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Jorge Bermejo Carbonell & Richard A. Werner

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ECONOMIC GEOGRAPHY

Does Foreign Direct Investment Generate Economic Growth? A New Empirical Approach Applied to Spain

JorgeBermejoCarbonell
ICADE Business School
Comillas Pontifical University
Madrid 28008
Spain
bermejo14@hotmail.com

Richard A. Werner
Centre for Banking, Finance and Sustainable Development
University of Southampton, Southampton Business School
Southampton SO17 1BJ
UK
werner@soton.ac.uk

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abstract

It is often asserted with confidence that foreign direct investment (FDI) is beneficial for economic growth in the host economy. Empirical evidence has been mixed, and there remain gaps in the literature. The majority of FDI has been directed at developed countries. Single-country studies are needed, due to the heterogeneous relationship between FDI and growth, and because the impact of FDI on growth is said to be largest in open, advanced developed countries with an educated workforce and developed financial markets (although research has focused on developing countries). We fill these gaps with an improved empirical methodology to check whether FDI has enhanced growth in Spain, one of the largest receivers of FDI, whose gross domestic product growth was above average but has escaped scrutiny. During the observation period 1984–2010, FDI rose significantly, and Spain offered ideal conditions for FDI to unfold its hypothesized positive effects on growth. We run a horse race between various potential explanatory variables, including the neglected role of *bank credit for the real economy*. The results are robust and clear: The favorable Spanish circumstances yield no evidence for FDI to stimulate economic growth. The Spanish EU and euro entry are also found to have had no positive effect on growth. The findings call for a fundamental rethinking of methodology in economics.

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> FDI is one of the most relevant aspects of the recent wave of globalization
>
> —Bajo-Rubio, Díaz-Mora, and Díaz-Roldán (2010, 374).

> Over the last 40 years . . . FDI . . . has been a prominent driver of Spanish economic growth.
>
> —Villaverde and Maza (2012, 722)

The effect of foreign direct investment (FDI) on the host economy has attracted much research. Economic theorists and policy makers frequently emphasize purported benefits of FDI. Rigorous empirical evidence has been less abundant.[1] Most studies examine the impact of FDI on developing economies, but FDI is mainly received by developed countries (Lucas 1990; Gourinchas and Jeanne 2013). Macroeconomic analyses that account for groups of developed countries often report either a negative impact on growth (Mencinger 2003; Carkovic and Levine 2005; Johnson 2006; Türkcan, Duman, and Yetkiner 2008; Herzer 2012) or an inconclusive effect (De Mello 1999). By contrast, several macro-based articles on both developed and developing countries indicate a positive effect of FDI inflows (Olofsdotter 1998; Reisen and Soto 2001), albeit differing by country, and indicating the importance of host economy characteristics (Alfaro et al. 2004; Li and Liu 2005; Batten and Vo 2009). The empirical literature seems to agree that any positive effect of FDI on growth is largest among developed countries, since they have the absorptive capacity to benefit from the foreign investment.

Since potential heterogeneity in the relationship between FDI and economic growth calls for single-country research, we examine new evidence from one important advanced FDI receiver economy, using a robust new methodology. Our article focuses on the neglected case of Spain, a developed economy with good data availability, developed financial

[1] See Bornschier, Chase-Dunn, and Rubinson (1978); Firebaugh (1992, 1996); Pantulu and Poon (2003). Pavlínek (2004), analyzing the central European automobile industry, reports adverse effects of FDI. Pavlínek (2012) examines whether FDI in the same industry and region has enhanced research and development (R&D) in the host country and reports s*trong barriers to future development*. Country studies in economic geography include Leichenko and Erickson (1997), who report a positive effect of FDI on US state-level export performance, and Sun (2001), reporting an uneven effect of FDI in China on export performance. Jones and Wren (2004) analyze the impact of FDI on employment in northeast England and question the policies of inward investment agencies. Cole, Elliott, and Zhang (2011) report an influence of FDI on the pattern of industrial pollution in China. Zhao and Zhang (2007), in a study on China, report that FDI may influence the urban agglomeration pattern. Phelps and Wood (2006) analyze the political economy of the interaction between global capital and local stakeholders.

markets, an educated workforce and one of the largest net FDI receivers during the last quarter century (World Bank data). During the observation period (1984–2010) Spain recorded above-average growth (Garcia-Santana et al. 2016), rendering it ideally suited to showcase positive effects of FDI.

Ours is one of the first studies to deploy the general-to-specific (GETS) econometric methodology, previously used on FDI only by Herzer (2012), on developing countries. It allows an objective selection of potential explanatory variables of gross domestic product (GDP) growth from an initial general model with many variables, including FDI. Neutral statistical criteria are used to then sequentially simplify to the *specific* (parsimonious) form without losing information or inadvertently influencing the empirical evaluation.

The literature has ignored the banking sector, despite calls to include it in models of the economy and capital flows (e.g., Werner 1994, 1997, 2005, 2012, 2013b). Recently, it has been empirically proven that banks create new money when extending loans, rendering prior savings unnecessary for investment and growth (Werner 2014a, 2016). Moreover, Werner (2016) points out that in our international financial architecture, foreign-denominated money (which is bank-created and bank-based credit or accounting money) will never enter the receiver economy (but results in domestic bank credit expansion, which can be achieved without foreign investment). This greatly diminishes the theoretical case for FDI to boost growth, especially when domestic credit creation for the real economy is represented in a model of GDP growth, as in our contribution (Werner 1992, 1994, 1997, 2012). Empirically, bank credit creation for GDP transactions survives the GETS methodology of a rigorous downward reduction to the parsimonious form as a significant explanatory variable of Spanish GDP growth. As prior studies failed to include it, they must have suffered from omitted variable bias, rendering their results unreliable. Based on our much-improved empirical model, we show, with greater power than previously, that FDI has no significant positive effect on economic growth. We help solve the puzzle of high Spanish growth from the mid-1990s to 2008, since our model accounts for Spanish GDP without structural breaks during the twenty-seven years of our observation period from 1984 to 2010. In addition, new results on the impact of interest rates and joining the European Union and the euro on Spanish growth are derived: they are not significant.

The next section reviews the literature on growth and the effect of FDI on growth. This is followed by a section discussing FDI and Spanish growth, before presenting the new empirical evaluation of the impact of FDI on Spanish growth. The final section discusses the empirical findings and concludes. We find no positive effect of FDI on GDP in the important Spanish case, when the environment was most favorable for FDI to deliver growth. The interest rate—emphasized by central bank spokespersons—is also not instrumental in influencing GDP, although a variable previously omitted in economic models (domestic credit creation for *real economy* transactions) is. The parsimonious model does not suffer from visible statistical problems. This finding calls into question the wisdom of providing financial incentives to foreign firms to attract FDI or of joining a monetary, economic, and political union.

The Link between FDI and Growth

Theory

In the influential Harrod (1939) and Domar (1947) growth models, savings are key, driving capital accumulation and growth. Rostow (1959) seems to provide evidence that savings are needed for development. Since raising savings may be difficult in the short term, especially for developing countries, economists led by the International

Monetary Fund (IMF) and the World Bank have advised nations to borrow *savings* from abroad—via loans, portfolio investments, and FDI—to augment domestic savings and achieve a targeted growth rate. Governments and regional administrations, keen to enhance growth, have since competed for FDI through tax incentives and subsidies. Many developing countries were lured into incurring large foreign-denominated debts, which are hard to service and not rarely resulted in foreign control over their most valuable resources. Thus, foreign investment is not without risks such as the extraction of profits or retooling of an economy for foreign, not domestic, purposes (see Hughes 1979; Dixon and Boswell 1996; Kentor 1998). Herzer, Hühne, and Nunnenkamp (2014) find a significant increase of inequality in developing countries from FDI, with causality from FDI to inequality.[2]

When neoclassical growth theory (Solow 1956; Swan 1956) replaced the Harrod–Domar theory, a new rationale for the flow of funds from rich countries to developing nations was found: as diminishing returns to capital, and a lower capital stock in developing countries are assumed, returns on capital should be higher in developing countries, enticing international capital from rich to poor countries, helping the latter catch up. This narrative also provided theoretical support for developing countries to utilize foreign investment, including FDI. But empirical evidence has suggested otherwise: long-run growth is empirically due to technical progress, not capital or investment (Abramovitz 1956; Solow 1957). Moreover, capital was found not to flow from rich to poor countries, but rather from poor countries to the rich (e.g., Lucas 1990; Gourinchas and Jeanne 2013).

With technical progress outside neoclassical (*exogenous growth*) models, technology transfer from abroad via FDI remained a key recommendation by international organizations for countries to enhance growth (Blomström, Lipsey, and Zejan 1994; Balasubramanyam, Salisu, and Sapsford 1996; Blomström and Kokko 1998; Blomström and Sjöholm 1999).

When the Solow–Swan *exogenous growth* theory was challenged by the *endogenous growth* theory (Lucas 1988; Barro 1990; Romer 1990), emphasizing the role of technology, FDI remained justified to transfer technology, igniting domestic productivity (Johnson 2006).[3] Yet, evidence that technology gets transferred to receiver countries has remained sparse (e.g., Young and Lan 1997; Ashraf, Herzer, and Nunnenkamp 2016, found no positive effect of FDI on total factor productivity in 123 countries).

Evidence

A number of studies reported support for the theory that FDI benefits growth:[4] Reisen and Soto (2001) report that foreign portfolio and direct investment boost

[2] Chintrakarn, Herzer, and Nunnenkamp (2012) found mixed results for the United States using state-level data.

[3] It is also said FDI might improve transport/communication infrastructure of the host country and raise the level of human capital (Noorbakhsh and Paloni 2001).

[4] Microeconomic evidence from firms is mixed. Several articles found positive knowledge transfer effects on domestic firms (e.g., Blomström and Sjöholm 1999). On the other hand, Lichtenberg and Van Pottelsberghe De La Potterie (1998) find no significant effect of FDI on technology diffusion among thirteen Organization for Economic Cooperation and Development (OECD) countries, although outward FDI improves access to international technologies. Aitken and Harrison (1999) find FDI inflows generate negative productivity effects in Venezuelan industry, since multinational enterprises substitute FDI for indigenous output. Djankov and Hoekman (2000) distinguish between domestic firms with and without foreign partnerships and detect significant negative spillovers of foreign partnerships. Castellani and Zanfei (2003) report no effect of FDI on productivity in Spain and France, but a positive effect in Italy.

growth. Basu and Guariglia (2007) conclude the link between FDI and growth is positive and significant in 119 countries (as is FDI and income inequality).

Several studies find growth-enhancing effects of FDI conditional on the host environment (De Mello 1997). Borensztein, De Gregorio, and Lee (1998) argue that FDI boosts growth via technology diffusion, if the host economy boasts sufficient absorptive capacity.[5] Hermes and Lensink (2003) concur, finding a needed minimum level of human capital. Durham (2004) finds in a large multicountry study that FDI is not significantly correlated with growth, interpreting this as evidence of needed absorptive capacity of the host economy. So developed economies with greater human capital should benefit more from FDI. This is supported by Prasad, Rajan, and Subramanian (2007) and Batten and Vo (2009). Likewise, Blomström, Lipsey, and Zejan (1994) find no relationship between education and FDI inflows for developing countries. But other studies fail to concur: Campos and Kinoshita (2002) reestimate the model in Borensztein, De Gregorio, and Lee (1998) and find that FDI exogenously affects growth, irrespective of human capital. Li and Liu (2005) report a positive and significant effect for both developed and developing countries, and a significant role for human capital to enhance the impact of FDI.

The idea of the need for sufficient *absorptive capacity* is supported by research on socioeconomic conditions for R&D investment to be turned into innovation and growth (see, e.g., Bilbao-Osorio and Rodríguez-Pose 2004). It was expanded in the context of FDI by Hermes and Lensink (2003), who report that FDI is an insignificant determinant of growth and can only exert a positive effect when the domestic financial system has developed enough—suggesting that FDI should be more beneficial to developed economies. Alfaro et al. (2004) support Hermes and Lensink (2003). Later studies tried to incorporate all aspects of absorptive capacity: Carkovic and Levine (2005) test the hypotheses that the effect of FDI depends on the level of human capital, domestic financial markets (Hermes and Lensink 2003; Alfaro et al. 2004), and initial income (Blomström, Lipsey, and Zejan 1994). Accounting for country-specific effects, they, however, conclude that FDI inflows do not robustly affect economic growth.

Balasubramanyam, Salisu, and Sapsford (1996) test the link between economic growth, FDI, and trade strategies, and argue that FDI inflows enhance growth in export-oriented but not import-substituting countries. They even suggest FDI is a more powerful determinant of growth than domestic investment (due to *crowding-in*, viz. Romer 1993).

Bornschier, Chase-Dunn, and Rubinson (1978) conclude that FDI has a negative impact on the growth of developing countries. Fry (1993) concurs, reporting that in eleven countries, FDI exerts a negative impact on growth. De Mello (1999) shows that FDI has a positive effect on OECD countries, but a negative one for non-OECD countries.[6] In a panel study of thirty-six developing countries, Agosin and Machado (2005, 149) find that FDI "at best left domestic investment unchanged," although at times, especially in Latin America, it crowded out domestic investment. Carkovic and Levine (2005) criticize earlier studies on the effect of FDI on growth due to endogeneity and perform a multicountry test using the generalized method of moments

[5] Borensztein, De Gregorio, and Lee (1998) used human capital as a proxy for the absorptive capacity of the economy. Previously, Nelson and Phelps (1966) and Benhabib and Spiegel (1994) argued that growth-enhancing effects of FDI depend on human capital.

[6] Roy and Van Den Berg (2006) report US growth is enhanced by FDI. Ram and Zhang (2002) report FDI enhances economic growth, but not robustly—only with certain econometric specifications. Türkcan, Duman, and Yetkiner (2008) employ six different models that predict a positive impact of FDI on growth but find significance only in two of them.

(GMM). They find no robust boost of growth from FDI. Herzer (2012) analyzes the effect of FDI on economic growth in forty-four developing countries, adopting the GETS methodology to identify country-specific factors (e.g., primary export dependence), and reports a negative effect on growth but also large cross-country differences. Johnson (2006) reports that FDI accelerates growth in developing countries but not in developed countries. Xu (2000) finds a positive effect of FDI on economic growth of the developed countries in his sample.

Nair-Reichert and Weinhold (2001) report causality running from FDI to economic growth, though with heterogeneity across the panel. They report that greater openness to trade boosts the growth-enhancing effect of FDI (supporting Balasubramanyam, Salisu, and Sapsford 1996). Hansen and Rand (2006) report strong causality from FDI to growth regardless of development level. Bidirectional Granger causality between FDI and growth was reported by Choe (2003)[7]and Chowdhury and Mavrotas (2006). Duttaray, Dutt, and Mukhopadhyay (2008) test causality for each country of their sample, reporting ambiguous results. Zhang (2001) argues that country-specific conditions throw doubt on the hypothesis that FDI leads to higher growth. Mencinger (2003) finds that FDI exerts a negative impact on economic growth, with causality unidirectionally from FDI to growth. Other scholars (Herzer, Klasen, and Nowak-Lehmann 2008) find no causality from FDI to growth.

In sum, there is no empirical consensus on a positive effect of FDI on host-country growth, nor on the direction of causation. The contention that FDI positively affects growth, technological progress, and capital accumulation remains "a less controversial hypothesis in theory than in practice" (De Mello 1999, 148). The majority of the literature however largely agrees that if a positive effect of FDI is to be generated, host-country capacity is required, making it most likely that developed countries will benefit from FDI.

Gaps in the Literature

Many macroeconomic studies of the impact of FDI on growth use a specific econometric model, pursuant to the hypothetico-deductive research methodology. Those that focus on real GDP growth as a dependent variable assume that decision makers are perfectly informed, hence able to distinguish nominal and real variables with ease. Meanwhile, the domestic banking system is often omitted. All of these aspects are problematic. Despite the vast literature, there remain gaps in terms of theory, methodology, and content.

First, the postulated relationship between FDI and growth is based on a particular view of the role of banks. The financial crisis of 2008 highlighted that banks have been unduly neglected in economics. In economic geography, it was argued that only models are useful that include banks' ability to create credit and money without prior savings as central structural features of our economic system (Werner 2013b). Instead, dominant postwar growth theories, from Harrod and Domar to Solow and beyond, assume that growth is driven by investment, requiring prior savings. In that case, weak growth, due to insufficient savings, is said to be curable by foreign borrowing or FDI. Based on such economics, the

[7] After removing Ireland from the sample, FDI no longer Granger causes economic growth, showing a lack of robustness and the importance of country-specific research. Basu, Chakraborty, and Reagle (2003) report bidirectional Granger causality between FDI and growth. After controlling for factors, such as degree of openness, relatively closed economies yield unidirectional causality from growth to FDI. Hsiao and Hsiao (2006) report that Granger causality is heterogeneous across countries. In contrast, the panel data Granger causality test indicates FDI Granger causes economic growth directly and indirectly (through exports).

influential Washington-based institutions (IMF, World Bank, US Treasury, Federal Reserve, USAID [US Agency for International Development]—known for forming the "Washington consensus" set of recommended policies) have, for the past seventy years, dispensed the advice that developing countries should welcome such foreign savings to generate economic growth. This thinking remains dominant among IMF and central bank staff (e.g., Prasad, Rajan, and Subramanian 2007).[8] This "Washington consensus" was welcomed by the international banking industry, since it enabled the international banks to expand their lending business, namely to developing countries with valuable assets that are effectively earmarked and encumbered as collateral.

However, the economics described above is faulty. For one, it is based on a particular theory of banking, namely, the theory that assumes banks are mere financial intermediaries, unable to increase the money supply, merely gathering deposits and lending these out. Borrowing from abroad is thought to enter the economy in the same way as gold did in the monetary transmission of David Hume's (1752) price-species flow mechanism. Based on this thinking, economists saw no need to include banks and their operations in their models of growth, or of FDI and growth. Thus, it came to pass that in the theories by Solow, Harrod and Domar, and even the more recent macroeconomic growth theories, banks do not feature; many models of growth do not even include money (since banks or money "would only obscure the analysis" [Romer 2011], 4, according to the macroeconomics textbook most widely used in masters-level economics courses in the United Kingdom).

However, after five thousand years of banking, banks have finally been empirically shown not to be financial intermediaries, but rather creators of the money supply (Werner 2014a, 2016). All loan principals extended by banks are newly created and added to the money supply, accounting for about 97 percent of the money supply (see Werner 2005, 2014c).

A rise in the number of transactions requires an increase in net purchasing power exerted to pay for these transactions (*equation of exchange* or *quantity equation*). This can in practice only be achieved through private banks' credit extension (Werner 1997). Hence, bank credit is the appropriate (though neglected) measure of the money supply (the neglect is surprising, since the internal, unpublished models at the IMF center on domestic credit creation [Werner 2014b]). Further, credit needs to be disaggregated into credit for GDP transactions (*real economy credit*) determining nominal GDP growth and credit for non-GDP transactions (*financial credit*, to non-banks and property industry—since asset and property transactions are not part of GDP), determining asset markets (the Quantity Theory of Credit [Werner 1992, 1997, 2005, 2012]). Thus, a test of the impact of FDI on economic growth needs to control for domestic credit creation for GDP transactions, as otherwise results suffer from omitted variable bias. This could explain the previous ambiguous evidence on the impact of FDI on receiver-country growth.

Even more damaging, as Werner (2016) explains, due to the rules of international banking, foreign currency essentially stays abroad—since digital ledger entries in foreign banks stay abroad and do not *enter* the domestic economy. If exchanged into local currency, domestic credit creation results in the domestic currency—a process fully under control of the domestic financial system. This implies that in theory, capital flows do not determine GDP growth and in empirical models should *not* be expected to impact GDP growth independently, if domestic bank credit creation for GDP

[8] "[C]learly, though, the reliance of these countries on domestic savings to finance investment comes at a cost—there is less investment and consumption than there would be if these countries could draw in foreign capital on the same terms as industrial countries" (Prasad, Rajan, and Subramanian 2007, 205).

transactions ("real economy credit") is included as explanatory variable—something lacking hitherto.

The majority of empirical studies on the impact of FDI have used the specific-to-general econometric research methodology. Beginning estimation with one ad hoc model favored by researchers, a priori restrictions are imposed often without sound empirical justification. Since the true data-generating process is unknown, this may introduce biases. A more powerful methodology is to nest a hypothesis within a general empirical model that includes a variety of potentially relevant variables, including those emanating from competing hypotheses and additionally including the variables the researchers consider important. This general model with many variables, and their lags, is then reduced to the parsimonious form by following an objective procedure (e.g., sequentially dropping the variable with the most insignificant *t*-statistic and reestimating until all variables are significant at the 5 percent level).

This is what the GETS methodology does, by identifying the restricted, or parsimonious, model (Hendry and Mizon 1978). The GETS methodology is particularly advisable when the literature has remained inconclusive: It allows an objective *horse race* between potential explanatory variables, treating competing theories equally. The standard variables favored by old theories are included in the initial general unrestricted model (GUM) but also new variables deriving from a clearer understanding of the functioning of the international payments system, namely, bank credit for real-economy transactions. The data then tells us which explanations are statistically significant and which can be dropped without losing information.

We offer further methodological innovations. Although most variables (including GDP, FDI, exchange rates, wages, and interest) are compiled in nominal terms, researchers have often used inflation-adjusted (*real*) variables. The inflation adjustment is usually based on subjective elements (arbitrary baskets and proxies representing the unknown true deflator). Also, there is no empirical evidence that agents base their decisions consistently on unobservable so-called "real" variables. Thus, there has been growing interest in models in observed market values, that is, nominal terms (Werner 1997, 2013a). Another common problem is the use of components of the dependent variable as regressors, such as private investment, raising endogeneity issues. We avoid this. Further, if the relationship between FDI and growth is heterogeneous among countries, panel results may suffer from misleading inference:[9] a large positive effect for a country may offset many small negative effects that occurred in other countries (Choe 2003). This calls for country studies.

Choice of Country

The literature agrees that absorptive capacity is important for FDI to enhance growth. It can be measured in terms of human capital, openness to trade, development of financial markets, etc. The country of choice should thus be open, well-developed, and a major receiver of FDI. Spain is such a country, with well-developed financial markets and institutions, open to trade, an educated workforce, and relatively high economic growth. This allows a stricter test of the role of FDI within our improved research methodology, because it makes it far more likely that FDI exerts a positive effect on growth, should such an effect exist.

[9] Banerjee, Marcellino, and Osbat (2004) point out that when there is cross-unit cointegration, results based on using standard panel cointegration methods are likely to be dramatically biased. Herzer, Klasen, and Nowak-Lehmann (2008) confirm this type of bias.

Table 1

Total Nominal FDI, Stock of FDI and FDI to GDP by Country (1984–2010)

Country	FDI Net Inflows (BoP), Cumulative Total in US $ Billions	Stock of FDI in US$ Billions	Nominal GDP (2010) in US$ Billions	Average of Cumulative FDI as % of 2010 GDP
United States	3,472	3,915	14,964	1
Netherlands	1,903	628	836	8
United Kingdom	1,725	1,428	2429	3
China	1,581	832	6100	1
France	858	717	2646	1
Germany	820	1,077	3417	1
Belgium	615	512	483	5
Spain	**600**	**644**	**1431**	**2**
Canada	578	953	1613	1
Brazil	428	675	2208	1
Mexico	362	376	1051	1
Ireland	362	364	221	6

Columns 1 and 2: Source: World Bank (2011).

Column 3: Source: UNCTAD (2012) statistical data.

Column 4: Source: World Bank (2011).

Spain is also of interest because economists have noted that there is a puzzle: Spain's growth has been unusually high. Since FDI was also high, we test the hypothesis whether it contributed to this strong growth or whether there were other causes.

Table 1 lists the top twelve receivers of FDI from 1984 to 2010, by considering the cumulative net inflows (in US dollars). Focusing on the industrialized countries, we are left with the United States, the United Kingdom, Canada, and six eurozone countries. Since the United States, as the dominant economic, financial, and political power in the postwar era, is an outlier (it single-handedly accounts for a fifth of all cumulative FDI net inflows to all OECD members), although this is also true for the United Kingdom (as the previous dominant financial and political power), we are left with either Canada or eurozone FDI receiver countries.

A eurozone country is desirable, because there are no trade barriers within the European Union, and the single currency is said to enhance trade and capital flows by eliminating exchange rate uncertainty. This suggests a larger possible impact of FDI on growth. Several eurozone countries are major recipients of FDI. But Germany, France, Belgium, and the Netherlands are in close geographic proximity with other EU countries, allowing them to trade and invest without a strong need for FDI. It is recognized in economic geography (Gren 2003) that peripheral countries may need more FDI to catch up with the core. So it is an efficient research strategy to first investigate the role of FDI in a suitable peripheral eurozone country that meets the criteria above and is a major FDI recipient. Ireland, Portugal, and Spain fit the bill (Barry 2004). Of these, Spain is the largest FDI recipient.[10] Within the eurozone, Spain is the fifth largest recipient of cumulative FDI from 1984 to 2010, just behind the more central Netherlands, France, Germany, and Belgium (Table 1). The sixth largest FDI recipient, peripheral Ireland, received significantly less FDI.[11] Considering cumulative

[10] Peripheral Spain in 2012 and 2013 received more money in EU funds than it contributed (Eurostat 2017). This makes a positive influence of FDI on GDP (and a positive EU effect) a priori more likely.

[11] There is a study on FDI and growth in Ireland, which concludes the "Irish experience suggests that foreign investment is not necessary for growth. . . . FDI was not catalytic; it was opportunistic" (Bradfield 2006, 331).

FDI received by countries in the eurozone (UNCTAD data [column 3], Table 1), Spain was, by 2012, a top-three FDI receiver in the eurozone.

We next consider the relative size of FDI in proportion to annual GDP (Table 1). Spain's large GDP puts it in the class of major industrialized economies. As the Netherlands, Belgium, and Ireland are significantly smaller economies, their FDI relative to GDP appears larger. Special factors apply to all three of these smaller economies that attract disproportionate FDI. Belgium and the Netherlands are not periphery countries, although Ireland seems one of the most successful tax havens in the European Union, attracting incoming FDI. They are of lesser initial interest as a case study for the application of our new methodology.

Spain is a suitable case to apply our methodology to a major industrialized economy: boasting highly developed financial markets, it is located inside the eurozone but on its geographic periphery, and it has received significant amounts of FDI over the past decades, while there are few special reasons for this to be the case. As recently as 2015, a researcher pointed out the following: "Today, Spain is Europe's . . . second [economy] for inward FDI" (Myro 2015, 40). Spain also recorded economic growth above the EU average during the observation period, which in conventional theory could well be due to FDI. Thus, according to the current state of research, if FDI has a positive effect on receiver-country growth, it should be significant in the case of Spain.

FDI and Growth in Spain

FDI

During the 1980s, under liberalization and economic integration, leading up to the European Common Market of 1992, global FDI soared. Production became increasingly international. Graham and Krugman (1993) speak of an *FDI wave*, directed mainly at industrialized economies and rendering Spain one of the largest net importers of FDI. A top-three receiver of FDI in the eurozone by cumulative total (1984–2010), Spain became also a top-ten FDI receiver among OECD countries in 2010 (OECD 2010; Figure 1). During the observation period (1984–2010), FDI to Spain grew on average by 47 percent, and the stock of FDI grew on average by 12.2 percent (Bank of Spain/Banco de Espana 2011). Spain experienced both FDI surges and periods of stagnation (see the

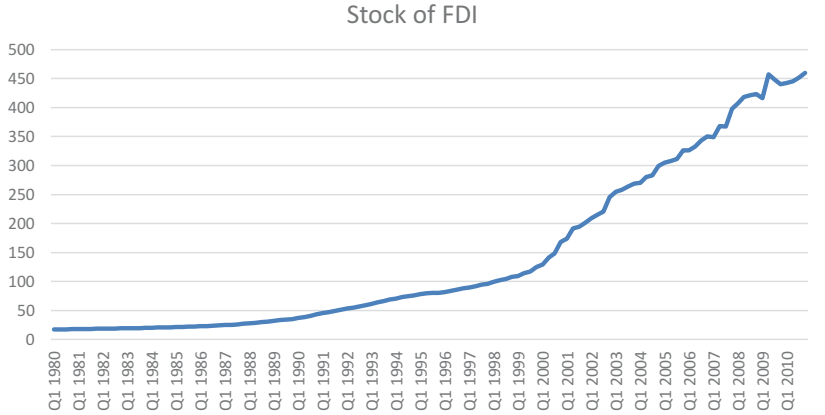

Figure 1. Stock of incoming Spanish FDI (1980–2010).
Source: Spanish National Bureau of Statistics (INE 2011).

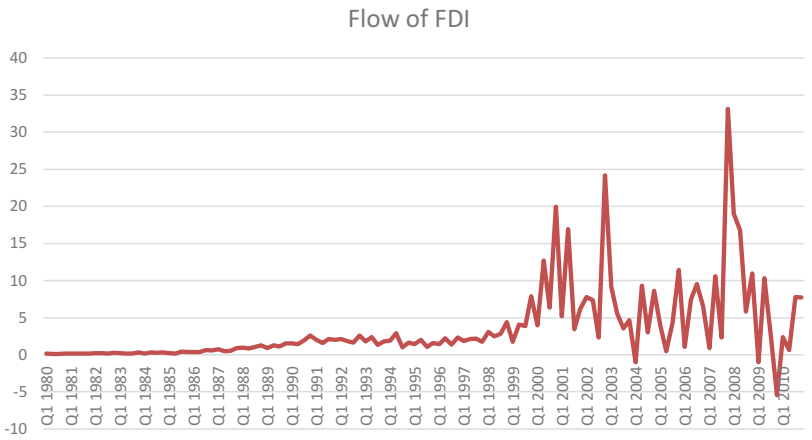

Figure 2. Incoming Spanish FDI (1980–2010).
Source: Spanish National Bureau of Statistics (INE 2011).

flow of FDI in Figure 2). Between 2007 and 2008, FDI skyrocketed. The financial crisis of 2008 reversed this.

Despite the size of FDI flows to Spain, there are few studies on it (Bajo-Rubio and Sosvilla-Rivero 1994; Bajo-Rubio and López-Pueyo 2002; Bajo-Rubio, Díaz-Mora, and Díaz-Roldán 2010; Villaverde and Maza 2012). Most simply *assume* a positive effect of FDI on growth and proceed to focus on identifying determinants of FDI, presumably in the quest to help policy makers attract even more FDI. Even recent studies that make bold statements about a positive effect of FDI on Spanish growth ("FDI has been a crucial factor in the process of intense growth enjoyed by the Spanish economy" [Bajo-Rubio, Díaz-Mora, and Díaz-Roldán 2010, 374]), provide little evidence. Villaverde and Maza (2012) assert a positive effect of incoming FDI on growth and then hide in a footnote the caveat that this link is not empirically established. Bajo-Rubio, Díaz-Mora, and Díaz-Roldán (2010) present empirical work linking the cumulative stock of FDI-per-employee to GDP-per-employee. However, their methodology is problematic (they postulate a production function in real terms that includes the cumulative stock of gross nominal FDI per employee, without a test for spurious correlation—what interests us the impact of net FDI on total GDP, not productivity). As seen below, other researchers found weak productivity growth in Spain. Moreover, Bajo-Rubio, Díaz-Mora, and Díaz-Roldán (ibid., 381) concede "it would not be unlikely that the results found in the present paper should be qualified in the near future." Thus, there is a paucity of appropriate long-term studies on the impact of incoming FDI on Spanish GDP growth—a gap we address.

From 1995 to 2008, 83.8 percent of total FDI was in manufacturing and services (Villaverde and Maza 2012). Manufacturing FDI was dominant until about 1985 (chemicals, automobiles, and machinery). From 1986 onward, nonmanufacturing FDI overtook, led by real estate, finance, and insurance (Bajo-Rubio and Sosvilla-Rivero 1994; Bajo-Rubio and López-Pueyo 2002). The 1990s and 2000s were characterized by a large expansion of the financial sector in Spain and a concomitant increase in real estate–related economic activity. This was reflected in FDI, with high-profile foreign investments in construction, property, and hotel development. Construction FDI accounted for 17 percent of total FDI in 2010 (Invest in Spain 2010).

Villaverde and Maza (2012) consider the geographic distribution of FDI among the seventeen regions (1995–2008) and found extreme regional bias: 79 percent of total FDI went to Madrid and Cataluña, of which most went to Madrid. Madrid's share of Spanish FDI was over three times above its GDP-based proportion. In the words of Rodríguez-Pose (2000, 93), "Madrid and Catalonia are too economically powerful and have attracted too much FDI to be compared with any of the declining regions." Díaz-Vázquez (2003) suggests that the FDI impact on growth, development, and capital accumulation in Spain was likely to be negligible, since the predominant type of FDI until 1997 was acquisitions of existing Spanish firms (brownfield investment). The subsequent shift toward greenfield investment, accounting for 59 percent of total investments by 2010 (Invest in Spain 2010), could still deliver a positive impact on growth.[12]

Villaverde and Maza (2012, 731) caution that their recommendations on how to enhance FDI hold only "under the assumption that FDI enhances economic growth." Although FDI has been a visible part of globalization, any potential benefits have been concentrated. Rodríguez-Pose (1998, 455–56) warns about the "persistence of regional disparities" in contradiction to "certain sectors of the literature." It is thus necessary to examine the more fundamental question, whether FDI indeed has a positive effect on economic growth.

GDP

Researchers wonder why Spanish GDP growth was so high from the mid-1990s until 2008 (3.5 percent average growth, above the EU average of 2.2 percent [Garcia-Santana et al. 2016]). Garcia-Santana et al. notice the puzzle that simultaneously total productivity fell (at an annual rate of 0.7 percent), although it increased in the European Union and the United States. So Spanish GDP growth "was based on factor accumulation rather than productivity gains" (ibid.). They research why total factor productivity fell, not why both factor accumulation and GDP grew so much. They note, "It remains to be understood why the Spanish economy accumulated capital and labor at such a fast pace despite the negative increase in aggregate productivity" (Garcia-Santana et al. 2016, 3).

One hypothesis consistent with the pronouncements by politicians and economists is that the high growth was due to incoming FDI. The timing is suggestive. In 1992, EEC Council Directive No. 88/361/CEE became effective in Spain (Royal Decree 1816/1991), allowing the free movement of capital between residents of EEC member states. Foreign investors have since been able to operate any type of business under the same conditions as a local investor. In addition, the Spanish government has been providing "various incentives for investors, such as grants, tax benefits, professional training, preferential access to credit, etc." (Santander 2015). So by conventional economic thinking the unusually high economic growth could be due to incoming FDI. We shall test this hypothesis.

The Empirical Model

Our empirical test fills the gaps in the literature. A country study on a major developed economy that is a leading FDI recipient (Spain) is conducted over a period of twenty-seven years (1984–2010).[13] The analytically superior GETS econometric methodology is adopted (following Hendry and Mizon 1978; Hoover and Pérez 1999;

[12] The authors in Myro (2014) point at limitations of the distributional data due to "strong dissociation" between recorded location—often a firm's Spanish registered office—and actual location of tangible assets.

[13] The period ends in 2010 due to changes in the definitions of disaggregated credit series in 2011. Future research needs to bridge these breaks in the series or consider other relevant countries.

Table 2

Data Used

Variable	Description	Source
GDP	Nominal GDP not seasonally adjusted, in thousands of euros	Spanish National Bureau of Statistics (INE)
FDI	FDI inflows in thousands of euros	Bank of Spain
CREDIT	Productive credit creation, includes credit to the finance industry (excluding construction) plus credit to finance agricultural sector plus credit to finance, commerce, and reparations in thousands of euro	Bank of Spain
BANKL	Bank lending from the rest of the world to Spain in thousands of euros	Bank of Spain
COMM	Commodities index that includes oil prices	Reuters Commodities Index: Thompson and Reuters Datastream
EUR_DM	EUR/DM exchange rate (peseta derived)	Thompson and Reuters Datastream
EUR_USD	EUR/USD exchange rate (peseta derived)	Thompson and Reuters Datastream
LABOR	Employed workforce	Spanish National Bureau of Statistics (INE)
EDU	Average number of years of secondary and tertiary schooling of labor	Valencian Institute of Economic Research
M1	Money Supply M1	Thompson and Reuters Datastream
M2	Money Supply M2	Thompson and Reuters Datastream
ST_RATES	Overnight interbank interest rates	Spanish National Bureau of Statistics (INE)
G7 GDP	Total GDP of the G7 countries in thousands of euros	Thompson and Reuters Datastream

and hitherto the only FDI study, Herzer 2012), whereby emphasis is placed on observed relevant variables (i.e., nominal variables, rendering the model dimensionally consistent). The data series used are discussed in Table 2.

The GUM has to pass the usual diagnostic tests to ensure validity, after which reduction to the parsimonious (*specific*) model begins. The GETS approach allows testing for dynamic relationships that would be difficult to identify in specific-to-general models (most studies focus on contemporaneous correlations).

The dependent variable is nominal GDP growth. The GETS methodology allows explanatory variables favored by prior authors to compete with variables unduly neglected. The increasing external openness of the Spanish economy requires the inclusion of exchange rates and foreign demand.[14] As a proxy for foreign demand, G7 economies' nominal GDP is used (Reuters Datastream 2011). Short-term interest rates (overnight interbank rates; Spanish National Bureau of Statistics [INE] 2011) are included as the proclaimed instrument of monetary policy (Woodford 2003) and main determinant in neoclassical theory of consumption and investment.[15] The quantity of money (M1 and M2, Datastream) is included as a relevant target of Spanish monetary policy until 1994 (Ballabriga, Álvarez, and Jareño 1998), and because it is used as a proxy for financial development in the literature (King and Levine 1993; Alfaro et al. 2004) upon which a beneficial effect of FDI may depend. The employed population is included as a factor of production (Spanish National Bureau of Statistics [INE] 2011). Unlike investment, this supply-side variable is not a component of GDP; hence, inclusion is unproblematic. Following Blomström, Lipsey, and Zejan (1994), Borensztein, De Gregorio, and Lee (1998), and De Mello (1999), the educational level of labor (*human capital*; Valencia Institute of

[14] We use the dollar exchange rate for the 1980s and the DM-exchange rate for the decade of the nineties (Reuters Datastream 2011).

[15] Long-term interest rates are excluded, because the debt market was not developed in Spain (the first ten-year government bond issuance occurred in February 1989). Before this, the government was mainly financed by the Bank of Spain.

Economic Research 2011) is a potential explanatory variable, not least since Spanish high levels of human capital imply a higher absorptive capacity to realize positive effects of FDI. As Spain is a commodity importer, the Reuters Commodities Index (including crude oil; Reuters Datastream 2011) is included.

According to the Quantity Theory of Credit (Werner 1997, 2005, 2012), bank credit for GDP transactions represents the impact of domestic banks on GDP. Previous researchers that paid attention to the role of credit as a determinant of economic growth did not distinguish between the different categories of credit.[16] *Credit for the real economy* was successfully utilized in a model of Spanish nominal GDP (without analyzing FDI and controlling for fewer factors; Werner 2014b). We further subtract unproductive consumer credit from real economy credit to obtain a measure of *productive credit creation* (Werner 2005). This includes industry (excluding construction), credit to the agricultural sector, and credit to commerce (Bank of Spain/Banco de Espana 2011). In addition, money from different countries that employ the same currency (euros) can easily flow into Spain (since January 1999, when fixed exchange rates were introduced). Hence, we also include foreign bank lending (ibid.), as an additional explanatory variable of economic growth, not tested in Werner (2014b).[17]

FDI data (Bank of Spain/Banco de Espana 2011) are included as potential source of funding and technology, in line with conventional theory.

Finally, dummy variables are employed to account for two potential structural changes, which were implemented because of their expected positive impact on Spanish economic growth (Argandoña 2005):[18] the accession of Spain to the Common European Market in 1986 and the introduction of the euro in 1999.

A negative impact on growth is expected from currency appreciation, commodity price rises, and short-term interest rate rises (Woodford 2003), although a positive impact on growth is expected from external demand; labor; the educational level; bank credit creation for productive real economy transactions (Werner 2005); foreign bank lending; monetary deepening (M1/M2); EU and euro dummies; and, finally, FDI.

The general autoregressive distributed lag (ADL) model of nominal GDP (called "GDP" in the regression output (Spanish National Bureau of Statistics [INE] 2011) is

$$\Delta \mathrm{GDP}_t = \alpha_i + \sum_{i=1}^{4} \beta \Delta \mathrm{GDP}_{t-i} + \sum_{j} \sum_{i=0}^{4} \gamma_j \Delta X_{j_{t-i}}$$

where dependent variables X_j, in seasonal log differences, symbolized by Δ, each with four lags, are as follows:

FDI = FDI inflows (ibid.)
CREDIT = Spanish productive credit for real economy transactions (ibid.; authors' calculations)
BANKL = Bank lending from abroad (ibid.)
COMM = International commodities index (Reuters Datastream 2011)

[16] See, for instance, De Gregorio and Guidotti (1995), but also see Herzer (2012).
[17] Unfortunately, data available on foreign bank lending is not disaggregated by use.
[18] Frankel and Rose (2002) argue that free trade areas and even more so currency unions stimulate growth, due to greater trade with major partners. They find support in a cross-sectional analysis of over two hundred regions and small countries. However, it is not clear that their finding is applicable to large countries such as Spain.

G7GDP = Total GDP of G7 countries (ibid.)
EUR_DM = EUR/DM exchange rate (peseta derived)
EUR_USD = EUR/USD exchange rate (peseta derived)
LABOR = Employed Spanish population (Spanish National Bureau of Statistics [INE] 2011)
EDU = Educational level of employed population (Valencia Institute of Economic Research 2011)
M1 = Money supply M1 Spain (Reuters Datastream 2011)
M2 = Money supply M2 Spain (Reuters Datastream 2011)
ST_RATES = Spanish overnight interbank interest rates (Spanish National Bureau of Statistics [INE] 2011)

Estimation

To manage seasonality, the log level data is transformed into first seasonal differences.[19] The observation period is, due to data availability, from 1984 (Q1) until 2010 (Q4). Unit root tests are carried out, including a drift and a trend for GDP and without a trend for the other variables. The augmented Dickey–Fuller (ADF; Dickey and Fuller 1981) and the Phillips–Perron (PP; Phillips and Perron 1988) tests of the null of the presence of a unit root (i.e., nonstationarity), and the more powerful Kwiatkowski–Phillips–Schmidt–Shin (KPSS; Kwiatkowski et al. 1992) test, are conducted. The three tests, with lag length based on the Akaike information criterion, robustly show that none of the seasonal differenced variables have a unit root; thus, all variables are I(1) (integrated of order one).[20] The general unrestricted autoregressive distributed lag (ADL) model is estimated with ordinary least squares. The regular diagnostic tests, including error normality and omitted variables, are performed to analyze the validity of the model.[21]

Results and Discussion

The general unrestricted model was found valid without statistical problems. The subsequent elimination procedure to the parsimonious form reruns the model each time a new restriction (of zero coefficient) is imposed, until all insignificant variables are eliminated. Linear restriction and redundant variable tests are carried out during the elimination process as robustness checks. The *parsimonious* (specific) model is again subjected to the standard diagnostic tests. At each stage, the model has to comply with the Gauss–Markov conditions to allow inference of population parameters from the estimation. Table 3 shows the parsimonious form of the ADL model. It passes all diagnostic tests.

Further reduction may be possible, since both the first and fourth lag of M2 show almost identical coefficients and *t*-statistics but opposite signs. The linear restriction test confirms that both can be dropped. Hence, testing for model reduction continues, since some variables turn out to be insignificant once M2 variables are excluded, delivering a simpler model. Its general diagnostic tests

[19] Econometric software Eviews 6.0. is used.
[20] Both the ADF and the PP tests are significant at the 1 percent significance level (the null of a unit root is rejected) although the KPSS test is insignificant (the null of stationary is not rejected) for all seasonally differenced variables.
[21] These tests include the Ramsey RESET test for misspecification error and residual tests such as ARCH LM test for the presence of autoregressive conditional heteroscedasticity in the errors, Breusch–Godfrey LM serial correlation test, Jarque–Bera normality test and heteroscedastic errors tests—White's (when possible) and Breush–Pagan–Godfrey's heteroscedasticity tests.

Table 3

Parsimonious Model (I)

Dependent Variable: ΔGDP		Method: Ordinary Least Squares		
Observations: 107		Sample Period: 1984Q2–2010Q4		
Independent Variables	Coefficient	Std. Error	I-Statistic	Prob.
Constant	−0.0485	0.0086	−5.6501	0.0000
ΔGDP(−2)	0.2588	0.0904	2.8630	0.0054
ΔGDP(−3)	0.2424	0.0861	2.8165	0.0061
ΔBANKL	−0.0516	0.0223	−2.3127	0.0233
ΔBANKL(−1)	0.09211	0.0246	3.7480	0.0003
ΔFDI	−0.0009	0.0005	−1.9133	0.0593
ΔFDI(−1)	−0.0015	0.0005	−2.9255	0.0045
ΔFDI(−2)	−0.0010	0.0005	−1.8364	0.0701
ΔG7GDP(−2)	0.6976	0.1932	3.6117	0.0005
ΔG7GDP(−3)	−0.5198	0.2109	−2.4651	0.0159
ΔEUR_USD	−0.0618	0.0168	−3.6788	0.0004
ΔEUR_USD(−2)	0.0375	0.0166	2.2581	0.0267
ΔEUR_USD(−4)	−0.0469	0.0143	−3.2830	0.0015
ΔEDU	2.0564	0.3571	5.7582	0.0000
ΔEDU(−3)	−2.0378	0.6879	−2.9625	0.0040
ΔEDU(−4)	2.4872	0.6062	4.1028	0.0001
ΔM1	−0.0272	0.0103	−2.6319	0.0102
ΔM1(−3)	0.0349	0.0136	2.5613	0.0123
ΔM1(−4)	−0.0324	0.0135	−2.4065	0.0184
ΔM2	0.5529	0.0928	5.9545	0.0000
ΔM2(−1)	−0.3608	0.0927	−3.8944	0.0002
ΔM2(−3)	−0.1787	0.0942	−1.8984	0.0613
ΔM2(−4)	0.3023	0.0857	3.5271	0.0007
ΔST_RATES(−1)	0.1452	0.0643	2.2568	0.0268
ΔCREDIT(−1)	0.0944	0.0296	3.1875	0.0021
R-squared	0.9422	Mean dependent var		0.0812
Adjusted *R*-squared	0.9224	S.D. Dependent var		0.0399
S.E. of regression	0.0111	Akaike info criterion		−5.9412
Sum squared resid	0.0098	Schwarz criterion		−5.2418
Log likelihood	345.8567	Hannan–Quinn criter.		−5.6577
F-statistic	47.6717	Durbin–Watson stat		2.0557
Prob (*F*-statistic)	0.0000			
Ramsey RESET Test:				
F-statistic	1.2612	Prob. F(1.78)		0.2649
Log likelihood ratio	1.7163	Prob. Chi-Square (1)		0.1902
Breusch-Godfrey Serial Correlation LM Test:				
F-statistic	0.9003	Prob. F(4,75)		0.4682
Obs**R*-squared	4.9023	Prob. Chi-Square (4)		0.2975
Heteroskedasticity Test: Breusch–Pagan–Godfrey				
F-statistic	0.8381	Prob. F(27,79)		0.6906
Obs**R*-squared	23.8238	Prob. Chi-Square (27)		0.6401
Scaled explained SS	12.2933	Prob. Chi-Square (27)		0.9931
Heteroskedasticity Test: ARCH				
F-statistic	0.0093	Prob. F(1,104)		0.9233
Obs**R*-squared	0.0095	Prob. Chi-Square (1)		0.9224
Jarque–Bera Test:				
JB Statistic	0.5987	Prob. Chi-Square (2)		0.7413

indicate no statistical problems.[22] The high value of the *F*-statistic for the RESET test and the low value of the Durbin–Watson statistic suggest that the third lag of GDP, with the lowest significance of all variables, may not be needed. The redundant variable test is performed, and results imply that the coefficient of the third lag of GDP is significantly different from zero at a 10 percent and a 5 percent level of significance, but not at 1 percent. However, once it is dropped, the RESET test performs better and other diagnostic statistics still hold (the Durbin–Watson statistic is closer to two).[23]

The final parsimonious model is reported in Table 4. It passes all standard tests: It is a valid model from which inferences can be drawn. It reveals that economic growth depends on the growth rates of past GDP, past G7 GDP, the current and past exchange rate EUR/USD, current and past employment (labor), current and past educational level, current M2 and past productive real economy credit. All other potential explanatory variables—including FDI—dropped out due to lack of significance: commodities prices, the exchange rate EUR/DM, the money supply M1, foreign bank lending, short-term interest rates, and also FDI.

Several robustness tests are carried out.[24] No structural breaks were found. The model is able to explain Spanish nominal GDP growth, including the high growth period from the mid-1990s onward as well as the collapse in growth after the 2008 crisis.

Lastly, the exogeneity of independent variables is checked. Pairwise Granger causality between nominal GDP and the independent variables is calculated by an ADL model with four lags (Table 5) to determine short-run exogeneity. It is found that past values of productive credit are important for forecasting future nominal GDP values, but not the reverse (predictive power i.e., Granger causality running unidirectionally from productive credit to nominal GDP). It is the same for G7 GDP and labor. However, in the case of M2, bidirectional causality is found between nominal GDP and M2 as well as between nominal GDP and human capital. Thus, to avoid potential endogeneity problems involving M2 and human capital, the model is estimated using the instrumental variable (IV) technique and the two-stage least squares method, following Stock and Watson (2007), using lagged values of the endogenous variables as instruments. The results of the two-stage least squares estimation (Table 6) are almost identical, except for the insignificant coefficient of M2 under the former specification. Thus, the model is considered valid.

The variable on which this articles focuses—FDI—does not exert a significant impact on Spanish economic growth. However, in the specification of Table 3, it is possible to observe a significant (and small) *negative* effect of FDI on nominal GDP. This may be due to Spanish FDI inflows being dominated by foreign takeovers in the construction sector.

The results differ from most previous articles concerning the effect of FDI on economic growth in advanced developed economies that used either cross-sectional

[22] Although the Durbin–Watson statistic is low, the Breusch–Godfrey LM serial correlation test does not reveal autocorrelation of the residuals for any lag length.

[23] A confirmation of the redundancy of the third lag of GDP is that after its elimination, the coefficient of the first lag of GDP incorporates almost all the information in the third lag of GDP.

[24] The recursive residuals plot showed a possible structural break in the third quarter of 1993, which is tested using the CUSUM and CUSUMSQ tests, which have greater power than the Chow test. The tests rejected this possibility. To further confirm parameter stability, the N-Step Chow Forecast test is performed, delivering no evidence of structural break. The recursive coefficients estimation does not show increased variation of any parameter as long as the sample size gets bigger.

Table 4

Parsimonious Model (II)

Dependent Variable: ΔGDP		Method: Ordinary Least Squares		
Observations: 107		Sample Period: 1984Q2–2010Q4		
Independent Variables	Coefficient	Std. Error	*t*-Statistic	Prob.
Constant	−0.0228	0.0059	−3.8525	0.0002
ΔGDP(−2)	0.5073	0.0784	6.4696	0.0000
ΔG7GDP(−2)	1.0377	0.1925	5.3901	0.0000
ΔG7GDP(−3)	−0.7760	0.2115	−3.6679	0.0004
ΔEUR_USD	−0.0525	0.0161	−3.2561	0.0160
ΔEUR_USD(−2)	0.0468	0.0178	2.6323	0.0099
ΔEUR_USD(−4)	−0.0337	0.0146	−2.3012	0.0236
ΔLABOR	1.0239	0.2000	5.1191	0.0000
ΔLABOR(−1)	−0.9679	0.2130	−4.5430	0.0000
ΔEDU	1.8704	0.3657	5.1150	0.0000
ΔEDU(−3)	−2.3666	0.7165	−3.3030	0.0014
ΔEDU(−4)	2.6455	0.6570	4.0265	0.0001
ΔM2	0.0915	0.0393	2.3275	0.0221
ΔCREDIT(−1)	0.0679	0.0275	2.4660	0.0155
R-squared	0.9055	Mean dependent var		0.0812
Adjusted *R*-squared	0.8923	S.D. Dependent var		0.0399
S.E. of regression	0.0131	Akaike info criterion		−5.7117
Sum squared resid	0.0159	Schwarz criterion		−5.3620
Log likelihood	320.7467	Hannan–Quinn criter.		−5.5700
F-statistic	68.5448	Durbin–Watson stat		1.7099
Prob (*F*-statistic)	0.0000			
Ramsey RESET Test:				
F-statistic	0.4733	Prob. F(1.78)		0.4932
Log likelihood ratio	0.5491	Prob. Chi-Square (1)		0.4587
Breusch-Godfrey Serial Correlation LM Test:				
F-statistic	1.5180	Prob. F(4,75)		0.2037
Obs**R*-squared	6.8338	Prob. Chi-Square (4)		0.1449
Heteroskedasticity Test: Breusch–Pagan–Godfrey				
F-statistic	0.7924	Prob. F(13,93)		0.6630
Obs**R*-squared	10.6706	Prob. Chi-Square (13)		0.6384
Scaled explained SS	6.1771	Prob. Chi-Square (13)		0.9395
Heteroskedasticity Test: White				
F-statistic	1.2579	Prob. F(104,2)		0.5457
Obs*R-squared	105.3888	Prob. Chi-Square (104)		0.9224
Scaled explained SS	61.0090	Prob. Chi-Square (104)		0.9998
Heteroskedasticity Test: ARCH				
F-statistic	2.6123	Prob. F(104,2)		0.1091
Obs*R-squared	2.5973	Prob. Chi-Square (1)		0.1070
Jarque-Bera Test:				
JB Statistic	1.1183	Prob. Chi-Square (2)		0.5717

or panel data in their analysis, but the results are in line with Herzer (2012) on developing countries.

Although Balasubramanyam, Salisu, and Sapsford (1996), Borensztein, De Gregorio, and Lee (1998), and, more recently, Durham (2004) find that a negative effect of FDI is due to the low absorptive capacity of the host economy, Spain has a high level of human

Table 5

Pairwise Granger Causality Tests

Sample:	1984Q2–2010Q4		
Lags:	4		
Null Hypothesis:	Obs.	*F*-Statistic	Prob.
ΔG7GDP does not Granger Cause ΔGDP	104	4.5244	0.0022
ΔGDP does not Granger Cause ΔG7GDP		1.9733	0.1048
ΔEUR_USD does not Granger Cause ΔGDP	104	0.6807	0.6070
ΔGDP does not Granger Cause ΔEUR_USD		1.6757	0.1620
ΔLABOR does not Granger Cause ΔGDP	104	4.8612	0.0013
ΔGDP does not Granger Cause ΔLABOR		0.2765	0.8925
ΔEDU does not Granger Cause ΔGDP	104	2.7882	0.0307
ΔGDP does not Granger Cause ΔEDU		2.2603	0.0683
ΔM2 does not Granger Cause ΔGDP	104	1.1034	0.3596
ΔGDP does not Granger Cause ΔM2		2.1628	0.0791
ΔCREDIT does not Granger Cause ΔGDP	104	2.4217	0.0536
ΔGDP does not Granger Cause ΔCREDIT		1.1929	0.3190

Table 6

Two-Stage Least Square Estimation

Dependent Variable: ΔGDP		Method: Two-stage Least Squares		
Observations: 107		Sample Period: 1984Q2–2010Q4		
Instrument List:	HC(−1) HC(−4) HC(−5) M2(−1)			
Independent Variables	Coefficient	Std. Error	t-Statistic	Prob.
Constant	−0.0230	0.0067	−3.4095	0.0010
ΔGDP(−2)	0.5229	0.0838	6.2397	0.0000
ΔG7GDP(−2)	1.0827	0.2077	5.2120	0.0000
ΔG7GDP(−3)	−0.8402	0.2397	−3.5048	0.0007
ΔEUR_USD	−0.0532	0.0170	−3.1278	0.0024
ΔEUR_USD(−2)	0.0484	0.0186	2.6020	0.0108
ΔEUR_USD(−4)	−0.0336	0.0153	−2.1949	0.0307
ΔLABOR	0.9945	0.2097	4.7424	0.0000
ΔLABOR(−1)	−0.9301	0.2238	−4.1557	0.0001
ΔEDU	2.4611	0.5867	4.1945	0.0001
ΔEDU(−3)	−4.2915	1.5226	−2.8185	0.0059
ΔEDU(−4)	4.0859	1.2221	3.3433	0.0012
ΔM2	0.0709	0.0477	1.4868	0.1404
ΔCREDIT(−1)	0.0713	0.0290	2.4579	0.0158
R-squared	0.8970	Mean dependent var		0.0812
Adjusted *R*-squared	0.8826	S.D. Dependent var		0.0399
S.E. of regression	0.0137	Sum squared resid		0.0174
F-statistic	62.1407	Durbin–Watson stat		1.7418
Prob (*F*-statistic)	0.0000	Second-Stage SSE		0.0178

capital that should help realize FDI benefits. Hermes and Lensink (2003) and Alfaro et al. (2004) conclude that negative FDI effects are due to low financial development, but Spain has high financial development. Xu (2000) finds that FDI exerts a positive and robust effect on economic growth of developed countries, but this is not the case of Spain. This underscores that cross-country conclusions cannot be extrapolated to the individual countries within a sample, since a high positive FDI impact in an economy can offset many negative FDI effects for many countries.

Although other studies have also found a positive impact of human capital on economic growth, previous analyses did not control for its endogeneity. The positive and significant effect of money supply M2 on growth seems to support the conclusions by Alfaro et al. (2004). However, the significance of M2 is not robust in all

specifications, since the two-stage least squares estimation shows an insignificant positive impact of financial development on economic growth. Thus, the findings are more in line with Carkovic and Levine (2005), who find that FDI is insignificant irrespective of degree of financial development.

As expected, foreign demand, human capital, productive credit creation, and labor have significant positive effects on growth, while the exchange rate EUR/USD exerts the expected negative impact.

The negative impact of FDI in Table 3 suggests that FDI is a rival of domestic investment. This is when FDI is funded by the banking system of the receiver country, thus competing for funds with domestic investment (crowding out host investment). This and the insignificance of foreign bank lending confirm earlier findings that FDI and portfolio investment are substitutes (Ruffin and Rassekh 1986; Werner 1994), in line with recent research on how settlement of banking flows works in practice (Werner 2016).

So far the literature on FDI had neglected the appropriate role of bank credit. By considering the credit creation powers of banks, their impact on Spanish growth was found to be significant while at the same time providing the theoretical reason why FDI cannot be expected to help economic growth (see above: foreign-denominated money stays abroad and when *exchanged* into domestic money results in domestic credit creation, which is more sustainably created by lending to domestic counterparties). With both foreign bank lending and FDI eliminated, a primacy of domestic banking in economic development is established in line with Werner (1997, 2005, 2014a, 2014b, 2016), as well as the longitudinal research on the determinants of nominal growth of a major industrialized economy by Ryan-Collins, Werner, and Castle (2016). It is also in line with World Bank (1993) and the literature on the *East Asian Economic Miracle* (for details, including institutional foundations of investment credit policies, see Werner 2003a, 2003b).

Short-term interest rates drop out from the final parsimonious model, contradicting the central banks' claim that rates are a key monetary policy tool. In the first parsimonious reduction (Table 3), where short-term rates are significant, the coefficient is positive, as Werner (2005) had argued, and as Lee and Werner (2018) also report on the United States, the United Kingdom, Germany, and Japan. To explore the possible cause–effect relationship between interest rates and growth in Spain, several pairwise Granger causality tests with different lag specifications are performed (Table 7).[25] It is found that changes in short-term rates are not cause, but rather consequence of economic growth. This represents a further rejection of the precrisis *monetary policy consensus* (Woodford 2003) and raises questions about the central banks' claims to rely on interest rates as monetary policy instrument: interest-targeting cannot affect growth. This is another empirical *anomaly* of conventional monetary theory (Belongia and Chalfant 1990) and supports Werner (2005) who argues that markets are rationed, rendering quantities more important than prices. These findings call for a fundamental rethinking of macroeconomics.

A corollary is that recent reductions of interest rates—including into negative territory—are unhelpful. Negative rates on banks' reserves at the central bank are a tax on banks—hurting especially those banks that are lending for the productive economy and thus reducing growth prospects.

[25] As long as the number of lags increases, the probability that past values of nominal GDP help forecast future interest rates is higher, and for specifications of five lags or more, nominal GDP Granger causes short-term interest rates, but short-term interest rates do not Granger cause nominal GDP for any lag length.

Table 7

Pairwise Granger Causality Tests for nom.GDP and Short-Term Interest

Sample:	1984Q2–2010Q4		
Null Hypothesis:	Obs.	*F*-Statistic	Prob.
Lags: 1			
ΔST_RATES does not Granger Cause ΔGDP	107	0.0003	0.9855
ΔGDP does not Granger Cause ΔST_RATES		0.14852	0.7007
Lags: 2			
ΔST_RATES does not Granger Cause ΔGDP	106	0.0175	0.9827
ΔGDP does not Granger Cause ΔST_RATES		2.2888	1.1066
Lags: 3			
ΔST_RATES does not Granger Cause ΔGDP	105	0.4622	0.7093
ΔGDP does not Granger Cause ΔST_RATES		1.5896	0.1968
Lags: 4			
ΔST_RATES does not Granger Cause ΔGDP	104	0.4101	0.8010
ΔGDP does not Granger Cause ΔST_RATES		1.0547	0.3834
Lags: 5			
ΔST_RATES does not Granger Cause ΔGDP	103	1.2155	0.3081
ΔGDP does not Granger Cause ΔST_RATES		2.2927	0.0518
Lags: 6			
ΔST_RATES does not Granger Cause ΔGDP	102	1.5865	0.1603
ΔGDP does not Granger Cause ΔST_RATES		2.7758	0.0161
Lags: 7			
ΔST_RATES does not Granger Cause ΔGDP	101	1.2533	0.2833
ΔGDP does not Granger Cause ΔST_RATES		2.6587	0.0154
Lags: 8			
ΔST_RATES does not Granger Cause ΔGDP	100	0.9887	0.4509
ΔGDP does not Granger Cause ΔST_RATES		2.7423	0.0098
Lags: 9			
ΔST_RATES does not Granger Cause ΔGDP	99	0.6757	0.7285
ΔGDP does not Granger Cause ΔST_RATES		2.3619	0.0202
Lags: 10			
ΔST_RATES does not Granger Cause ΔGDP	98	0.8029	0.6263
ΔGDP does not Granger Cause ΔST_RATES		1.9032	0.0573

Given counterproductive European Central Bank (ECB) policies in earlier years, it would not be surprising if joining the Eurozone was not beneficial for Spanish GDP growth. We test this and the EU entry of Spain by adding two dummy variables for the time periods of EU and euro entry, DUMMY_EU and DUMMY_EURO, to the final parsimonious model. The general diagnostic tests are carried out again to ensure valid inferences. The results are presented in Table 8: the accession to the Common Market has a negative and insignificant effect on economic growth. Although Argandoña (2005) points out that the Spanish entrance in the European Union might have negative effects, and Werner (2003a, 2006) warns accession countries of the danger of ECB-induced credit bubbles and crises, Frankel and Rose (2002) claim that being part of the EU free trade area would lead to improved growth. This is not substantiated in the important Spanish case.

Table 9 shows the effect of the introduction of the euro on Spain: the dummy is even more insignificant. Neither EU entry nor the adoption of the euro had demonstrable effects on Spanish growth. This is an important finding, relevant for countries considering whether to join, or exit the EU or eurozone.

Conclusions

There have been an insufficient number of relevant country studies on the quantitative impact of incoming FDI on economic growth of developed receiver countries.

Table 8

Parsimonious Model with EU Dummy

Dependent Variable: ΔGDP		Method: Ordinary Least Squares		
Observations: 107		Sample Period: 1984Q2–2010Q4		
Independent Variables	Coefficient	Std. Error	*t*-Statistic	Prob.
Constant	−0.0110	0.0101	−1.0899	0.2786
ΔGDP(−2)	0.4737	0.0815	5.815	0.0000
ΔG7GDP(−2)	0.9967	0.1936	5.1485	0.0000
ΔG7GDP(−3)	−0.8007	0.2111	−3.7928	0.0003
ΔEUR_USD	−0.0545	0.0161	−3.3829	0.0011
ΔEUR_USD(−2)	0.0433	0.0179	2.4262	0.0172
ΔEUR_USD(−4)	−0.0373	0.0148	−2.5211	0.0134
ΔLABOR	0.9515	0.2053	4.6348	0.0000
ΔLABOR(−1)	−0.8523	0.2269	−3.7568	0.0003
ΔEDU	2.0531	0.3856	5.3245	0.0000
ΔEDU(−3)	−2.3162	0.7134	−3.2465	0.0016
ΔEDU(−4)	2.6147	0.6538	3.9996	0.0001
ΔM2	0.1062	0.0404	2.2721	0.0101
ΔCREDIT(−1)	0.0630	0.0276	2.2835	0.0247
DUMMY_EU	−0.01155	0.0081	−1.4252	0.1575
R-squared	0.9075	Mean dependent var		0.0812
Adjusted *R*-squared	0.8935	S.D. Dependent var		0.0399
S.E. of regression	0.0130	Akaike info criterion		−5.7117
Sum squared resid	0.0156	Schwarz criterion		−5.3402
Log likelihood	320.7467	Hannan–Quinn criterion		−5.5630
F-statistic	64.4996	Durbin–Watson stat		1.7066
Prob (*F*-statistic)	0.0000			
Ramsey RESET Test:				
F-statistic	1.0738	Prob. F(1,91)		0.3028
Log likelihood ratio	1.2552	Prob. Chi-Square (1)		0.2626
Breusch–Godfrey Serial Correlation LM Test:				
F-statistic	1.7173	Prob. F(4,88)		0.1533
Obs*R-squared	7.7475	Prob. Chi-Square (4)		0.1013
Heteroskedasticity Test: Breusch–Pagan–Godfrey				
F-statistic	1.4382	Prob. F(14,92)		0.1517
Obs**R*-squared	19.2128	Prob. Chi-Square (14)		0.1570
Scaled explained SS	11.0471	Prob. Chi-Square (14)		0.6823
Heteroskedasticity Test: ARCH				
F-statistic	1.4484	Prob. F(1, 104)		0.2315
Obs**R*-squared	1.4560	Prob. Chi-Square (1)		0.2276
Jarque–Bera Test:				
JB Statistic	0.9157	Prob. Chi-Square (2)		0.6326

Spain was a top receiver of FDI, provided the kind of environment considered most favorable for FDI to have a positive impact on growth (developed financial markets, skilled labor, etc.), and Spanish GDP growth was surprisingly high from the mid-1990s onward.

We examined the quantitative effect of incoming FDI on Spanish GDP growth using the GETS econometric methodology. Given the large body of inconclusive research on this question, this method offers a decisive new avenue to gain clarity in a way that

Table 9

Parsimonious Model with Euro Dummy

Dependent Variable: ΔGDP		Method: Ordinary Least Squares		
Observations: 107		Sample Period: 1984Q2–2010Q4		
Independent Variables	Coefficient	Std. Error	*t*-Statistic	Prob.
Constant	−0.0286	0.0113	−2.5362	0.0129
ΔGDP(−2)	0.5133	0.0793	6.4736	0.0000
ΔG7GDP(−2)	1.0403	0.1932	5.3840	0.0000
ΔG7GDP(−3)	−0.7738	0.2123	−3.6449	0.0004
ΔEUR_USD	−0.0537	0.0163	−3.2942	0.0014
ΔEUR_USD(−2)	0.0474	0.0179	2.6509	0.0095
ΔEUR_USD(−4)	−0.0356	0.0150	−2.3693	0.0199
ΔLABOR	0.9969	0.2055	4.8503	0.0000
ΔLABOR(−1)	−0.9573	0.2145	−4.4631	0.0000
ΔEDU	1.9962	0.4210	4.7417	0.0000
ΔEDU(−3)	−2.4168	0.7236	−3.3398	0.0012
ΔEDU(−4)	2.8317	0.7266	3.8973	0.0002
ΔM2	0.0911	0.0394	2.3090	0.0234
ΔCREDIT(−1)	0.0648	0.0281	2.3061	0.0234
DUMMY_Euro	0.0034	0.0081	0.6095	0.5437
R-squared	0.9059	Mean dependent var		0.0812
Adjusted *R*-squared	0.8916	S.D. Dependent var		0.0399
S.E. of regression	0.0131	Akaike info criterion		−5.6971
Sum squared resid	0.0159	Schwarz criterion		−5.3224
Log likelihood	319.7940	Hannan–Quinn criterion		−5.5452
F-statistic	63.2452	Durbin–Watson stat		1.7413
Prob (*F*-statistic)	0.0000			
Ramsey RESET Test:				
F-statistic	0.7378	Prob. F(1,91)		0.3926
Log likelihood ratio	0.8640	Prob. Chi-Square (1)		0.3526
Breusch–Godfrey Serial Correlation LM Test:				
F-statistic	1.8330	Prob. F(4,88)		0.1296
Obs*R-squared	7.2295	Prob. Chi-Square (4)		0.1235
Heteroskedasticity Test: Breusch–Pagan–Godfrey				
F-statistic	0.7316	Prob. F(14,92)		0.7376
Obs*R-squared	10.7191	Prob. Chi-Square (14)		0.7079
Scaled explained SS	6.1769	Prob. Chi-Square (14)		0.9618
Heteroskedasticity Test: ARCH				
F-statistic	2.4867	Prob. F(1,104)		0.1179
Obs*R-squared	2.4753	Prob. Chi-Square (1)		0.1156
Jarque–Bera Test:				
JB Statistic	0.9980	Prob. Chi-Square (2)		0.6071

encompasses prior work and allows testing a number of hypothesized arguments objectively.

The general model reflects advances in the understanding of the role of banks as creators of the money supply. The bank variable survived the rigorous sequential downward reduction to the parsimonious form to emerge as an important determinant of nominal GDP growth: domestic bank credit creation for productive GDP transactions. Granger causality tests indicate unilateral causation from this real economy bank credit to nominal GDP growth. Thus, the small but growing literature in economic

geography calling for the role of bank credit to be included in empirical and theoretical studies (Werner 2013b) is supported. Meanwhile, interest rates dropped out as insignificant (corroborating the Quantity Theory of Credit; Werner 1997). The results are robust, since the estimated parsimonious model seems free from structural breaks, spurious correlations, and problems with endogeneity of variables.

We highlight the neglected issue of how FDI is funded: Given the rules in international banking, FDI is funded locally using money of the receiver country that is in reality, created by domestic banks. Since banks create money out of nothing (Werner 2016), and foreign currency-denominated funds mostly do not physically enter the receiver country, it is neither possible nor necessary to boost economic growth with foreign-denominated money. FDI competes with private domestic investment for funds, crowding out domestic investment (an extension of the substitution of foreign direct and indirect investment shown previously by Werner 1994). This fatally damages the theoretical case for beneficial FDI. In our study this crowding out effect of FDI, although expected to be smaller in euro-denominated Spain, was empirically supported.

 These empirical findings call for more research on the impact of our bank and payments system infrastructure on economic outcomes. They are consistent with the high economic growth observed in bank-centered economies that did not rely on foreign investment to boost their growth, but rather deployed domestic credit to fund domestic investments (e.g., the East Asian "miracle" economies, including Japan and Taiwan, see; Werner 2003a).

We unambiguously show that FDI had no significant positive effect on Spanish GDP growth from 1984 to 2010, despite both high FDI and economic growth and ideal conditions for FDI to boost growth, as judged by previous literature. For the above reasons, our results supersede earlier ambiguous findings concerning the impact of FDI on growth. FDI is not a determinant of Spanish economic growth. What is beneficial for Spanish economic growth is the stimulation of productive domestic credit creation, employment, foreign demand, and education.

Tax breaks and other benefits to attract FDI have been criticized by economic geographers (e.g., Zhang 2011). We find they are indeed inadvisable: Spanish policy makers had better not waste Spanish taxpayers' funds on attracting FDI and instead spend more on domestic education.

We also found that interest rates are not as useful for monetary policy as thought, because (1) they lag nominal GDP growth and drop out of the GETS model when it is reduced to the parsimonious form; and (2) they are positively correlated with growth (i.e., if one were to use them as a policy tool to stimulate growth, a *rise* in rates would be appropriate). As Werner (2005) argues, in our world of disequilibrium, quantities are more important than prices (including the price of money, interest). Therefore, the Spanish central bank and ECB had better encourage vigorous bank credit growth for productive real economy investments (e.g., business investments, especially for the implementation of new technologies). This can be done by switching support from big banks to small local community banks that lend to productive small and medium-sized enterprises. Yet, to the contrary, the ECB's negative interest policy and flat yield curve weaken small banks and keep real economy credit depressed. ECB policies have mainly helped big banks lending for financial speculation, in line with the ECB's stated goal to reduce the number of banks—in practice forcing the many stable community banks not affected by the 2008 crisis to merge and become much

larger banks which are encouraged by monetary policy to lend for property speculation—the next crash in the making. Instead, positive rates and a steepening yield curve (e.g., by ending government bond purchases by the central bank) are more advisable to stimulate growth.

Our study also yields insights on the impact of EU membership: we found that neither joining the European Union nor adopting the euro boosted Spanish nominal GDP growth, raising doubts about the reasons for Spanish politicians to promote these changes. Frequent claims by public figures concerning the growth-enhancing impact of EU membership need to be reconsidered. This is consistent with recent empirical work on postwar UK growth by Ryan-Collins, Werner, and Castle (2016), which finds some evidence of a long-term negative effect from joining the European Union.

There are other corollaries from our findings. For instance, the contribution by Garcia-Santana et al. (2016) on the puzzle of high growth in the face of negative productivity growth in Spain is cast in a new light: FDI could not have been the source of the capital accumulation that caused the high growth. Instead, the high growth was credit driven. The observed decline in productivity could have been a function of bank credit for non-GDP (i.e., asset) transactions, which expanded rapidly. Such bank credit creation causes property and financial asset bubbles (Werner 1997, 2005), which lowers the productivity of the workforce: As more people engage in speculative buying and selling of ownership rights in assets, productivity falls, because man hours are devoted to asset transactions that are a zero-sum game for the economy (for this reason routinely excluded from national income). Hence, the more a population is engaged in speculation, due to rationing of time, the fewer human resources are available for productive activities. Productivity declines. (The impression of *wealth creation* through such bank credit-driven asset bubbles is an illusion, encouraged by the popular press and theories such as the efficient market hypothesis. The illusion is designed to allow the early movers in this pyramid scheme to sell out to the late-coming—usually retail—investors, who will bear the brunt of the losses; ordinary taxpayers are usually and unnecessarily made to pay for the subsequent bank bailouts; Werner 2014b).

The case for a beneficial effect of FDI can be considered rejected. Policy implications include that governments should not spend resources on attracting FDI, since FDI has no discernible positive impact on growth. The finding that FDI has no discernible positive impact on growth further undermines the precrisis mainstream macroeconomics. Using the *hypothetico–deductive–axiomatic* methodology, the hitherto dominant approach in macroeconomics heaps highly unrealistic assumptions on empirically disproven *axioms* to proclaim a theoretical imaginary world of *equilibrium* and *efficient markets* that cannot be improved upon by government intervention (although central bank intervention is usually and strangely exempt).

By contrast, the present study adopted the scientific research method, also known as the *inductive* methodology, which bases theories on empirical facts and tests, using the objective GETS econometric methodology. This requires the reality of human institutions to be reflected in economic models such as banks as creators of the money supply. Moreover, without the many unrealistic assumptions, market equilibrium is impossible. Thus, we know that market equilibrium cannot be expected, even less so *market efficiency* (Werner 2005). Empirically based scientific economics does not postulate that a nation must receive foreign investment to prosper, since many counterexamples exist such as the meteoric rise of Japan in the twentieth century or the many

successfully developing economic powers surveyed by Friedrich List (1841). Japanese policy makers had in fact adopted the inductive methodology to reach a more useful understanding of the economy than what the neoclassical narrative had to offer, upon which they embarked on targeted government intervention, especially in institutional design and credit guidance, with phenomenal results (see Carrington and Edwards 1979; Werner 2003a, 2003b). This calls for a rethinking of modern economics.

Why have economists been reluctant to consider scientific research methods? An underresearched dimension is that of powerful actors influencing academic research (see Werner 2016). FDI is at the center of the drive toward globalization, which is advanced by central banks and other central planners (such as at the EU or the IMF). Our article demonstrates the important role played by bank credit creation, which is also under the control of central banks (on the influence of central banks on economics, see Ishii and Werner 2003).

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