Consumption and Aggregate Constraints: International Evidence*

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September 16, 2004

Abstract

This paper documents that region-level consumption exhibits excess sensitivity to lagged income in Italy, Japan, Spain, the United Kingdom and West Germany. However, *region-specific* (idiosyncratic) consumption exhibits substantially less sensitivity to lagged region-specific income. Also, excess sensitivity is inversely related to standard measures of openness and credit market integration and for most countries, it has decreased over time. These findings are consistent with those reported in Ostergaard, Sørensen & Yosha (2002) for U.S. state-level and Canadian province-level data, and provide empirical support for the hypothesis that closed-economy constraints may partly be responsible for the excess sensitivity phenomenon in aggregate data.

Keywords: Permanent Income Hypothesis, Consumption, Regional Data, Openness.

JEL Classification: E21, F41.

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1 Introduction

A key implication of the rational expectations version of the Permanent Income Hypothesis (henceforth, PIH) is that consumption should follow a martingale process. Hall (1978), who first discussed this implication, found that variables known in the previous period generally were insignificant in explaining the change in current consumption. By contrast, many subsequent studies found consumption to be "too sensitive" to lagged information on income (see, e.g., Flavin 1981, Hayashi 1982, Nelson 1987, Hansen & Singleton 1983), and those have spawned an extensive literature that seeks to explain this *excess sensitivity* phenomenon.

In a recent paper, Ostergaard, Sørensen & Yosha (2002) use regional data from the U.S. states and Canadian provinces to test the PIH. Consistent with the results of previous studies based on national-level data, they report that region-level consumption exhibits excess sensitivity to lagged region-level income. However, when aggregate (nation-wide) fluctuations are controlled for, they find that region-specific consumption exhibits substantially less excess sensitivity to lagged region-specific income. They conjecture that this result may be explained by closed-economy constraints: frictions in international credit markets and/or the slow adjustment of net imports in response to fluctuations in aggregate consumption demand. Indeed, at the country level, it is conceivable that it may take time to borrow in international credit markets and adjust the quantity of goods imported. Regions within countries, on the other hand, are relatively more open in the sense that they can easily borrow and import goods among themselves. Thus, even if the PIH model fails at the country-level, the model should perform better with region-specific (idiosyncratic) consumption and income.

In this paper, we provide international evidence on how ignoring closed-economy constraints can lead to rejection of the PIH in aggregate data. We show that the result in Ostergaard et al. (2002) is very robust and that excess sensitivity is more severe in less open economies, providing the first empirical support for the underlying economic mechanism that Ostergaard et al. (2002) only conjecture.

First, we use regional data from Italy, Japan, Spain, the United Kingdom and West Germany, finding considerable excess sensitivity of consumption to lagged income, in line with results of previous studies using country-level data (see, e.g., Japelli & Pagano 1989, Bacchetta & Gerlach 1997). Next, we control for aggregate fluctuations in consumption and income, and

show that region-specific consumption exhibits substantially less sensitivity to lagged region-specific income. In fact, we only find excess sensitivity in Italy. We also perform the same analysis for a sample of 21 OECD countries to determine if our findings are a result of the methodology used. In this case, however, controlling for aggregate effects does not result in lower excess sensitivity. Furthermore, restricting the sample to European Union members does result in lower excess sensitivity, suggesting that closed-economy constraints are less binding within this group. Finally, and perhaps more importantly, we document that the magnitude of the excess sensitivity coefficient is negatively correlated with standard measures of openness and financial market integration and that for most countries, excess sensitivity has decreased over time.

Overall, these results ratify the hypothesis that excess sensitivity in macroeconomic data can be partly explained by closed-economy constraints or the lack of integration in credit/goods markets across countries. Thus, our findings suggest that national borders matter.

The remainder of the paper is organized as follows. Section 2 presents the empirical methodology. Section 3 discuss the data, while Section 4 presents the results. Section 5 explores the relationship between excess sensitivity, openness and financial market integration. Section 6 concludes.

2 Empirical Methodology

For a given country, we denote region i's real per capita consumption and income in period t by C_{it} and Y_{it}, and aggregate (nation-wide) per capita consumption and income by C_t and Y_t respectively. The standard test for excess sensitivity is to regress current consumption changes on lagged income changes, i.e.,

$$\text{Model 1:} \quad \Delta \log C_{it} = \alpha_i + \beta \Delta \log Y_{i,t-1} + \varepsilon_{it}, \tag{1}$$

where α_i denotes region fixed effects, β represents the excess sensitivity parameter, and ε_{it} is a zero mean, independently and identically distributed random disturbance term.

Under the PIH, the parameter β is hypothesized to equal zero, which implies that changes in consumption are uncorrelated with lagged changes in income. On the other hand, if $\beta > 0$,

consumption is said to be excessively sensitive to lagged income. With regional data, excess sensitivity of consumption could appear because: (i) credit/goods markets are not well-integrated across countries, and/or (ii) regions within a country are not fully integrated.[1]

One way of disentangling these two effects is to remove the aggregate component in regional data, and estimate Model 1 using region-specific income and consumption data. If regions within countries are relatively well-integrated, we should observe less (or no) excess sensitivity after controlling for aggregate effects. We use three alternative approaches to control for aggregate fluctuations. First, aggregate consumption and income are subtracted from their corresponding regional components to obtain region-specific (idiosyncratic) consumption and income. That is, we estimate the following regression equation.

$$\text{Model 2:} \quad \Delta(\log C_{it} - \log C_t) = \alpha_i + \beta\Delta(\log Y_{i,t-1} - \log Y_{t-1}) + \varepsilon_{it}. \tag{2}$$

Second, we allow for time fixed effects (υ_t) that capture common shocks to all regions in the country.

$$\text{Model 3:} \quad \Delta \log C_{it} = \alpha_i + \upsilon_t + \beta\Delta \log Y_{i,t-1} + \varepsilon_{it}. \tag{3}$$

Finally, aggregate effects are taken into account by including the change in aggregate consumption in the regression. In essence, shocks that affect the entire economy may already be reflected in aggregate consumption movements.

$$\text{Model 4:} \quad \Delta \log C_{it} = \alpha_i + \beta\Delta(\log Y_{i,t-1} - \log Y_{t-1}) + \gamma\Delta \log C_t + \varepsilon_{it}. \tag{4}$$

If frictions in international credit/goods markets are important, the estimate of β in Model 1 should be significantly different from 0. However, if regions within countries are relatively well-

[1]Note that this test of the PIH relies on a constant interest rate. When a country is not well integrated in the world credit market, an increase in aggregate consumption demand would imply more competition for domestic funds creating an upward pressure in interest rates. Tests of the PIH in aggregate data which allow for time-varying interest rates (Mankiw 1981), and time-varying stochastic interest rates (Hansen & Singleton 1982,1983) also fail. Ostergaard et al. (2002) and Sørensen & Yosha (2000) conjecture that measured interest rates may not fully capture close-economy constraints, so we follow their approach of controlling for aggregate effects more generally instead.

integrated, region-specific consumption should exhibit little or no sensitivity to lagged region-specific income, i.e., the estimate of β in models 2-4 should be insignificantly different from zero.

Models 1-4 are estimated using a weighted generalized least squares fixed effects procedure, where α_i is allowed to differ across cross-section units by estimating different constants for each region.

3 Data

Table 1 summarizes the regional data availability and data sources for the countries considered: Italy, Japan, Spain, the U.K., and West Germany. Annual data is employed except for the Spanish provinces, which is bi-annual.[2] Data on regional population and national CPI are utilized to express the consumption and income series in real per-capita terms.

[INSERT TABLE 1 HERE]

It is well-known that the PIH applies best to the relationship between nondurable consumption plus services and disposable income, however, due to data limitations, we consider alternative series whenever these variables are not available. Regional disposable income is not obtainable for all the countries in our sample and so, as in many studies, Gross Regional Product (GRP) is used as a proxy variable. For those countries where disposable income is available, we report results using both GRP and regional disposable income. Moreover, only one country in our sample, Italy, has regional nondurable consumption so we use regional total consumption instead. We also present data for the U.S. and Canada to compare our results to those in Ostergaard et al. (2002). For the U.S., consumption data is not available at the state level and retail sales are used as a proxy.

In addition, we consider a sample of OECD countries. We use data on annual PPP-adjusted real GDP, real total consumption, and population over the 1960-2000 period from the *Penn*

[2]Spain has a three-tier level of government: central, regional and local. At the regional level there are 17 "self-governing" (autonomous) communities plus the cities of Ceuta and Melilla. We refer to these communities as regions. At the local level, there are 50 provinces plus the cities of Ceuta and Melilla. We use data for both regions and provinces since they come from different sources and are available for different time periods. See Table 1 for details.

World Tables. Our OECD sample consists of the following 21 countries: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Greece, Ireland, Italy, Japan, Luxembourg, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, the U.K., and the U.S. Finally, in some regressions, we restrict the sample to the 15 European Union members (EU-15) before May 2004: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden, and the U.K.

[INSERT TABLE 2 HERE]

Before proceeding with the empirical analysis, we present some summary statistics of our regional data in Table 2. Column (1) reports the panel average of regional consumption and income growth. It is apparent that average consumption growth is very similar to income (or GRP) growth in most countries, with the exception of the U.S. and Japan, where it is lower. For the U.S., this is not surprising since consumption is proxied by retail sales which do not include expenditures on services such as health and education that tend to increase as income increases. For Japan, on the other hand, the result may be explained by demographic factors (i.e., older population) or simply higher saving.

With respect to the dispersion of consumption and income growth, column (2) shows that income growth is more volatile than consumption growth except in the U.S. This is the well-known stylized fact that aggregate consumption is not as volatile as aggregate income, whether income is taken to be disposable income or GRP. For the U.S., the higher dispersion in consumption may reflect the larger measurement error in retail sales data.

Columns (3)-(5) report the minimum, maximum and standard deviation of the region-specific averages of consumption and income growth rates to give an idea of regional differences within a country. Finally, column (6) shows the standard deviation of the time specific averages to illustrate the importance of aggregate effects.

4 Discussion of Results

As a first step in our empirical investigation, we perform augmented Dickey-Fuller tests for the presence of a unit root in the consumption and income series for each region. The values of

the test statistics indicate that the null hypothesis of a unit root cannot be rejected in most regions. Thus, these results are in concordance with the widely held view that the consumption and income series display unit root or near unit root behavior.[3] Consequently, we perform our empirical analysis using first differenced data.

The results of estimating models 1 to 4 using region-level data for each country are summarized in Table 3. In column (1), estimates of the excess sensitivity coefficient β, when common aggregate shocks are not controlled for, are all positive and significantly different from zero at the 5 percent level. The magnitude of the coefficient varies across countries, ranging from 0.036 for the Japanese prefectures to 0.512 for the Spanish provinces. Note, however, that these coefficients should be compared with caution since we are using different time periods for the different countries in our estimations. For example, excess sensitivity appears to be lower for the Spanish regions than the Spanish provinces. This is probably caused by the fact that the sample period for Spanish provinces is 1967-1997 versus 1985-1996 for the Spanish regions. Obviously the integration of the Spanish economy in the world credit market was fostered after the country joined the European Union—then the European Community—in 1986. Aside from these differences, as seen in Table 3, Spain and Italy have higher estimates of excess sensitivity than Japan, the U.K. and West Germany. Also, note the estimated coefficient tends to be higher when using GRP (versus disposable income) and total consumption (versus nondurable consumption) data.

[INSERT TABLE 3 HERE]

Model 2 estimates the amount of excess sensitivity using region-specific income and consumption observations. The results indicate that the excess sensitivity coefficients are much smaller than those in column (1). In fact, there is no evidence of significant excess sensitivity of consumption for any of the new countries considered with the exception of Italy. In columns (3) and (4), we present the results using alternative ways of controlling for aggregate effects. Similar to those in column (2), the excess sensitivity coefficients are small and insignificantly different from zero in most countries. This suggests that regions within a country suffer less from closed-economy constraints than the country as a whole, as hypothesized.

We perform the same analysis for a sample of 21 OECD countries and find excess sensitivity of current consumption to lagged income as well. However, in this case, controlling for aggregate

[3]Detailed tables reporting unit root tests are available from the authors upon request.

effects does not result in lower excess sensitivity. This implies that closed-economy constraints are as important for each of the OECD countries as for the OECD as a whole. Finally, we repeat the exercise for the group of EU-15 countries. In this case, controlling for aggregate effects does lower excess sensitivity slightly, indicating that the EU-15 members are somewhat more integrated than OECD countries.[4]

In summary, controlling for aggregate effects leads to a substantial reduction in the estimate of the excess sensitivity coefficient for the individual countries, to some extent for EU-15 members, but not for the OECD sample. Regions within a country are relatively open in the sense that they can more easily borrow and import goods among themselves and consequently, the estimated excess sensitivity coefficient decreases when controlling for aggregate effects in our individual country regressions. In other words, excess sensitivity may be explained by closed-economy constraints or the lack of integration of a country as a whole in the world credit/goods markets rather than lack of integration of regions within a country. Based on our findings, regions are better integrated within the U.K., West Germany, Japan and Spain than in Italy.

5 The Importance of Closed-Economy Constraints

The foregoing discussion suggests that closed-economy constraints may be responsible for the excess sensitivity phenomenon at the country-level. As such, it is only natural to investigate further whether variables that proxy for closed-economy constraints affect the magnitude of the excess sensitivity coefficient.

We start with a measure relating to the commodities market. Figure 1 plots the excess sensitivity coefficients of Model 1—the model which does not control for aggregate effects—against a standard measure of openness: trade (exports plus imports) divided by GDP.[5] In particular, we calculate the average trade to GDP ratio of each country for the time period considered in the estimation of the excesses sensitivity parameter. Note that since different periods are used in the individual country regressions, different periods are used as well to compute this trade average (see Table 1 for details). Also, since we find that the estimated

[4]To further examine the robustness of the results to minor changes in specification, we also estimate these four models using the variables in levels instead of logs. The results are qualitatively similar and not reported here. Tables available from the authors upon request.

[5]The trade to GDP ratio is obtained from the World Development Indicators published by the World Bank.

excess sensitivity coefficients are generally higher when using GRP than when using disposable income, we separate those countries with data on regional disposable income from those with GRP.

[INSERT FIGURE 1 HERE]

Figure 1 is instructive. Excess sensitivity is systematically larger the higher the measure of openness, with Japan being a clear outlier. The case of Spain is particularly revealing. Spain(1) covers regional data from 1985-1996 while Spain(2) consists of provincial data from 1967-1995. Average openness is higher for Spain(1) and the excess sensitivity coefficient is lower. To formally test the significance of the relationship between the variables, we calculate Pearson correlation coefficients. They are -0.96 (p-value=0.01, excluding Japan) and -0.98 (p-value=0.01) for Figure 1, top and bottom, respectively, indicating an inverse relationship between openness and excess sensitivity.[6]

A more systematic approach to examine the effects of openness on excess sensitivity using the individual country regional data, is to run the following regression:

$$\Delta \log C_{it} = \alpha_i + \beta \Delta \log Y_{i,t-1} + \gamma(\Delta \log Y_{i,t-1} \times \ trade_t) + \varepsilon_{it}, \tag{5}$$

where α_i denotes region fixed effects and ε_{it} is a zero mean, independently and identically distributed random disturbance. $trade_t$ is the ratio of exports plus imports to GDP, normalized to have zero mean for easier interpretation of the coefficients. β represents the excess sensitivity parameter when trade is equal to its average over the sample period and γ captures the changes in the excess sensitivity coefficient due to trade. If frictions in the goods market are indeed an important closed-economy constraint, then more open economies should exhibit lower excess sensitivity—i.e., γ should be negative. The columns labelled "Trade" in Table 4 summarize the estimation results of equation (5).

[INSERT TABLE 4 HERE]

It is noteworthy that γ is negative and significantly different from zero in most cases, indicating that increases in trade decrease the magnitude of the excess sensitivity coefficient. Also,

[6]The numbers for the U.S. are not entirely comparable since consumption is proxied by retail sales. Including the U.S., the correlation in the bottom panel of Figure 1 is -0.8 (p-value=0.1).

the size of the γ coefficient varies by country (ranging from -1.2 for Canada to -6.6 of the U.K.), and is far from negligible in most cases. For example, for the U.K., a 1% increase in trade over the sample average would lower the excess sensitivity coefficient by 0.066. For the OECD and the EU-15, trade has a negative and significant effect on the excess sensitivity coefficient as well.

Next, we turn to examine whether closed-economy constraints relating to international credit markets are important as well. We follow previous studies in assuming that financial integration may increase financial efficiency, which should stimulate the demand for funds and increase the size of the domestic financial market.[7] We measure the size of the domestic financial market, as is standard in the literature, by the value of the private credit provided by deposit money banks and other financial institutions relative to GDP ("*credit*").[8]

[INSERT FIGURE 2 HERE]

Figure 2 depicts the estimated excess sensitivity coefficients for each country against the credit variable. The pattern is not as clear as with the trade measure; Pearson correlations are -0.69 (p-value=0.13) and 0.54 (p-value=0.34) for Figure 2, top and bottom, respectively. We next turn to the individual country regressions allowing for an interaction term of the credit variable and lagged income growth:

$$\Delta \log C_{it} = \alpha_i + \beta \Delta \log Y_{i,t-1} + \delta(\Delta \log Y_{i,t-1} \times \ credit_t) + \varepsilon_{it}. \tag{6}$$

The columns labelled "Credit" in Table 4 report the regression results of equation (6). δ is negative and significantly different from zero in most countries, implying that a relaxation of international credit market imperfections would decrease excess sensitivity coefficients. For the OECD and the EU-15 as a whole, $credit_t$ has the predicted negative effect on the excess sensitivity coefficient but is only marginally significant for the OECD group.

For completeness, we include both the interaction term for trade and credit in the same regression. Results are reported in Table 4 under the columns labelled "Both". It is evident that δ and γ remain negative and significant in many countries, suggesting that the two economic mechanisms have an independent role in explaining excess sensitivity.[9]

[7] See for example Levine & Zervos (1998) and Guiso, Jappelli, Padula & Pagano (2004).
[8] The *credit* variable is obtained from the World Bank's Financial Structure Database.
[9] The two mechanisms could be complementary as well. Imports may adjust slowly because of international

One may argue that our proxy for financial integration may reflect mainly credit constraints (as opposed to closed-economy constraints), which are known to influence consumption behavior and lead to rejection of the PIH. We perform one alternative regression by taking advantage of our European sample of countries. In 1992, the European Union lifted capital controls and started the process of full financial integration. We create a dummy variable for financial integration, fi_t, which takes on the value of 0 before 1992 and 1 otherwise, and use it instead of our previous credit variable. Results are reported in Table 5. δ is negative and significant for all countries in the European sample but the U.K. Interestingly, the coefficient of fi_t is insignificant for the OECD group while it is significantly negative for the EU-15 members. When adding the trade interaction term to the regression, the effect of trade remains negative and significant for most countries.

[INSERT TABLE 5 HERE]

Our previous results suggest that as countries become more open and integrated in the world credit market, we should expect excess sensitivity to decrease. In order to check if this pattern is observed in our sample of countries, we run our final regression:

$$\Delta \log C_{it} = \alpha_i + \beta + \zeta(\Delta \log Y_{i,t-1} \times t) + \varepsilon_{it}, \tag{7}$$

where ζ captures changes in the excess sensitivity coefficient over time. Table 6 summarizes the results.

[INSERT TABLE 6 HERE]

For all countries except the U.K. and Japan, ζ is estimated to be negative and significantly different from zero. Interestingly, although these two countries are very different (the U.K. is the most open country in our sample while Japan is quite closed), our measure of openness does not exhibit a trend in the U.K. and it exhibits a negative trend in the Japanese case. All the other countries but Italy show significant positive trends in trade.[10]

credit markets are imperfect, which may explain why for Canada the sign of γ changes. For this country the correlation between $trade_t$ and $credit_t$ is the highest, 0.8.

[10]Fitting a linear trend to the trade measure for the different countries delivered the following coefficients: U.K., 0.01; Germany, 0.48*; Italy, -0.25; Spain (regions), 0.73*; Spain (provinces), 0.64*; Japan -0.55*; Canada, 0.82*; and the U.S., 0.42*. An asterisk (*) denotes significant at the 5% level. In Italy the series had a clear U shape.

In summary, estimates of the excess sensitivity coefficient are inversely related to standard measures of openness and financial market integration, and for most countries excess sensitivity has decreased over time. These facts may be explained by a relaxation of closed-economy constraints which may arise from either an increase in trade, a better integration of financial markets, or both.

6 Concluding Remarks

In this paper, we examine the relationship between changes in consumption and lagged changes in income using region-level data from Italy, Japan, Spain, the United Kingdom and West Germany. Hall's (1978) version of the PIH predicts that consumption should follow a martingale process—i.e., changes in consumption should be independent of lagged changes in income if the PIH is true.

Our empirical findings reveal that region-level consumption exhibits excess sensitivity to lagged income. However, we also find that region-specific consumption exhibits substantially less sensitivity to lagged region-specific income. Thus, once aggregate income and consumption fluctuations are controlled for, the deviation from PIH consumption behavior in macroeconomic data becomes smaller. We also document that estimated excess sensitivity coefficients are inversely related to standard measures of openness and credit market integration and that for most countries, excess sensitivity has decreased over time. In closing, these findings are consistent with those reported in Ostergaard et al. (2002) for U.S. state-level and Canadian province-level data, and provide empirical support for the hypothesis that closed-economy constraints may partly be responsible for the excess sensitivity phenomenon.

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Table 1: Regional Data on Consumption and Income

Country	No. Regions	Years	Consumption	Disp. Income	GRP
U.K.	11	1971-1994	Total	Yes	No
West Germany	11	1970-1997	Total	No	Yes
Italy	20	1980-1995	Total, Nondur.	No	Yes
Spain (Regions)	18	1985-1996	Total	Yes	Yes
Spain (Provinces)	52	1967-1995*	Total	Yes	Yes
Japan	47	1975-1993	Total	No	Yes
U.S.	50	1963-1995	Retail Sales	Yes	No
Canada	10	1961-1996	Total, Nondur.	Yes	No

Data Sources:
(1) U.K. data from *Regional Trends*, a yearly publication of the U.K. Central Statistical Office.
(2) West Germany's data from *"Arbeitskreis Volkswirtschaftliche Gesamtrechnungen der Länder"*, Statistisches Landesamt Baden-Württemberg, Stuttgard.
(3) Italian Data from *"Conti Economici Territoriali: Conti Regionali"* published by ISTAT, the Italian Central Statistical Office.
(4) Spain's regions data from *"Contabilidad Regional de España"* published by the INE, the Spanish National Statistical Office.
(5) Spain's provinces data from *"Renta Nacional de España y su Distribución Provincial"* published by the BBV, Banco Bilbao Vizcaya. *Data are bi-annual.
(6) Japan's data from *Annual Report of Prefectural Accounts*, published by the Economic Planning Agency of the Government of Japan.
(7) U.S. data from the *Bureau of Economic Analysis* for disposable income and GDP and from the *Survey of Buying Power* for Retail Sales
(8) Canadian data from CANSIM.

Table 2: Summary Statistics

	mean, $\bar{x}_{..}$	$\overline{\text{sd}(x_{it})}$	$\max(\bar{x}_{i.})$	$\min(\bar{x}_{i.})$	$\text{sd}(\bar{x}_{i.})$	$\text{sd}(\bar{x}_{.t})$
	(1)	(2)	(3)	(4)	(5)	(6)
United Kingdom						
$\Delta \log C_{it}$ (Total)	2.14	3.40	2.33	1.90	0.12	2.86
$\Delta \log Y_{it}$ (GRP)	1.88	3.46	2.29	1.40	0.26	2.96
$\Delta \log Y_{it}$ (Disp. Inc.)	2.25	3.59	3.02	1.91	0.30	2.96
West Germany						
$\Delta \log C_{it}$ (Total)	2.04	1.91	2.43	0.85	0.42	1.61
$\Delta \log Y_{it}$ (GRP)	1.93	2.14	2.42	1.47	0.27	1.75
Italy						
$\Delta \log C_{it}$ (Total)	1.87	1.87	2.32	1.37	0.28	1.64
$\Delta \log C_{it}$ (Nondur.)	1.72	1.95	2.19	1.27	0.23	1.59
$\Delta \log Y_{it}$ (GRP)	1.57	2.04	2.43	0.92	0.36	1.28
Spain (regions)						
$\Delta \log C_{it}$ (Total)	3.06	2.78	3.73	2.53	0.30	2.28
$\Delta \log Y_{it}$ (GRP)	3.07	3.04	3.98	1.54	0.58	2.14
$\Delta \log Y_{it}$ (Disp. Inc.)	2.95	3.12	3.82	2.15	0.43	2.30
Spain (provinces)						
$\Delta \log C_{it}$ (Total)	2.76	3.56	4.38	1.46	1.04	6.05
$\Delta \log Y_{it}$ (GRP)	2.83	2.84	3.95	1.58	1.13	4.68
$\Delta \log Y_{it}$ (Disp. Inc.)	2.73	3.62	4.31	1.47	1.03	6.27
Japan						
$\Delta \log C_{it}$ (Total)	2.35	3.48	3.84	0.97	0.60	1.33
$\Delta \log Y_{it}$ (GRP)	3.20	4.57	5.85	2.37	0.67	1.78
U.S.						
$\Delta \log C_{it}$ (Total Retail Sales)	1.21	5.15	2.34	0.22	0.46	3.32
$\Delta \log Y_{it}$ (Disp. Inc.)	1.92	2.91	2.57	1.35	0.32	2.21
Canada						
$\Delta \log C_{it}$ (Nondur)	2.24	1.96	2.80	1.81	0.27	1.52
$\Delta \log Y_{it}$ (Disp. Inc.)	2.33	3.78	2.94	1.69	0.43	2.79

All variables in percentages.
$\bar{x}_{..}$ is the panel mean. $\overline{\text{sd}(x_{it})}$ is the average regional standard deviation of x; $\bar{x}_{i.}$ is region i's specific mean. $\text{sd}(\bar{x}_{i.})$ is the standard deviation of the region specific means, while $\text{sd}(\bar{x}_{.t})$ is the standard deviation of the time specific averages.
Explicitly:
$\overline{\text{sd}(x_{it})} = \frac{1}{N}\sum_i \sqrt{\frac{\sum_t (x_{it}-\bar{x}_{i.})^2}{T-1}}$, $\text{sd}(\bar{x}_{i.})=\sqrt{\frac{\sum_i (\bar{x}_{i.}-\bar{x}_{..})^2}{N-1}}$, and $\text{sd}(\bar{x}_{.t})=\sqrt{\frac{\sum_t (\bar{x}_{.t}-\bar{x}_{..})^2}{T-1}}$

Table 3: Sensitivity of Regional/Provincial Level Consumption to Lagged Income

Country	Model 1 (1)	Model 2 (2)	Model 3 (3)	Model 4 (4)
United Kingdom (11 regions):	0.13*	0.06	0.06	0.07
Total Cons. and Disp. Income	(0.06)	(0.05)	(0.05)	(0.05)
United Kingdom (11 regions):	0.23*	0.03	0.01	0.03
Total Cons. and GRP	(0.06)	(0.07)	(0.07)	(0.07)
West Germany (11 Landers):	0.20*	–0.02	–0.01	–0.02
Total Cons. and GRP	(0.05)	(0.05)	(0.04)	(0.05)
Italy (20 Regions):	0.36*	0.05*	0.05*	0.04*
Total Cons. and GRP	(0.05)	(0.02)	(0.02)	(0.02)
Italy (20 Regions):	0.32*	0.05	0.08*	0.05
Nondur Cons. and GRP	(0.05)	(0.04)	(0.04)	(0.04)
Spain (18 Regions):	0.28*	–0.01	–0.02	0.02
Total Cons. and Disp. Income	(0.07)	(0.06)	(0.02)	(0.04)
Spain (18 Regions):	0.49*	–0.02	0.01	–0.03
Total Cons. and GRP	(0.05)	(0.03)	(0.02)	(0.03)
Spain (52 Provinces):	0.37*	0.08	0.06	0.08**
Total Cons. and Disp. Income	(0.03)	(0.04)	(0.04)	(0.04)
Spain (52 Provinces):	0.51*	0.02	0.02	0.02
Total Cons. and GRP	(0.03)	(0.05)	(0.05)	(0.05)
Japan (47 Prefectures):	0.04*	–0.02	–0.04	–0.01
Total Cons. and GRP	(0.02)	(0.02)	(0.03)	(0.02)
US (50 states)	0.32*	0.14*	0.18*	0.14*
Total Retail Sales and Disp. Income	(0.04)	(0.05)	(0.05)	(0.05)
Canada (10 Provinces)	0.21*	0.08*	0.02	0.07*
Total Cons. and Disp. Income	(0.03)	(0.03)	(0.02)	(0.03)
Canada (10 Provinces)	0.18*	0.02	–0.01	0.02
Nondur. Cons. and Disp. Income	(0.03)	(0.02)	(0.02)	(0.02)
OECD	0.23*	0.42*	0.25*	0.16*
Total Cons. and GDP	(0.04)	(0.03)	(0.04)	(0.04)
EU–15	0.25*	0.12**	0.20*	0.12**
Total Cons. and GDP	(0.05)	(0.06)	(0.06)	(0.06)

Standard errors in parentheses. *Significant at the 5% level. **Significant at the 10% level.

C_{it} and Y_{it} are consumption and GRP/income in region i in period t. C_t and Y_t are national consumption and GDP/income respectively.

Model 1: $\Delta \log C_{it} = \alpha_i + \beta \Delta \log Y_{i,t-1} + \varepsilon_{it}$.
Model 2: $\Delta(\log C_{it} - \log C_t) = \alpha_i + \beta \Delta(\log Y_{i,t-1} - \log Y_{t-1}) + \varepsilon_{it}$.
Model 3: $\Delta \log C_{it} = \alpha_i + \upsilon_t + \beta \Delta \log Y_{i,t-1} + \varepsilon_{it}$.
Model 4: $\Delta \log C_{it} = \alpha_i + \beta \Delta(\log Y_{i,t-1} - \log Y_{t-1}) + \gamma \Delta \log C_t + \varepsilon_{it}$.

The table presents estimates for β, the excess sensitivity parameter. All models are estimated using a weighted generalized least squares fixed effects regression procedure, where α_i is allowed to differ across cross-section units by estimating different constants for each region/province. In Model 3, υ_t denotes time fixed effects.

Table 4: Excess Sensitivity, Trade and Credit

	Trade (1)		Credit (2)		Both (3)		
	$\hat{\beta}$	$\hat{\gamma}$	$\hat{\beta}$	$\hat{\delta}$	$\hat{\beta}$	$\hat{\gamma}$	$\hat{\delta}$
United Kingdom	0.16*	–2.40	0.15*	0.20	0.17*	–2.03	0.10
Total Cons. and Disp. Inc.	(0.06)	(1.50)	(0.06)	(0.20)	(0.06)	(1.58)	(0.17)
United Kingdom	0.29*	–6.60*	0.24*	0.20	0.30*	–7.63*	–0.26
Total Cons. and GRP	(0.06)	(1.40)	(0.06)	(0.20)	(0.06)	(1.62)	(0.20)
Germany	0.18*	–2.20*	0.18*	–1.10*	0.18*	–1.82*	–0.34
Total Cons. and GRP	(0.05)	(0.70)	(0.05)	(0.40)	(0.05)	(0.94)	(0.54)
Italy	0.33*	–3.40*	0.29*	–11.90*	0.27*	–2.58*	–10.87*
Total Cons. and GRP	(0.05)	(1.00)	(0.05)	(2.00)	(0.05)	(1.01)	(2.01)
Italy	0.28*	–4.20*	0.26*	–9.10*	0.23*	–3.62*	–7.84*
Nondur Cons. and GRP	(0.05)	(1.00)	(0.05)	(2.10)	(0.05)	(0.99)	(2.05)
Spain (regions)	0.27*	–2.30	0.41*	–5.90*	0.40*	–4.57**	–6.54*
Total Cons. and Disp. Inc.	(0.07)	(2.80)	(0.07)	(1.20)	(0.07)	(2.61)	(1.26)
Spain (regions)	0.43*	–3.30*	0.49*	–3.90*	0.43*	–3.37*	–3.99*
Total Cons. and GRP	(0.06)	(1.30)	(0.05)	(0.90)	(0.05)	(1.26)	(0.88)
Spain (provinces)	0.32*	–3.30*	0.47*	–4.10*	0.43*	–1.34*	–3.42*
Total Cons. and Disp. Inc.	(0.04)	(0.60)	(0.04)	(0.50)	(0.04)	(0.65)	(0.61)
Spain (provinces)	0.49*	–2.30*	0.60*	–3.60*	0.58*	–0.81	–3.25*
Total Cons. and GRP	(0.03)	(0.50)	(0.03)	(0.50)	(0.04)	(0.52)	(0.54)
Japan	0.01	–1.70*	–0.07	0.10	0.55*	–3.94*	0.00*
Total Cons. and GRP	(0.02)	(0.40)	(0.09)	(0.10)	(0.13)	(0.62)	(0.00)
U.S.	0.29*	–4.10*	0.31*	–0.10	0.30*	–1.31	0.03
Total Cons. and Disp. Inc.	(0.04)	(0.90)	(0.04)	(0.20)	(0.04)	(1.08)	(0.27)
Canada	0.18*	–1.50*	0.18*	–0.90*	0.31*	3.48*	–2.48*
Total Cons. and Disp. Inc.	(0.04)	(0.60)	(0.04)	(0.20)	(0.04)	(0.97)	(0.39)
Canada	0.18*	–1.20*	0.18*	–0.50*	0.25*	1.74*	–1.43*
Nondur Cons. and Disp. Inc.	(0.03)	(0.50)	(0.03)	(0.20)	(0.04)	(0.79)	(0.32)
OECD	0.24*	–0.59*	0.22*	–0.18**	0.23	–0.49**	–0.11
Total Cons. and GDP	(0.04)	(0.25)	(0.04)	(0.10)	(0.04)	(0.27)	(0.11)
EU-15	0.24*	–0.54*	0.25*	–0.08	0.24*	–0.54**	0.04
Total Cons. and GDP	(0.05)	(0.27)	(0.05)	(0.19)	(0.05)	(0.29)	(0.20)

Standard errors in parentheses. *Significant at the 5% level. **Significant at the 10% level.

Regression (1): $\Delta \log C_{it} = \alpha_i + \beta \Delta \log Y_{i,t-1} + \gamma(\Delta \log Y_{i,t-1} \times \ trade_t) + \varepsilon_{it}$
Regression (2): $\Delta \log C_{it} = \alpha_i + \beta \Delta \log Y_{i,t-1} + \delta(\Delta \log Y_{i,t-1} \times \ credit_t) + \varepsilon_{it}$
Regression (3): $\Delta \log C_{it} = \alpha_i + \beta \Delta \log Y_{i,t-1} + \gamma(\Delta \log Y_{i,t-1} \times \ trade_t) + \delta(\Delta \log Y_{i,t-1} \times \ credit_t) + \varepsilon_{it}$

C_{it} and Y_{it} are consumption and GDP/income in region i in period t. C_t and Y_t are national consumption and GDP/income respectively. "$trade_t$" is defined as exports plus imports divided by GDP. "$credit_t$" is private credit by deposit money banks and other financial institutions relative to GDP.

The trade and credit variables are normalized to have zero mean for easier interpretation of the coefficients.

Estimation results using a weighted generalized least squares fixed effects regression procedure, where α_i is allowed to differ across cross-section units by estimating different constants for each region/province.

Table 5: Excess Sensitivity, Financial Integration and Trade

	Financial Integration (1)		Fin. Integr. and Trade (2)		
	$\hat{\beta}$	$\hat{\delta}$	$\hat{\beta}$	$\hat{\delta}$	$\hat{\gamma}$
United Kingdom	0.13*	0.10	0.16*	0.08	–2.35
Total Cons. And Disp. Inc.	(0.06)	(0.19)	(0.06)	(0.19)	(1.49)
United Kingdom	0.23*	0.07*	0.30*	–0.16	–6.73*
Total Cons. And GRP	(0.06)	(0.39)	(0.06)	(0.38)	(1.48)
Germany	0.27*	–0.35*	0.25*	–0.37*	–2.36*
Total Cons. And GRP	(0.05)	(0.11)	(0.05)	(0.10)	(0.67)
Italy	0.49*	–0.60*	0.47*	–0.54*	–1.27
Total Cons. And GRP	(0.05)	(0.10)	(0.06)	(0.11)	(1.10)
Italy	0.43*	–0.53*	0.38*	–0.40*	–2.58*
Nondur Cons. And GRP	(0.05)	(0.10)	(0.05)	(0.11)	(1.08)
Spain (regions)	0.40*	–0.47*	0.42*	–0.50*	1.94
Total Cons. And Disp. Inc.	(0.07)	(0.11)	(0.08)	(0.12)	(2.84)
Spain (regions)	0.53*	–0.54*	0.57*	–0.62*	1.88
Total Cons. And GRP	(0.05)	(0.09)	(0.06)	(0.12)	(1.62)
Spain (provinces)	0.47*	–0.86*	0.47*	–0.87*	0.06
Total Cons. And Disp. Inc.	(0.03)	(0.07)	(0.04)	(0.09)	(0.62)
Spain (provinces)	0.59*	–1.14*	0.59*	–1.12*	–0.27
Total Cons. And GRP	(0.03)	(0.09)	(0.03)	(0.10)	(0.47)
OECD	0.24*	–0.08	0.24*	–0.01	–0.59*
Total Cons. And GDP	(0.04)	(0.09)	(0.04)	(0.10)	(0.27)
EU-15	0.27*	–0.22**	0.25*	–0.14	–0.43
Total Cons. And GDP	(0.06)	(0.13)	(0.06)	(0.14)	(0.29)

Standard errors in parentheses. *Significant at the 5% level. **Significant at the 10% level.

Regression (2): $\Delta \log C_{it} = \alpha_i + \beta \Delta \log Y_{i,t-1} + \delta(\Delta \log Y_{i,t-1} \times \ fi_t) + \varepsilon_{it}$
Regression (3): $\Delta \log C_{it} = \alpha_i + \beta \Delta \log Y_{i,t-1} + \delta(\Delta \log Y_{i,t-1} \times \ fi_t) + \gamma(\Delta \log Y_{i,t-1} \times \ trade_t) + \varepsilon_{it}$

C_{it} and Y_{it} are consumption and GDP/Income in region i in period t. C_t and Y_t are national consumption and GDP/Income respectively. "$trade_t$" is defined as exports plus imports divided by GDP. "fi_t" is a dummy variable that takes the value 1 after 1992 when the EU lifted capital controls and started the process of full financial integration.

The trade and credit variables are normalized to have zero mean for easier interpretation of the coefficients.

Estimation results using a weighted generalized least squares fixed effects regression procedure, where α_i is allowed to differ across cross-section units by estimating different constants for each region/province.

Table 6: Excess Sensitivity over Time

	$\hat{\beta}$	$\hat{\zeta}$ ($\times 100$)
United Kingdom	–0.04	1.90*
Total Cons. and Disp. Inc.	(0.09)	(0.80)
United Kingdom	–0.06	2.60*
Total Cons. and GRP	(0.11)	(0.90)
Germany	0.34*	–1.10*
Total Cons. and GRP	(0.84)	(0.50)
Italy	0.64*	–3.30*
Total Cons. and GRP	(0.11)	(1.20)
Italy	0.53*	–2.50*
Nondur. Cons. and GRP	(0.11)	(1.20)
Spain (regions)	1.11*	–14.90 *
Total Cons. and Disp. Inc.	(0.13)	(2.20)
Spain (regions)	0.88*	–9.30*
Total Cons. and GRP	(0.08)	(1.50)
Spain (provinces)	0.64*	–4.50*
Total Cons. and Disp. Inc.	(0.05)	(0.60)
Spain (provinces)	0.74*	–3.40*
Total Cons. and GRP	(0.05)	(0.60)
Japan	0.03	0.06
Total Cons. and GRP	(0.04)	(0.30)
US	0.41*	–0.70**
Total Cons. and Disp. Inc.	(0.07)	(0.40)
Canada	0.37*	–1.20*
Total Cons. and Disp. Inc.	(0.06)	(0.40)
Canada	0.27*	–0.50*
Disp. Inc., Nondur. Cons.	(0.05)	(0.30)
OECD	0.32*	–0.60*
Total Cons. And GDP	(0.05)	(0.27)
EU-15	0.35*	–0.79**
Total Cons. And GDP	(0.09)	(0.42)

Standard errors in parentheses.

*Significant at the 5% level. **Significant at the 10% level.

Regression (1): $\Delta \log C_{it} = \alpha_i + \beta \Delta \log Y_{i,t-1} + \zeta(\Delta \log Y_{i,t-1} \times t) + \varepsilon_{it}$

Estimation results using a weighted generalized least squares fixed effects regression procedure, where α_i is allowed to differ across cross-section units by estimating different constants for each region/province.

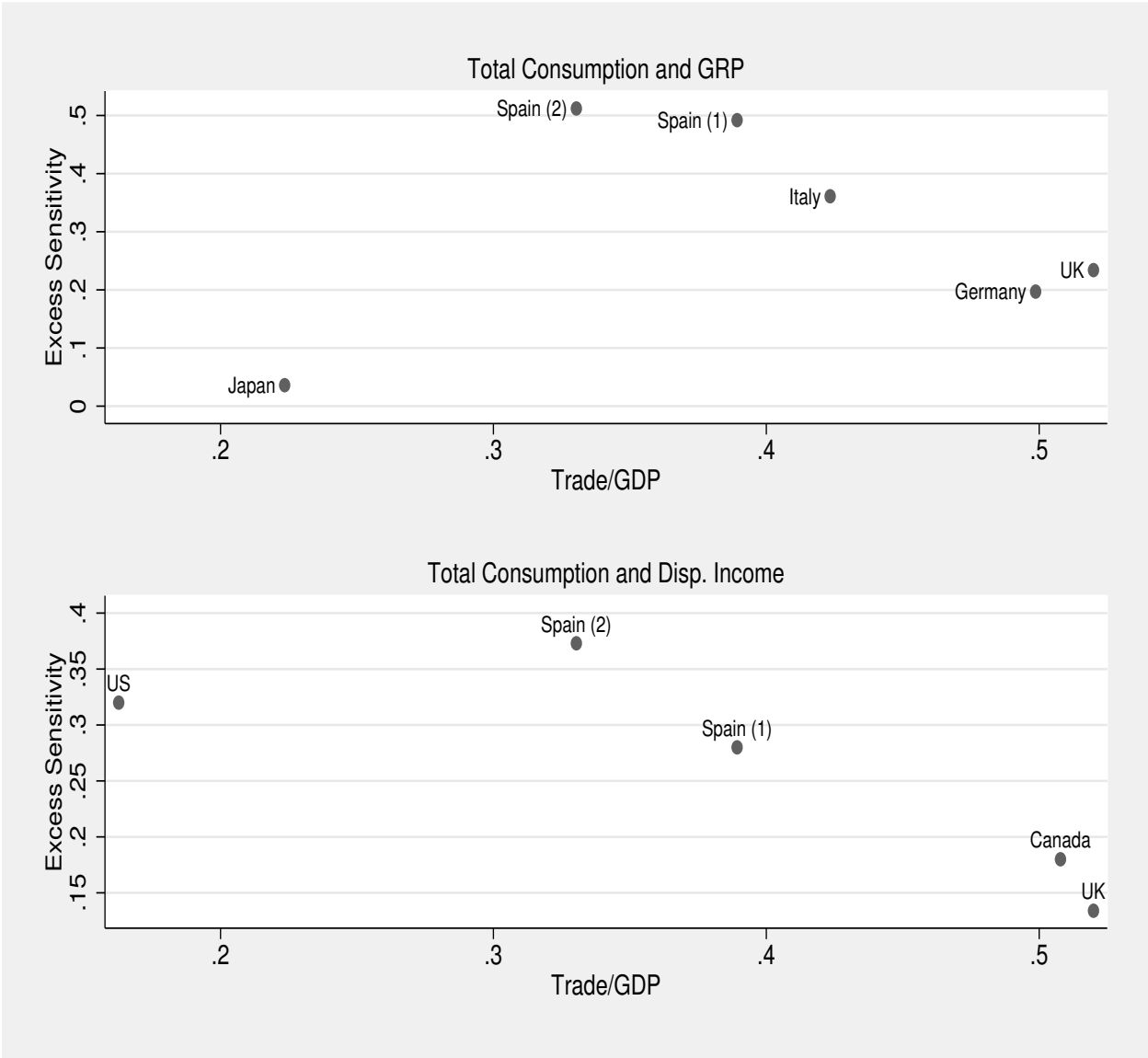

Figure 1: Excess Sensitivity and Trade

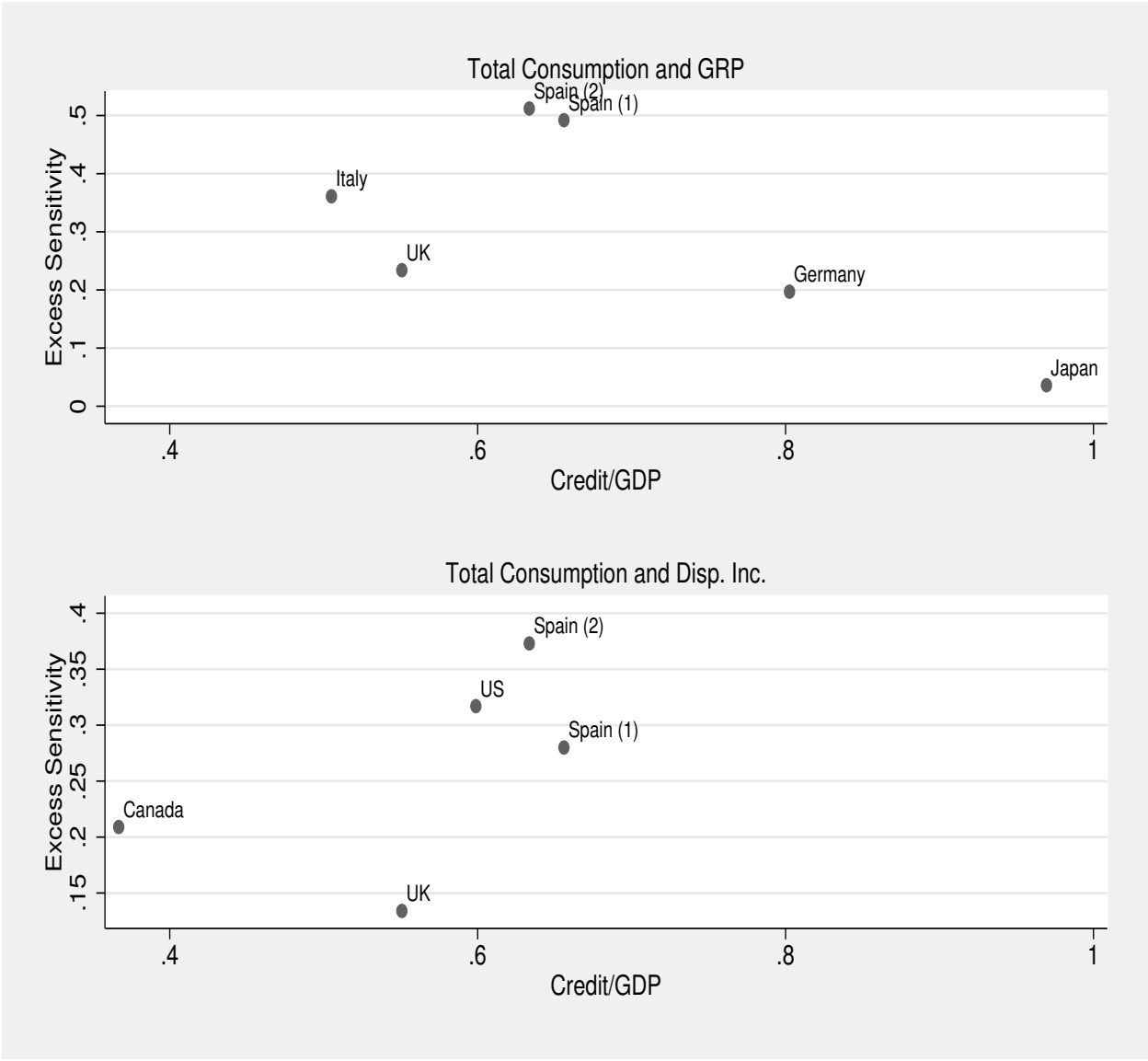

Figure 2: Excess Sensitivity and Credit