_{HH}^i \tilde{V}_e(E_H^i, a_{is}) \right], \tag{6.11}$$

and

$$\tilde{V}_e(E_H^i, a_{is}) \geq \tilde{V}_w(E_H^i, a_{is}).$$

Solution

The goal is to solve for the two cutoff values a_{is}^b and a_{is}^g.

First, consider the two equalities (6.5) and (6.6) in the $\left(-\infty, a_{is}^b\right)$ region. We can use them to solve for $\tilde{V}_w(E_L^i, a_{is})$ and $\tilde{V}_w(E_H^i, a_{is})$.

$$\tilde{V}_w(E_L^i, a_{is}) = \frac{\pi_{wxis}\left(a_{is}\right)}{1-\beta p_{LL}^i} + \beta \frac{p_{LH}^i}{1-\beta p_{LL}^i} \tilde{V}_w(E_H^i, a_{is})$$

$$\tilde{V}_w(E_H^i, a_{is}) = \frac{\pi_{wxis}\left(a_{is}\right)}{1-\beta p_{HH}^i} + \beta \frac{p_{HL}^i}{1-\beta p_{HH}^i} \tilde{V}_w(E_L^i, a_{is})$$

$$\tilde{V}_w(E_L^i, a_{is}) = \nu^i \left[\frac{\pi_{wxis}\left(a_{is}\right)}{1-\beta p_{LL}^i} + \beta \frac{p_{LH}^i}{\left(1-\beta p_{LL}^i\right)\left(1-\beta p_{HH}^i\right)} \pi_{wxis}\left(a_{is}\right)\right]$$

$$\tilde{V}_w(E_H^i, a_{is}) = \nu^i \left[\frac{\pi_{wxis}\left(a_{is}\right)}{1-\beta p_{HH}^i} + \beta \frac{p_{HL}^i}{\left(1-\beta p_{LL}^i\right)\left(1-\beta p_{HH}^i\right)} \pi_{wxis}\left(a_{is}\right)\right]$$

where $\nu^i = \left(1-\beta^2 p_{LH}^i p_{HL}^i / \left[\left(1-\beta p_{LL}^i\right)\left(1-\beta p_{HH}^i\right)\right]\right)^{-1}$.

Similarly, consider the two equalities (6.10) and (6.11) in the whole support $(-\infty, +\infty)$. We can use them to solve for $\tilde{V}_e(E_L^i, a_{is})$ and $\tilde{V}_e(E_H^i, a_{is})$.

$$\tilde{V}_e(E_L^i, a_{is}) = \frac{\pi_{wxis}\left(a_{is}\right) + \pi_{exis}\left(a_{is}, E_L^i\right)}{1-\beta p_{LL}^i} + \beta \frac{p_{LH}^i}{1-\beta p_{LL}^i} \tilde{V}_e(E_H^i, a_{is})$$

$$\tilde{V}_e(E_H^i, a_{is}) = \frac{\pi_{wxis}\left(a_{is}\right) + \pi_{exis}\left(a_{is}, E_H^i\right)}{1-\beta p_{HH}^i} + \beta \frac{p_{HL}^i}{1-\beta p_{HH}^i} \tilde{V}_e(E_L^i, a_{is})$$

$$\tilde{V}_e(E_L^i, a_{is}) = \nu^i \left[\frac{\left(1-\beta p_{HH}^i\right) + \beta\left(1-p_{LL}^i\right)}{\left(1-\beta p_{LL}^i\right)\left(1-\beta p_{HH}^i\right)} \pi_{wxis}\left(a_{is}\right) + \frac{\pi_{exis}\left(a_{is}, E_L^i\right)}{1-\beta p_{LL}^i} + \frac{\beta p_{LH}^i \pi_{exis}\left(a_{is}, E_H^i\right)}{\left(1-\beta p_{LL}^i\right)\left(1-\beta p_{HH}^i\right)}\right] \tag{6.12}$$

$$\tilde{V}_e(E_H^i, a_{is}) = \nu^i \left[\frac{\left(1-\beta p_{LL}^i\right) + \beta\left(1-p_{HH}^i\right)}{\left(1-\beta p_{LL}^i\right)\left(1-\beta p_{HH}^i\right)} \pi_{wxis}\left(a_{is}\right) + \frac{\pi_{exis}\left(a_{is}, E_H^i\right)}{1-\beta p_{HH}^i} + \frac{\beta p_{HL}^i \pi_{exis}\left(a_{is}, E_L^i\right)}{\left(1-\beta p_{LL}^i\right)\left(1-\beta p_{HH}^i\right)}\right]. \tag{6.13}$$

We shall now solve for a_{is}^b. Using the expressions above for $\tilde{V}_w(E_L^i, a_{is})$ and $\tilde{V}_e(E_L^i, a_{is})$ and equation (6.8) evaluated at the a^b_{is} cutoff, we can solve for a^b_{is},

$$\tilde{V}_w(E^i_L, a^b_{is}) = \tilde{V}_e(E^i_L, a^b_{is}) - K_{xi}$$

$$\nu^i \left[\frac{\pi_{wxis}\left(a^b_{is}\right)}{1-\beta p^i_{LL}} + \beta \frac{p^i_{LH}}{(1-\beta p^i_{LL})(1-\beta p^i_{HH})} \pi_{wxis}\left(a^b_{is}\right) \right] =$$

$$= \nu^i \left[\frac{(1-\beta p^i_{HH}) + \beta(1-p^i_{LL})}{(1-\beta p^i_{LL})(1-\beta p^i_{HH})} \pi_{wxis}\left(a^b_{is}\right) + \frac{\pi_{exis}\left(a^b_{is}, E^i_L\right)}{1-\beta p^i_{LL}} + \frac{\beta p^i_{LH} \pi_{exis}\left(a^b_{is}, E^i_H\right)}{(1-\beta p^i_{LL})(1-\beta p^i_{HH})} \right] - K_{xi}$$

$$\pi_{wxis}\left(a^b_{is}\right) + \beta \frac{p^i_{LH}}{(1-\beta p^i_{HH})} \pi_{wxis}\left(a^b_{is}\right) =$$

$$= \frac{(1-\beta p^i_{HH}) + \beta(1-p^i_{LL})}{(1-\beta p^i_{HH})} \pi_{wxis}\left(a^b_{is}\right) + \pi_{exis}\left(a^b_{is}, E^i_L\right) + \frac{\beta p^i_{LH} \pi_{exis}\left(a^b_{is}, E^i_H\right)}{(1-\beta p^i_{HH})} - \left(1-\beta p^i_{LL}\right) \frac{K_{xi}}{\nu^i}$$

$$\pi_{exis}\left(a^b_{is}, E^i_L\right) + \frac{\beta p^i_{LH}}{(1-\beta p^i_{HH})} \pi_{exis}\left(a^b_{is}, E^i_H\right) = \left(1-\beta p^i_{LL}\right) \frac{K_{xi}}{\nu^i}$$

$$A_{is} \frac{\left(a^b_{is}\right)^{\sigma_s - 1}}{\left(e^{x,i}_L\right)^{\sigma_s}} + \frac{\beta p^i_{LH}}{(1-\beta p^i_{HH})} A_{is} \frac{\left(a^b_{is}\right)^{\sigma_s - 1}}{\left(e^{x,i}_H\right)^{\sigma_s}} = \left(1-\beta p^i_{LL}\right) \frac{K_{xi}}{\nu^i}$$

$$a^b_{is} = \left(1-\beta p^i_{LL}\right)^{\frac{1}{\sigma_s-1}} \left[\frac{1}{\left(e^{x,i}_L\right)^{\sigma_s}} + \frac{\beta p^i_{LH}}{(1-\beta p^i_{HH})\left(e^{x,i}_H\right)^{\sigma_s}} \right]^{-\frac{1}{\sigma_s-1}} \left(\frac{K_{xi}}{A_{is}\nu^i} \right)^{\frac{1}{\sigma_s-1}} \Leftrightarrow$$

$$\Leftrightarrow a^b_{is} = \left(\left[\left(1-\beta p^i_{LL}\right)\left(1-\beta p^i_{HH}\right) - \beta^2 p^i_{LH} p^i_{HL} \right] \frac{K_{xi}}{A_{is}} \right)^{\frac{1}{\sigma_s-1}} \left[\frac{1-\beta p^i_{HH}}{\exp\left\{\sigma_s E^i_L\right\}} + \frac{\beta p^i_{LH}}{\exp\left\{\sigma_s E^i_H\right\}} \right]^{-\frac{1}{\sigma_s-1}}$$

Similarly, we now solve for the a^g_{is} cutoff. First, though, we need to find an expression for $\tilde{V}_w(E^i_H, a_{is})$ valid at a^g_{is}. We can use (6.8), (6.9), and (6.12)

$$\tilde{V}_w(E_H^i, a_{is}) = \frac{\pi_{wxis}(a_{is})}{1-\beta p_{HH}^i} + \frac{\beta}{1-\beta p_{HH}^i} p_{HL}^i \tilde{V}_w(E_L^i, a_{is})$$

$$\tilde{V}_w(E_H^i, a_{is}) = \frac{\pi_{wxis}(a_{is})}{1-\beta p_{HH}^i} + \frac{\beta}{1-\beta p_{HH}^i} p_{HL}^i \left[\tilde{V}_e(E_L^i, a_{is}) - K_{xi}\right]$$

$$\tilde{V}_w(E_H^i, a_{is}) = \frac{\pi_{wxis}(a_{is})}{1-\beta p_{HH}^i}$$

$$+\frac{\beta}{1-\beta p_{HH}^i} p_{HL}^i \left\{\nu^i \left[\frac{(1-\beta p_{HH}^i) + \beta(1-p_{LL}^i)}{(1-\beta p_{LL}^i)(1-\beta p_{HH}^i)} \pi_{wxis}(a_{is})\right]\right\} +$$

$$+\frac{\beta}{1-\beta p_{HH}^i} p_{HL}^i \left\{\nu^i \left[\frac{\pi_{exis}(a_{is}, E_L^i)}{1-\beta p_{LL}^i} + \frac{\beta p_{LH}^i \pi_{exis}(a_{is}, E_H^i)}{(1-\beta p_{LL}^i)(1-\beta p_{HH}^i)}\right] - K_{xi}\right\}$$

Now, using the expression above for $\tilde{V}_e(E_H^i, a_{is})$ and equation (6.7) evaluated at the a_{is}^g cutoff, we can solve for a_{is}^g,

$$\frac{\pi_{wxis}(a_{is}^g)}{1-\beta p_{HH}^i} +$$

$$+\frac{\beta}{1-\beta p_{HH}^i} p_{HL}^i \left\{\nu^i \left[\frac{(1-\beta p_{HH}^i) + \beta(1-p_{LL}^i)}{(1-\beta p_{LL}^i)(1-\beta p_{HH}^i)} \pi_{wxis}(a_{is}^g)\right]\right\} +$$

$$+\frac{\beta}{1-\beta p_{HH}^i} p_{HL}^i \left\{\nu^i \left[\frac{\pi_{exis}(a_{is}^g, E_L^i)}{1-\beta p_{LL}^i} + \frac{\beta p_{LH}^i \pi_{exis}(a_{is}^g, E_H^i)}{(1-\beta p_{LL}^i)(1-\beta p_{HH}^i)}\right] - K_{xi}\right\} =$$

$$= \nu^i \left[\frac{(1-\beta p_{LL}^i) + \beta(1-p_{HH}^i)}{(1-\beta p_{LL}^i)(1-\beta p_{HH}^i)} \pi_{wxis}(a_{is}^g) + \frac{\pi_{exis}(a_{is}^g, E_H^i)}{1-\beta p_{HH}^i} + \frac{\beta p_{HL}^i \pi_{exis}(a_{is}^g, E_L^i)}{(1-\beta p_{LL}^i)(1-\beta p_{HH}^i)}\right] - K_{xi}$$

$$\left[\frac{1}{\nu^i} + \frac{\beta p_{HL}^i (1-\beta p_{HH}^i) + \beta\beta p_{HL}^i (1-p_{LL}^i)}{(1-\beta p_{LL}^i)(1-\beta p_{HH}^i)}\right] \pi_{wxis}(a_{is}^g) +$$

$$+\frac{\beta p_{HL}^i \pi_{exis}(a_{is}^g, E_L^i)}{1-\beta p_{LL}^i} + \frac{\beta p_{HL}^i \beta p_{LH}^i \pi_{exis}(a_{is}^g, E_H^i)}{(1-\beta p_{LL}^i)(1-\beta p_{HH}^i)} - \beta p_{HL}^i \frac{K_{xi}}{\nu^i} =$$

$$= \frac{(1-\beta p_{LL}^i) + \beta(1-p_{HH}^i)}{(1-\beta p_{LL}^i)} \pi_{wxis}(a_{is}^g) + \pi_{exis}\left(a_{is}^g, E_H^i\right) + \frac{\beta p_{HL}^i \pi_{exis}(a_{is}^g, E_L^i)}{(1-\beta p_{LL}^i)} - \left(1-\beta p_{HH}^i\right) \frac{K_{xi}}{\nu^i}$$

$$\frac{\beta p_{HL}^i \pi_{exis}(a_{is}^g, E_L^i)}{1-\beta p_{LL}^i} + \frac{\beta p_{HL}^i \beta p_{LH}^i \pi_{exis}(a_{is}^g, E_H^i)}{(1-\beta p_{LL}^i)(1-\beta p_{HH}^i)} - \beta p_{HL}^i \frac{K_{xi}}{\nu^i} =$$

$$= \pi_{exis}\left(a_{is}^g, E_H^i\right) + \frac{\beta p_{HL}^i \pi_{exis}(a_{is}^g, E_L^i)}{(1-\beta p_{LL}^i)} - \left(1-\beta p_{HH}^i\right) \frac{K_{xi}}{\nu^i}$$

$$\left[1 - \frac{\beta p_{HL}^i \beta p_{LH}^i}{(1-\beta p_{LL}^i)(1-\beta p_{HH}^i)}\right] \pi_{exis}\left(a_{is}^g, E_H^i\right) = (1-\beta) \frac{K_{xi}}{\nu^i}$$

$$\pi_{exis}\left(a_{is}^{g},E_{H}^{i}\right)=\left(1-\beta\right)K_{xi},$$

since

$$\nu^{i}=\left(1-\frac{\beta^{2}\left(1-p_{LL}^{i}\right)\left(1-p_{HH}^{i}\right)}{\left(1-\beta p_{LL}^{i}\right)\left(1-\beta p_{HH}^{i}\right)}\right)^{-1}.$$

Finally, using the profit function,

$$\pi_{exis}\left(a_{is},E^{i}\right)=A_{is}\frac{\left(a_{is}\right)^{\sigma_{s}-1}}{\left(e^{x,i}\right)^{\sigma_{s}}}.$$

we have

$$a_{is}^{g}=\left[\left(1-\beta\right)\frac{K_{xi}}{A_{is}}\left(e_{H}^{x,i}\right)^{\sigma_{s}}\right]^{\frac{1}{\sigma_{s}-1}}$$

where $e_{H}^{x,i}=\exp E_{H}^{i}$ and $A_{is}\equiv\left(\frac{\rho_{s}^{\sigma_{s}}}{\sigma_{s}-1}\right)\mu_{s}Y_{i}(P_{is})^{\sigma_{S}-1}c^{1-\sigma_{S}}$.

Full Problem

We can now solve the full problem. The current exchange rate is E^{i}. The exchange rate in the next period changes with probability γ. If it changes, it becomes E_{L}^{i} with probability p_{L}^{i} and E_{H}^{i} with probability p_{H}^{i}. After that, it evolves according to the transition matrix defined previously. Just like above, an exporter has no incentive to stop exporting, while a non-exporter will start exporting only if it expects to be able to cover the sunk cost K_{xi}. This is more likely the more productive the firm is.

The intuition is that there will be a productivity cutoff above which a firm decides to start exporting. This cutoff is a function of several parameters, including the size of the sunk cost, the current exchange rate, the probability of switching to the sub-problem, and the sub-problem cutoffs. We can define two productivity intervals, described by the cutoff a_{is}^{U}.

The Problem of a Non-exporter

Let's consider a non-exporting firm with productivity a_{is}. The value of the firm is $V_{w}(E^{i},a_{is})$.[28] The firm optimally chooses if to become an exporter or not as follows. If the firm enters into the

[28]Note the difference in notation: the value of the firm is $V_{w}(E^{i},a_{is})$ and not $\tilde{V}_{w}(E^{i},a_{is})$.

export market its value switches to $V_e(E^i, a_{is})$ but the firm has to pay K_{xi}. Alternatively, the firm could stay out of the export market for one more period, when the exchange rate will have changed to E^i_L with probability γp^i_L or to E^i_H with probability γp^i_H or stayed the same with probability $1-\gamma$. The payoff from this strategy is the sum of domestic flow profits $\pi_{wxis}(a_{is})$ in the current period and the expected continuation value,

$$E\left[V_w(E^i + dE^i, a_{is})\right] = \gamma p^i_L \tilde{V}_w(E^i_L, a_{is}) + \gamma p^i_H \tilde{V}_w(E^i_H, a_{is}) + (1-\gamma)\, V_w(E^i, a_{is})$$

By Bellman's Principle of Optimality, $V_w(E^i, a_{is})$ must be the better of the two alternatives, that is,

$$\begin{aligned} &V_w(E^i, a_{is}) = \\ &= max\left\{V_e(E^i, a_{is}) - K_{xi}, \pi_{wxis}(a_{is}) + \beta\left[\gamma p^i_L \tilde{V}_w(E^i_L, a_{is}) + \gamma p^i_H \tilde{V}_w(E^i_H, a_{is}) + (1-\gamma)\, V_w(E^i, a_{is})\right]\right\} \end{aligned}$$

The intuition is that there is a productivity cutoff value, a^U_{is}, above which the firm prefers to export. This gives the following conditions.

- At all productivity levels at which it is optimal to stay as a non exporter, i.e. $\forall a_{is} \leq a^U_{is}$, two conditions apply. First, we have the Bellman equation

  $$\beta^{-1} V_w(E^i, a_{is}) = \beta^{-1}\pi_{wxis}(a_{is}) + \gamma p^i_L \tilde{V}_w(E^i_L, a_{is}) + \gamma p^i_H \tilde{V}_w(E^i_H, a_{is}) + (1-\gamma)\, V_w(E^i, a_{is}). \tag{6.14}$$

  The Bellman equation (6.14) makes it clear that the entitlement to the continuation value is an asset, and that $V_w(E^i, a_{is})$ is its value. On the left-hand side we have the normal return per period of time that a decision maker (i.e. the firm's owner), using β as the discount rate, would require for holding this asset. On the right-hand side, there is the expected rate of capital gain (or loss), i.e. the expected total return per unit time from holding the asset. The equality becomes a no-arbitrage or equilibrium condition, expressing the investors willingness to hold the asset, i.e. the willingness to stay as a non exporter. The second condition is the inequality

$$V_w(E^i, a_{is}) \geq V_e(E^i, a_{is}) - K_{xi},$$

which implies that the second term in (6.14) is larger than the first one.

- Similarly, at all a_{is} where switching to export is optimal, i.e. $\forall a_{is} \geq a_{is}^U$, we have two conditions. First, the inequality

$$\beta^{-1} V_w(E^i, a_{is}) \geq \beta^{-1} \pi_{wxis}(a_{is}) + \gamma p_L^i \tilde{V}_w(E_L^i, a_{is}) + \gamma p_H^i \tilde{V}_w(E_H^i, a_{is}) + (1-\gamma) V_w(E^i, a_{is}),$$

which shows that, using again the no-arbitrage interpretation introduced above, the normal return per period of time required for holding the "non-exporting" asset is higher than its expected total return. Therefore, an investor would prefer not to hold the asset anymore, i.e. to pay the cost K_{xi}, exercise the option right, and receive in return a new asset (i.e. "being an exporter") whose value is $V_e(E^i, a_{is})$. The second condition (often called "the value-matching condition") implies that, over the range $(a_{is}^U, +\infty)$, the first term in (6.14) is the largest one,

$$V_w(E^i, a_{is}) = V_e(E^i, a_{is}) - K_{xi}. \tag{6.15}$$

The Problem of an Exporter

Consider an exporting firm with productivity a_{is} when the current exchange rate is E^i. The value of the firm is $V_e(E^i, a_{is})$. The firm has no reason to choose to stop exporting. Its value is equal to the cash flow from selling in the foreign market plus the expected continuation value, i.e.

$$V_e(E^i, a_{is}) = \pi_{wxis}(a_{is}) + \pi_{exis}\left(a_{is}, E^i\right) + \beta \left[(1-\gamma) V_e(E^i, a_{is}) + \gamma p_L^i \tilde{V}_e(E_L^i, a_{is}) + \gamma p_H^i \tilde{V}_e(E_H^i, a_{is})\right], \tag{6.16}$$

and

$$V_e(E^i, a_{is}) \geq V_w(E^i, a_{is}).$$

Using (6.14) and (6.16) we can solve for $V_w(E^i, a_{is})$ and $V_e(E^i, a_{is})$, respectively, has a function of the $\tilde{V(.)}$s found in the sub-problem.

$$V_w(E^i,a_{is}) = \frac{\pi_{wxis}(a_{is})}{1-\beta(1-\gamma)} + \frac{\beta}{1-\beta(1-\gamma)}\left[\gamma p_L^i \tilde{V}_w(E_L^i,a_{is}) + \gamma p_H^i \tilde{V}_w(E_H^i,a_{is})\right]$$

$$V_e(E^i,a_{is}) = \frac{\pi_{wxis}(a_{is}) + \pi_{exis}(a_{is},E^i)}{1-\beta(1-\gamma)} + \frac{\beta}{1-\beta(1-\gamma)}\left[\gamma p_L^i \tilde{V}_e(E_L^i,a_{is}) + \gamma p_H^i \tilde{V}_e(E_H^i,a_{is})\right].$$

Note that the expected continuation value for a non exporter assumes a different form according to the firm's current productivity level. In particular, we have to distinguish three cases on the basis of the productivity cutoffs, a_{is}^b and a_{is}^g, found in the sub-problem.

$$V_w(E^i,a_{is}) = \begin{cases} \frac{\pi_{wxis}(a_{is})}{1-\beta(1-\gamma)} + \frac{\beta}{1-\beta(1-\gamma)}\left[\gamma p_L^i \tilde{V}_w(E_L^i,a_{is}) + \gamma p_H^i \tilde{V}_w(E_H^i,a_{is})\right], \forall a_{is} \leq a_{is}^b \\ \frac{\pi_{wxis}(a_{is})}{1-\beta(1-\gamma)} + \frac{\beta}{1-\beta(1-\gamma)}\left\{\gamma p_L^i \left[\tilde{V}_e(E_L^i,a_{is}) - K_{xi}\right] + \gamma p_H^i \left[\tilde{V}_e(E_H^i,a_{is}) - K_{xi}\right]\right\}, \forall a_{is} \geq a_{is}^g \\ \frac{\pi_{wxis}(a_{is})}{1-\beta(1-\gamma)} + \frac{\beta}{1-\beta(1-\gamma)}\left\{\gamma p_L^i \left[\tilde{V}_e(E_L^i,a_{is}) - K_{xi}\right] + \gamma p_H^i \tilde{V}_w(E_H^i,a_{is})\right\}, \forall a_{is} \in \left(a_{is}^b, a_{is}^g\right) \end{cases}$$

We can then use equation (6.15), evaluated at a_{is}^U, to solve for a_{is}^U.

$$\frac{\pi_{wxis}(a_{is}^U)}{1-\beta(1-\gamma)} + \frac{\beta}{1-\beta(1-\gamma)}\left[\gamma p_L^i \tilde{V}_w(E_L^i,a_{is}^U) + \gamma p_H^i \tilde{V}_w(E_H^i,a_{is}^U)\right] =$$

$$= \frac{\pi_{wxis}\left(a_{is}^U\right) + \pi_{exis}\left(a_{is}^U,E^i\right)}{1-\beta(1-\gamma)} + \frac{\beta}{1-\beta(1-\gamma)}\left[\gamma p_L^i \tilde{V}_e(E_L^i,a_{is}^U) + \gamma p_H^i \tilde{V}_e(E_H^i,a_{is}^U)\right] - K_{xi}$$

Again, there are three different cases we should consider according to where a_{is}^U stands with respect to a_{is}^b and a_{is}^g. Of course, at this point we do not know which case is valid. We are going to solve for a_{is}^U in each case and check if the value of a_{is}^U that we find belongs to the assumed region of the productivity space.

Case 1: $a_{is}^U \leq a_{is}^b$ Here, we have

$$V_w(E^i,a_{is}) = \frac{\pi_{wxis}(a_{is})}{1-\beta(1-\gamma)} + \frac{\beta}{1-\beta(1-\gamma)}\left[\gamma p_L^i \tilde{V}_w(E_L^i,a_{is}) + \gamma p_H^i \tilde{V}_w(E_H^i,a_{is})\right] \tag{6.17}$$

and

$$V_e(E^i, a_{is}) = \frac{\pi_{wxis}\left(a_{is}\right) + \pi_{exis}\left(a_{is}, E^i\right)}{1-\beta\left(1-\gamma\right)} + \frac{\beta}{1-\beta\left(1-\gamma\right)}\left[\gamma p_L^i \tilde{V}_e(E_L^i, a_{is}) + \gamma p_H^i \tilde{V}_e(E_H^i, a_{is})\right].$$
(6.18)

Recall that, in the region $a_{is} < a_{is}^b$,

$$\tilde{V}_w(E_L^i, a_{is}) = \nu^i \left[\frac{\pi_{wxis}\left(a_{is}\right)}{1-\beta p_{LL}^i} + \beta \frac{p_{LH}^i}{\left(1-\beta p_{LL}^i\right)\left(1-\beta p_{HH}^i\right)} \pi_{wxis}\left(a_{is}\right)\right]$$

$$\tilde{V}_w(E_H^i, a_{is}) = \nu^i \left[\frac{\pi_{wxis}\left(a_{is}\right)}{1-\beta p_{HH}^i} + \beta \frac{p_{HL}^i}{\left(1-\beta p_{LL}^i\right)\left(1-\beta p_{HH}^i\right)} \pi_{wxis}\left(a_{is}\right)\right].$$

Using the two equations above as well as (6.12) and (6.13), we can rewrite (6.17)

$$\begin{aligned} V_w(E^i, a_{is}) = & \frac{\pi_{wxis}(a_{is})}{1-\beta\left(1-\gamma\right)} + \\ & + \frac{\beta}{1-\beta\left(1-\gamma\right)} \gamma p_L^i \nu^i \left[\frac{\pi_{wxis}\left(a_{is}\right)}{1-\beta p_{LL}^i} + \beta \frac{p_{LH}^i}{\left(1-\beta p_{LL}^i\right)\left(1-\beta p_{HH}^i\right)} \pi_{wxis}\left(a_{is}\right)\right] + \\ & + \frac{\beta}{1-\beta\left(1-\gamma\right)} \gamma p_H^i \nu^i \left[\frac{\pi_{wxis}\left(a_{is}\right)}{1-\beta p_{HH}^i} + \beta \frac{p_{HL}^i}{\left(1-\beta p_{LL}^i\right)\left(1-\beta p_{HH}^i\right)} \pi_{wxis}\left(a_{is}\right)\right] \Leftrightarrow \\ \Leftrightarrow V_w(E^i, a_{is}) = & \left[1 + \beta\gamma\nu^i \left(\frac{p_L^i}{1-\beta p_{LL}^i} + \frac{p_H^i}{1-\beta p_{HH}^i} + \beta \frac{p_L^i p_{LH}^i + p_H^i p_{HL}^i}{\left(1-\beta p_{LL}^i\right)\left(1-\beta p_{HH}^i\right)}\right)\right] \frac{\pi_{wxis}(a_{is})}{1-\beta\left(1-\gamma\right)} \end{aligned}$$

and (6.18)

$$
\begin{aligned}
V_e(E^i, a_{is}) = & \frac{\pi_{wxis}\left(a_{is}\right) + \pi_{exis}\left(a_{is}, E^i\right)}{1 - \beta\left(1-\gamma\right)} + \\
& + \frac{\beta}{1-\beta\left(1-\gamma\right)}\gamma p_L^i \left[\nu^i \left(\frac{\left(1-\beta p_{HH}^i\right) + \beta\left(1-p_{LL}^i\right)}{\left(1-\beta p_{LL}^i\right)\left(1-\beta p_{HH}^i\right)}\pi_{wxis}\left(a_{is}\right)\right)\right] + \\
& + \frac{\beta}{1-\beta\left(1-\gamma\right)}\gamma p_L^i \left[\nu^i \left(\frac{\pi_{exis}\left(a_{is}, E_L^i\right)}{1-\beta p_{LL}^i} + \frac{\beta p_{LH}^i \pi_{exis}\left(a_{is}, E_H^i\right)}{\left(1-\beta p_{LL}^i\right)\left(1-\beta p_{HH}^i\right)}\right)\right] + \\
& + \frac{\beta}{1-\beta\left(1-\gamma\right)}\gamma p_H^i \left[\nu^i \left(\frac{\left(1-\beta p_{LL}^i\right) + \beta\left(1-p_{HH}^i\right)}{\left(1-\beta p_{LL}^i\right)\left(1-\beta p_{HH}^i\right)}\pi_{wxis}\left(a_{is}\right)\right)\right] + \\
& + \frac{\beta}{1-\beta\left(1-\gamma\right)}\gamma p_H^i \left[\nu^i \left(\frac{\pi_{exis}\left(a_{is}, E_H^i\right)}{1-\beta p_{HH}^i} + \frac{\beta p_{HL}^i \pi_{exis}\left(a_{is}, E_L^i\right)}{\left(1-\beta p_{LL}^i\right)\left(1-\beta p_{HH}^i\right)}\right)\right] \Leftrightarrow \\
\Leftrightarrow V_e(E^i, a_{is}) = & \left[1 + \beta\gamma\nu^i \left(\frac{p_L^i}{1-\beta p_{LL}^i} + \frac{p_H^i}{1-\beta p_{HH}^i} + \beta\frac{p_L^i p_{LH}^i + p_H^i p_{HL}^i}{\left(1-\beta p_{LL}^i\right)\left(1-\beta p_{HH}^i\right)}\right)\right]\frac{\pi_{wxis}(a_{is})}{1-\beta\left(1-\gamma\right)} + \\
& + \frac{\pi_{exis}\left(a_{is}, E^i\right)}{1-\beta\left(1-\gamma\right)} + \frac{\beta\gamma\nu^i}{1-\beta\left(1-\gamma\right)}\left[\left(\frac{p_L^i}{1-\beta p_{LL}^i} + \frac{\beta p_H^i p_{HL}^i}{\left(1-\beta p_{LL}^i\right)\left(1-\beta p_{HH}^i\right)}\right)\pi_{exis}\left(a_{is}, E_L^i\right)\right] + \\
& + \frac{\beta\gamma\nu^i}{1-\beta\left(1-\gamma\right)}\left[\left(\frac{p_H^i}{1-\beta p_{HH}^i} + \frac{\beta p_L^i p_{LH}^i}{\left(1-\beta p_{LL}^i\right)\left(1-\beta p_{HH}^i\right)}\right)\pi_{exis}\left(a_{is}, E_H^i\right)\right].
\end{aligned}
$$

Determining a_{is}^U for Case 1

$$V_w(E^i, a_{is}^U) = V_e(E^i, a_{is}^U) - K_{xi} \Leftrightarrow$$

$$\Leftrightarrow K_{xi} = \frac{\pi_{exis}\left(a_{is}^U, E^i\right)}{1-\beta\left(1-\gamma\right)} + \frac{\beta\gamma\nu^i}{1-\beta\left(1-\gamma\right)}\left(\frac{p_L^i}{1-\beta p_{LL}^i} + \frac{\beta p_H^i p_{HL}^i}{\left(1-\beta p_{LL}^i\right)\left(1-\beta p_{HH}^i\right)}\right)\pi_{exis}\left(a_{is}^U, E_L^i\right) +$$

$$+ \frac{\beta\gamma\nu^i}{1-\beta\left(1-\gamma\right)}\left(\frac{p_H^i}{1-\beta p_{HH}^i} + \frac{\beta p_L^i p_{LH}^i}{\left(1-\beta p_{LL}^i\right)\left(1-\beta p_{HH}^i\right)}\right)\pi_{exis}\left(a_{is}^U, E_H^i\right) \Leftrightarrow$$

$$\Leftrightarrow \frac{\left(1-\beta p_{LL}^i\right)\left(1-\beta p_{HH}^i\right)\left[1-\beta\left(1-\gamma\right)\right]}{\beta\gamma}K_{xi} = \frac{\left(1-\beta p_{LL}^i\right)\left(1-\beta p_{HH}^i\right)}{\beta\gamma}\pi_{exis}\left(a_{is}^U, E^i\right) +$$

$$+ \left[\left(1-\beta p_{HH}^i\right)p_L^i + \beta p_H^i p_{HL}^i\right]\nu^i\pi_{exis}\left(a_{is}^U, E_L^i\right) + \left[\left(1-\beta p_{LL}^i\right)p_H^i + \beta p_L^i p_{LH}^i\right]\nu^i\pi_{exis}\left(a_{is}^U, E_H^i\right) \Leftrightarrow$$

$$\Leftrightarrow \frac{\left[\left(1-\beta p_{LL}^i\right)\left(1-\beta p_{HH}^i\right) - \beta^2\left(1-p_{LL}^i\right)\left(1-p_{HH}^i\right)\right]\left[1-\beta\left(1-\gamma\right)\right]}{\beta\gamma}\frac{K_{xi}}{A_{is}} =$$

$$= \frac{\left[\left(1-\beta p_{LL}^i\right)\left(1-\beta p_{HH}^i\right) - \beta^2\left(1-p_{LL}^i\right)\left(1-p_{HH}^i\right)\right]}{\beta\gamma}\frac{\left(a_{is}^U\right)^{\sigma_s-1}}{\exp\left\{\sigma_s E^i\right\}} +$$

$$+ \left[\left(1-\beta p_{HH}^i\right)p_L^i + \beta p_H^i p_{HL}^i\right]\frac{\left(a_{is}^U\right)^{\sigma_s-1}}{\exp\left\{\sigma_s E_L^i\right\}} + \left[\left(1-\beta p_{LL}^i\right)p_H^i + \beta p_L^i p_{LH}^i\right]\frac{\left(a_{is}^U\right)^{\sigma_s-1}}{\exp\left\{\sigma_s E_H^i\right\}} \Leftrightarrow$$

$$\Leftrightarrow a_{is}^U = \left[\frac{\left[\left(1-\beta p_{LL}^i\right)\left(1-\beta p_{HH}^i\right) - \beta^2\left(1-p_{LL}^i\right)\left(1-p_{HH}^i\right)\right]\left[1-\beta\left(1-\gamma\right)\right]}{\beta\gamma}\frac{K_{xi}}{A_{is}}\right]^{\frac{1}{\sigma_s-1}} \cdot$$

$$\cdot \left[\frac{\left(1-\beta p_{LL}^i\right)\left(1-\beta p_{HH}^i\right) - \beta^2 p_{LH}^i p_{HL}^i}{\beta\gamma\exp\left\{\sigma_s E^i\right\}} + \frac{\left(1-\beta p_{HH}^i\right)p_L^i + \beta p_H^i p_{HL}^i}{\exp\left\{\sigma_s E_L^i\right\}} + \frac{\left(1-\beta p_{LL}^i\right)p_H^i + \beta p_L^i p_{LH}^i}{\exp\left\{\sigma_s E_H^i\right\}}\right]^{-\frac{1}{\sigma_s-1}} \Leftrightarrow$$

$$\Leftrightarrow a_{is}^U = \left[\frac{\left[\left(1-\beta p_{LL}^i\right)\left(1-\beta p_{HH}^i\right) - \beta^2\left(1-p_{LL}^i\right)\left(1-p_{HH}^i\right)\right]\left[1-\beta\left(1-\gamma\right)\right]}{\beta\gamma}\frac{K_{xi}}{A_{is}}\right]^{\frac{1}{\sigma_s-1}} \cdot$$

$$\cdot \left[\frac{1-\beta+\beta-\beta^2-\beta p_{HH}^i\left(1-\beta\right)-\beta p_{LL}^i\left(1-\beta\right)}{\beta\gamma\exp\left\{\sigma_s E^i\right\}} + \frac{\left(1-\beta p_{HH}^i\right)-p_H^i\left(1-\beta\right)}{\exp\left\{\sigma_s E_L^i\right\}} + \frac{\left(1-\beta\right)p_H^i + \beta p_{LH}^i}{\exp\left\{\sigma_s E_H^i\right\}}\right]^{-\frac{1}{\sigma_s-1}} \Leftrightarrow$$

$$\Leftrightarrow a_{is}^U = \left[\left[\left(1-\beta p_{LL}^i\right)\left(1-\beta p_{HH}^i\right) - \beta^2\left(1-p_{LL}^i\right)\left(1-p_{HH}^i\right)\right]\frac{1-\beta+\beta\gamma}{\beta\gamma}\frac{K_{xi}}{A_{is}}\right]^{\frac{1}{\sigma_s-1}} \cdot$$

$$\cdot \left[\frac{\left(1-\beta\right)\left(1+\beta\left[1-p_{HH}^i-p_{LL}^i\right]\right)}{\beta\gamma\exp\left\{\sigma_s E^i\right\}} + \frac{\left(1-\beta p_{HH}^i\right)-p_H^i\left(1-\beta\right)}{\exp\left\{\sigma_s E_L^i\right\}} + \frac{\left(1-\beta\right)p_H^i + \beta\left(1-p_{LL}^i\right)}{\exp\left\{\sigma_s E_H^i\right\}}\right]^{-\frac{1}{\sigma_s-1}} \Leftrightarrow$$

$$\Leftrightarrow a_{is}^U = \left[\left[\left(1-\beta p_{LL}^i\right)\left(1-\beta p_{HH}^i\right) - \beta^2\left(1-p_{LL}^i\right)\left(1-p_{HH}^i\right)\right]\frac{1-\beta+\beta\gamma}{\beta\gamma}\frac{K_{xi}}{A_{is}}\right]^{\frac{1}{\sigma_s-1}} \cdot$$

$$\cdot \left[\left(1-\beta\right)\left(\frac{1+\beta\left[1-p_{HH}^i-p_{LL}^i\right]}{\beta\gamma\exp\left\{\sigma_s E^i\right\}} + p_H^i\left[\frac{1}{\exp\left\{\sigma_s E_H^i\right\}} - \frac{1}{\exp\left\{\sigma_s E_L^i\right\}}\right]\right) + \frac{\left(1-\beta p_{HH}^i\right)}{\exp\left\{\sigma_s E_L^i\right\}} + \frac{\beta\left(1-p_{LL}^i\right)}{\exp\left\{\sigma_s E_H^i\right\}}\right]^{-\frac{1}{\sigma_s-1}}$$

In order to compare a_{is}^U for Case 1 with the upper threshold of this region

$$a_{is}^b = \left(\left[\left(1-\beta p_{LL}^i\right)\left(1-\beta p_{HH}^i\right) - \beta^2\left(1-p_{LL}^i\right)\left(1-p_{HH}^i\right)\right]\frac{K_{xi}}{A_{is}}\right)^{\frac{1}{\sigma_s-1}}\left[\frac{1-\beta p_{HH}^i}{\exp\left\{\sigma_s E_L^i\right\}} + \frac{\beta\left(1-p_{LL}^i\right)}{\exp\left\{\sigma_s E_H^i\right\}}\right]^{-\frac{1}{\sigma_s-1}},$$

we build the following the ratio

$$\frac{a_{is}^U}{a_{is}^b} = \left(\frac{\left[\left(1-\beta p_{LL}^i\right)\left(1-\beta p_{HH}^i\right) - \beta^2\left(1-p_{LL}^i\right)\left(1-p_{HH}^i\right)\right] \frac{1-\beta+\beta\gamma}{\beta\gamma} \frac{K_{xi}}{A_{is}}}{\left[\left(1-\beta p_{LL}^i\right)\left(1-\beta p_{HH}^i\right) - \beta^2\left(1-p_{LL}^i\right)\left(1-p_{HH}^i\right)\right] \frac{K_{xi}}{A_{is}}} \right)^{\frac{1}{\sigma_s-1}} +$$

$$+ \left(\frac{1-\beta p_{HH}^i}{\exp\left\{\sigma_s E_L^i\right\}} + \frac{\beta\left(1-p_{LL}^i\right)}{\exp\left\{\sigma_s E_H^i\right\}} \right)^{\frac{1}{\sigma_s-1}} \cdot$$

$$\cdot \left[(1-\beta)\left(\frac{1+\beta\left[1-p_{HH}^i-p_{LL}^i\right]}{\beta\gamma\exp\left\{\sigma_s E^i\right\}} + p_H^i\left[\frac{1}{\exp\left\{\sigma_s E_H^i\right\}} - \frac{1}{\exp\left\{\sigma_s E_L^i\right\}}\right] \right) + \frac{\left(1-\beta p_{HH}^i\right)}{\exp\left\{\sigma_s E_L^i\right\}} + \frac{\beta\left(1-p_{LL}^i\right)}{\exp\left\{\sigma_s E_H^i\right\}} \right]^{-\frac{1}{\sigma_s-1}} =$$

$$= \left(\frac{1-\beta+\beta\gamma}{\beta\gamma}\right)^{\frac{1}{\sigma_s-1}} +$$

$$+ \left[(1-\beta) \frac{\frac{1+\beta\left[1-p_{HH}^i-p_{LL}^i\right]}{\beta\gamma\exp\left\{\sigma_s E^i\right\}} + p_H^i\left[\frac{1}{\exp\left\{\sigma_s E_H^i\right\}} - \frac{1}{\exp\left\{\sigma_s E_L^i\right\}}\right]}{\frac{\left(1-\beta p_{HH}^i\right)}{\exp\left\{\sigma_s E_L^i\right\}} + \frac{\beta\left(1-p_{LL}^i\right)}{\exp\left\{\sigma_s E_H^i\right\}}} + 1 \right]^{-\frac{1}{\sigma_s-1}} =$$

$$= \left(\frac{1-\beta+\beta\gamma}{\beta\gamma}\right)^{\frac{1}{\sigma_s-1}} +$$

$$+ \left[(1-\beta) \frac{\frac{1+\beta\left[1-p_{HH}^i-p_{LL}^i\right]}{\beta\gamma\exp\left\{\sigma_s E^i\right\}} + p_H^i\left[\frac{1}{\exp\left\{\sigma_s E_H^i\right\}} - \frac{1}{\exp\left\{\sigma_s E_L^i\right\}}\right]}{\frac{\left(1-\beta p_{HH}^i\right)}{\exp\left\{\sigma_s E_L^i\right\}} + \frac{\beta\left(1-p_{LL}^i\right)}{\exp\left\{\sigma_s E_H^i\right\}} - \frac{\beta\left(1-p_{LL}^i\right)}{\exp\left\{\sigma_s E_L^i\right\}} + \frac{\beta\left(1-p_{LL}^i\right)}{\exp\left\{\sigma_s E_L^i\right\}}} + 1 \right]^{-\frac{1}{\sigma_s-1}} =$$

$$= \left(\frac{1-\beta+\beta\gamma}{\beta\gamma}\right)^{\frac{1}{\sigma_s-1}} +$$

$$+ \left[(1-\beta) \frac{\frac{1+\beta\left[1-p_{HH}^i-p_{LL}^i\right]}{\beta\gamma\exp\left\{\sigma_s E^i\right\}} + p_H^i\left[\frac{1}{\exp\left\{\sigma_s E_H^i\right\}} - \frac{1}{\exp\left\{\sigma_s E_L^i\right\}}\right]}{\frac{1+\beta-\beta p_{HH}^i-\beta p_{LL}^i}{\exp\left\{\sigma_s E_L^i\right\}} + \beta\left(1-p_{LL}^i\right)\left[\frac{1}{\exp\left\{\sigma_s E_H^i\right\}} - \frac{1}{\exp\left\{\sigma_s E_L^i\right\}}\right]} + 1 \right]^{-\frac{1}{\sigma_s-1}} =$$

$$= \left(\frac{1-\beta+\beta\gamma}{\beta\gamma}\right)^{\frac{1}{\sigma_s-1}} +$$

$$+ \left[\frac{1-\beta}{\beta\gamma} \frac{\frac{1+\beta\left[1-p_{HH}^i-p_{LL}^i\right]}{\exp\left\{\sigma_s E^i\right\}} + \beta\gamma p_H^i\left[\frac{1}{\exp\left\{\sigma_s E_H^i\right\}} - \frac{1}{\exp\left\{\sigma_s E_L^i\right\}}\right]}{\frac{1+\beta\left[1-p_{HH}^i-p_{LL}^i\right]}{\exp\left\{\sigma_s E_L^i\right\}} + \beta\left(1-p_{LL}^i\right)\left[\frac{1}{\exp\left\{\sigma_s E_H^i\right\}} - \frac{1}{\exp\left\{\sigma_s E_L^i\right\}}\right]} + 1 \right]^{-\frac{1}{\sigma_s-1}}.$$

Note that, if $E^i > E_L^i$ and $\gamma p_H^i > 1 - p_{LL}^i$,

$$\frac{\frac{1+\beta\left[1-p_{HH}^i-p_{LL}^i\right]}{\exp\{\sigma_s E^i\}} + \beta\gamma p_H^i\left[\frac{1}{\exp\{\sigma_s E_H^i\}} - \frac{1}{\exp\{\sigma_s E_L^i\}}\right]}{\frac{1+\beta\left[1-p_{HH}^i-p_{LL}^i\right]}{\exp\{\sigma_s E_L^i\}} + \beta\left(1-p_{LL}^i\right)\left[\frac{1}{\exp\{\sigma_s E_H^i\}} - \frac{1}{\exp\{\sigma_s E_L^i\}}\right]} < 1 \Leftrightarrow$$

$$\Leftrightarrow \frac{1-\beta}{\beta\gamma}\frac{\frac{1+\beta\left[1-p_{HH}^i-p_{LL}^i\right]}{\exp\{\sigma_s E^i\}} + \beta\gamma p_H^i\left[\frac{1}{\exp\{\sigma_s E_H^i\}} - \frac{1}{\exp\{\sigma_s E_L^i\}}\right]}{\frac{1+\beta\left[1-p_{HH}^i-p_{LL}^i\right]}{\exp\{\sigma_s E_L^i\}} + \beta\left(1-p_{LL}^i\right)\left[\frac{1}{\exp\{\sigma_s E_H^i\}} - \frac{1}{\exp\{\sigma_s E_L^i\}}\right]} < \frac{1-\beta}{\beta\gamma} \Leftrightarrow$$

$$\Leftrightarrow \frac{1-\beta}{\beta\gamma}\frac{\frac{1+\beta\left[1-p_{HH}^i-p_{LL}^i\right]}{\exp\{\sigma_s E^i\}} + \beta\gamma p_H^i\left[\frac{1}{\exp\{\sigma_s E_H^i\}} - \frac{1}{\exp\{\sigma_s E_L^i\}}\right]}{\frac{1+\beta\left[1-p_{HH}^i-p_{LL}^i\right]}{\exp\{\sigma_s E_L^i\}} + \beta\left(1-p_{LL}^i\right)\left[\frac{1}{\exp\{\sigma_s E_H^i\}} - \frac{1}{\exp\{\sigma_s E_L^i\}}\right]} + 1 < \frac{1-\beta+\beta\gamma}{\beta\gamma} \Leftrightarrow$$

$$\Leftrightarrow 1 < \frac{1-\beta+\beta\gamma}{\beta\gamma}\left[\frac{1-\beta}{\beta\gamma}\frac{\frac{1+\beta\left[1-p_{HH}^i-p_{LL}^i\right]}{\exp\{\sigma_s E^i\}} + \beta\gamma p_H^i\left[\frac{1}{\exp\{\sigma_s E_H^i\}} - \frac{1}{\exp\{\sigma_s E_L^i\}}\right]}{\frac{1+\beta\left[1-p_{HH}^i-p_{LL}^i\right]}{\exp\{\sigma_s E_L^i\}} + \beta\left(1-p_{LL}^i\right)\left[\frac{1}{\exp\{\sigma_s E_H^i\}} - \frac{1}{\exp\{\sigma_s E_L^i\}}\right]} + 1\right]^{-1} \Leftrightarrow$$

$$\Leftrightarrow 1 < \left(\frac{1-\beta+\beta\gamma}{\beta\gamma}\right)^{\frac{1}{\sigma_s-1}}\left[\frac{1-\beta}{\beta\gamma}\frac{\frac{1+\beta\left[1-p_{HH}^i-p_{LL}^i\right]}{\exp\{\sigma_s E^i\}} + \beta\gamma p_H^i\left[\frac{1}{\exp\{\sigma_s E_H^i\}} - \frac{1}{\exp\{\sigma_s E_L^i\}}\right]}{\frac{1+\beta\left[1-p_{HH}^i-p_{LL}^i\right]}{\exp\{\sigma_s E_L^i\}} + \beta\left(1-p_{LL}^i\right)\left[\frac{1}{\exp\{\sigma_s E_H^i\}} - \frac{1}{\exp\{\sigma_s E_L^i\}}\right]} + 1\right]^{-\frac{1}{\sigma_s-1}} \Leftrightarrow$$

$$\Leftrightarrow 1 < \frac{a_{is}^U}{a_{is}^b} \Leftrightarrow a_{is}^b < a_{is}^U.$$

Thus, it is sufficient that $E^i > E_L^i$ and $\gamma p_H^i > 1 - p_{LL}^i$ for the full-problem cutoff faced by firms in region b to fall out of this region, making the subset of *least efficient* firms become irrelevant to the full problem cutoff determination - all of them wait, even when facing the full problem.

Case 2: $a_{is}^U \geq a_{is}^g$ Here we have

$$V_w(E^i, a_{is}) = \frac{\pi_{wxis}(a_{is})}{1-\beta(1-\gamma)} + \frac{\beta}{1-\beta(1-\gamma)}\left\{\gamma p_L^i\left[\tilde{V}_e(E_L^i, a_{is}) - K_{xi}\right] + \gamma p_H^i\left[\tilde{V}_e(E_H^i, a_{is}) - K_{xi}\right]\right\}$$
(6.19)

and

$$V_e(E^i, a_{is}) = \frac{\pi_{wxis}(a_{is}) + \pi_{exis}(a_{is}, E^i)}{1-\beta(1-\gamma)} + \frac{\beta}{1-\beta(1-\gamma)}\left[\gamma p_L^i\tilde{V}_e(E_L^i, a_{is}) + \gamma p_H^i\tilde{V}_e(E_H^i, a_{is})\right].$$
(6.20)

Recall that

$$\tilde{V}_e(E_L^i, a_{is}) = \nu^i\left[\frac{\left(1-\beta p_{HH}^i\right) + \beta\left(1-p_{LL}^i\right)}{\left(1-\beta p_{LL}^i\right)\left(1-\beta p_{HH}^i\right)}\pi_{wxis}(a_{is}) + \frac{\pi_{exis}(a_{is}, E_L^i)}{1-\beta p_{LL}^i} + \frac{\beta p_{LH}^i\pi_{exis}(a_{is}, E_H^i)}{\left(1-\beta p_{LL}^i\right)\left(1-\beta p_{HH}^i\right)}\right],$$

$$\tilde{V}_e(E_H^i, a_{is}) = \nu^i\left[\frac{\left(1-\beta p_{LL}^i\right) + \beta\left(1-p_{HH}^i\right)}{\left(1-\beta p_{LL}^i\right)\left(1-\beta p_{HH}^i\right)}\pi_{wxis}(a_{is}) + \frac{\pi_{exis}(a_{is}, E_H^i)}{1-\beta p_{HH}^i} + \frac{\beta p_{HL}^i\pi_{exis}(a_{is}, E_L^i)}{\left(1-\beta p_{LL}^i\right)\left(1-\beta p_{HH}^i\right)}\right].$$

Determining a_{is}^U for Case 2

$$V_w(E^i, a_{is}^U) = V_e(E^i, a_{is}^U) - K \Leftrightarrow$$

$$\Leftrightarrow \frac{\pi_{wxis}(a_{is}^U)}{1-\beta(1-\gamma)} + \frac{\beta}{1-\beta(1-\gamma)}\left\{\gamma p_L^i\left[\tilde{V}_e(E_L^i, a_{is}^U) - K_{xi}\right] + \gamma p_H^i\left[\tilde{V}_e(E_H^i, a_{is}^U) - K_{xi}\right]\right\} =$$

$$= \frac{\pi_{wxis}\left(a_{is}^U\right) + \pi_{exis}\left(a_{is}^U, E^i\right)}{1-\beta(1-\gamma)} + \frac{\beta}{1-\beta(1-\gamma)}\left[\gamma p_L^i \tilde{V}_e(E_L^i, a_{is}^U) + \gamma p_H^i \tilde{V}_e(E_H^i, a_{is}^U)\right] - K_{xi} \Leftrightarrow$$

$$\Leftrightarrow -\frac{\beta\gamma}{1-\beta(1-\gamma)}K_{xi} = \frac{\pi_{exis}\left(a_{is}^U, E^i\right)}{1-\beta(1-\gamma)} - K_{xi} \Leftrightarrow$$

$$\Leftrightarrow \pi_{exis}\left(a_{is}^U, E^i\right) = [1-\beta]\, K_{xi} \Leftrightarrow$$

$$\Leftrightarrow a_{is}^U = \left([1-\beta]\frac{K_{xi}}{A_{is}}\right)^{\frac{1}{\sigma_s - 1}} \exp\left\{\frac{\sigma_s}{\sigma_s - 1}E^i\right\}.$$

Comparing with the threshold

$$a_{is}^g = \left[(1-\beta)\frac{K_{xi}}{A_{is}}\exp\left\{\sigma_s E_H^i\right\}\right]^{\frac{1}{\sigma_s - 1}},$$

we can see that if $E_H^i > E^i$, $a_{is}^g > a_{is}^U$; thus, it's sufficient that $E_H^i > E^i$ for the full-problem cutoff faced by firms in region g to fall out of this region, making the subset of *most efficient* firms become irrelevant to the full problem cutoff determination - all of them enter, even when facing the full problem.

Case 3: $a_{is}^U \in \left(a_{is}^b, a_{is}^g\right)$ Here we have

$$V_w(E^i, a_{is}) = \frac{\pi_{wxis}(a_{is})}{1-\beta(1-\gamma)} + \frac{\beta}{1-\beta(1-\gamma)}\left\{\gamma p_L^i\left[\tilde{V}_e(E_L^i, a_{is}) - K_{xi}\right] + \gamma p_H^i \tilde{V}_w(E_H^i, a_{is})\right\} \quad (6.21)$$

and

$$V_e(E^i, a_{is}) = \frac{\pi_{wxis}\left(a_{is}\right) + \pi_{exis}\left(a_{is}, E^i\right)}{1-\beta(1-\gamma)} + \frac{\beta}{1-\beta(1-\gamma)}\left[\gamma p_L^i \tilde{V}_e(E_L^i, a_{is}) + \gamma p_H^i \tilde{V}_e(E_H^i, a_{is})\right]. \quad (6.22)$$

Recall that

$$\tilde{V}_w(E_L^i, a_{is}) = \tilde{V}_e(E_L^i, a_{is}) - K_{xi},$$

$$\tilde{V}_w(E_H^i, a_{is}) = \pi_{wxis}\left(a_{is}\right) + \beta\left[p_{HL}^i \tilde{V}_w(E_L^i, a_{is}) + p_{HH}^i \tilde{V}_w(E_H^i, a_{is})\right],$$

$$\tilde{V}_e(E_L^i, a_{is}) = \nu^i \left[\frac{\left(1-\beta p_{HH}^i\right)+\beta\left(1-p_{LL}^i\right)}{\left(1-\beta p_{LL}^i\right)\left(1-\beta p_{HH}^i\right)}\pi_{wxis}\left(a_{is}\right) + \frac{\pi_{exis}\left(a_{is}, E_L^i\right)}{1-\beta p_{LL}^i} + \frac{\beta p_{LH}^i \pi_{exis}\left(a_{is}, E_H^i\right)}{\left(1-\beta p_{LL}^i\right)\left(1-\beta p_{HH}^i\right)}\right], \quad (6.23)$$

$$\tilde{V}_e(E_H^i, a_{is}) = \nu^i \left[\frac{\left(1-\beta p_{LL}^i\right)+\beta\left(1-p_{HH}^i\right)}{\left(1-\beta p_{LL}^i\right)\left(1-\beta p_{HH}^i\right)}\pi_{wxis}\left(a_{is}\right) + \frac{\pi_{exis}\left(a_{is}, E_H^i\right)}{1-\beta p_{HH}^i} + \frac{\beta p_{HL}^i \pi_{exis}\left(a_{is}, E_L^i\right)}{\left(1-\beta p_{LL}^i\right)\left(1-\beta p_{HH}^i\right)}\right]. \quad (6.24)$$

Using three of the equations above, we get

$$\begin{aligned}\tilde{V}_w(E_H^i, a_{is}) = {} & \frac{\pi_{wxis}\left(a_{is}\right)}{1-\beta p_{HH}^i} + \\ & + \frac{\beta p_{HL}^i \nu^i}{1-\beta p_{HH}^i}\left(\frac{\left(1-\beta p_{HH}^i\right)+\beta\left(1-p_{LL}^i\right)}{\left(1-\beta p_{LL}^i\right)\left(1-\beta p_{HH}^i\right)}\pi_{wxis}\left(a_{is}\right) + \frac{\pi_{exis}\left(a_{is}, E_L^i\right)}{1-\beta p_{LL}^i}\right) + \\ & + \frac{\beta p_{HL}^i}{1-\beta p_{HH}^i}\left(\nu^i\left[\frac{\beta p_{LH}^i \pi_{exis}\left(a_{is}, E_H^i\right)}{\left(1-\beta p_{LL}^i\right)\left(1-\beta p_{HH}^i\right)}\right] - K_{xi}\right). \quad (6.25)\end{aligned}$$

Using (6.21)-(6.25) we determine a_{is}^U as follows

$$
\begin{aligned}
& V_w(E^i, a_{is}^U) = V_e(E^i, a_{is}^U) - K_{xi} \Leftrightarrow \\
& \Leftrightarrow \frac{\pi_{wxis}(a_{is}^U)}{1-\beta(1-\gamma)} + \frac{\beta}{1-\beta(1-\gamma)} \left\{ \gamma p_L^i \left[\tilde{V}_e(E_L^i, a_{is}^U) - K_{xi} \right] + \gamma p_H^i \tilde{V}_w(E_H^i, a_{is}^U) \right\} = \\
& = \frac{\pi_{wxis}\left(a_{is}^U\right) + \pi_{exis}\left(a_{is}^U, E^i\right)}{1-\beta(1-\gamma)} + \frac{\beta}{1-\beta(1-\gamma)} \left[\gamma p_L^i \tilde{V}_e(E_L^i, a_{is}^U) + \gamma p_H^i \tilde{V}_e(E_H^i, a_{is}^U) \right] - K_{xi} \Leftrightarrow \\
& \Leftrightarrow \left[1-\beta+\beta\gamma p_H^i\right] K_{xi} = \pi_{exis}\left(a_{is}^U, E^i\right) + \beta\gamma p_H^i \left[\tilde{V}_e(E_H^i, a_{is}^U) - \tilde{V}_w(E_H^i, a_{is}^U) \right] \Leftrightarrow \\
& \Leftrightarrow \left(1-\beta p_{HH}^i\right)\left[1-\beta+\beta\gamma p_H^i\right] K_{xi} = \left(1-\beta p_{HH}^i\right) \pi_{exis}\left(a_{is}^U, E^i\right) + \\
& + \beta\gamma p_H^i \nu^i \left[\frac{\left(1-\beta p_{LL}^i\right) + \beta\left(1-p_{HH}^i\right)}{\left(1-\beta p_{LL}^i\right)} \pi_{wxis}\left(a_{is}^U\right) + \pi_{exis}\left(a_{is}^U, E_H^i\right) + \frac{\beta p_{HL}^i \pi_{exis}\left(a_{is}^U, E_L^i\right)}{\left(1-\beta p_{LL}^i\right)} \right] + \\
& - \beta\gamma p_H^i \left[\pi_{wxis}\left(a_{is}^U\right) + \beta p_{HL}^i \left(\nu^i \left[\frac{\left(1-\beta p_{HH}^i\right) + \beta\left(1-p_{LL}^i\right)}{\left(1-\beta p_{LL}^i\right)\left(1-\beta p_{HH}^i\right)} \pi_{wxis}\left(a_{is}^U\right) \right] \right) \right] + \\
& - \beta\gamma p_H^i \left[\beta p_{HL}^i \left(\nu^i \left[\frac{\pi_{exis}\left(a_{is}^U, E_L^i\right)}{1-\beta p_{LL}^i} + \frac{\beta p_{LH}^i \pi_{exis}\left(a_{is}^U, E_H^i\right)}{\left(1-\beta p_{LL}^i\right)\left(1-\beta p_{HH}^i\right)} \right] - K_{xi} \right) \right] \Leftrightarrow \\
& \Leftrightarrow \left(1-\beta p_{HH}^i\right)\left[1-\beta+\beta\gamma p_H^i\right] K_{xi} = \left(1-\beta p_{HH}^i\right) \pi_{exis}\left(a_{is}^U, E^i\right) + \\
& + \beta\gamma p_H^i \left(1-\beta p_{HH}^i\right) \frac{\left(1-\beta p_{LL}^i\right) + \beta\left(1-p_{HH}^i\right)}{\left(1-\beta p_{LL}^i\right)\left(1-\beta p_{HH}^i\right) - \beta^2\left(1-p_{LL}^i\right)\left(1-p_{HH}^i\right)} \pi_{wxis}\left(a_{is}^U\right) + \\
& + \beta\gamma p_H^i \nu^i \left[\pi_{exis}\left(a_{is}^U, E_H^i\right) + \frac{\beta p_{HL}^i \pi_{exis}\left(a_{is}^U, E_L^i\right)}{\left(1-\beta p_{LL}^i\right)} \right] + \\
& - \beta\gamma p_H^i \left[\frac{\left(1-\beta p_{LL}^i\right)\left(1-\beta p_{HH}^i\right) + \beta\left(1-p_{HH}^i\right)\left(1-\beta p_{HH}^i\right)}{\left(1-\beta p_{LL}^i\right)\left(1-\beta p_{HH}^i\right) - \beta^2\left(1-p_{LL}^i\right)\left(1-p_{HH}^i\right)} \pi_{wxis}\left(a_{is}^U\right) \right] + \\
& - \beta^2\gamma p_H^i p_{HL}^i \left(\nu^i \left[\frac{\pi_{exis}\left(a_{is}^U, E_L^i\right)}{1-\beta p_{LL}^i} + \frac{\beta p_{LH}^i \pi_{exis}\left(a_{is}^U, E_H^i\right)}{\left(1-\beta p_{LL}^i\right)\left(1-\beta p_{HH}^i\right)} \right] - K_{xi} \right) \Leftrightarrow \\
& \Leftrightarrow \left(1-\beta p_{HH}^i\right)\left[1-\beta+\beta\gamma p_H^i\right] K_{xi} = \left(1-\beta p_{HH}^i\right) \pi_{exis}\left(a_{is}^U, E^i\right) + \\
& + \beta\gamma p_H^i \nu^i \left[\pi_{exis}\left(a_{is}^U, E_H^i\right) + \frac{\beta p_{HL}^i \pi_{exis}\left(a_{is}^U, E_L^i\right)}{\left(1-\beta p_{LL}^i\right)} \right] + \\
& - \beta^2\gamma p_H^i p_{HL}^i \left(\nu^i \left[\frac{\pi_{exis}\left(a_{is}^U, E_L^i\right)}{1-\beta p_{LL}^i} + \frac{\beta p_{LH}^i \pi_{exis}\left(a_{is}^U, E_H^i\right)}{\left(1-\beta p_{LL}^i\right)\left(1-\beta p_{HH}^i\right)} \right] - K_{xi} \right) \Leftrightarrow \\
& \Leftrightarrow \left(1-\beta p_{HH}^i\right)\left[1-\beta+\beta\gamma p_H^i\right] K_{xi} = \left(1-\beta p_{HH}^i\right) \pi_{exis}\left(a_{is}^U, E^i\right) + \\
& + \left[\beta\gamma p_H^i \nu^i - \frac{\beta^2\gamma p_H^i p_{HL}^i \nu^i \beta p_{LH}^i}{\left(1-\beta p_{LL}^i\right)\left(1-\beta p_{HH}^i\right)} \right] \pi_{exis}\left(a_{is}^U, E_H^i\right) + \\
& + \left[\frac{\beta\gamma p_H^i \nu^i \beta p_{HL}^i}{1-\beta p_{LL}^i} - \frac{\beta^2\gamma p_H^i p_{HL}^i \nu^i}{1-\beta p_{LL}^i} \right] \pi_{exis}\left(a_{is}^U, E_L^i\right) + \beta^2\gamma p_H^i \left(1-p_{HH}^i\right) K_{xi} \Leftrightarrow
\end{aligned}
$$

$$\Leftrightarrow \left[\left(1-\beta p^i_{HH}\right)\left[1-\beta+\beta\gamma p^i_H\right]-\beta^2\gamma p^i_H\left(1-p^i_{HH}\right)\right]K_{xi}=\left(1-\beta p^i_{HH}\right)\pi_{exis}\left(a^U_{is},E^i\right)+$$

$$+\left[\frac{\left(1-\beta p^i_{LL}\right)\left(1-\beta p^i_{HH}\right)\beta\gamma p^i_H-\beta^2\gamma p^i_H p^i_{HL}\beta p^i_{LH}}{\left(1-\beta p^i_{LL}\right)\left(1-\beta p^i_{HH}\right)-\beta^2\left(1-p^i_{LL}\right)\left(1-p^i_{HH}\right)}\right]\pi_{exis}\left(a^U_{is},E^i_H\right)+$$

$$+\left(1-\beta p^i_{HH}\right)\left[\frac{\beta\gamma p^i_H\beta p^i_{HL}-\beta^2\gamma p^i_H p^i_{HL}}{\left(1-\beta p^i_{LL}\right)\left(1-\beta p^i_{HH}\right)-\beta^2\left(1-p^i_{LL}\right)\left(1-p^i_{HH}\right)}\right]\pi_{exis}\left(a^U_{is},E^i_L\right)\Leftrightarrow$$

$$\Leftrightarrow \left[\left(1-\beta p^i_{HH}\right)\left[1-\beta+\beta\gamma p^i_H\right]-\beta^2\gamma p^i_H\left(1-p^i_{HH}\right)\right]K_{xi}=$$

$$=\left(1-\beta p^i_{HH}\right)\pi_{exis}\left(a^U_{is},E^i\right)+\beta\gamma p^i_H\pi_{exis}\left(a^U_{is},E^i_H\right)\Leftrightarrow$$

$$\Leftrightarrow \left[\left(1-\beta p^i_{HH}\right)\left[1-\beta+\beta\gamma p^i_H\right]-\beta^2\gamma p^i_H\left(1-p^i_{HH}\right)\right]\frac{K_{xi}}{A_{is}}=$$

$$=\left(a^U_{is}\right)^{\sigma_s-1}\left[\frac{\left(1-\beta p^i_{HH}\right)}{\exp\left\{\sigma_s E^i\right\}}+\frac{\beta\gamma p^i_H}{\exp\left\{\sigma_s E^i_H\right\}}\right]\Leftrightarrow$$

$$\Leftrightarrow \left[\left(1-\beta p^i_{HH}\right)\left[1-\beta+\beta\gamma p^i_H\right]-\beta^2\gamma p^i_H\left(1-p^i_{HH}\right)\right]\frac{K_{xi}}{A_{is}}\exp\left\{\sigma_s E^i\right\}=$$

$$=\left(a^U_{is}\right)^{\sigma_s-1}\left[1-\beta p^i_{HH}+\beta\gamma p^i_H\exp\left\{\sigma_s\left(E^i-E^i_H\right)\right\}\right]\Leftrightarrow$$

$$\Leftrightarrow \left[\frac{\left(1-\beta p^i_{HH}\right)\left(1-\beta\right)+\left(1-\beta\right)\beta\gamma p^i_H}{1-\beta}\right]^{\frac{1}{\sigma_s-1}}a^D_{is}=$$

$$=a^U_{is}\left[1-\beta p^i_{HH}+\beta\gamma p^i_H\exp\left\{\sigma_s\left(E^i-E^i_H\right)\right\}\right]^{\frac{1}{\sigma_s-1}}\Leftrightarrow$$

$$\Leftrightarrow \left[1-\beta p^i_{HH}+\beta\gamma p^i_H\right]^{\frac{1}{\sigma_s-1}}a^D_{is}=a^U_{is}\left[1-\beta p^i_{HH}+\beta\gamma p^i_H\exp\left\{\sigma_s\left(E^i-E^i_H\right)\right\}\right]^{\frac{1}{\sigma_s-1}}\Leftrightarrow$$

$$\Leftrightarrow a^U_{is}=a^D_{is}\left[\frac{1-\beta p^i_{HH}+\beta\gamma p^i_H}{1-\beta p^i_{HH}+\beta\gamma p^i_H\exp\left\{\sigma_s\left(E^i-E^i_H\right)\right\}}\right]^{\frac{1}{\sigma_s-1}}.$$

This corresponds to the threshold presented in Section 5.

Financial regimes and political events: stock markets volatility around cabinet elections

Rúben Branco

Abstract

Stock market returns volatility varies considerably overtime, showing periods of persistent and constant pattern - volatility *regimes*. This study analyzes the stock market volatility behavior around cabinet elections. Three OECD countries are studied - Japan, U.K. and Germany - in the period 1960-2008. In order to identify potential regime changes, the SWARCH model developed in Hamilton and Susmel (1994) is used. Estimates show significant impacts on stock market volatility in the periods before elections, after the new cabinet takes office and between those two events - the *government formation period*. These impacts operate both directly through the ARCH process determining daily volatility and by originating volatility regime shifts. One specific pattern is common to all the countries studied: stock markets volatility is higher during government formation periods than in periods far from elections, before elections or after newly-elected cabinets take office. During government formation periods, estimated stock-returns standard error increases by 14%-271%, relative to its average far from elections.

Part I

Introduction

1 Financial volatility and political events

Stock market returns volatility varies considerably overtime, showing periods of persistent and constant pattern - volatility *regimes*. This volatility reacts intensely to major economic and political events, either through sudden variations or by shifting towards a different *regime*. This study analyzes the stock market volatility behavior around a regular political event, pivotal to democracy: the cabinet election.

Figures 1 and 2 show the evolution of the 1-month standard deviation of stock market index returns, for 23 OECD countries[1], in the 1989-2009 period. Figure 1 presents each country's time series, whereas Figure 2 presents the time series of the cross-section simple average. Both Figures show a clear, temporary and isolated volatility increase subsequent to the 2008-crisis. This volatility increase is general to all the countries plotted.

There seems to be also a generalized volatility *regimes*, particularly evident in Figure 2: the (average) standard deviation is almost always *below* 1 in 1993-1997 and 2003-2007, being almost always *above* 1 in 1998-2002 and 2008-2009.

Besides globalized macroeconomic crises like the one occurred in 2008, stock market volatility also reacts to intense political events, like the one that took place in Italy, 1998. On October 9, the Government headed by Romano Prodi collapsed after losing a confidence motion in Parliament by one vote. Prime-minister Prodi called this motion after the Communist Refoundation (CR) party had withdrawn its parliamentary support to the Government, due to disagreements over the 1999 Government budget. CR did not integrate the cabinet, but its support granted the cabinet a parliamentary majority. After a failed and turmoil-generating attempt by Prodi to form a new cabinet, a new Government took office on October 28, under Presidential invitation and Massimo

[1] These countries are Countries are Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, UK and USA.

D'Alema's leadership. In spite of the early signs of inexperience by the new cabinet and some additional political unrest in the following period, the fall of Prodi's Government ended a coalition Government whose parliamentary majority was supported by an outside-cabinet agreement with the CR. The same event gave rise to an executive that proved capable of effectively ending the budget deadlock[2].

Figure 3 shows the reaction by stock market returns to this episode. During the turmoil period mediating Prodi's cabinet collapse (09-10-1998) and D'Alema's Government rise (28-10-1998), Italian stock market returns seem to transition to a lower-volatility regime[3]. Comparing the month preceding 09-10-1998 to the one succeeding 28-10-1998, the stock returns' standard deviation decreases by 56%, from 3.2 to 1.4 percentage points. This strong decrease signals a positive reaction to the rise of the new cabinet and consequent budget-crisis resolution.

This study tests potential reactions by stock market volatility to regular democratic elections. Three OECD countries are studied - Japan, U.K. and Germany - considering the period 1960-2008. The elections targeted are those determining the choice of a new cabinet[4]. Three political periods around elections are assessed: the period preceding the election day; the period succeeding the day in which the newly-elected cabinet takes office; and the period mediating these two days - government formation period.

Two types of impact from these political periods are tested: direct impact on daily volatility and potential shift in volatility regime. In order to identify both these impact channels, the methodology developed in Hamilton and Susmel (1994) is used. These authors introduce a class of Markov-switching ARCH models describing stock prices - the SWARCH model - and attain improved statistical fit and forecasts. The SWARCH model allows testing for direct impacts on volatility through the ARCH process, but allows also the identification of low-, moderate- and high-volatility regimes, which typically last for several years. Examples of studies using or extending this model are: Cai (1994), Gray (1996) and Klaasen (2002), developing extensions of

[2]Sources for the political episode described are Keesing's World News Archives (www.keesings.com) and the European Journal of Political Research 36: 317–325, 1999.

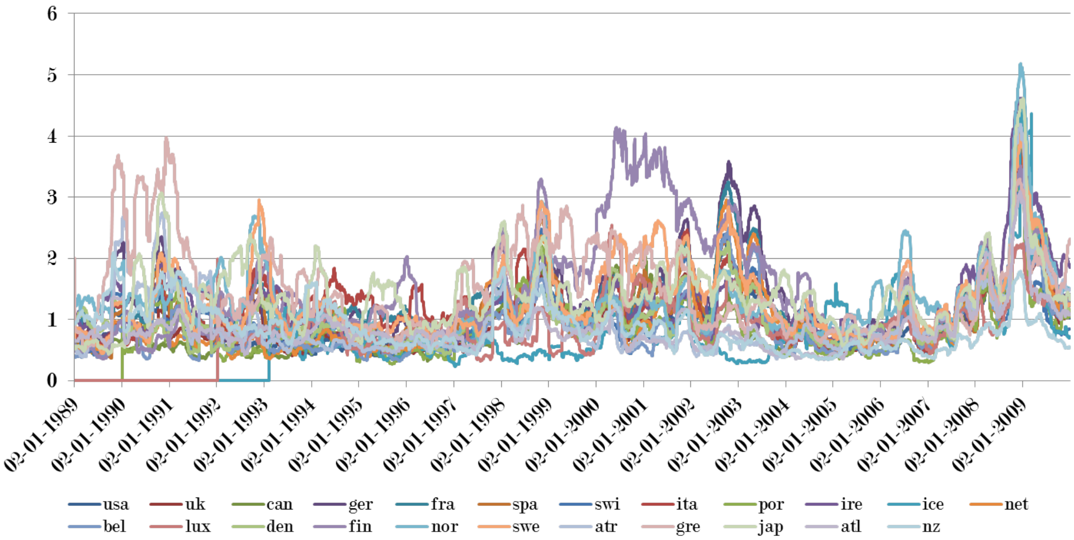
[3]Standard deviation of 2.73 percentage points between 08-08-1998 and 08-10-1998 and 1.55 percentage points between 29-10-1998 and 29-12-1998. Standard deviation for the whole 1998 year is 1.60.

[4]This choice may be done either through the selection of Parliament representatives or through the direct choice of the cabinet leader, as in the case of the U.S.A. (not directly analyzed in this study).

the model; Hamilton and Lin (1996) and Baele (2005), assessing stock market returns; and Fong (1998), an application to the study of the evolution of volatility in the DM/£ exchange rates.

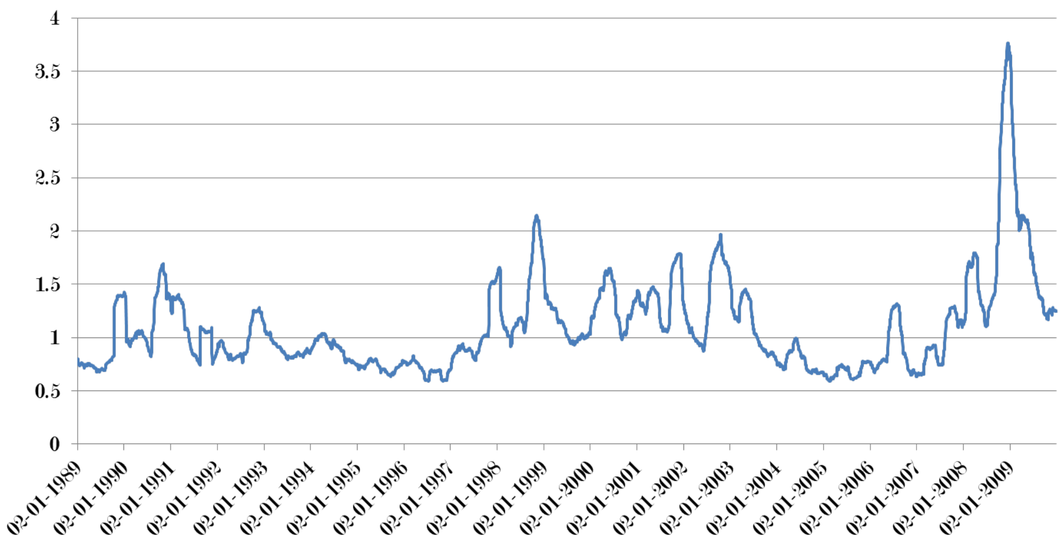
Part II describes the methodology used, Part III presents the results and Part IV discusses the results and concludes.

Figure 1. 1-month moving standard deviation of stock market index return, percentage points, daily, 23 OECD countries, 1989-2009



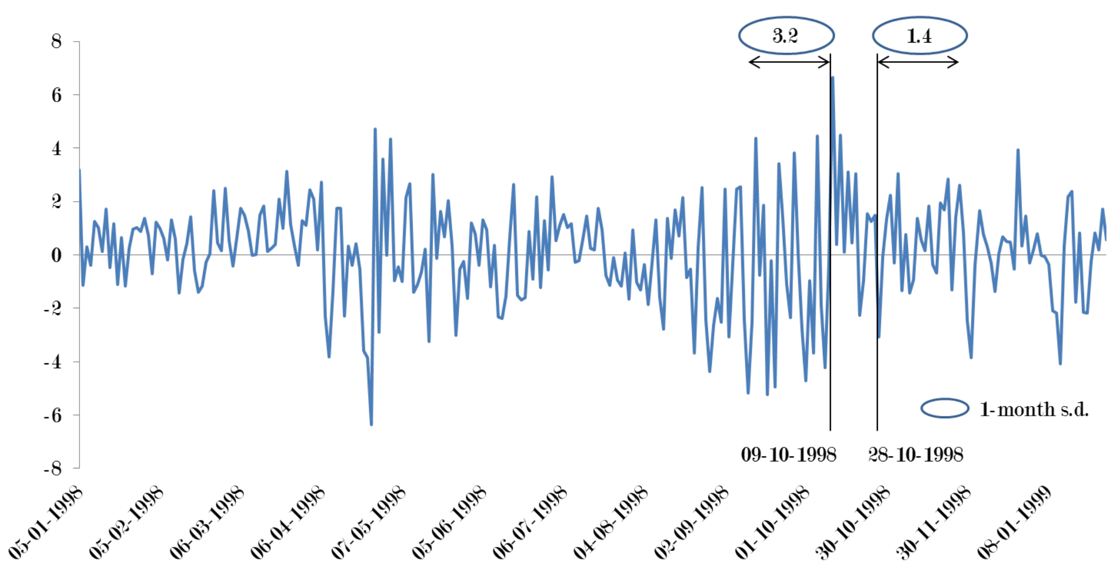
Notes: Countries are Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, UK and USA. For each country, the daily return of the stock market index is computed and, subsequently, a daily series is built containing the standard deviation of the last 22 business days, $[t-21, t]$. Stock market index prices from Datastream. Appendix F presents further details on the data used.

Figure 2. 1-month moving standard deviation of stock market index return, percentage points, daily, simple average across 23 OECD countries, 1989-2009



Notes: Countries are Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, UK and USA. For each country, the daily return of the stock market index is computed and, subsequently, a daily series is built containing the standard deviation of the last 22 business days, $[t-21, t]$. Stock market index prices from Datastream. Appendix F presents further details on the data used.

Figure 3. Stock market index return, percentage points, daily, Italy, 1998-1999



Notes: Stock market index built by Datastream for the Italian market. Appendix F presents further details on the data used. Figures in blue circles denote 1-month standard deviation for the period indicated by the arrows, in stock returns' units (percentage points).

Part II

Methodology

2 The SWARCH process

Hamilton and Susmel (1994) introduce an innovative ARCH process, in which parameters assume different discrete states - *regimes* -, with transitions between these states being governed by an unobserved Markov chain. This process is named SWARCH. The authors test it using U.S. weekly stock returns attaining improved statistical fit and forecasts.

The SWARCH process may be described as follows[5]. Let y_t be the stock market return following the AR(1) process

$$y_t = \alpha + \phi y_{t-1} + u_t, \alpha \in \mathbb{R}$$

and $s_t \in \{1, 2, ..., K\}$ an unobserved random variable, described by the following Markov chain

$$Prob\left(s_t = j | s_{t-1} = i, s_{t-2} = k, ..., y_{t-1}, y_{t-2}, ...\right) = Prob\left(s_t = j | s_{t-1} = i\right) = p_{ij} \quad (1)$$

for $i, j = 1, 2, ..., K$. $s_t$shall denote the regime the process is in at date t, governing the size of the stock-returns auto-regression residual

$$u_t = \sqrt{g_{s_t}} \tilde{u}_t$$

where $\tilde{u}_t$ follows the standard ARCH(2) process

$$\tilde{u}_t = h_t \nu_t,$$

with ν_t a zero mean, unit variance i.i.d. sequence and

$$h_t^2 = a_0 + a_1 \tilde{u}_{t-1}^2 + a_2 \tilde{u}_{t-2}^2. \quad (2)$$

[5]This study uses the parsimonious version of the SWARCH process empirically tested in Hamilton and Susmel (1994).

Equation (2) shall be denoted as *ARCH equation*. Furthermore, 2 and 3 regimes shall be alternatively considered for s_t, always normalizing the first regime to unity $(g_1 = 1)$ and assigning it to the lowest volatility states $(g_j \geq 1, j \neq 1)$. We adapt the authors' algorithm[6] to evaluate and maximize the sample log-likelihood function

$$\mathscr{L} = \sum_{t=1}^{T} \ln f\left(y_t | y_{t-1}, y_{t-2}, ..., y_1\right)$$

subject to the constraints $g_1 = 1$, $\sum_{j=1}^{K} p_{ij} = 1$ for $i = 1, 2, ..., K$, and $0 \leq p_{ij} \leq 1$ for $i, j = 1, 2, ..., K$. The algorithm also produces the series of *smoothed probabilities*

$$p_{it} = Prob\left(s_t = i | y_T, y_{T-1}, ..., y_1\right),$$

denoting the estimated probability that we are in regime i at date t, given the whole-sample information. There will be K smoothed probabilities for each date t, all summing to unity for each t.

[6] Available online at http://weber.ucsd.edu/~jhamilto/software.htm#Markov.

3 Controlling for U.S. stock market volatility

The international correlation between stock market returns[7] implies that a large portion of the volatility in a national stock market index may be determined by the volatility of other stock markets - *contagion*. Given that the focus of this study is to isolate national causes of volatility - specifically those linked to national political events - an important extension of the SWARCH process consists of controlling for the volatility of global stock markets.

To this purpose, the ARCH specification of h_t^2 - equation (2) above - is augmented with a measure of the U.S. stock market volatility. This control variable is built by the author and consists of a daily series measuring, for each date t, the standard deviation of the S&P500 daily returns[8], for the 3-month (66-business-days) period $[t-56, t+10]$. This variable replicates closely the CBOE S&P500 3-Month Volatility Index (VIX), an actual financial index designed as a daily measure of the 3-month implied volatility of the S&P500 - see Appendix G for further details on the VIX replication. The VIX is available[9] only from 02-01-2002 onwards, whereas the computed S&P500 standard deviation starts from 19-03-1964.

The latter shall henceforth be named *vix* and used to control for the U.S. stock market volatility, by augmenting the ARCH specification as follows

$$h_t^2 = a_0 + a_1 \tilde{u}_{t-1}^2 + a_2 \tilde{u}_{t-2}^2 + b_0 vix_t^2. \tag{3}$$

[7]See Figure 1 and Appendix E for empirical evidence.
[8]From Datastream database. See Appendix F for details on data source and definitions.
[9]In Bloomberg database.

4 Introducing and analyzing *political periods*

The impact of political events on stock market's volatility shall be measured in three ways: (i) by augmenting the ARCH specification of h_t^2 with dummies signaling periods preceding elections, succeeding changes or mediating both; (ii) by analyzing the emergence of particular volatility regimes (s_t) around *elections* and subsequent *cabinet changes* (the latter correspond to the days in which a newly-elected cabinet takes office) ; (iii) by estimating the impact of political periods on the daily series of estimated stock-returns standard errors.

In order to implement all these analyses, the following dummy variables are built, signaling *political periods*: (a) *gfp* (*government formation period*), taking value 1 for the dates *between an election and the change originated by that same election* (and zero otherwise)[10]; (b) *belect22*, *belect10* and *belect5*, taking value 1 for the dates within a 22-, 10- or 5-days window preceding an *election* (and zero otherwise)[11], and (c) *achange22*, *achange10* and *achange5*, taking value 1 for the dates within a 22-, 10- or 5-days window succeeding a *cabinet change* (and zero otherwise)[12].

The impact tested in (i) is directly assessed through the estimated coefficients of these political-period dummies in the augmented ARCH equation

$$h_t^2 = a_0 + a_1\tilde{u}_{t-1}^2 + a_2\tilde{u}_{t-2}^2 + b_0 vix_t^2 + b_1 belectN_t + b_2 gfp_t + b_3 achangeN_t,\ N_t \in \{5, 10, 22\}\,. \quad (4)$$

Using the smoothed probabilities produced by the 2-regimes SWARCH model estimation, a dummy variable $high_t$ is built, taking value 1 for the dates in which the probability of being in the high-volatility regime is greater than 0.5 ($Prob\,(s_t = 2|y_T, y_{T-1}, ..., y_1) > 0.5$); this dummy is zero otherwise. From the 3-regimes SWARCH, two dummies are built, $middle_t$ and $high_t$, taking value 1 for the dates in which the highest smoothed probability is the probability of being, respectively, in the middle- or in the high-volatility regime ($Prob\,(s_t = 2|y_T, y_{T-1}, ..., y_1)$ and $Prob\,(s_t = 3|y_T, y_{T-1}, ..., y_1)$, respectively) - being zero otherwise. Analysis (ii) above is performed by regressing these regime dummies and the underlying smoothed probability series p_{it}, $i =$

[10]The dummy *gfp* takes value 0 (zero) for election and change days.
[11]The *belect* dummies take value 0 (zero) for the election day.
[12]The *achange* dummies take value 0 (zero) for the change day.

$1, 2, ..., K$, on the political-period dummies.

Only elections (changes) followed (preceded) by a government formation period are considered. The periods for which political dummies assume value zero (one) shall be referred to as "outside (inside) political periods". Note that the smoothed probabilities used to perform analysis (ii) may be estimated through a SWARCH process with any of the three ARCH equations presented - equations (2)-(4).

Significant impacts in the ARCH equation - analysis (i) - represent certain increases/decreases in volatility around political events, as opposed to impacts on the regimes' smoothed probabilities in analysis (ii). Given the basic structure of the SWARCH process, exposed in Section 2, both these impacts are *complementary.*

Analysis (iii) assesses the total impact of each political dummy, at the standard error dimension (enhancing comparability with average stock returns). The estimated variance daily series is retrieved from the optimization of the SWARCH process, transposed to standard errors, and regressed on the political variables (and on the squared-*vix*). This series of variances consists of the daily estimates for

$$E\left[\hat{u}_t^2\right] = \sum_{i=1}^{K}\sum_{j=1}^{K}\sum_{l=1}^{K}\left[\hat{f}_{ijl}E\left[u_t^2|s_t, s_{t-1}, s_{t-2}, u_t, u_{t-1}, u_{t-2}\right]\right] = \sum_{i=1}^{K}\sum_{j=1}^{K}\sum_{l=1}^{K}\left[\hat{f}_{ijl}\nu_t^2\hat{h}_t^2\right] =$$

$$= \sum_{i=1}^{K}\sum_{j=1}^{K}\sum_{l=1}^{K}\left[\hat{f}_{ijl}\hat{g}_i\nu_t^2\left(\hat{a}_0 + \frac{\hat{a}_1}{\hat{g}_j}\hat{\tilde{u}}_{t-1}^2 + \frac{\hat{a}_2}{\hat{g}_l}\hat{\tilde{u}}_{t-2}^2 + \hat{b}_0 vix_t^2 + \hat{b}_1 belectN_t + \hat{b}_2 gfp_t + \hat{b}_3 achangeN_t\right)\right], \tag{5}$$

where $\hat{f}_{ijl}$ represents the estimate for $Prob\left(s_t = i, s_{t-1} = j, s_{t-2} = l|y_t, y_{t-1}, ..., y_1\right)$[13].

Note that only analysis (i) is embedded in the estimation of the SWARCH process, whereas both analysis (i) and (iii) consist of post-estimation assessments[14]. Figures 4 and 5 represent, respectively, the empirical methodology followed and the conceptual impact channels tested. In both Figures, the specific stages at which analyses (i)-(iii) take effect.

[13]In the case at hand, i, j, $l \in \{1, 2, 3\}$. Hamilton and Susmel (1994) name $\hat{f}_{ijl}$ *filtered probability.*

[14]A potential improvement consists of augmenting the SWARCH process by allowing the regime-transition probabilities in the Markov chain - equation (1) - to be a function of the political-period dummies. This way, the regimes' smoothed probabilities are already estimated under the assumption of potential impact by the proximity to political events.

Part III presents and discusses the results from the application of the model exposed in Sections 2-4 to three OECD countries - Japan, U.K. and Germany - for the period 1960-2008[15]. This discussion shall focus on the results from analysis (i)-(iii), using the results from the estimation of a SWARCH process containing the vix and political periods in the ARCH specification - equation (4). The number of volatility regimes is set to three ($K = 3$) and the set of political periods lengths is restricted to $\{10, 22\}$[16].

Daily stock market returns come from Datastream database and political events' dates are collected by the author from Woldendorp et al (1998) and a set of political compendiums and archives. Only business days are considered. Appendix F presents sources, definitions and summary statistics of the data used.

[15] Due to missing values, the most extended series used for U.K. and Germany start in 1968 and 1965, respectively.

[16] Results using 5-days political periods consistently lack robustness

Figure 4. Sequential estimation methodology

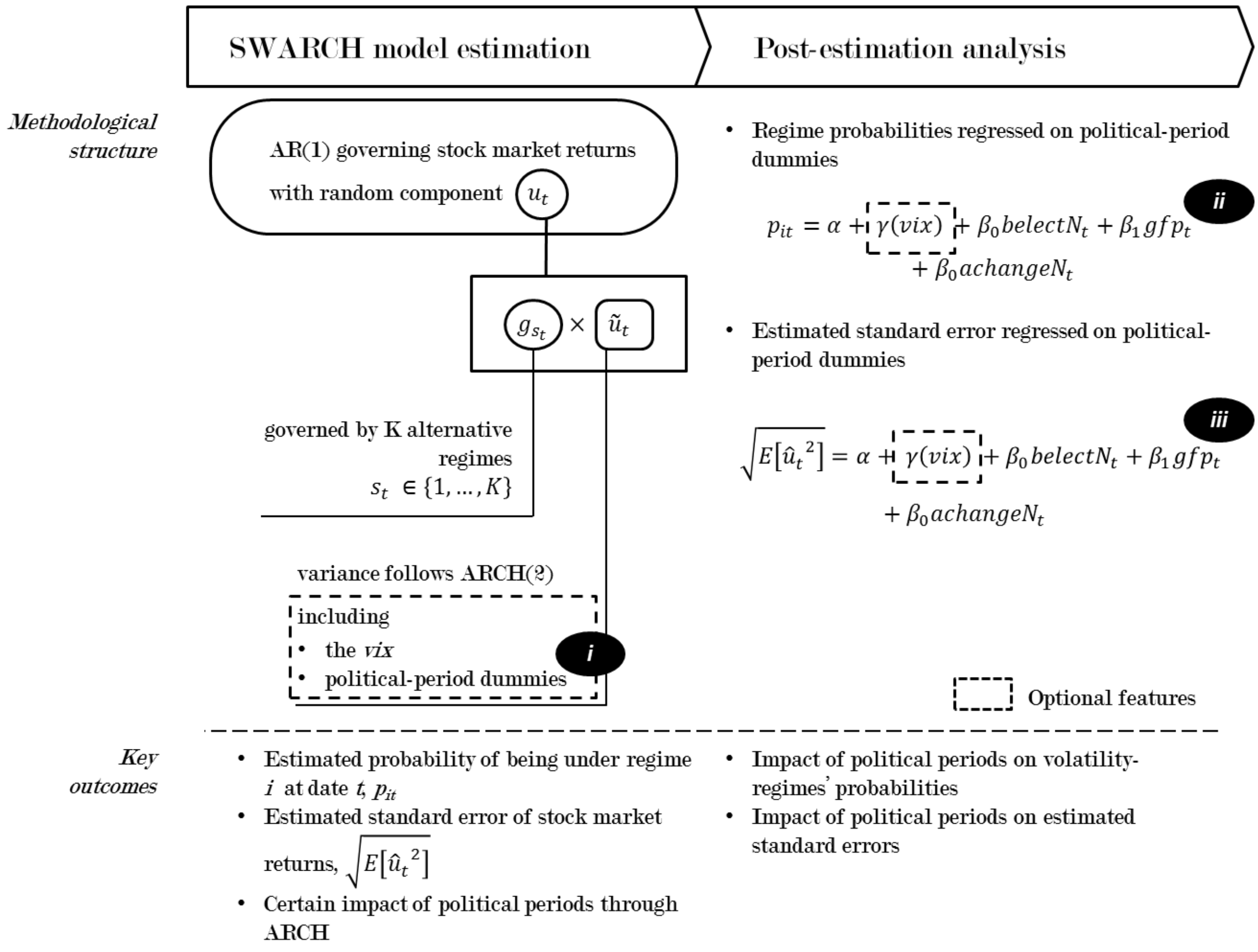
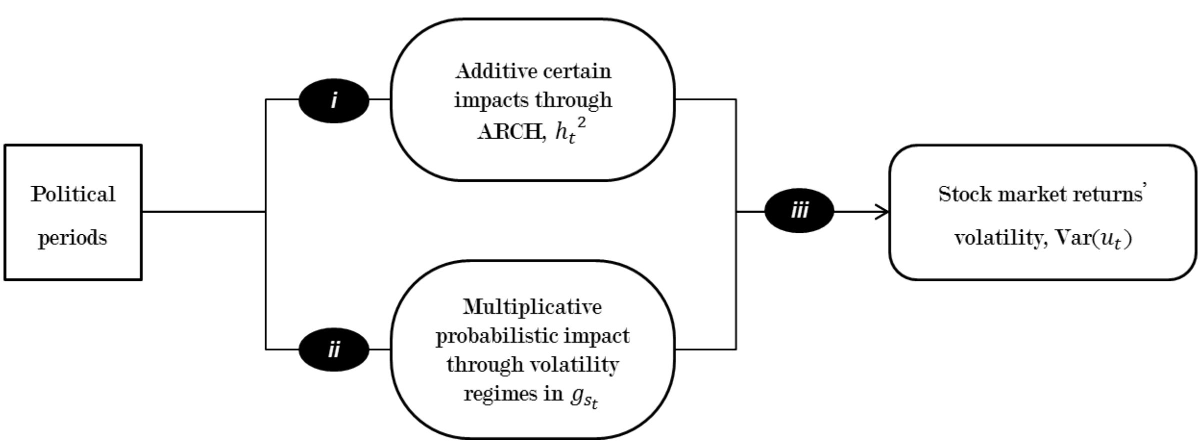


Figure 5. Impact channels linking political periods to stock market returns volatility



Part III

Results

5 Japan

This section discusses the application of the SWARCH model to the Japanese stock market index NIKKEI225.

After fitting the SWARCH process to the data, the dummies $middle_t$ and $high_t$ and the correspondent smoothed probabilities, $smiddle_t := p_{2t}$ and $shigh_t := p_{3t}$ are regressed on the political-period dummies, in order to search for significantly different volatility regimes around political events. Given that the dummies ($middle_t$ and $high_t$) represent discrete transformations of the smoothed probabilities, the analysis shall focus on the latter.

Tables 1-3 report the results of analyses (i)-(iii) from Section 4[17]. The table reporting the results from the smoothed probabilities' regressions - Table 2 - includes the estimates for g_i, the variance multipliers associated to middle- and high-volatility regimes. These estimates result from the SWARCH process estimation - not from the smoothed probabilities' regressions - and each estimate is reported in the column associated to the respective combination of volatility regime and political-period window (e.g. in the first column with results, Table 2 reports the estimate for g_2, the middle-regime multiplier, attained when the SWARCH optimization framework used 22-days political dummies in the ARCH equation). Appendixes A-D provide the full set of results for Japan exploring all the potential methodological frameworks, including ARCH specifications of equations (2)-(4)[18].

These results may be summarized as follows:

1. Outside political periods, the average estimated conditional[19] standard error of the daily stock market return is 1.07 percentage points (see the intercept of regressions excluding thevix in Table 24, Appendix D).

[17] Using the specific framework indicated in the end of Section 4.
[18] Including also an ARCH specification without the vix and with the political periods.
[19] $\sqrt{E\left[\hat{u}_t^2\right]}$

2. The days preceding elections are associated to a standard error decrease in 0.17-0.19 percentage points (16-17% of its average outside political periods) - Table 3. This reduction is driven by a (certain) decrease in the mean-reversion term of the variance auto-regressive component (Table 1) and, in the 10 days preceding elections, a decrease in the probability of high-volatility regimes (Table 2). There is an increase in the probability of middle-volatility regimes during the days preceding elections (Table 2), which, nevertheless, does not compensate the other volatility-reducing effects.

3. During gfp's, the standard error increases in 0.15 percentage points (14%) relative to days outside political periods (Table 3). This volatility increase is driven by a (certain) positive impact in the mean-reversion term of the variance auto-regressive component (Table 1) and an increase in the probability of middle-volatility regimes (Table 2). There is a decrease in the probability of high volatility regimes during these periods, which does not compensate the other volatility-increasing impacts.

4. The days succeeding cabinet changes are associated to a standard error decrease in 0.12-0.13 percentage points (11-12%) with respect to days outside political periods (Table 3); such impact is driven by a (certain) decrease in the mean-reversion term of the variance auto-regressive component (Table 1), not compensated by the increase in the probabilities of middle- and high-volatility regimes (Table 2).

It can be seen in Appendixes A-C that results attained using the 3-regimes SWARCH evolve as the *vix* and the political dummies are progressively included in the ARCH specification, underlining the relevance of these variables to a correct understanding of the impact channels under study. Appendix D shows that the *vix* is also crucial to a correct accounting of the global impact of political periods on the stock market volatility, given the changes in the political estimates produced by the removal of this control.

Table 1. ARCH equation, 3-regimes, with *vix* (estimated within SWARCH optimization), Japan

dep. var.		variance auto-regressive component, h^2	
indep. var.			
vix^2		0.139***	0.139***
		(0.013)	(0.013)
gfp		0.000009**	0.000010***
		(0.000004)	(0.000004)
belect	*22*	-0.000007***	
		(0.000002)	
	10		-0.000006*
			(0.000003)
achange	*22*	-0.000010***	
		(0.000002)	
	10		-0.000009***
			(0.000003)

* Significant at 10% level, ** Significant at 5% level, *** Significant at 1% level. Standard errors in parenthesis.

Table 2. Regimes' smoothed probabilities regressed on political dummies (sequentially estimated, after SWARCH optimization, 3-regimes, with *vix* and political dummies in ARCH), Japan

dep. var.		smiddle		shigh	
indep. var.					
gfp		0.278***	0.260***	-0.038***	-0.048***
		(0.018)	(0.018)	(0.014)	(0.014)
belect	*22*	0.083***		-0.027	
		(0.026)		(0.017)	
	10		0.107***		-0.075***
			(0.038)		(0.021)
achange	*22*	0.113***		0.040*	
		(0.027)		(0.022)	
	10		0.103**		0.010
			(0.041)		(0.033)
Intercept		0.466***	0.470***	0.151***	0.158***
		(0.004)	(0.004)	(0.003)	(0.003)
$\hat{g}_i$		3.497***	3.450***	13.723***	13.403***
		(0.140)	(0.139)	(0.659)	(0.639)
N		10,579	10,591	10,579	10,591
R^2		0.018	0.015	0.001	0.001

* Significant at 10% level, ** Significant at 5% level, *** Significant at 1% level. Robust standard errors in parenthesis. Except where explicitly indicated otherwise, all (non-)significant coefficients in the table maintain (non-)significance in corresponding robust OLS and tobit regressions, including specifications with each explanatory variable isolated. $^{(a)}$Non-significant when isolated, both in robust OLS and tobit.

Table 3. Estimated standard errors regressed on political dummies (sequentially estimated, after SWARCH optimization, 3-regimes, with *vix* and political dummies in ARCH), Japan

dep. variable		$\sqrt{E\left[\hat{u}_t^2\right]}$	
indep. variables			
	vix	0.71663***	0.71669***
		(0.02430)	(0.02240)
	gfp	0.00145***	0.00154***
		(0.00021)	(0.00021)
belect	*22*	-0.00173***	
		(0.00020)	
	10		-0.00187***
			(0.00028)
achange	*22*	-0.00125***	
		(0.00020)	
	10		-0.00115***
			(0.00030)
	Intercept	0.00457***	0.00452***
		(0.00020)	(0.00018)
	N	10,579	10,591
	R^2	0.334	0.349

* Significant at 10% level, ** Significant at 5% level, *** Significant at 1% level. Robust standard errors in parenthesis. Except where explicitly indicated otherwise, all (non-)significant coefficients in the table maintain (non-)significance in corresponding specifications with each explanatory variable isolated.

6 U.K.

The stock market index used for the U.K. case is the FTSE All-Share. Tables 4-6 report the results from analyses (i)-(iii) described in Section 4[20]. Appendix I replicates those analysis removing the *vix* from the ARCH specification and from the regressions of estimated standard errors on political periods.

The results for the U.K. show that:

1. Outside political periods, the average estimated conditional[21] standard error of the daily stock market return is 0.95-0.96 percentage points (see the intercept of regressions excluding the*vix* in Table 35, Appendix I).

2. Days before elections are associated to a standard error decrease in 0.06-0.16 percentage points (6-17% of its average outside political periods) - Table 6. This decrease is driven by a (certain) negative impact in the mean-reversion term of the variance auto-regressive component (Table 4), which is not compensated by the increase in the probability of middle-volatility regimes (Table 5).

3. During gfp's, the standard error increases in 2.56-2.59 percentage points (267-271%) relative to its average outside political periods (Table 6). This volatility increase is driven by a positive impact in the probability of middle-volatility regimes (Table 5), which is not compensated by the (certain) decrease in the mean-reversion term of the variance auto-regressive component (Table 4). Note that the increase in the estimated standard error during gfp's in U.K. is much larger than that occurring in Japanese gfp's, in spite of the larger negative impact through the ARCH equation in the case of the U.K.. This is partly due to the larger positive impact on $E\left[g\right]=\sum_{i=1}^{K}p_i g_i$ in the U.K. case *versus* the Japanese case; the absence of impact from the high-regime probability in the U.K. is the key factor unbalancing $\Delta E\left[g\right]$[22]. Note that U.K. gfp's have, on average, 1.2 days of duration (there are 12 gfp days

[20]Using the specific framework indicated in the end of Section 4.

[21]$\sqrt{E\left[\hat{u}_t^2\right]}$

[22]Note that, considering the 22-days window, in the U.K. case $\triangle_{gfp}E\left[g\right]=\sum_{i=1}^{K}\left(\triangle p_i\right)g_i=-0.393\times 1+0.393\times 2.345+0\times 8.229=0.529$, whereas, in the Japanese case, $\triangle_{gfp}E\left[g\right]=\sum_{i=1}^{K}\left(\triangle p_i\right)g_i=-0.24\times 1+0.278\times 3.497-0.038\times 13.723=0.211$. The high-volatility regime is responsible for a divergence larger than the final difference

to 10 elections)[23]. Such feature implies that the lagged-variances in the ARCH component of gfp-variances include before-election days for a large portion of the U.K. gfp's. Given the standard-error decrease associated to days before elections, this lower duration by U.K. gfp's may generate a downward bias in the (already large) estimated impact of gfp days on volatility, relative to other countries estimates.

4. Days succeeding cabinet changes are associated to a standard error decrease in 0.15-0.17 percentage points (15-18%) relative to its average outside political periods (Table 6). This decrease is driven by a (certain) negative impact in the mean-reversion term of the variance auto-regressive component (Table 4), not compensated by the increase in the probability of middle-volatility regimes in the 22-days window (Table 5).

Appendix I shows that, similarly to the Japanese case, the political impacts on the ARCH equation, on the smoothed probabilities, and on the estimated standard errors change profile with the removal of the *vix*. This confirms that this control, besides statistically significant, is crucial to a correct understanding of the mechanics and magnitude of political events' impacts on stock markets volatility.

$(0.038 \times 13.723 = 0.521 > 0.318 = 0.529 - 0.211)$, being compensated by contrary divergences in the other regimes.

[23] In Japan there is an average of 26 gfp days per election (364 gfp days to 14 elections). See Table 28, Appendix F.

Table 4. ARCH equation, 3-regimes, with *vix* (estimated within SWARCH optimization), U.K.

dep. var.		variance auto-regressive component, h^2	
indep. var.			
vix^2		0.324***	0.322***
		(0.024)	(0.024)
gfp		-0.000632**	-0.000635**
		(0.000275)	(0.000279)
belect	*22*	-0.000009**	
		(0.000004)	
	10		-0.000011**
			(0.000005)
achange	*22*	-0.000011***	
		(0.000004)	
	10		-0.000010*
			(0.000006)

* Significant at 10% level, ** Significant at 5% level, *** Significant at 1% level. Standard errors in parenthesis.

Table 5. Regimes' smoothed probabilities regressed on political dummies (sequentially estimated, after SWARCH optimization, 3-regimes, with *vix* and political dummies in ARCH), U.K.

dep. var.		smiddle		shigh	
indep. var.					
gfp		0.393***	0.361***	0.008	0.007
		(0.079)	(0.084)	(0.078)	(0.078)
belect	*22*	0.157***		0.011	
		(0.029)		(0.018)	
	10		0.123***		0.008
			(0.044)		(0.029)
achange	*22*	0.068**		0.018	
		(0.027)		(0.020)	
	10		0.007		0.014
			(0.038)		(0.030)
Intercept		0.416***	0.417***	0.083***	0.083***
		(0.004)	(0.004)	(0.003)	(0.003)
$\hat{g}_i$		2.345***	2.350***	8.229***	8.233***
		(0.108)	(0.108)	(0.607)	(0.603)
N		9,665	9,677	9,665	9,677
R^2		0.007	0.002	0.000	0.000

* Significant at 10% level, ** Significant at 5% level, *** Significant at 1% level. Robust standard errors in parenthesis. Except where explicitly indicated otherwise, all (non-)significant coefficients in the table maintain (non-)significance in corresponding robust OLS and tobit regressions, including specifications with each explanatory variable isolated.

Table 6. Estimated standard errors regressed on political dummies (sequentially estimated, after SWARCH optimization, 3-regimes, with *vix* and political dummies in ARCH), U.K.

dep. variable		$\sqrt{E\left[\hat{u}_t^2\right]}$	
indep. variables			
	vix	0.86475***	0.85377***
		(0.02011)	(0.01881)
	gfp	0.02560***	0.02586***
		(0.00279)	(0.00291)
belect	*22*	-0.00062***	
		(0.00020)	
	10		-0.00164***
			(0.00021)
achange	*22*	-0.00172***	
		(0.00018)	
	10		-0.00146***
			(0.00027)
	Intercept	0.00173***	0.00180***
		(0.00017)	(0.00016)
	N	9,665	9,677
	R^2	0.595	0.605

* Significant at 10% level, ** Significant at 5% level, *** Significant at 1% level. Robust standard errors in parenthesis. Except where explicitly indicated otherwise, all (non-)significant coefficients in the table maintain (non-)significance in corresponding specifications with each explanatory variable isolated.

7 Germany

The analysis developed for the U.K. is replicated for Germany, using the DAX 30 Performance stock market index. Tables 7-9 report the results of analyses (i)-(iii) from Section 4[24]. Appendix J replicates those analyses removing the *vix* from the ARCH specification and from the regressions of estimated standard errors on political periods.

The results are summarized below:

1. Outside political periods, the average estimated conditional[25] standard error of the daily stock market return is 1.07 percentage points (see the intercept of regressions excluding the*vix* in Table 38, Appendix J).

2. Days before elections are associated to a standard error increase in 0.06-0.10 percentage points (5-9% of its average outside political periods) - Table 9. This increase is driven by a positive impact in the probability of high-volatility regimes, which is not compensated by the decrease in the probability of middle-regimes (22-days window) - Table 8. As the election approaches and we enter the 10-days window, the negative impact on the middle-regime probability disappears, yielding a higher impact on the estimated s.e..

3. During gfp's, the standard error increases in 0.25-0.33 percentage points (24-31%) relative to its average outside political periods (Table 6). This volatility increase is also driven by an increase in the probability of high-volatility regimes (Table 8), which is not compensated by the decrease in the probability of middle-regimes (Table 8). Note that the gfp-impacts through ARCH and on the middle-regime probabilities are not robust to the several time spans in the before-election and after-change periods. Moreover, the gfp-impact on high-regime probability is also very sensitive to the political periods span.

4. Days succeeding cabinet changes are associated to a standard error increase in 0.17-0.21 percentage points (16-20%) relative to its average outside political periods (Table 9). Tables 7 and 8 present no specific source for such impact, though.

[24] Using the specific framework indicated in the end of Section 4.

[25] $\sqrt{E\left[\hat{u}_t^2\right]}$

According to Appendix J, the removal of the *vix* changes the profile of the political impacts on stock returns' volatility. As in the cases of Japan and U.K., the *vix* proves pivotal to a correct description of channels and magnitudes associated to the impacts of political events in stock markets volatility.

Table 7. ARCH equation, 3-regimes, with *vix* (estimated within SWARCH optimization), Germany

dep. var.		variance auto-regressive component, h^2	
indep. var.			
	vix^2	0.425***	0.402***
		(0.026)	(0.026)
	gfp	-0.000090***	0.000014*
		(0.000006)	(0.000008)
belect	*22*	-0.000001	
		(0.000004)	
	10		0.000000
			(0.000006)
achange	*22*	0.000007	
		(0.000005)	
	10		0.000012
			(0.000009)

* Significant at 10% level, ** Significant at 5% level, *** Significant at 1% level. Standard errors in parenthesis.

Table 8. Regimes' smoothed probabilities regressed on political dummies (sequentially estimated, after SWARCH optimization, 3-regimes, with *vix* and political dummies in ARCH), Germany

dep. var.		smiddle		shigh	
indep. var.					
gfp		-0.138***	-0.018	0.147***	0.060***
		(0.020)	(0.022)	(0.025)	(0.021)
belect	*22*	-0.075***		0.107***	
		(0.024)		(0.024)	
	10		-0.043		0.109***
			(0.037)		(0.035)
achange	*22*	0.030		-0.009	
		(0.023)		(0.017)	
	10		0.016		-0.016
			(0.037)		(0.029)
Intercept		0.473***	0.473***	0.196***	0.203***
		(0.004)	(0.004)	(0.003)	(0.003)
$\hat{g}_i$		2.319***	2.305***	6.313***	6.116***
		(0.109)	(0.108)	(0.306)	(0.297)
N		10,667	10,679	10,667	10,679
R^2		0.005	0.000	0.008	0.002

* Significant at 10% level, ** Significant at 5% level, *** Significant at 1% level. Robust standard errors in parenthesis. Except where explicitly indicated otherwise, all (non-)significant coefficients in the table maintain (non-)significance in corresponding robust OLS and tobit regressions, including specifications with each explanatory variable isolated.

Table 9. Estimated standard errors regressed on political dummies (sequentially estimated, after SWARCH optimization, 3-regimes, with *vix* and political dummies in ARCH), Germany

dep. variable		$\sqrt{E\left[\hat{u}_t^2\right]}$	
indep. variables			
	vix	1.00261***	1.00516***
		(0.01509)	(0.01406)
	gfp	0.00252***	0.00333***
		(0.00020)	(0.00021)
belect	*22*	0.00056**	
		(0.00026)	
	10		0.00095***
			(0.00036)
achange	*22*	0.00168***	
		(0.00024)	
	10		0.00210***
			(0.00035)
	Intercept	0.00196***	0.00190***
		(0.00012)	(0.00011)
	N	10,667	10,679
	R^2	0.660	0.687

* Significant at 10% level, ** Significant at 5% level, *** Significant at 1% level. Robust standard errors in parenthesis. Except where explicitly indicated otherwise, all (non-)significant coefficients in the table maintain (non-)significance in corresponding specifications with each explanatory variable isolated.

Part IV

Conclusion

8 Government formation periods ignite volatility

Periods around democratic elections and subsequent cabinet changes are associated to significant impacts on the volatility of stock markets returns. Such impacts operate both directly through the ARCH process determining daily volatility and by originating volatility regime shifts. The three countries studied - Japan, U.K. and Germany - show heterogeneous profiles with respect to those impacts, but one specific pattern is common to all the countries: stock markets volatility is higher during government formation periods than outside political periods, before elections or after newly-elected cabinets take office. This result is particularly surprising given that the election eliminates a large part of the uncertainty associated to the new cabinet's identity, especially when producing a single-party majority in Parliament[26]. Figures 6-11 plot the impacts of political periods (a) on the estimated standard errors of stock market returns and (b) on the probabilities of being under each volatility regime (3-regimes framework)[27].

In all the countries studied the estimated stock-returns' standard error increases during government formation periods, relative to its average outside political periods (far from elections or subsequent cabinet changes). This standard-error increase measures, relative to the average outside political periods, 14% in the case of Japan, 24-31% in the case of Germany, and 267-271% in the case of the U.K. (the results for the U.K. gfp's shall be read carefully, given the low average duration of these periods, 1.2 days). Also in all the countries, stock-returns' standard errors are clearly higher during government formation periods than during the periods preceding elections or

[26] Between 1960 and 2008, Japan is governed by majoritarian cabinets in 86% of the business days and by single-party cabinets in 70% of those days. In the case of the U.K. and Germany, those percentages are, for the same period, 99%/100% and 96%/4%. Except for Germany, the vast majority of elected Governments in the sample studied are, thus, single-party cabinets holding majoritarian support in Parliament. In such cases, the elected party has no need to negotiate with other parties in order to ensure cabinet formation/stability and the election should determine with strong certainty the profile of the coming Government. See Appendix F for sources of the political data mentioned.

[27] These Figures are based on the results presented in Part III.

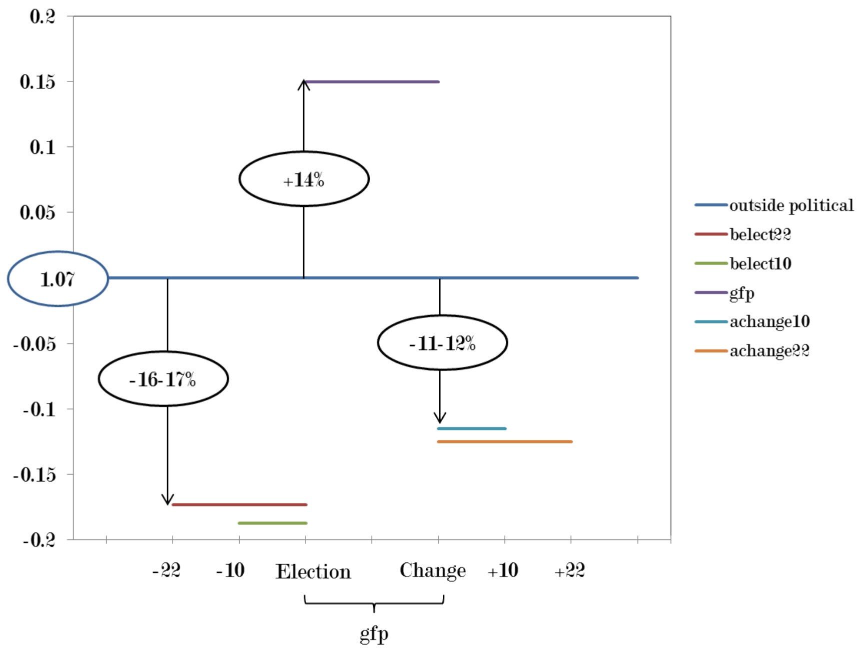
after the new cabinet takes office.

In terms of the impact on volatility regimes, the three countries analyzed are much more heterogeneous. In Japan, the middle-volatility regime becomes more probable both before elections and after cabinet changes (8-11 percentage points increase), relative to its average probability outside political periods; but it's maximum average probability is attained during government formation periods: 74%, meaning that in almost 3 fourths of the gfp days, Japanese stock market is under a middle-volatility regime. The high-volatility regime loses probability during the 10 days preceding elections, relative to its average probability outside political periods. During gfp's, the high-regime probability increases relative to the days before the election, remaining below the average outside political periods. After the cabinet takes office, though, the high-volatility regime becomes more probable than outside political periods, reaching 20% (one in each five days). Thus, in Japan, the day in which the newly-elected cabinet takes office determines a shift in volatility-regime trends. As the election approaches and takes place, moderate volatility becomes increasingly frequent, but extreme-volatility episodes lose frequency. As the new cabinet takes office, moderate volatility loses frequency and extreme volatility becomes more frequent.

An opposite profile is found in Germany. Extreme volatility becomes more frequent before elections and during the gfp (probability around 30% in both periods), returning to the average probability outside political events (20%), after the new cabinet takes office.

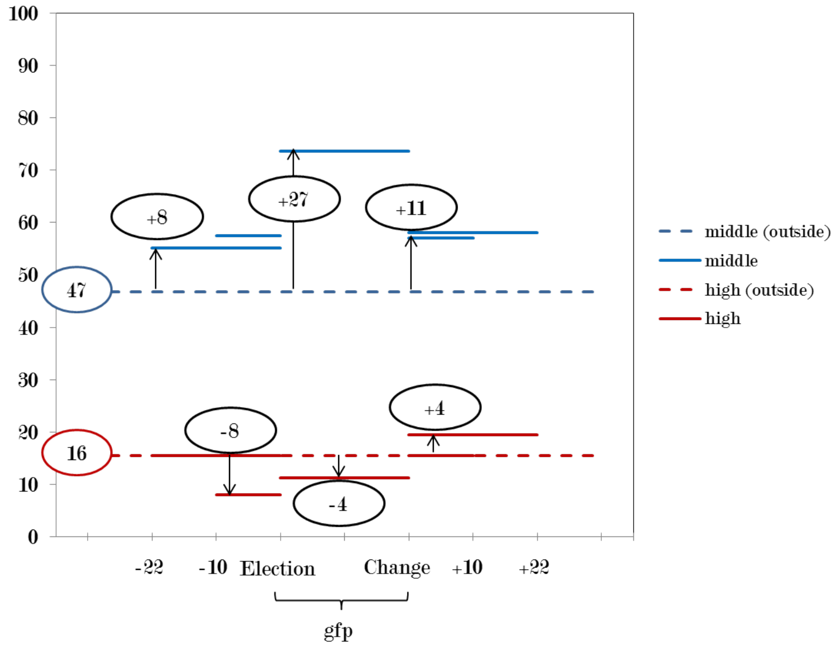
In the case of the U.K., the high-volatility regime is very infrequent, especially if compared to the other two countries. Moreover, this low frequency by the high-regime (8%) is not changed throughout political periods - all the action takes place between the low- and middle-volatility regimes. Note that the low-volatility regime is the most frequent outside political events, with an average probability of 50% ($= 100 - 42 - 8$). Oppositely, during all the political periods studied, the middle-volatility regime becomes the most probable, with maximum probability attained during the government formation periods: 80%, almost doubling its average probability outside political periods. As in Japan and Germany, the day in which the new cabinet takes office plays a pivotal role in volatility regime trends. Until that day, moderate volatility episodes show increasing frequency, experiencing afterwards a downturn towards the average outside political periods.

Figure 6. Stock market returns' volatility during political periods: estimated standard errors (in percentage points), Japan, Tables 3 and 24



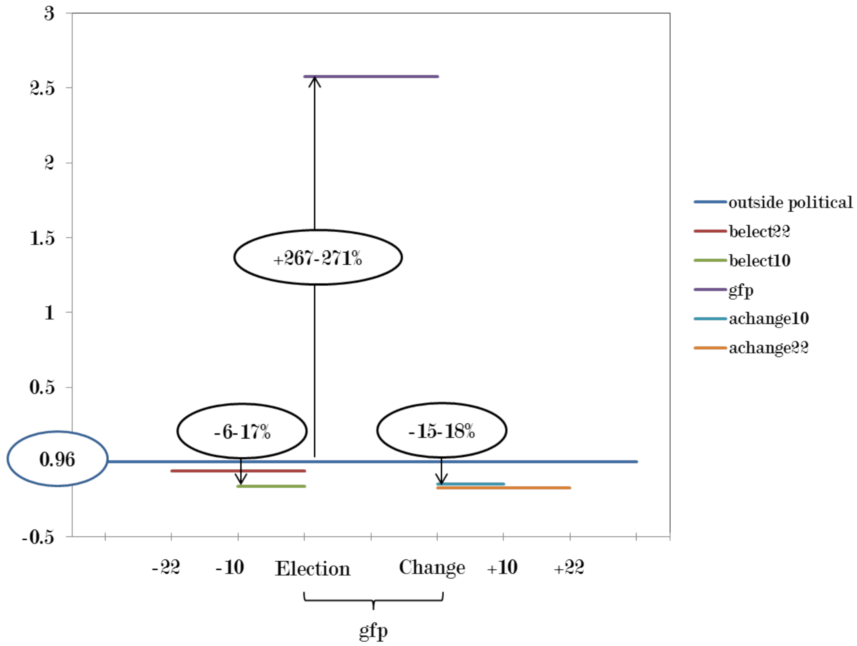
Notes: Vertical axis denotes difference with respect to the average outside political periods, in stock returns units (percentage points). Horizontal axis represents political events and number of days before(-)/after(+).

Figure 7. Stock market returns' volatility during political periods: probability of being at middle-/high-volatility regime (%), Japan, Table 2



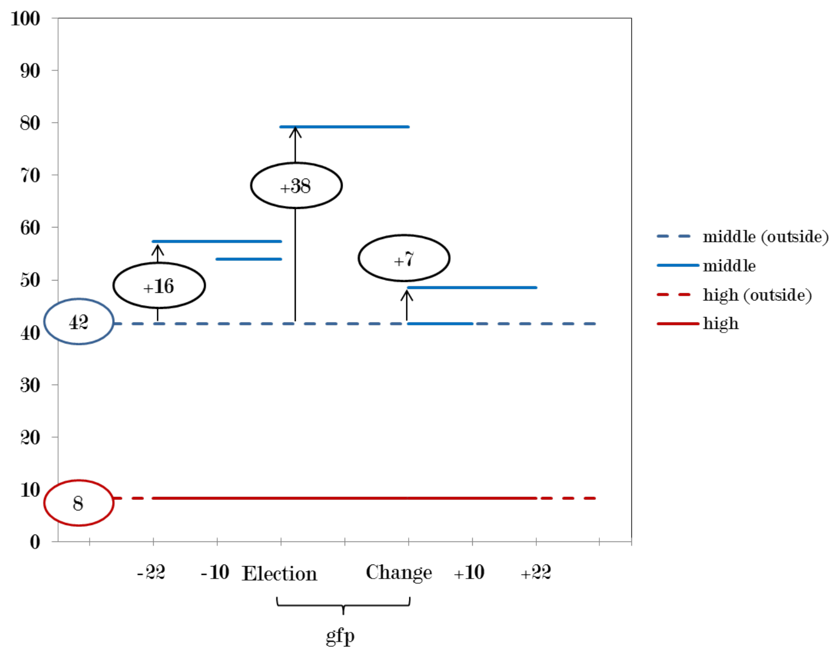
Notes: Estimates for the same political period were averaged when divergent. Vertical axis denotes probability of being under a volatility regime, in percentage (%). Horizontal axis represents political events and number of days before(-)/after(+).

Figure 8. Stock market returns' volatility during political periods: estimated standard errors (in percentage points), U.K., Tables 6 and 35



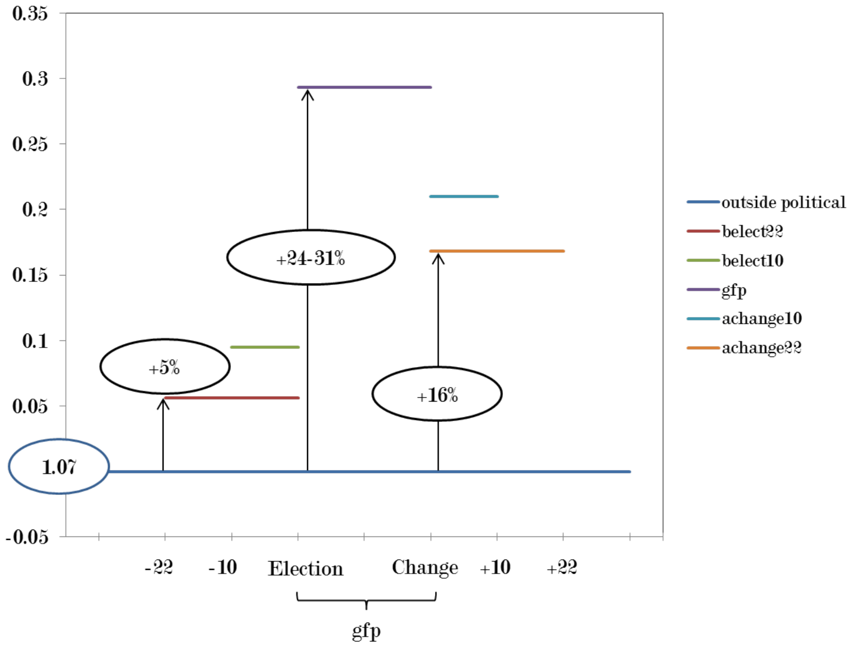
Notes: Vertical axis denotes difference with respect to the average outside political periods, in stock returns units (percentage points). Horizontal axis represents political events and number of days before(-)/after(+).

Figure 9. Stock market returns' volatility during political periods: probability of being at middle-/high-volatility regime (%), U.K., Table 5



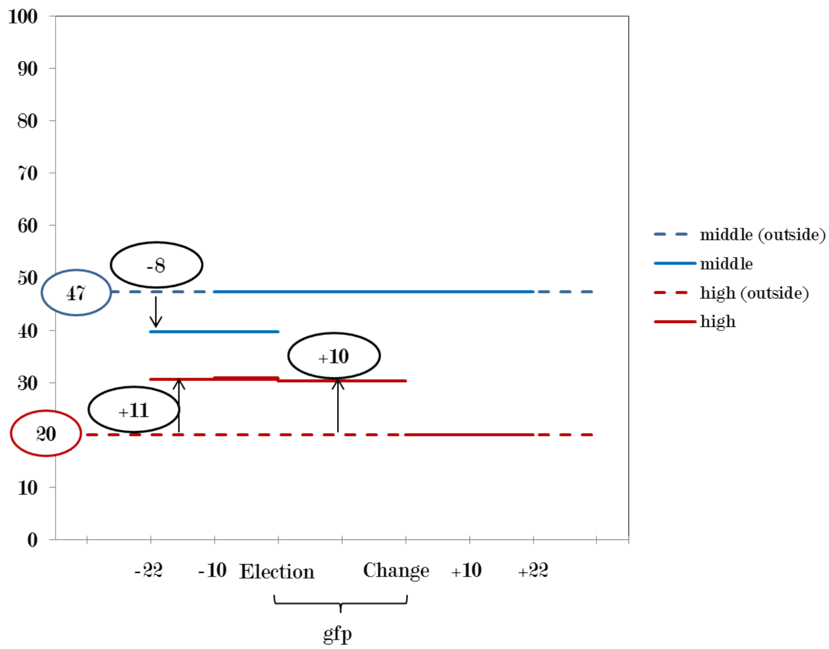
Notes: Estimates for the same political period were averaged when divergent. Vertical axis denotes probability of being under a volatility regime, in percentage (%). Horizontal axis represents political events and number of days before(-)/after(+).

Figure 10. Stock market returns' volatility during political periods: estimated standard errors (in percentage points), Germany, Tables 9 and 38



Notes: Vertical axis denotes difference with respect to the average outside political periods, in stock returns units (percentage points). Horizontal axis represents political events and number of days before(-)/after(+).

Figure 11. Stock market returns' volatility during political periods: probability of being at middle-/high-volatility regime (%), Germany, Table 8



Notes: Estimates for the same political period were averaged when divergent. Vertical axis denotes probability of being under a volatility regime, in percentage (%). Gfp-impact on middle-regime probability not plotted due to lack of robustness to political period spans; gfp-impact on high-volatility regime shall be read with caution, due to its high sensitivity to the political periods span (See Section 7). Horizontal axis represents political events and number of days before(-)/after(+).

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APPENDIX

A. Results for Japan, without *vix* nor political periods in ARCH

The framework applied in this section consists of the SWARCH process without the *vix* control nor any political-period dummy in the ARCH specification - equation (2). This model is run alternatively with K=2 (2 volatility regimes) and K=3 (3 volatility regimes), producing (a) estimates for the values of g_2 and, in the 3-regimes framework, g_3 - the highest-regimes of the multiplicative factors in the stock-returns' variance - and (b) a daily series for the (smoothed) probability of having been at each of these regimes, at each date t.

The 2-regimes estimation yields $\hat{g}_2 = 6.06$ (significant at 1% level, with a s.e. of 0.21) and the 3-regimes estimation yields $\hat{g}_2 = 3.94$ and $\hat{g}_3 = 15.74$ (s.e. estimation unfeasible[28]).

The detailed results from analysis (ii) described in Section 4 are provided in Tables 10-12 and can be summarized as follows:

1. using 2 regimes...

   (a) outside political periods, the average probability of being at the high-volatility regime at date t is about 42% - on average, stock returns are under the low-volatility regime, or, on another perspective, stock returns are at the low-volatility regime 42% of the times;

   (b) the days preceding elections show a significantly lower probability of high-volatility regime in 12-13 percentage points (p.p.), reaching a high-regime probability of about 30%;

   (c) government formation periods (gfp's) show a significantly higher probability of high-volatility regime in 28 p.p., reaching an average high-regime probability of 70% (during these periods we are *on average*, or, in other words, *70% of the times* at the high-volatility regime); this represents a sizable volatility increase around the election, from 30% of high-volatility probability to the exact complement with respect to the certain event.

[28]Estimated variance-covariance matrix not positive definite, either through the Hessian of the log likelihood or through the outer product of the score.

2. using 3 regimes...

   (a) outside political periods, the average probability of being at the middle-volatility regime is about 40-41% and the average probability of being at the high-volatility regime is about 12% - low-volatility remains the most probable regime;

   (b) preceding elections, there is a significant decrease in the high-regime probability in 6-7 p.p.; this represents a reduction in about one half of it's average value, in favor of the low-regime probability (the middle-regime probability is not significantly different);

   (c) during gfp's, the middle-regime probability significantly increases in 26 p.p., to a smoothed probability of 66-67%, and the high-regime probability significantly increases in 3 p.p., to a smoothed probability of about 15%; the middle regime becomes, thus, the most probable regime during gfp's.

The estimated regime parameters and the impacts on the smoothed probabilities show that: in the days preceding elections, the expected multiplicative coefficient in returns' variance, $E[g] = \sum_{i=1}^{K} \hat{p}_i \hat{g}_i$ decreases in about 0.66 units[29] according to the 2-regimes framework, and in 1.03 units[30] according to the 3-regime framework; in gfp days, the expected multiplicative coefficient increases in 1.42 units[31] according to the 2-regime framework, and in 1.21 units[32] in the 3-regimes version; in the days after cabinet changes, there is no significant change in the expected multiplicative coefficient[33]. All these impacts in $E[g]$ are relative to its average value outside political periods.

Note that introducing the third regime produces a sizable impact on the decrease in $E[g]$ associated to days preceding elections - from 0.66 to 1.03 - adding also information on the profile of the volatility changes occurred in each political period: the 3-regimes framework shows that the decrease in volatility before elections is associated to a decrease in the probability of more extreme and infrequent volatility states, while the increase in volatility during gfp days is mostly due to the increase in the probability of moderate and more frequent volatility states. With a smoothed

[29] $-0.66 = -0.13 \times 6.06 + 0.13 \times 1$

[30] $-1.03 = -0.07 \times 15.74 + 0 \times 3.94 + 0.07 \times 1$

[31] $1.42 = 0.28 \times 6.06 - 0.28 \times 1$

[32] $1.21 = 0.03 \times 15.74 + 0.26 \times 3.94 - 0.29 \times 1$

[33] General formula for the computation of the impact on $E[g]$ is $\Delta E[g] = \sum_{i=1}^{K} (\Delta p_i)\, g_i$, where Δp_i represents the estimated coefficient of a given political-period dummy in the smoothed probabilities regression.

probability of 12%, the third and most extreme regime seems non-negligible, suggesting that the 3-regimes approach provides a more reliable analysis of the stock-returns' volatility profile.

Table 10. Regressing regimes' probabilities and dummies, after SWARCH model estimation (*vix* and political periods excluded from ARCH, 2-regimes), Japan, 1960-2008

		dependent variable: high-regime							
		shigh				high			
indep. var.									
	gfp	0.281***	0.276***	0.279***	0.280***	0.291***	0.287***	0.289***	0.290***
		(0.020)	(0.020)	(0.020)	(0.020)	(0.024)	(0.024)	(0.024)	(0.024)
belect	*22*		-0.133***				-0.151***		
			(0.022)				(0.025)		
	10			-0.120***				-0.150***	
				(0.032)				(0.037)	
	5				-0.116**[(a)]				-0.158***
					(0.052)				(0.050)
achange	*22*		-0.026				-0.005		
			(0.024)				(0.029)		
	10			-0.027				-0.003	
				(0.035)				(0.043)	
	5				-0.011				0.057
					(0.050)				(0.063)
	Intercept	0.416***	0.420***	0.417***	0.416***	0.411***	0.416***	0.413***	0.412***
		(0.004)	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)	(0.005)	(0.005)
	N	11,596	11,596	11,596	11,596	11,596	11,596	11,596	11,596
	R^2	0.012	0.015	0.013	0.013	0.011	0.014	0.012	0.012

* Significant at 10% level, ** Significant at 5% level, *** Significant at 1% level. Robust standard errors in parenthesis. Except where explicitly indicated otherwise, all (non-)significant coefficients in the table maintain (non-)significance in respective robust-probit and tobit regressions, including specifications with each explanatory variable isolated (the latter also run using robust OLS). [(a)] Significant at 1% level in robust OLS, but only at 5% level in corresponding tobit.

Table 11. Regressing regimes' probabilities and dummies, after SWARCH model estimation (*vix* and political periods excluded from ARCH, 3-regimes), Japan, 1960-2008. Assessing the middle-regime.

		dependent variable: middle-regime							
		smiddle				middle			
indep. var.									
	gfp	0.257***	0.256***	0.257***	0.257***	0.274***	0.272***	0.274***	0.274***
		(0.020)	(0.020)	(0.020)	(0.020)	(0.024)	(0.024)	(0.024)	(0.024)
belect	*22*		-0.034[(a)]				-0.052*		
			(0.022)				(0.027)		
	10			-0.009				-0.015	
				(0.033)				(0.040)	
	5				0.004				-0.007
					(0.045)				(0.057)
achange	*22*		-0.001				-0.018		
			(0.025)				(0.028)		
	10			0.022				-0.004	
				(0.037)				(0.043)	
	5				0.041				-0.001
					(0.053)				(0.062)
	Intercept	0.404***	0.405***	0.404***	0.404***	0.407***	0.409***	0.407***	0.407***
		(0.004)	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)	(0.005)	(0.005)
	N	11,596	11,596	11,596	11,596	11,596	11,596	11,596	11,596
	R^2	0.012	0.013	0.013	0.013	0.010	0.010	0.010	0.010

* Significant at 10% level, ** Significant at 5% level, *** Significant at 1% level. Robust standard errors in parenthesis. Except where explicitly indicated otherwise, all (non-)significant coefficients in the table maintain (non-)significance in respective robust OLS, robust probit and tobit regressions, including specifications with each explanatory variable isolated.[(a)] Significant at 10% level when isolated, in robust OLS and tobit.

Table 12. Regressing regimes' probabilities and dummies, after SWARCH model estimation (*vix* and political periods excluded from ARCH, 3-regimes), Japan, 1960-2008. Assessing the high-regime.

		dependent variable: high-regime							
		shigh				high			
indep. var.									
	gfp	0.031**	0.029*	0.030*	0.031**	0.022	0.021	0.022	0.022
		(0.016)	(0.016)	(0.016)	(0.016)	(0.017)	(0.017)	(0.017)	(0.017)
belect	*22*		-0.063***				-0.050***		
			(0.010)				(0.013)		
	10			-0.061***				-0.051***	
				(0.017)				(0.019)	
	5				-0.071***				-0.065***
					(0.020)				(0.023)
achange	*22*		-0.001				0.017		
			(0.017)				(0.019)		
	10			0.002				0.030	
				(0.025)				(0.030)	
	5				-0.004				0.020
					(0.036)				(0.041)
	Intercept	0.115***	0.117***	0.116***	0.115***	0.104***	0.105***	0.105***	0.105***
		(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
	N	11,596	11,596	11,596	11,596	11,596	11,596	11,596	11,596
	R^2	0.000	0.002	0.001	0.001	0.000	0.001	0.001	0.000

* Significant at 10% level, ** Significant at 5% level, *** Significant at 1% level. Robust standard errors in parenthesis. Except where explicitly indicated otherwise, all (non-)significant coefficients in the table maintain (non-)significance in corresponding robust OLS, robust probit and tobit regressions, including specifications with each explanatory variable isolated.

B. Results for Japan, with *vix* and without political periods in ARCH

The ARCH specification now follows equation (3). The 2-regimes estimation yields $\hat{g}_2 = 5.68$ (significant at 1% level, with a s.e. of 0.22) and an estimated coefficient for the squared-*vix* in the ARCH equation of $b_0 = 0.074$, with an estimated standard error (s.e.) of 0.010, yielding statistical significance at 1% level.

The 3-regimes version produces an estimated coefficient for the squared-*vix* of $b_0 = 0.126$ and the following estimates for the regimes' multiplicative effects: $\hat{g}_2 = 3.58$ and $\hat{g}_3 = 13.48$ (s.e. estimation unfeasible for all these coefficients[34]).

Tables 13-15 provide detailed results from the regressions of smoothed probabilities and regime dummies on the political periods. Results from the 2-regimes framework are not very distant from those attained without controlling for the *vix*, but, in the 3-regimes framework, there are two novelties: (a) the middle-regime probability significantly increases before elections, in 6-11 p.p. (6, 10 and 11 p.p. in the 22-, 10- and 5-days window, respectively) - there was no significant change in this regime, when not controlling for the *vix* - and (b) there is no significant change in the high-regime probability during gfp's - there was a significant increase without the *vix*.

Still according to the 3-regimes framework, $E[g]$ decreases, relative to its average outside political periods, in 0.72, 0.74 and 0.84 units[35] in the 22-, 10- and 5-days periods before elections, respectively - this decrease measured around 1.03 units, without controlling for the *vix*. In gfp periods, $E[g]$ increases, relative to its average outside political periods, in 0.72 units, when controlling for the *vix* - this impact compares to the 1.21-units increase implied by the results without the *vix*.

[34] Estimated variance-covariance matrix not positive definite, either through the Hessian of the log likelihood or through the outer product of the score.

[35] Similar computations to those applied to the results from the framework without controlling for the *vix*; these computations use two-decimal-places rounded numbers.

Table 13. Regressing regimes' probabilities and dummies, after SWARCH model estimation (*vix* included in ARCH, political periods excluded from ARCH, 2-regimes), Japan, 1960-2008

		dependent variable: high-regime							
		shigh				high			
indep. var.									
	gfp	0.278***	0.274***	0.276***	0.277***	0.281***	0.278***	0.280***	0.280***
		(0.020)	(0.020)	(0.020)	(0.020)	(0.024)	(0.024)	(0.024)	(0.024)
belect	*22*		-0.112***				-0.081***		
			(0.025)				(0.029)		
	10			-0.098***				-0.068[a]	
				(0.035)				(0.043)	
	5				-0.096*				-0.070
					(0.048)				(0.060)
achange	*22*		-0.031				-0.014		
			(0.027)				(0.031)		
	10			-0.046				-0.037	
				(0.040)				(0.046)	
	5				-0.040				-0.014
					(0.058)				(0.067)
	Intercept	0.442***	0.446***	0.443***	0.443***	0.439***	0.442***	0.440***	0.439***
		(0.004)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
	N	10,579	10,579	10,579	10,579	10,579	10,579	10,579	10,579
	R^2	0.013	0.014	0.013	0.013	0.011	0.011	0.011	0.011

* Significant at 10% level, ** Significant at 5% level, *** Significant at 1% level. Robust standard errors in parenthesis. Except where explicitly indicated otherwise, all (non-)significant coefficients in the table maintain (non-)significance in respective robust-probit and tobit regressions, including specifications with each explanatory variable isolated (the latter also run using robust OLS). [a] Significant at 10% level when isolated, both in robust OLS and probit.

Table 14. Regressing regimes' probabilities and dummies, after SWARCH model estimation (*vix* included in ARCH, political periods excluded from ARCH, 3-regimes), Japan, 1960-2008. Assessing the middle-regime.

		dependent variable: middle-regime							
		smiddle				middle			
indep. var.									
	gfp	0.275***	0.276***	0.276***	0.276***	0.309***	0.311***	0.310***	0.310***
		(0.018)	(0.018)	(0.018)	(0.018)	(0.023)	(0.023)	(0.023)	(0.023)
belect	*22*		0.063**				0.103***		
			(0.025)				(0.030)		
	10			0.099***				0.125***	
				(0.037)				(0.044)	
	5				0.105**				0.113*[(a)]
					(0.051)				(0.062)
achange	*22*		-0.029				-0.043[(a)]		
			(0.025)				(0.030)		
	10			-0.021				-0.061	
				(0.038)				(0.046)	
	5				0.011				-0.031
					(0.055)				(0.067)
	Intercept	0.452***	0.451***	0.451***	0.451***	0.457***	0.455***	0.456***	0.457***
		(0.004)	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)	(0.005)	(0.005)
	N	10,579	10,579	10,579	10,579	10,579	10,579	10,579	10,579
	R^2	0.015	0.016	0.016	0.016	0.013	0.014	0.014	0.013

* Significant at 10% level, ** Significant at 5% level, *** Significant at 1% level. Robust standard errors in parenthesis. Except where explicitly indicated otherwise, all (non-)significant coefficients in the table maintain (non-)significance in respective robust OLS, robust probit and tobit regressions, including specifications with each explanatory variable isolated.[(a)] Significant at 10% level when isolated, in robust OLS and probit. [(a)]Non-significant when isolated, in probit.

Table 15. Regressing regimes' probabilities and dummies, after SWARCH model estimation (*vix* included in ARCH, political periods excluded from ARCH, 3-regimes), Japan, 1960-2008. Assessing the high-regime.

		dependent variable: high-regime							
		shigh				high			
indep. var.									
	gfp	-0.004	-0.006	-0.005	-0.005	-0.004	-0.006	-0.005	-0.005
		(0.016)	(0.016)	(0.016)	(0.016)	(0.018)	(0.018)	(0.018)	(0.018)
belect	*22*		-0.071***				-0.074***		
			(0.014)				(0.015)		
	10			-0.075***				-0.075***	
				(0.021)				(0.022)[a]	
	5				-0.086***				-0.090***
					(0.025)[b]				(0.026)[a]
achange	*22*		0.013				0.019		
			(0.021)				(0.022)		
	10			0.009				0.021	
				(0.033)				(0.034)	
	5				-0.002				0.012
					(0.046)				(0.048)
Intercept		0.145***	0.147***	0.146***	0.146***	0.136***	0.137***	0.137***	0.136***
		(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)
N		10,579	10,579	10,579	10,579	10,579	10,579	10,579	10,579
R^2		0.000	0.002	0.001	0.001	0.000	0.000	0.001	0.000

* Significant at 10% level, ** Significant at 5% level, *** Significant at 1% level. Robust standard errors in parenthesis.Except where explicitly indicated otherwise, all (non-)significant coefficients in the table maintain (non-)significance in corresponding robust OLS, robust probit and tobit regressions, including specifications with each explanatory variable isolated. [a]Significant only at 5% level in respective probit. [b]Significant only at 5% level in respective tobit.

C. Results for Japan, with political periods in ARCH

The tables below report the estimated coefficients for the *vix* and the political dummies in the ARCH equation.

Table 16. Estimation of coefficients in ARCH equation including political periods, within 2-regimes SWARCH model estimation

		dependent variable: h_t^2					
indep. var.							
	vix^2	-	-	-	0.079***	0.079***	0.078***
					(0.012)	(0.012)	(0.012)
	gfp	0.00006***	0.00006***	0.00006***	0.00006***	0.00006***	0.00006***
		(0.00001)	(0.00001)	(0.000009)	(0.000009)	(0.000009)	(0.000009)
belect	*22*	-0.000003			0.000002		
		(0.000004)			(0.000005)		
	10		-0.0000008			0.000004	
			(0.000006)			(0.000007)	
	5			-0.000001			0.000002
				(0.000008)			(0.000009)
achange	*22*	-0.000005			-0.000002		
		(0.000005)			(0.000004)		
	10		-0.000003			-0.000002	
			(0.000007)			(0.000006)	
	5			0.000006			0.000005
				(0.00001)			(0.00001)

* Significant at 10% level, ** Significant at 5% level, *** Significant at 1% level. Standard errors in parenthesis.

Table 17. Estimation of coefficients in ARCH equation including political periods, within 3-regimes SWARCH model estimation

		dependent variable: h_t^2					
indep. var.							
	vix^2	-	-	-	0.139***	0.139***	0.133***
					(0.013)	(0.013)	(0.013)
	gfp	0.00001***	0.00001***	0.00001***	0.000009**	0.00001***	0.00001***
		(0.000004)	(0.000004)	(0.000004)	(0.000004)	(0.000004)	(0.000004)
belect	*22*	-0.000008***			-0.000007***		
		(0.000002)			(0.000002)		
	10		-0.000007*			-0.000006*	
			(0.000004)			(0.000003)	
	5			-0.000007			-0.000006
				(0.000005)			(0.000004)
achange	*22*	-0.00001***			-0.00001***		
		(0.000002)			(0.000002)		
	10		-0.00001***			-0.000009***	
			(0.000003)			(0.000003)	
	5			-0.000007			-0.000004
				(0.000005)			(0.000005)

* Significant at 10% level, ** Significant at 5% level, *** Significant at 1% level. Standard errors in parenthesis.

It is still possible to regress the regime dummies/probabilities on the political dummies, in order to capture the *regime-impacts* of political periods. The table below reports the results attained using 22-days windows for the political dummies.

Table 18. Regressing regimes' probabilities and dummies on 22-days political periods, after SWARCH model estimation (political periods included in ARCH, 2-regimes), Japan, 1960-2008

SWARCH estimated...	... without *vix* in ARCH		... with *vix* in ARCH	
	dep. variable: high-regime		dep. variable: high-regime	
	shigh	high	shigh	high
indep. variables				
gfp	-0.233***	-0.222***	-0.283***	-0.285***
	(0.018)	(0.021)	(0.018)	(0.019)
belect22	-0.153***	-0.164***	-0.208***	-0.221***
	(0.022)	(0.025)	(0.021)	(0.025)
achange22	-0.056**[(b)]	-0.049*[(a)]	-0.098***	-0.095***
	(0.024)	(0.028)	(0.026)	(0.029)
Intercept	0.421***	0.416***	0.439***	0.437***
	(0.004)	(0.005)	(0.005)	(0.005)
N	11,592	11,592	10,579	10,579
R^2	0.012	0.009	0.019	0.016

* Significant at 10% level, ** Significant at 5% level, *** Significant at 1% level. Robust standard errors in parenthesis. Except where explicitly indicated otherwise, all (non-)significant coefficients in the table maintain (non-)significance in corresponding robust OLS, robust probit and tobit regressions, including specifications with each explanatory variable isolated. [(a)]Non-significant when isolated, both in robust OLS and probit. [(b)]When isolated, significant at 10% level in robust OLS and attaining p-value of 0.1006 in respective tobit.

Table 19. Regressing regimes' probabilities and dummieson 22-days political periods, after SWARCH model estimation (political periods included in ARCH, 3-regimes), Japan, 1960-2008

SWARCH estimated...	... without *vix* in ARCH				... with *vix* in ARCH			
dep. var.	middle-regime		high-regime		middle-regime		high-regime	
	smiddle	middle	shigh	high	smiddle	middle	shigh	high
indep. var.								
gfp	0.259***	0.292***	-0.006	-0.005	0.278***	0.303***	-0.038***	-0.033**$^{(a)}$
	(0.020)	(0.024)	(0.015)	(0.016)	(0.018)	(0.022)	(0.014)	(0.017)
belect22	0.054**	0.065**	-0.048***	-0.051***	0.083***	0.095***	-0.027	-0.034*
	(0.022)	(0.028)	(0.013)	(0.014)	(0.026)	(0.030)	(0.017)	(0.019)
achange22	0.042*$^{(d)}$	0.052*$^{(c)}$	0.027	0.021	0.113***	0.118***	0.040*	0.038$^{(b)}$
	(0.025)	(0.029)	(0.019)	(0.020)	(0.027)	(0.030)	(0.022)	(0.024)
Intercept	0.404***	0.405***	0.128***	0.119***	0.466***	0.477***	0.151***	0.140***
	(0.004)	(0.005)	(0.003)	(0.003)	(0.004)	(0.005)	(0.003)	(0.004)
N	11,592	11,592	11,592	11,592	10,579	10,579	10,579	10,579
R^2	0.013	0.012	0.001	0.001	0.018	0.014	0.001	0.001

* Significant at 10% level, ** Significant at 5% level, *** Significant at 1% level. Robust standard errors in parenthesis. Except where explicitly indicated otherwise, all (non-)significant coefficients in the table maintain (non-)significance in corresponding robust OLS, robust probit and tobit regressions, including specifications with each explanatory variable isolated. $^{(a)}$Significant at 10% level only in respective probit. $^{(b)}$Significant at 10% level in respective probit and, when isolated, in robust OLS and probit. $^{(c)}$Non-significant when isolated, both in robust OLS and probit. $^{(d)}$Non-significant when isolated, both in robust OLS and tobit.

The next tables report the results attained for the regime-impacts, when using the 10-days windows for the political dummies.

Table 20. Regressing regimes' probabilities and dummies on 10-days political periods, after SWARCH model estimation (political periods included in ARCH, 2-regimes), Japan, 1960-2008

SWARCH estimated...	... without *vix* in ARCH		... with *vix* in ARCH	
	dep. variable: high-regime		dep. variable: high-regime	
	shigh	high	shigh	high
indep. variables				
gfp	-0.240***	-0.245***	-0.281***	-0.283***
	(0.018)	(0.020)	(0.018)	(0.019)
belect10	-0.192***	-0.201***	-0.254***	-0.279***
	(0.028)	(0.034)	(0.026)	(0.032)
achange10	-0.161***	-0.239***	-0.169***	-0.198***
	(0.031)	(0.033)	(0.035)	(0.040)
Intercept	0.415***	0.411***	0.436***	0.434***
	(0.004)	(0.005)	(0.005)	(0.005)
N	11,613	11,613	10,591	10,591
R^2	0.013	0.012	0.018	0.016

* Significant at 10% level, ** Significant at 5% level, *** Significant at 1% level. Robust standard errors in parenthesis. Except where explicitly indicated otherwise, all (non-)significant coefficients in the table maintain (non-)significance in corresponding robust OLS, robust probit and tobit regressions, including specifications with each explanatory variable isolated.

Table 21. Regressing regimes' probabilities and dummies on 10-days political periods, after SWARCH model estimation (political periods included in ARCH, 3-regimes), Japan, 1960-2008

SWARCH estimated...	... without *vix* in ARCH				... with *vix* in ARCH			
dep. var.	middle-regime		high-regime		middle-regime		high-regime	
	smiddle	middle	shigh	high	smiddle	middle	shigh	high
indep. variables								
gfp	0.237***	0.230***	-0.011	-0.008	0.260***	0.263***	-0.048***	-0.041**
	(0.020)	(0.025)	(0.014)	(0.016)	(0.018)	(0.023)	(0.014)	(0.016)
belect10	0.035	0.014	-0.067***	-0.062***	0.107***	0.097**	-0.075***	-0.083***
	(0.034)	(0.041)	(0.018)	(0.019)	(0.038)	(0.044)	(0.021)	(0.022)
achange10	0.039	0.035	0.007	0.018	0.103**	0.112**	0.010	0.013
	(0.038)	(0.043)	(0.028)	(0.030)	(0.041)	(0.046)	(0.033)	(0.034)
Intercept	0.404***	0.405***	0.126***	0.116***	0.470***	0.485***	0.158***	0.145***
	(0.004)	(0.005)	(0.003)	(0.003)	(0.004)	(0.005)	(0.003)	(0.004)
N	11,613	11,613	11,613	11,613	10,591	10,591	10,591	10,591
R^2	0.011	0.007	0.001	0.001	0.015	0.010	0.001	0.001

* Significant at 10% level, ** Significant at 5% level, *** Significant at 1% level. Robust standard errors in parenthesis. Except where explicitly indicated otherwise, all (non-)significant coefficients in the table maintain (non-)significance in corresponding robust OLS, robust probit and tobit regressions, including specifications with each explanatory variable isolated.

Finally, the tables below present the results for the political impacts on regime dummies and probabilities, when using 5-days windows for the political dummies.

Table 22. Regressing regimes' probabilities and dummies on 5-days political periods, after SWARCH model estimation (political periods included in ARCH, 2-regimes), Japan, 1960-2008

SWARCH estimated...	... without *vix* in ARCH		... with *vix* in ARCH	
	dep. variable: high-regime		dep. variable: high-regime	
	shigh	high	shigh	high
indep. variables				
gfp	-0.246***	-0.250***	-0.279***	-0.280***
	(0.017)	(0.019)	(0.018)	(0.019)
belect5	-0.210***	-0.221***	-0.258***	-0.262***
	(0.036)	(0.045)	(0.035)	(0.047)
achange5	-0.219***	-0.252***	-0.214***	-0.246***
	(0.043)	(0.046)	(0.049)	(0.053)
Intercept	0.413***	0.408***	0.433***	0.432***
	(0.004)	(0.005)	(0.004)	(0.005)
N	11,622	11,622	10,595	10,595
R^2	0.012	0.011	0.016	0.011

* Significant at 10% level, ** Significant at 5% level, *** Significant at 1% level. Robust standard errors in parenthesis. Except where explicitly indicated otherwise, all (non-)significant coefficients in the table maintain (non-)significance in corresponding robust OLS, robust probit and tobit regressions, including specifications with each explanatory variable isolated.

Table 23. Regressing regimes' probabilities and dummies on 5-days political periods, after SWARCH model estimation (political periods included in ARCH, 3-regimes), Japan, 1960-2008

SWARCH estimated...	... without *vix* in ARCH				... with *vix* in ARCH			
dep. var.	middle-regime		high-regime		middle-regime		high-regime	
	smiddle	middle	shigh	high	smiddle	middle	shigh	high
indep. variables								
gfp	0.226***	0.220***	-0.017	-0.011	0.244***	0.249***	-0.051***	-0.042**
	(0.020)	(0.025)	(0.014)	(0.016)	(0.018)	(0.024)	(0.014)	(0.016)
belect5	0.024	-0.005	-0.082***	-0.080***	0.090*[(a)]	0.092	-0.092***	-0.100***
	(0.049)	(0.057)	(0.021)	(0.023)	(0.054)	(0.062)	(0.026)	(0.026)
achange5	0.049	-0.064	-0.016	0.005	0.018	-0.032	-0.009	0.002
	(0.053)	(0.063)	(0.036)	(0.041)	(0.054)	(0.068)	(0.046)	(0.048)
Intercept	0.403***	0.405***	0.129***	0.120***	0.462***	0.477***	0.158***	0.146***
	(0.004)	(0.005)	(0.003)	(0.003)	(0.004)	(0.005)	(0.003)	(0.004)
N	11,622	11,622	11,622	11,622	10,595	10,595	10,595	10,595
R^2	0.010	0.006	0.001	0.000	0.012	0.008	0.001	0.001

* Significant at 10% level, ** Significant at 5% level, *** Significant at 1% level. Robust standard errors in parenthesis. Except where explicitly indicated otherwise, all (non-)significant coefficients in the table maintain (non-)significance in corresponding robust OLS, robust probit and tobit regressions, including specifications with each explanatory variable isolated. [(a)]Non-significant when isolated, both in robust OLS and tobit.

D. Results for Japan, with political periods in ARCH - estimated standard errors regressed on political period dummies

Table 24. Estimated standard errors regressed on political dummies (sequentially estimated, after SWARCH optimization, 3-regimes, with political dummies in ARCH)

		dep. variable: $\sqrt{E\left[\hat{u}_t^2\right]}$						
vix in ARCH?		No	Yes					
indep. var.								
	vix	-	-	-	-	0.71663***	0.71669***	0.70450***
						(0.02430)	(0.02240)	(0.02156)
	gfp	0.00262***	0.00256***	0.00264***	0.00272***	0.00145***	0.00154***	0.00164***
		(0.00023)	(0.00025)	(0.00025)	(0.00025)	(0.00021)	(0.00021)	(0.00021)
belect	*22*	-0.00206***	-0.00226***			-0.00173***		
		(0.00020)	(0.00022)			(0.00020)		
	10			-0.00252***			-0.00187***	
				(0.00029)			(0.00028)	
	5				-0.00295***			-0.00229***
					(0.00035)			(0.00032)
achange	*22*	-0.00150***	-0.00206***			-0.00125***		
		(0.00022)	(0.00023)			(0.00020)		
	10			-0.00203***			-0.00115***	
				(0.00033)			(0.00030)	
	5				-0.00083[(a)]			0.00007
					(0.00054)			(0.00051)
	Intercept	0.01071***	0.01073***	0.01070***	0.01066***	0.00457***	0.00452***	0.00459***
		(0.000)	(0.00006)	(0.00005)	(0.00005)	(0.00020)	(0.00018)	(0.00018)
	N	11,592	10,579	10,591	10,595	10,579	10,591	10,595
	R^2	0.018	0.016	0.012	0.010	0.334	0.349	0.347

* Significant at 10% level, ** Significant at 5% level, *** Significant at 1% level. Robust standard errors in parenthesis. Except where explicitly indicated otherwise, all (non-)significant coefficients in the table maintain (non-)significance in corresponding specifications with each explanatory variable isolated. [(a)] Significant at 10% level when isolated in robust OLS.

E. International contagion

The table below shows the correlation between each national stock market index return with the U.S.A. stock market index return (S&P500). Note that all national stock market indexes are significantly correlated with the U.S.A. stock market index.

Table 25. National stock market index return regressed on U.S.A. stock market index return (S&P500)

Dep. variable:daily return of...	Coefficient of USA return[(a)]		Constant		Number of obs.	R-sq
	estimate	robust s. e.	estimate	robust s. e.		
UK	0.353***	(0.018)	0.024**	(0.011)	9,394	0.117
Canada	0.610***	(0.012)	0.002	(0.007)	9,407	0.492
Germany	0.442***	(0.020)	0.008	(0.011)	10,220	0.142
France	0.544***	(0.026)	0.002	(0.017)	5,195	0.219
Spain	0.334***	(0.026)	0.013	(0.014)	6,993	0.100
Switzerland	0.312***	(0.021)	0.012	(0.010)	8,513	0.131
Italy	0.306***	(0.020)	0.027*	(0.014)	8,521	0.062
Portugal	0.253***	(0.024)	0.004	(0.014)	4,533	0.095
Ireland	0.226***	(0.025)	0.025*	(0.014)	8,824	0.035
Iceland	0.058**	(0.025)	0.046***	(0.017)	3,606	0.005
Netherlands	0.408***	(0.020)	0.010	(0.011)	8,650	0.165
Belgium	0.291***	(0.020)	0.015	(0.010)	8,440	0.113
Luxembourg	0.076***	(0.021)	0.035**	(0.016)	4,137	0.008
Denmark	0.227***	(0.023)	0.033**	(0.014)	6,845	0.050
Finland	0.425***	(0.033)	0.012	(0.023)	5,276	0.089
Norway	0.332***	(0.029)	0.023	(0.017)	6,940	0.063
Sweden	0.415***	(0.025)	0.027	(0.017)	6,428	0.112
Austria	0.196***	(0.022)	0.021*	(0.012)	7,160	0.048
Greece	0.251***	(0.027)	0.040*	(0.024)	4,963	0.028
Japan	0.389***	(0.026)	0.024**	(0.012)	8,081	0.121
Australia	0.464***	(0.045)	0.012	(0.012)	5,552	0.309
New Zealand	0.341***	(0.015)	0.027*	(0.014)	4,053	0.165

* Significant at 10% level, ** Significant at 5% level, *** Significant at 1% level.[(a)]1-day-lagged U.S.A. return, in the case of Japan, Australia and New Zealand. See Appendix F for details on data source and definitions.

F. Data

Stock market indexes

Prices of stock market indexes are obtained from Datastream for the period 1960-2008, in daily frequency and expressed in local currency units (except for the Irish index, expressed in US dollars). The table below details the designation for each national index. Some series used are computed by Datastream ("DS") - for each of them, the table presents also an alternative actual series present in the database.

Table 26. Datastream designations for national stock market indexes

Country	Datastream designation of chosen index[(a)]	Designation of actual index also present in Datastream database
USA	S&P 500 COMPOSITE	-
UK	FTSE ALL SHARE	-
Canada	S&P/TSX COMPOSITE INDEX	-
Germany	DAX 30 PERFORMANCE	-
France	FRANCE CAC 40	-
Spain	MADRID SE GENERAL	-
Switzerland	SWITZ-DS Market	SWISS MARKET
Italy	ITALY-DS Market	MILAN MIB 30
Portugal	PORTUGAL-DS Market	PSI 20
Ireland	IRELAND-DS MARKET $	IRELAND SE OVERALL (ISEQ)
Iceland	OMX ICELAND ALL SHARE	-
Netherlands	NETHERLAND-DS Market	AEX INDEX (AEX)
Belgium	BELGIUM-DS Market	BEL 20
Luxembourg	LUXEMBURG-DS Market	LUXEMBOURG SE GENERAL
Denmark	COPENHAGEN KFX DS-CALCULATED	OMX COPENHAGEN (OMXC20)
Finland	OMX HELSINKI (OMXH)	-
Norway	NORWAY-DS Market	OSLO SE OBX
Sweden	SWEDEN-DS Market	OMX STOCKHOLM 30 (OMXS30)
Austria	AUSTRIA-DS Market	ATX - AUSTRIAN TRADED INDEX
Greece	GREECE-DS Market	ATHEX ALL SHARE
Japan	NIKKEI 225 STOCK AVERAGE	-
Australia	ASX ALL ORDINARIES 1971 >	-
New Zealand	NEW ZEALAN-DS Market	NZX 50

[(a)]"DS" denotes extended series, computed by Datastream.

The next table presents some summary statistics for each stock market index daily returns. These returns are expressed in percentage points and are attained by computing the daily variation of each index price, after removing repeated successive values.

Table 27. Summary statistics for Stock Market Indices returns, 1960-2008 (percentage points)

Country	Obs.	Mean	St. Dev.	Min.	Max.
Australia	7,293	0.029	0.994	-24.995	6.850
Austria	7,534	0.030	1.004	-8.835	10.154
Belgium	8,907	0.024	0.961	-12.186	8.290
Canada	9,805	0.023	0.933	-11.316	9.032
Denmark	7,209	0.045	1.157	-10.995	12.054
Finland	5,557	0.031	1.716	-15.973	15.677
France	5,470	0.017	1.410	-9.641	11.176
Germany	10,836	0.020	1.228	-12.812	11.402
Greece	5,250	0.047	1.699	-13.612	16.545
Iceland	3793	0.044	1.027	-30.670	5.269
Ireland	9,294	0.031	1.327	-15.494	15.892
Italy	9,008	0.036	1.358	-9.374	11.051
Japan	12,036	0.021	1.196	-14.901	13.236
Luxembourg	4,349	0.036	1.043	-6.596	10.672
Netherlands	9,112	0.023	1.106	-10.446	9.745
Norway	7,295	0.033	1.502	-19.012	10.872
New Zealand	5,311	0.014	0.983	-8.705	9.585
Portugal	4,782	0.011	0.969	-10.022	9.966
Spain	7,346	0.030	1.201	-10.661	10.374
Sweden	6,773	0.044	1.431	-8.146	11.475
Switzerland	8,970	0.022	0.952	-11.583	10.313
UK	9,847	0.030	1.089	-11.412	9.356
USA	11,076	0.029	1.030	-20.414	11.580

Political data

Dates in which cabinets took office were collected from Woldendorp et al (1998). The author extends the data in time span (to include the period from mid 90's to 2008) and adds dates of elections, based on the Political Data Yearbooks (1995-2009) – published by the European Journal of Political Research[36] –, the Keesing's Contemporary Archives[37], the Comparative Political Data Set (CPDS), 1960-2006[38], and several institutional and research websites[39].

The table below presents the election and change dates in the sample under study - note that, among these, the analysis focus only on elections and subsequent changes, mediated by a government formation period.

[36] See EJPR Vol. 48, no. 7-8 (2009), Vol. 47, no. 7-8 (2008) and Vol. 46, no. 7-8 (2007) for examples.

[37] www.keesings.com

[38] See Armingeon et al (2008).

[39] Examples are the US House of Representatives (Office of the Clerk), US Senate (archives), Parties and elections in Europe (www.parties-and-elections.de), Zaraté's Political Collections.

Table 28. Election and change dates in Japan, U.K. and Germany, 1960-2008

Japan		U.K.		Germany	
election	change	election	change		
18-11-1960	19-07-1960		21-10-1963		01-07-1960
	08-12-1960	15-10-1964	19-10-1964	15-09-1961	14-11-1961
21-11-1963	09-12-1963	31-03-1966	06-04-1966		19-11-1962
	09-11-1964	18-06-1970	22-06-1970		14-12-1962
27-01-1967	17-02-1967	28-02-1974	05-03-1974		16-10-1963
26-12-1969	14-01-1970	10-10-1974	18-10-1974	17-09-1965	26-10-1965
	07-07-1972		06-04-1976		28-10-1966
08-12-1972	22-12-1972	03-05-1979	07-05-1979		01-12-1966
	09-12-1974	09-06-1983	13-06-1983	26-09-1969	22-10-1969
03-12-1976	24-12-1976	11-06-1987	15-06-1987		17-05-1972
	08-12-1978		28-11-1990	17-11-1972	15-12-1972
05-10-1979	08-11-1979	09-04-1992	13-04-1992		16-05-1974
20-06-1980	17-07-1980	01-05-1997	02-05-1997	29-10-1976	15-12-1976
	26-11-1982	07-06-2001	08-06-2001	09-10-1980	04-11-1980
16-12-1983	26-12-1983	05-05-2005	06-05-2005		17-09-1982
	01-11-1984		27-06-2007		04-10-1982
04-07-1986	22-07-1986			04-03-1983	30-03-1983
	06-11-1987			23-01-1987	11-03-1987
	05-06-1989				04-10-1990
	09-08-1989			30-11-1990	17-01-1991
16-02-1990	28-02-1990			14-10-1994	17-11-1994
	05-11-1991			25-09-1998	27-10-1998
16-07-1993	09-08-1993			20-09-2002	22-10-2002
	28-04-1994			16-09-2005	22-11-2005
	30-06-1994				
	11-01-1996				
18-10-1996	07-11-1996				
	12-01-1998				
	30-07-1998				
	14-01-1999				
	05-04-2000				
23-06-2000	04-07-2000				
	26-04-2001				
07-11-2003	19-11-2003				
09-09-2005	31-10-2005				
	26-09-2006				
	26-09-2007				
	24-09-2008				

G. Replicating the VIX

The span limitation of the original VIX imposes a considerable sample constraint, given that, for instance, the stock markets index for Japan, NIKKEI225, is available starting 06-01-1959. Sample restrictions are minimized by using instead the series on S&P500 daily returns, which starts from 01-01-1964. Daily series are built containing the daily backward/forward 3-month standard deviation of the S&P500 returns. The VIX is alternatively regressed on a set of lags and forwards of these backward/forward standard deviation series. The two regressions providing highest R^2 are

Table 29. VIX regressed on...

	...*backward* 3-month S&P st.dev.	...*forward* 3-month S&P st.dev.
F10.bS&Psd	1143.998*** (15.66)	-
L56.fS&Psd	-	1137.743*** (15.01)
R^2	0.9077	0.9076

*** significant at 1% level. Robust standard errors in parenthesis. F10.bS&Psd and L56.fS&Psd denote a 10-days forward of the backward-standard-deviation series and a 56-days lag of the forward-standard-deviation series, respectively.

Note that, given 3 months correspond to 66 business days, a backward 3-month st. dev. starting at $t+10$, F10.bS&Psd, is equivalent to a forward 3-month st. dev. starting in at $t-56$, L56.fS&Psd - both measures cover the period $[t-56, t+10]$. This is the period chosen to replicate the VIX.

The tables below present the results from all the alternative regressions of the original VIX on the forwards and lags of the replicating standard deviation series (both backward and forward s.d.). The selected variables (isolated in the table above) are in bold.

Table 30. Regressing VIX on S&P500 standard deviation series, lags/forwards 1-33

	VIX regressed on...											
lag/	...*of backward* 3-month S&P st.dev....						...*forward* 3-month S&P st.dev....					
forward	...lagged			...forwarded			...lagged			...forwarded		
#...	estimate	sd	R-sq	estimate	sd	R-sq	estimate	sd	R-sq	estimate	sd	R-sq
0	1,162.164***	24.767	0.878	1,162.164***	24.767	0.878	753.279***	44.603	0.457	753.279***	44.603	0.457
1	1,163.881***	25.684	0.873	1,161.393***	23.793	0.883	761.510***	44.669	0.466	744.921***	44.451	0.448
2	1,164.898***	26.726	0.868	1,161.355***	22.740	0.889	769.906***	44.702	0.475	737.274***	44.393	0.440
3	1,166.720***	27.678	0.862	1,160.492***	21.788	0.893	778.568***	44.674	0.485	729.634***	44.346	0.431
4	1,168.439***	28.597	0.856	1,159.357***	20.788	0.897	786.700***	44.585	0.494	722.208***	44.295	0.423
5	1,170.697***	29.492	0.851	1,157.069***	19.861	0.900	794.653***	44.419	0.504	715.094***	44.241	0.416
6	1,173.078***	30.429	0.845	1,154.435***	19.018	0.902	802.408***	44.300	0.513	708.953***	44.253	0.409
7	1,175.053***	31.440	0.838	1,152.263***	18.047	0.904	810.520***	44.144	0.522	702.110***	44.120	0.402
8	1,177.192***	32.349	0.832	1,149.535***	17.203	0.906	819.037***	43.929	0.533	695.570***	44.005	0.395
9	1,179.304***	33.246	0.825	1,147.351***	16.207	0.907	827.593***	43.682	0.543	689.183***	43.875	0.388
10	1,180.707***	34.008	0.817	**1,143.998*** **	**15.668**	**0.908**	836.528***	43.416	0.554	682.637***	43.758	0.381
11	1,182.854***	34.793	0.811	1,141.001***	15.234	0.908	845.398***	43.154	0.565	677.061***	43.631	0.376
12	1,184.527***	35.648	0.803	1,137.122***	15.041	0.906	854.290***	42.868	0.575	671.071***	43.514	0.370
13	1,187.555***	36.409	0.796	1,133.060***	14.977	0.905	862.685***	42.502	0.586	665.604***	43.399	0.364
14	1,190.559***	37.078	0.789	1,129.982***	14.863	0.904	871.295***	42.111	0.597	660.136***	43.266	0.359
15	1,194.351***	37.773	0.783	1,125.037***	15.033	0.901	879.760***	41.619	0.607	655.010***	43.153	0.354
16	1,198.033***	38.459	0.777	1,121.047***	15.126	0.899	887.914***	41.146	0.617	650.128***	43.033	0.350
17	1,201.244***	39.074	0.771	1,115.943***	15.415	0.895	896.171***	40.674	0.628	645.352***	42.898	0.344
18	1,204.051***	39.791	0.763	1,111.547***	15.658	0.892	904.385***	40.155	0.638	640.413***	42.728	0.340
19	1,207.647***	40.342	0.756	1,107.220***	15.993	0.889	912.450***	39.612	0.649	635.867***	42.557	0.335
20	1,211.787***	40.743	0.749	1,102.220***	16.640	0.885	920.732***	38.991	0.659	630.719***	42.385	0.331
21	1,217.033***	41.166	0.743	1,097.240***	17.292	0.880	928.772***	38.308	0.670	626.379***	42.226	0.327
22	1,220.375***	41.312	0.736	1,092.339***	18.094	0.875	936.675***	37.595	0.680	622.398***	42.098	0.323
23	1,224.373***	41.745	0.729	1,086.504***	19.165	0.869	944.828***	36.896	0.691	618.497***	41.959	0.319
24	1,228.264***	41.984	0.722	1,080.880***	20.156	0.863	952.565***	36.175	0.701	614.643***	41.790	0.316
25	1,232.576***	42.161	0.714	1,074.922***	21.021	0.857	959.609***	35.501	0.710	610.679***	41.599	0.312
26	1,236.583***	42.228	0.707	1,068.841***	21.773	0.851	967.526***	34.760	0.720	606.721***	41.408	0.308
27	1,241.154***	42.210	0.699	1,063.346***	22.603	0.844	975.317***	33.982	0.730	603.019***	41.233	0.305
28	1,244.894***	42.157	0.691	1,057.327***	23.526	0.837	982.938***	33.114	0.741	599.272***	41.045	0.302
29	1,249.111***	42.124	0.683	1,051.799***	24.462	0.829	990.465***	32.345	0.751	596.074***	40.881	0.299
30	1,252.605***	42.032	0.675	1,045.640***	25.410	0.821	997.930***	31.485	0.761	591.870***	40.663	0.295
31	1,256.562***	41.815	0.668	1,040.133***	26.322	0.813	1,005.237***	30.608	0.771	588.431***	40.483	0.292
32	1,262.163***	41.729	0.661	1,033.623***	27.186	0.805	1,012.694***	29.719	0.780	584.510***	40.271	0.288
33	1,267.380***	41.457	0.655	1,027.150***	28.012	0.797	1,019.022***	28.816	0.789	581.527***	40.102	0.286

Table 31. Regressing VIX on S&P500 standard deviation series, lags/forwards 34-66

	VIX regressed on...											
lag/	...*backward* 3-month S&P st.dev....						...*forward* 3-month S&P st.dev....					
forward	...lagged			...forwarded			...lagged			...forwarded		
#...	estimate	sd	R-sq	estimate	sd	R-sq	estimate	sd	R-sq	estimate	sd	R-sq
0	1,162.164***	24.767	0.878	1,162.164***	24.767	0.878	753.279***	44.603	0.457	753.279***	44.603	0.457
34	1,272.336***	41.333	0.647	1,020.893***	28.911	0.788	1,025.553***	28.035	0.797	578.335***	39.918	0.283
35	1,275.226***	41.261	0.639	1,013.554***	29.750	0.779	1,031.843***	27.157	0.806	575.746***	39.788	0.280
36	1,278.608***	41.167	0.631	1,006.962***	30.649	0.770	1,037.644***	26.280	0.814	572.938***	39.582	0.277
37	1,282.563***	40.909	0.623	999.600***	31.449	0.761	1,044.017***	25.328	0.822	569.830***	39.403	0.274
38	1,286.160***	40.492	0.614	992.475***	32.211	0.752	1,049.994***	24.380	0.830	567.053***	39.239	0.272
39	1,290.074***	40.187	0.606	985.069***	33.085	0.742	1,056.170***	23.415	0.838	564.003***	39.080	0.269
40	1,294.244***	40.020	0.598	977.225***	33.910	0.732	1,061.723***	22.507	0.845	561.157***	38.951	0.267
41	1,297.209***	39.887	0.590	969.404***	34.706	0.721	1,067.201***	21.653	0.852	558.176***	38.768	0.264
42	1,296.673***	39.735	0.581	962.489***	35.349	0.712	1,072.880***	20.742	0.859	555.591***	38.632	0.262
43	1,299.895***	39.656	0.574	954.699***	36.068	0.702	1,079.189***	19.803	0.865	553.013***	38.473	0.259
44	1,301.470***	39.483	0.565	946.728***	36.803	0.691	1,085.284***	18.809	0.871	550.356***	38.307	0.257
45	1,302.709***	39.118	0.556	938.824***	37.494	0.681	1,090.290***	17.952	0.876	547.817***	38.150	0.255
46	1,304.062***	38.752	0.547	930.871***	38.137	0.671	1,094.827***	17.080	0.881	545.493***	38.017	0.252
47	1,302.181***	38.497	0.538	923.239***	38.774	0.661	1,099.735***	16.244	0.886	542.422***	37.817	0.250
48	1,303.286***	38.066	0.530	915.478***	39.399	0.651	1,104.946***	15.640	0.890	539.721***	37.644	0.247
49	1,305.370***	37.681	0.523	907.474***	40.009	0.641	1,109.737***	15.135	0.894	536.593***	37.444	0.245
50	1,307.262***	37.226	0.516	899.320***	40.507	0.630	1,114.142***	14.803	0.897	533.516***	37.259	0.242
51	1,307.601***	36.926	0.509	891.177***	40.989	0.620	1,118.359***	14.652	0.900	530.578***	37.101	0.239
52	1,309.506***	36.558	0.501	882.937***	41.462	0.610	1,122.856***	14.498	0.903	527.558***	36.944	0.237
53	1,308.956***	36.058	0.494	874.920***	41.875	0.600	1,125.899***	14.568	0.904	524.721***	36.769	0.234
54	1,309.869***	35.809	0.487	867.055***	42.303	0.590	1,130.653***	14.562	0.906	521.725***	36.616	0.232
55	1,309.624***	35.446	0.479	858.443***	42.660	0.579	1,134.039***	14.765	0.907	518.975***	36.463	0.230
56	1,308.993***	35.317	0.471	849.904***	43.001	0.569	**1,137.743*** **	**15.014**	**0.908**	516.297***	36.318	0.227
57	1,310.209***	35.211	0.464	841.125***	43.274	0.558	1,140.837***	15.547	0.908	513.544***	36.128	0.225
58	1,310.224***	34.798	0.458	832.628***	43.514	0.548	1,143.277***	16.226	0.907	511.194***	35.935	0.223
59	1,310.394***	34.613	0.451	824.199***	43.777	0.537	1,146.126***	16.882	0.905	508.167***	35.719	0.220
60	1,309.709***	34.502	0.445	815.914***	43.976	0.527	1,148.112***	17.921	0.903	504.895***	35.503	0.218
61	1,309.859***	34.370	0.438	807.855***	44.140	0.518	1,150.779***	18.846	0.901	501.499***	35.277	0.215
62	1,309.186***	34.380	0.432	799.958***	44.324	0.508	1,152.188***	20.051	0.898	498.628***	35.099	0.213
63	1,308.212***	34.356	0.426	792.045***	44.442	0.499	1,153.876***	21.031	0.894	495.754***	34.918	0.210
64	1,307.979***	34.578	0.419	783.837***	44.529	0.490	1,155.070***	21.990	0.890	492.636***	34.702	0.207
65	1,306.058***	34.912	0.413	775.879***	44.576	0.481	1,155.022***	23.072	0.885	489.720***	34.490	0.205
66	1,304.709***	35.403	0.406	767.849***	44.568	0.472	1,155.745***	24.099	0.880	486.239***	34.288	0.202

H. Correlations between *vix* and political periods

The table below displays the correlation vector assessing the bilateral correlation between the *vix* and each political-period dummy, for each country under study.

Table 32. Correlation between *vix* and political-period dummies of...

		...Japan	...U.K.	...Germany
belect	*22*	-0.0295	0.0233	0.0302
	10	-0.0218	0.0166	0.0217
	5	-0.0153	0.0107	0.0162
	gfp	0.0298	0.017	0.024
achange	*22*	-0.0336	0.0137	0.014
	10	-0.022	0.0124	0.0122
	5	-0.0153	0.0098	0.0094

I. Results for U.K., removing *vix*

Table 33. ARCH equation, 3-regimes, without *vix*

(estimated within SWARCH optimization), U.K.

dep. var.	variance auto-regressive component, h^2
indep. var.	
vix^2	-
gfp	0.000480**
	(0.000245)
belect22	-0.000073***
	(0.000005)
achange22	-0.000003
	(0.000005)

* Significant at 10% level, ** Significant at 5% level,

*** Significant at 1% level. Standard errors in parenthesis.

Table 34. Regimes' smoothed probabilities regressed on political dummies (sequentially estimated after SWARCH optimization with 3-regimes, ARCH excluding *vix* and including 22-days political periods in ARCH), U.K.

dep. var.	smiddle	shigh
indep. var.		
gfp	0.390***	0.031
	(0.083)	(0.036)
belect22	0.139***	0.041**
	(0.031)	(0.020)
achange22	0.159***	-0.028**
	(0.028)	(0.011)
Intercept	0.330***	0.071***
	(0.004)	(0.002)
$\hat{g}_i$	2.958***	14.911***
	(0.127)	(0.940)
N	9,665	9,665
R^2	0.007	0.001

* Significant at 10% level, ** Significant at 5% level, *** Significant at 1% level. Robust standard errors in parenthesis. Except where explicitly indicated otherwise, all (non-)significant coefficients in the table maintain (non-)significance in corresponding robust OLS and tobit regressions, including specifications with each explanatory variable isolated.

Table 35. Estimated standard errors regressed on political dummies, 3-regimes (sequentially estimated after SWARCH optimization), U.K.

dep. variable		$\sqrt{E\left[\hat{u}_t^2\right]}$	
ARCH framework (within SWARCH process)	without vix, with 22-days political periods	with vix, with 22-days political periods	with vix, with 10-days political periods
indep. variables			
vix	-	-	-
gfp	0.044***	0.02951***	0.02965***
	(0.006)	(0.00217)	(0.00233)
belect22	0.001***	0.00117***	
	(0.000)	(0.00030)	
belect10			0.00023
			(0.00040)
achange22	-0.000	-0.00024	
	(0.000)	(0.00024)	
achange10			0.00010
			(0.00036)
Intercept	0.010***	0.00954***	0.00958***
	(0.000)	(0.00005)	(0.00005)
N	9,665	9,665	9,677
R^2	0.112	0.043	0.041

* Significant at 10% level, ** Significant at 5% level, *** Significant at 1% level. Robust standard errors in parenthesis. Except where explicitly indicated otherwise, all (non-)significant coefficients in the table maintain (non-)significance in corresponding specifications with each explanatory variable isolated.

J. Results for Germany, removing *vix*

Table 36. ARCH equation, 3-regimes, without *vix* (estimated within SWARCH optimization), Germany

dep. var.	variance auto-regressive component, h^2
indep. var.	
vix^2	-
gfp	0.000015**
	(0.000006)
belect22	-0.000087***
	(0.000005)
achange22	-0.0000002
	(0.000005)

* Significant at 10% level, ** Significant at 5% level, *** Significant at 1% level. Standard errors in parenthesis.

Table 37. Regimes' smoothed probabilities regressed on political dummies (sequentially estimated after SWARCH optimization with 3-regimes, ARCH excluding *vix* and including 22-days political periods in ARCH), Germany

dep. var.	smiddle	shigh
indep. var.		
gfp	-0.031	0.104***
	(0.025)	(0.021)
belect22	-0.061**	0.120***
	(0.026)	(0.024)
achange22	-0.098***	0.126***
	(0.027)	(0.024)
Intercept	0.406***	0.056***
	(0.004)	(0.002)
$\hat{g}_i$	3.196***	17.847***
	(0.115)	(1.029)
N	10,667	10,667
R^2	0.002	0.018

* Significant at 10% level, ** Significant at 5% level, *** Significant at 1% level. Robust standard errors in parenthesis. Except where explicitly indicated otherwise, all (non-)significant coefficients in the table maintain (non-)significance in corresponding robust OLS and tobit regressions, including specifications with each explanatory variable isolated.

Table 38. Estimated standard errors regressed on political dummies (sequentially estimated, after SWARCH optimization with 3 regimes), Germany

dep. variable	$\sqrt{E\left[\hat{u}_t^2\right]}$		
ARCH framework (within SWARCH process)	without *vix*, with 22-days political periods	with *vix*, with 22-days political periods	with *vix*, with 10-days political periods
indep. variables			
vix	-	-	-
gfp	0.004***	0.00330***	0.00403***
	(0.000)	(0.00032)	(0.00047)
belect22	0.001***	0.00183***	
	(0.000)	(0.00052)	
belect10			0.00215***
			(0.00077)
achange22	0.002***	0.00243***	
	(0.000)	(0.00048)	
achange10			0.00287***
			(0.00072)
Intercept	0.011***	0.01066***	0.01070***
	(0.000)	(0.00005)	(0.00005)
N	10,667	10,667	10,679
R^2	0.022	0.016	0.018

* Significant at 10% level, ** Significant at 5% level, *** Significant at 1% level. Robust standard errors in parenthesis. Except where explicitly indicated otherwise, all (non-)significant coefficients in the table maintain (non-)significance in corresponding specifications with each explanatory variable isolated.

Epilogue

The three studies presented in this thesis produce very interesting results. Capital flows indeed react to some political profiles held by the cabinet in office or recently elected. Moreover, these flows adapt their reaction to policy according to *who* is the policymaker. Regarding the Euro impact on export market entry, the real options approach allows to develop of a clear argument in favor of firm-entry promotion through exchange volatility reduction. More specifically, the intensity of this entry-promotion effect shall depend on *how* credible the volatility reduction is. Finally, stock market returns show a clear volatility surge during the period mediating the day of a democratic election and the subsequent day in which the elected cabinet takes office. In spite of knowing the election winners, stock markets experience extraordinary volatility before knowing precisely *who* the next policymaker will be.

In the first chapter, the hypothesis that left-leaning cabinets set higher taxes finds empirical support, especially in the context of single-party. Equity inflows react positively to single-party right cabinets. FDI net flows react negatively to majoritarian cabinets and positively to budget deficits, signaling sensitivity to environment stability and fiscal stimulus. Oppositely, equity inflows react positively to majoritarian cabinets (potentially more active in countering negative GDP shocks) and negatively to budget deficits and public expenditure (potentially anticipating higher taxes). The magnitude of the direct impacts of political profiles on capital flows range from 0.3 to 4.7 GDP percentage points. Reactions to fiscal policy are attenuated when *left* or *right* cabinets are in office.

According to the model developed in the second chapter, the exchange rate uncertainty associated to the Euro contributed to export market entry by firms that would, otherwise, remain as non-exporters. The model produces a closed-form market-entry threshold clearly related to exchange rate volatility. This threshold specification allows for objective hypotheses, paving the way for promising empirical research.

The estimates produced in the third chapter show significant impacts on stock market volatility around democratic elections, with one pattern common to all countries studied: volatility rises during government formation periods (between election day and the day in which the elected cabinet takes office). Volatility is higher during this period than in periods far from elections, before elections or after newly-elected cabinets take office. These impacts operate both through the ARCH process guiding daily volatility and through volatility regime shifts. During government formation periods, estimated stock-returns standard error increases by 14%-271%, relative to its average far from elections.

The three essays integrating this thesis represent the foundation of several future research streams. More specifically, the theoretical cornerstone laid in the second chapter and the innovative dataset used in the first and third chapters open very interesting research avenues towards a better understanding of the Macroeconomic impacts of politics and policy.

What is past is prologue

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