IS LABOR FLEXIBILITY A SUBSTITUTE TO OFFSHORING? EVIDENCE FROM ITALIAN MANAFACTURING

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Is labor flexibility a substitute to offshoring? Evidence from Italian manafacturing

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Abstract

We test whether labor flexibility acts as a substitute to delocalization. Using Italian survey data, we show that a higher share of temporary workers appears to reduce the likelihood of future offshoring. However, once reverse causality and spurious correlation are controlled for with IV techniques, the relationship vanishes. This finding suggests that the threat of delocalization to win support for further labor market reforms is probably misplaced.

KEYWORDS: offshoring, labor flexibility, temporary work, delocalization, labor market reforms, cost saving

JEL Codes: J21, F16, F23

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1. Introduction

"Once again, the key to turning the single market and globalization into opportunities is the capacity to reform labour market and social policies in the right direction. Failing to do so would only exacerbate the fear towards 'Polish plumbers' and delocalization" (Sapir, 2006).

The link between globalization and labor market regulations goes widely undisputed in the literature and in the public debate. As the story goes, in a globalized world domestic labor protective legislation becomes too costly, causing firms either to succumb to their international competitors, or to move their production abroad. The threat of delocalization, by reinforcing the trade-off between job and employment security, is indeed a major driver in the political strive for labor market reforms (Stone 2012, Esping-Andersen and Regini 2000). The same arguments explain the stress international institutions like the OECD and the International Monetary Fund put on labor market reforms in the present financial crisis.[1]

While the literature has identified high domestic unit labor costs as one of the factors motivating firms' choice to delocalize, little effort has been devoted to test at a micro level whether more job stability fosters offshoring, as commonly assumed. In particular, no connections have so far been established between the diffusion of flexible work arrangements by means of non-standard contracts and the likelihood of offshoring. This is all the more interesting as labor market reforms in OECD countries in the past two decades have mainly occurred by introducing the possibility to hire under less protected, temporary contracts.

From a theoretical perspective, the impact of workforce composition on offshoring decisions is indeterminate. If firms consider production offshoring and workforce flexibility as two different cost-cutting strategies, then a higher share of temporary workers over total workforce should be associated with less delocalization. Indeed, non-standard contracts, and in particular fixed-term work arrangements, do entail lower dismissal costs, as no firing costs have to be paid upon expiration of the contract and in many countries no end-of-services allowances are due. Conversely, higher workforce flexibility (in terms of a higher share of temporary workers) could facilitate offshoring, as domestic production can be displaced abroad without bearing the high costs of permanent workers dismissal. Such costs entail not only monetary payments to workers, but also increased opposition by labor unions and more attention from the general public and the media, which might delay offshoring or deter it completely.

[1] See for instance IMF (2012), Barkbu et al. (2012), OECD (2012).

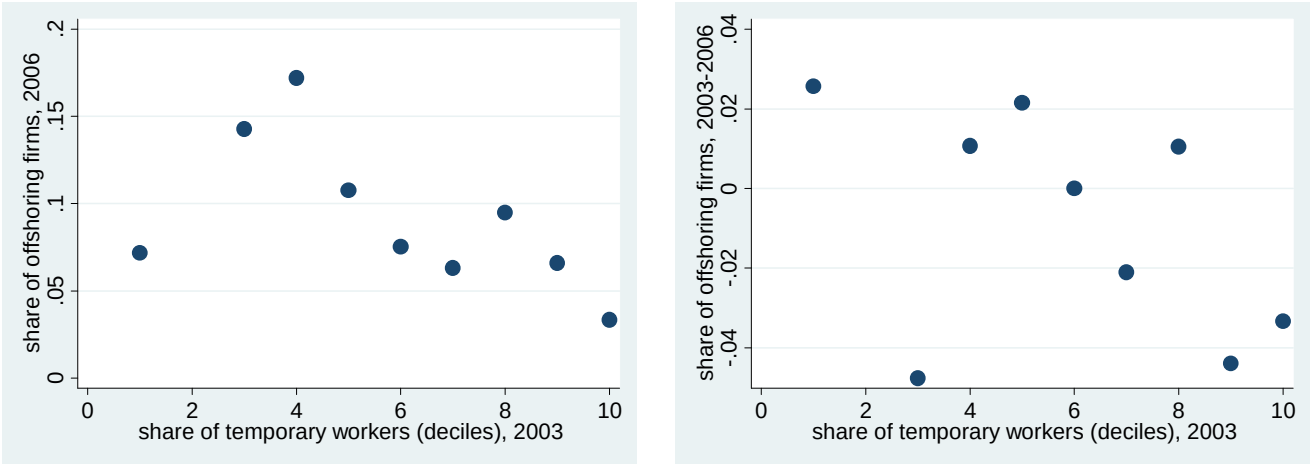
Therefore, the question whether labor market flexibility induces more or less offshoring has ultimately to be addressed at an empirical level. To the best of our knowledge, this paper is the first to postulate a relationship between offshoring decision and workforce composition in terms of temporary vs. open-ended workers, and to test this claim with firm-level data. Partially related to this research questions, Machikita and Sato (2011) find that FDI and/or outsourcing tend to encourage the replacement of permanent workers with temporary workers in home production by Japanese firms. This result may be consistent with the manufacturers' goal to save expected labor adjustment costs. Once the firm has already incurred the setup cost for the foreign plant, a more favorable foreign business opportunities can be dealt with dismissing temporary rather than permanent workers. Moreover, tougher competition may make the employment relationship fragile, reducing the workers' incentive to accumulate firm-specific skills. Hence, the efficiency advantage of permanent workers over temporary workers reduces and firms prefer substituting permanent with temporary workers. With respect to Machikita and Sato (2011), we test the existence of a causal nexus working in the opposite direction, from labor force composition to offshoring.

Our data refer to Italy, an interesting case study because it was the OECD country that liberalized the use of temporary contracts to the highest degree, in the period 1998-2008 (see Section 3, below). A first look at the data reinforces the opinion that domestic labor force flexibility and offshoring are substitutes, rather than complements (Figure 1). The variable on the vertical axes is the share of firms who had relocated part of their production abroad by 2006 in the left panel, and the share of firms who choose to relocate part of their production abroad in the period 2003-2006 in the right panel[2]. The variable on the horizontal axes is the share of temporary workers in 2003 (by deciles).

This aggregate pattern shows up even after controlling for a number of firm characteristics, as we show in our analysis. However, as common in the offshoring literature, an issue can be raised concerning reverse causality (from a propensity to future offshoring to a preference over actual workforce composition) and spurious correlation (some firm characteristics affecting both the propensity to future offshoring and the actual workforce composition). Indeed, we show by using appropriate instruments that once this endogeneity problem is controlled for, the relationship between actual workforce composition and future offshoring vanishes (whether the theoretical mechanisms at work discussed above are too weak or compensate each other, we can't tell). The negative correlation between offshoring and temporary employment that we find when reverse

[2] To be more precise, the outcome variable in the right panel can take a value of +1 if the firm had offshore activities in 2006 but not in 2003, a value of 0 if the firm either had offshore activities both in 2006 and in 2003, or neither in 2006 nor in 2003, and a value of -1 if the firm had offshore activities in 2003 but not in 2006.

causation is not controlled for is coherent with the firm-level literature on the effects of offshoring pointing to an increase in the demand for skilled labor and a decrease in the demand for unskilled labor (e.g. Becker et al. 2009 for Germany, Head and Ries 2002 for Japan, Hansson 2005 for Sweden), given that temporary jobs are more associated with unskilled labor.[3] On the other hand, it contradicts *prima facie* the results of Machikita and Sato (2011).



(a) Firms with offshoring activities in 2006 (b) Firms who relocated in 2003-2006

Figure 1: Aggregate relationship between offshoring and labor force flexibility. Source: our elaboration on Survey on Manufacturing Firm (SMF) data, IX and X waves.

The paper is structured as follows. Section 2 summarizes the literature on the effects of offshoring on domestic employment. Section 3 describes the season of labor market reforms that took place in most European countries since the beginning of the 1990s, and discusses the advantages of employing a flexible labor force in terms of lower labor costs. Section 4 describes our empirical strategy; Section 5 presents our main results, while Section 6 summarizes and concludes.

2. Extent and determinants of offshoring

At firm level, offshoring is defined as purchases of intermediate goods and services from foreign providers at arm's length or the transfer of particular tasks within the firm to a foreign location. At the aggregate level, offshoring is generally measured by the share of non-energy imported

[3] In 2003, the year when we measure employment composition, 60.5% of temporary workers had less than secondary education, against 41.6% of workers with an open-ended contract; 6.7% of temporary workers hold a university degree, against 12.5% of workers with an open-ended contract (Italian Labor Force Survey data).

intermediate inputs in the total purchase of non-energy intermediate inputs (Feenstra and Hanson 1996; 1999).[4] Since the nineties, the fragmentation of production has increased in several advanced economies. On average, the index of offshoring in OECD countries was 18 percent in 2005, 4 percentage higher than in 1995. In Italy, by contrast, the intensity of offshoring remained quite stable, at about 11 percent of total inputs in the manufacturing and 7 percent in the service sectors. In comparative terms, the intensity of offshoring in Italy is lower than in Germany (22%), but similar to the values reported in France and Germany (18%) and much higher than in the US and in Japan (OECD 2010).

The effects of offshoring on labor market outcomes have been extensively studied (see Crinò (2009) for a review). In a nutshell, offshoring may induce cost savings and improve productivity, resulting in a higher output. Thanks to the productivity-enhancing effect of offshoring, even factors of production whose tasks are offshored can benefits from the international delocalization of production (Grossman and Rossi-Hansberg 2008).[5]

Given the emphasis on the effects of outsourcing at firm, industry and economy-wide levels, it is quite surprising the limited attention devoted by the empirical literature on the determinants of offshoring.[6] Working on Japanese firms, Tomiura (2005) shows that offshorers are larger, more productive, produce more labor-intensive goods and have a larger dotation of information and communication technologies (ICT) than domestic firms. Moreover, firms with previous experience in foreign activities are more likely to start offshoring, since they face a lower fixed cost of delocalization. Diaz-Mora (2008) and Pelegrìn and Bolancé (2011) provide similar findings for Spain using, respectively, industry-level and firm-level data. Hyun (2010) shows that, for Korean manufacturers, productivity does not explain the decision to offshoring. The latter is more frequent among firms that are larger, with a higher usage of R&D and ICT, and with a higher labor intensity.

More generally, the choice of offshoring is mainly driven by two goals: 1) the reduction of costs of production, especially the search for lower labor costs, and 2) a greater proximity to new

[4] According to the OECD (2010) definition, the index of offshoring at the industry level is constructed as:

$$OFF_i = \sum_j \left(\frac{\text{purchases of inputs } j \text{ by industry } i}{\text{total inputs used by industry } i} \right) \times \frac{M_j}{D_j}$$

where *i* is the industry M_j are the imports of goods or services *j* and D_j is the domestic demand for goods or services *j*. National indicators are constructed aggregating industry-based measures.

[5] The empirical evidence broadly supports this view (Gorg et al. 2008; Daveri and Jona Lasinio 2008; Hijzen et al. 2010; Jabbour 2010). However, higher productivity comes at the cost of higher demand elasticities for production workers (Senses 2010), increasing job instability (Geishecker 2008; Lo Turco et al. 2012), broadening wage inequality due to the increase in the relative demand for skilled workers (Feenstra and Hanson 1996; 1999; Broccolini et al. 2011), and higher unemployment in presence of imperfect intersectoral labor mobility (Mitra and Ranjan 2010).

[6] A related strand of literature discusses the determinants of outsourcing and production subcontracting (see, for instance, Girma and Gorg 2004; Holl 2008).

markets, driven by the aim of increasing sales (OECD 2007). The firms' decision to locate abroad to reduce unit labor cost is the key issue explaining the great attention paid on offshoring by policy-makers and by the economic research. The existing evidence suggests that international outsourcing is primarily a cost-cutting strategy. Diaz-Mora (2008) finds that the offshoring intensity is higher in sectors with higher unit labor costs. Using firm-level data, Pelegrìn and Bolancé (2011) confirm the presence of cost-cutting strategies by offshoring firms, since firms with worse operating performance and labor-intensive activities are more likely to relocate part of their production abroad. The descriptive analysis of the X Survey on Manufacturing Firms, used in the empirical exercise, also indicates that firms' choices to delocalize primarily follow a cost-cutting strategy. Lower labor costs and input costs are indicated by, respectively, the 49% and the 21% of Italian offshoring firms as the main driver of delocalization decisions.

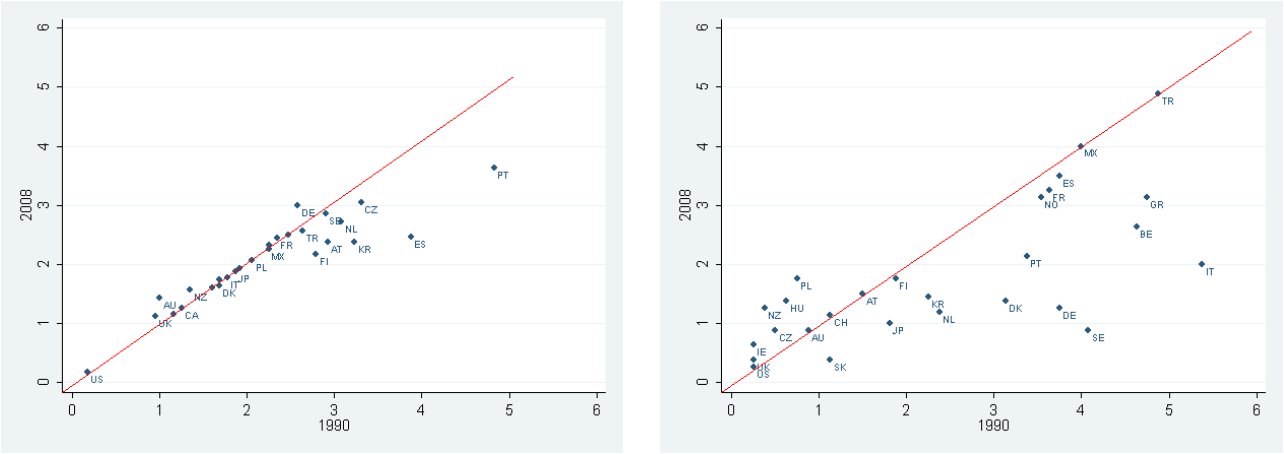
3. Labor market reforms

In the past twenty years most industrialized countries have undergone a process of labor market reforms aimed at introducing more degrees of flexibility in labor relationships. Given strong political opposition (in particular from labor unions) to lowering guarantees for the stock of open-ended workers, the trend undertook the path of least resistance and flexibility was introduced mainly "at the margin", by increasing the availability of more flexible, non-standard contracts for the flow of new hires. This is confirmed by Figure 2, which shows the evolution of the EPL (Employment Protection Legislation) index between 1990 and 2008 for open-ended (left panel) and temporary (right panel) contracts. Very little changed for open-ended contracts, with most countries lying exactly on the 45 degrees line. On the other hand, restrictions to the use of temporary contracts were lifted and the menu of non-standard contracts enlarged: most countries lie well below the diagonal, indicating lower restrictions. Italy is an interesting case in this respect, as it is the country where the EPL index for fixed-term contracts underwent the strongest reduction: from about 5.5 in 1990 – Italy was the country with the strongest restrictions in the sample – to about 2 in 2008, lower than France and Spain, and not far away from Germany, Denmark and the Netherlands.[7]

Not surprisingly, the use of non-standard contracts soared almost everywhere in Europe (Figure 3). The share of temporary contracts (fixed term direct-hire employees) over dependent employment was 13.7% in the EU27, in 2009, with figures as high as 18% in the Netherlands, 22%

[7] See also Brandt et al. (2005), who show that Italy was a strong complier with respect to the Oecd Jobs Stydy strategy. In particular, a major reform was carried out in 2001 and allowed the use of fixed-term direct-hires for any firm- or production-related technical or organizational reason.

in Portugal, 25.5% in Spain and 26.4% in Poland. Italy was about the EU average at 12.5%. This share skyrocketed to above 40% in the EU27 for younger workers in the 15-24 age bracket (France, Germany, Spain, Portugal and Sweden were at about 55%; Poland was at 62%; Italy at 44%).[8] Given the shorter duration of temporary contracts with respect to open-ended ones, the incidence of temporary contracts in hiring is even greater, with Spain reaching 80%.



(a) EPL index for open-ended workers (0 = minimum protection, 6= maximal protection)

(b) EPL index for temproary workers (0 = least constraints to hiring, 6= maximal constraints to hiring)

Figure 2: Evolution of EPL index, 1990-2008. Source: Berton et al. (2012)

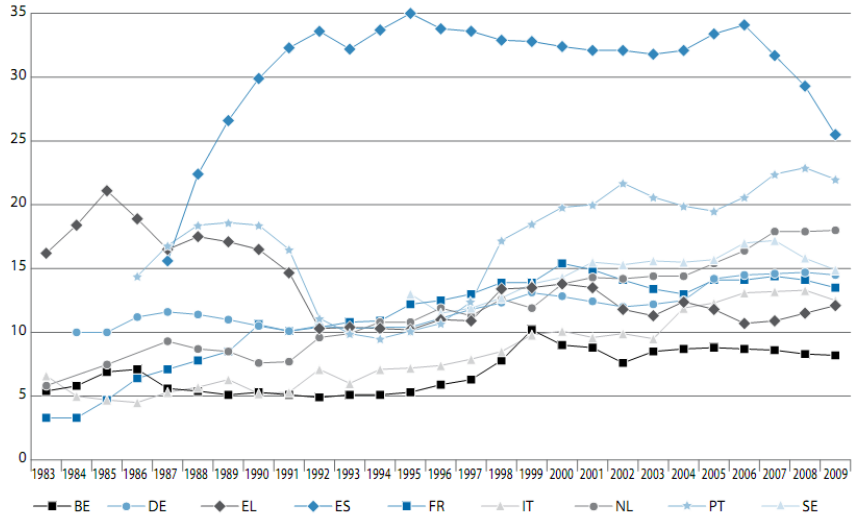


Figure 3: Temporary work in selected EU countries (% of total number of employees). Source: European Commission 2011

[8] The crisis induced a decrease in the share of fixed-term contracts, as those were the first to be dismissed. The maximum was achieved, in most countries, in 2007.

Temporary contracts are used, in addition to screening purposes[9], because they entail lower costs for firms, both in terms of dismissal costs and – in many cases – in terms of unit (wage) costs. They permit a sort of "employment at will" behaviour of firms, as temporary workers can be freely dismissed when the contract expires, and contract durations are generally short.[10] Moreover, in many countries no dismissal costs are due to the worker upon expiration.[11] On the contrary, firing an open-ended worker generally requires a justification, which can be challenged by the worker and reversed by a labor court, with the whole process taking time, money, and uncertainty. The threat of taking the firm to the court often induces high voluntary dismissal payments, even when they are not envisaged by the legislation (as in Italy). Moreover, upon termination of the contract open-ended workers are often provided with end-of-service allowances.

The wage bill for non-standard contracts is also lower, as these contracts often entail lower social contributions and wages are also lower due to a weaker bargaining position of fixed-term workers. The European Commission estimates an average wage penalty for temporary contracts of 14.2% (European Commission 2011). This average masks strong heterogeneity among contracts and among countries. For instance, in Germany temp agency workers appear to suffer from a more substantial penalty: Oberst et al (2007) estimate a wage gap of 29% for 2005, while Jahn (2008), after controlling for observed and unobserved characteristics, places the penalty at 15-18%. By converse, the most discriminated category in Italy is that of project workers[12], with a penalization of up to 25% in terms of net wage and up to 50% in terms of gross wage. On the contrary, temporary contracts (fixed-term direct hires) – the focus of our analysis – entail little or no wage discrimination and differ from open-ended contacts only insofar as they are characterized, as discussed above, by reduced dismissal costs (Berton et al. 2012).

4. Data and identification strategy

The data we use in the empirical analysis are drawn from the IX and X "Survey on Manufacturing Firm" (SMF) administered every three years by the Unicredit banking group. The SMF is a large survey of about 4,000 Italian manufacturing firms with more than 10 employees and includes several information on firms' internationalization and labor force composition over a three-years period. The sampling procedure creates a rotating panel so that around one third of firms

[9] See for instance (Portugal and Varejão, 2009)
[10] In facts, temporary contracts are less diffused in countries with a lower EPL for open-ended contracts, like the UK.
[11] Dismissal payments, proportional to accrued seniority, are envisaged in some countries (e.g. France and Spain).
[12] Wage and salary independent contractors in US parlance.

interviewed in 2003 are still present in the 2006 wave. Missing data and outliers in the main variables used in the analysis leave use with a trimmed dataset of 915 firms, whose descriptive statistics are reported in Table 1.

To identify the effect of labor flexibility of the firms' decision to offshore we estimate a model in which the dependent variable ($OFFSHORING_{2006}$) is a dummy equal to one for firms' stating to have delocalized part of their production process in 2006. The probability of offshoring in 2006 is function of the offshoring status in the previous wave ($OFFSHORING_{2003}$), of the share of flexible labor force in 2003 ($TEMPORARY_{2003}$) and of a set of control variables measured in 2006 (X_{2006}):

$$(1) \qquad OFFSHORING_{2006} = \Phi(OFFSHORING_{2003}, TEMPORARY_{2003}, X_{2006})$$

where Φ is the normal distribution function and *TEMPORARY* is the ratio of fixed-term direct-hire employees over the total number of dependent employees. The set of controls includes firm size (*SIZE*, as the logarithm of the number of employees in 2006), two dummies for innovative (*INNOVATION*, equal to one for firms which introduced a product or a process innovation between 2004 and 2006) and exporting (*EXPORT*) firms, a dummy for firms with a contraction in total sales between 2003 and 2005 (*NEGATIVE SALES*), a variable measuring multiple lending relationships (*MULTIPLE LENDING*), 4 regional dummies (one for each macro area, North-West, North-East, Centre and South), 13 industry dummies, and an index of skill intensity, measured as the share of white collars in firm's total employment (*SKILL INTENSITY*).[13] Definitions and summary statistics of the variables are presented in Table 1.

From the descriptive statistics appears that 9 percent of Italian firms delocalized part of its activities in 2006. The offshoring status is quite persistent, since 38 percent of 2003 offshoring firms delocalize also in 2006, and it is more likely for larger, exporting and innovative firms. Moreover, delocalization is more frequent among firms with multiple lending relationships, with a larger presence of white collars, and with a reduction in total sales between 2003 and 2005. The fact that offshoring is more likely amongst worse performance firms (in terms of sales) is consistent with the choice of offshoring as driven by cost savings reasons. Finally, firms that employed a larger share of temporary and flexible workers in 2003 were less likely to offshore in 2006. These differences are all statistically significant.

[13] As Benfratello et al. (2009), who also use data from the SMF, we are not able to control for firm's productivity. However, we test the robustness of our findings across alternative specification of the model, see below, Section 5.2.

Table 1: Variables' definitions and descriptive statistics

Variables	Description	Mean			# obs.
	Dependent variable				
OFFSHORING$_{2006}$ (0,1)	Dummy equal to 1 if the firm has declared to perform abroad part of his activities in 2006, 0 otherwise.	0.090			915
	Explanatory variables				
		OFFSHORING$_{2006}$		T-test	
		Yes	No	(one tail)	
OFFSHORING$_{2003}$ (0,1)	Dummy equal to 1 if the firm has declared to perform abroad part of his activities in 2003, 0 otherwise.	0.378	0.070	***	915
TEMPORARY$_{2003}$	Share of fixed-term direct-hire employees over total dependent employees, in 2003.	0.015	0.042	**	915
EXPORT$_{2006}$ (0,1)	Dummy equal to 1 if the firm exported abroad part of his production in 2006, 0 otherwise.	0.951	0.753	***	915
INNOVATION$_{2006}$ (0,1)	Dummy equal to 1 if the firm has introduced a product and/or process innovation in the period 2004-2006, 0 otherwise.	0.707	0.557	***	915
SIZE$_{2006}$	Logarithm of the number of employees, excluding term contract workers, in 2006.	4.781	4.316	***	915
SKILL INTENSITY$_{2006}$	Share of white collars employees over the total number of employees, in 2006.	0.427	0.358	***	915
MULTIPLE LENDING$_{2006}$	The number of banks with which the firm does business, in 2006.	7.963	6.191	***	915
NEGATIVE SALES (0,1)	Dummy equal to one if the firm has a negative variation in sales between 2005 and 2003	0.447	0.338	**	915
	Instrumental variables				
TEMPORARY_PROV	Share of temporary workers (fixed-term dependent employees and project workers) over the total dependent employees, at the provincial level, in 2002. Source: Italian Social Security Administration (INPS)		0.157		94
MIGRANTS_PROV	Share of foreign resident population over total resident population at the provincial level in 2002. Source: Italian Statistical Office (ISTAT).		0.013		94

Notes: our elaboration on Survey on Manufacturing Firm (SMF) data, IX and X waves. Data on instrumental variables originally refer to the 103 Italian administrative provinces, as were in 2002, but actual figures are based on 94 provinces, since provinces are aggregated to the old classification of 95 provinces and one province is not represented in the final SMF data set used in the analysis. * Significant at 10%; ** significant at 5%; *** significant at 1%.

Equation (1) is firstly estimated by a standard probit and a linear probability model. However, the model could suffer from simultaneity and omitted variable biases. Even if the labor market flexibility variable is predetermined, it could still be endogenous to the firms' offshoring propensity. In fact, the decision to delocalize part of the production process abroad in the near future could affect the current composition of the labor force. This may result in an increase of the share of flexible contracts, to facilitate the future offshoring process, or to a reduction of temporary workers, if firms see the expected delocalization as a cost-cutting strategy alternative to flexibilization

(Pelegrìn and Bolancé 2011). This case is consistent with the firms' own statements about the reasons why they offshore, with the descriptive analysis of the data (Table 1), and with the lower relative demand by offshoring firms for unskilled labor (Head and Ries 2002; Hijzen et al. 2005; Becker et al. 2009), where temporary workers are relatively more present. Under this scenario, the OLS estimates would be negatively biased. Second, it is possible that both offshoring and labor force flexibility are jointly driven by other unobserved factors, such as the degree of market competition.

To address these problems we rely on IV techniques. In absence of firm-level variables which could affect the composition of the labor force, but not the decision to delocalize part of the production, we instrument *TEMPORARY* with: 1) the share of temporary over total dependent employees at the provincial level in 2002 (*TEMPORARY_PROV*)[14], and 2) the share of foreign resident population over total resident population at the provincial level in 2002 (*MIGRANTS_PROV*). The former variable, being a measure of labor force flexibility calculated at the provincial level, should not affect the individual decision to offshore (the instrument is exogenous) but it should be correlated with *TEMPORARY* (the instrument is relevant), since the contract types workers are offered are highly persistent (Berton et al. 2011) and the aggregate number of employees with temporary contracts represents a pool from which firms can fish. Similar considerations can be made for the provincial share of migrants. Its correlation with the share of offshoring firms at provincial level is extremely low (0.04) and not statistically significant, making it an exogenous instrument. On the other hand, immigrants are more likely to hold an open-ended job with respect to natives: 72.0% vs. 64.8% among dependent employment, according to a study by Fondazione Moressa (Fondazione Moressa 2011).[15]

In addition to the economic justification for the choice of the instruments provided above, in our empirical analysis we test the statistical validity of the instruments.[16] In the robustness analysis we will further deepen the discussion of our IV strategy, see below, Section 5.2.

Our preferred specification is a linear probability model estimated by two-stage least squares (2SLS), which has the advantage of providing diagnostic tests for over-identifying restrictions,

[14] Italian Social Security Administration (INPS) data. We thank Fabio Berton for providing the computation.

[15] This is also due to a higher incidence of irregular work among immigrants, which partly substitutes temporary employment.

[16] We tried several different variables –at firm, industry, and provincial level– which may be candidate for being good instruments. In particular, we used firms' age, a dummy for firms which fired at least one employee in 2003, the share of temporary workers at regional and industry (2-digit) level, the provincial youth unemployment rate, a provincial measure of human capital stock, the ratio of labor force aged 15-34 over labor force aged 35-64 at province level, the provincial participation rates in the labor market of individuals aged 15-24, 15-34 and 25-34. All these variables proved to be bad instruments, either because they do not satisfy the relevance or the exogeneity condition.

under-identification, and weak identification.[17] Additionally, we report the results of the estimation of a probit model with endogenous regressors by maximum likelihood.

5. Results

5.1 Baseline model

The main results of the estimation of equation (1) are reported in Table 2. The OLS and the probit estimates (columns 1 and 2) confirm the negative correlation between labor flexibility and offshoring, showed in Figure 1. However, once we take into account the possible endogeneity of the labor force composition, the coefficient on *TEMPORARY* becomes positive but it is no more statistically significant (columns 4 and 6). This result confirms the presence of a negative bias of the OLS, consistent with offshoring firms reducing the demand for unskilled labor. Hence, the negative correlation between labor force flexibility and the subsequent propensity to offshore does not imply a casual link going from the former to the latter, neither the presence of a substitution effect between labor flexibility and offshoring. More formally, the IV estimates do not reject the null hypothesis that labor flexibility has no effect on the propensity to offshoring.

The first stage regressions and a battery of diagnostic tests suggest that the model is not mis-specified. The first stage regressions of the 2SLS (column 3) and of the probit model with endogenous regressors (column 5) show that the instruments are strongly correlated with the endogenous variables. The share of temporary workers in the province and the share of migrants in the total provincial population are, respectively, positively and negatively correlated with *TEMPORARY*, as expected. Coming to the 2SLS diagnostic tests, the Kleibergen–Paap rk Wald F-statistic is equal to 11.7, above than the Staiger and Stock (1997) rule of thumb value of 10, and between the Stock and Yogo (2005) 5 percent critical values for 10 and 15 percent maximum bias. This is evidence against the risk of a weakly identified model. The instruments satisfy the rank condition, since the Kleibergen–Paap rk LM statistic rejects the null hypothesis that the equation is underidentified. Finally, the exclusion restrictions are satisfied, since the Sargan-Hansen test of overidentifying restrictions (OIR) does not reject the null hypothesis that the instruments are uncorrelated with the error term.

[17] The Sargan-Hansen test of overidentifying restrictions (OIR) tests the null hypothesis that the instruments are uncorrelated with the error term. The Kleibergen–Paap rk LM statistic tests the null hypothesis that the excluded instruments are not correlated with the endogenous regressors (i.e. the equation is underidentified). The Kleibergen–Paap rk Wald F-statistic tests for weak identification (Baum et al., 2010).

Table 2: Regression results

Dep. Var.: *OFFSHORING*$_{2006}$	(1) OLS	(2) PROBIT	(3) 1st stage	(4) 2SLS	(5) 1st stage	(6) IVPROBIT
OFFSHORING$_{2003}$	0.246***	0.971***	0.018	0.238***	0.018	0.793***
	[0.054]	[0.202]	[0.016]	[0.055]	[0.015]	[0.256]
EXPORT$_{2006}$	0.061***	0.740***	-0.001	0.061***	-0.001	0.654***
	[0.013]	[0.209]	[0.011]	[0.011]	[0.011]	[0.253]
INNOVATION$_{2006}$	0.034**	0.255***	0.003	0.033**	0.003	0.219*
	[0.013]	[0.099]	[0.008]	[0.013]	[0.008]	[0.114]
SIZE$_{2006}$	0.012	0.121***	-0.001	0.012	-0.001	0.112**
	[0.010]	[0.046]	[0.004]	[0.009]	[0.004]	[0.047]
SKILL INTENSITY$_{2006}$	0.086***	0.710***	-0.015	0.092***	-0.015	0.686***
	[0.022]	[0.123]	[0.016]	[0.025]	[0.015]	[0.138]
MULTIPLE LENDING$_{2006}$	0.005**	0.024**	-0.001	0.005**	-0.001	0.024***
	[0.002]	[0.010]	[0.001]	[0.002]	[0.001]	[0.008]
NEGATIVE SALES	0.042**	0.350***	0.003	0.042***	0.003	0.307**
	[0.016]	[0.086]	[0.011]	[0.015]	[0.011]	[0.122]
TEMPORARY$_{2003}$	-0.167***	-3.749***		0.254		0.543
	[0.034]	[1.265]		[0.523]		[3.007]
MIGRANTS_PROV			-1.520***		-1.461***	
			[0.478]		[0.486]	
TEMPORARY_PROV			0.429***		0.435***	
			[0.136]		[0.134]	
Observations	915	915	915	915	915	915
R^2	0.137		0.021	0.079		
Pseudo R^2		0.205				
Overidentification				0.854		
Underidentification				0.045		
Weak instrument				11.709		

Notes: The table reports the coefficients and, in brackets, the associated standard errors clustered by region. * Significant at 10%; ** significant at 5%; *** significant at 1. At the bottom of the table we report some diagnostic tests. In particular, for the 2SLS we report the p-value of: 1) the Sargan-Hansen test of overidentifying restrictions (OIR) tests the null hypothesis that the instruments are uncorrelated with the error term; 2) the Kleibergen–Paap rk LM-statistic testing the null hypothesis that the excluded instruments are not correlated with the endogenous regressor; and 3) the Kleibergen–Paap rk Wald F-statistic testing for weak identification. All regressions include 13 industry dummies, 4 macro area dummies, and a constant, not shown for reasons of space.

The control variables are generally significant and with the expected signs. The fragmentation of production is path-dependent: the probability to offshoring in 2006 is 25 per cent higher for firms which have already delocalized their production process in 2003 than for firms which produced only domestically (according to estimates reported in column 4), a result consistent with the descriptive statistics (Table 1) and with the literature pointing out the fixed costs of delocalization (Tomiura 2005; Diaz-Mora 2008; Hyun 2010).

Confirming the main finding discussed by the firms' internationalization literature, export-oriented and innovative firms are more likely to delocalize the production process (Tomiura 2005; Diaz-Mora 2008; Barba Navaretti et al. 2008; Hyun 2010). Considering the 2SLS coefficients (column 4), which can be easily interpreted as marginal effects, exporting and innovative firms are,

respectively, 6.0 and 3.3 per cent more likely to offshore than firms which sell all their production in Italy and do not introduce product or process innovations.

While firm size is usually a good predictor of firm's internationalization, the coefficient on *SIZE* is significant only in the probit models, while not in the OLS and 2SLS estimates. This may be due to the presence of the lagged *OFFSHORING* variable, since in a static model the coefficient on *SIZE* is highly significant in all specifications (see Section 5.2 below).

Offshoring is more likely to occur for firms with a larger share of white collars, consistently with a larger presence of offshoring firms in skill-intensive sectors (Diaz-Mora 2008; Pelegrìn and Bolancé 2011). In addition, the choice to delocalize is more frequent among firms who were experiencing a negative performance in terms of sales, suggesting that offshoring may be driven by the need to reduce production costs to gain competitiveness. As regards the financial variable, results show that firms borrowing from more banks are more likely to offshore. This could be consistent with the fact that multiple lending is a more frequent phenomenon for large firms, but also with an easier access to bank credit, since multiple lending is associated with less binding financing constraints for Italian SMEs (Alessandrini et al. 2009). Finally, the macro area dummies are generally not significant, suggesting that geographical location is not correlated with firms' propensity to offshoring.

5.2 Robustness exercises

We run a battery of additional exercises to test the validity of our main findings. In particular, results are robust to: 1) the estimation of a static version of equation (1) excluding $OFFSHORING_{2003}$, which should be less subject to autocorrelation problems in the error term; 2) an alternative definition of *TEMPORARY*, including also project workers; 3) the inclusion of a series of additional control variables, potentially correlated with the offshoring decisions (i.e. firm's age, a dummy for credit rationed firms, a dummy for investment in R&D as alternative measure of innovation, a dummy for firms belonging to groups, a dummy for family firms); 4) the distinction between low-and high-tech industries; and 5) an IV estimation with exact identification, even if we slightly relax the exclusion restriction. While full results are reported in the Annex Tables, here we discuss the most relevant findings.

The estimation of a static model (Table 3) confirms our main results, showing also a positive and significant coefficient on *SIZE*, consistent with the empirical findings of the literature about the positive correlation between size and internationalization.

The negative correlation between flexible labor force and offshoring is confirmed even using

a broader definition of *TEMPORARY* including also project workers (Table 4). This correlation vanishes in the IV estimates and the first stage regression in the 2SLS is even better than in the baseline, since the F-statistic is now greater than 17, above the Stock and Yogo (2005) five percent critical values for ten percent maximum bias.

Adding several different control variables that may be correlated with the propensity to offshore does not alter the main regression results, neither provides valuable insights (Table 5). In additional regressions, we also included regional dummies instead of the four macro-area dummies and results are almost identical.

The lack of a causal effect going from labor flexibility to offshoring may be the outcome of some neglected heterogeneity. One possible source of heterogeneity is related to the intensity of R&D and ICT, which is generally associated with a higher propensity to offshoring (Tomiura 2005; Hyun 2010). Firms operating in high-technology sectors may be less exposed to international competition and they can choose to delocalize in order to expand their markets. By contrast, firms operating in low-tech, traditional sectors are more exposed to international competition and they may decide to delocalize for cost savings reasons in order to re-gain competitiveness. Hence, for the former offshoring is an active strategy whose relationship with labor flexibility is uncertain *a priori*, while for the latter offshoring may be a passive strategy, alternative to labor flexibility. Table 6 shows that the main result of the paper holds even if we split the sample between firms operating in low-tech and high-tech sectors. In both sub-samples we observe a negative correlation between *TEMPORARY* and *OFFSHORING* (column 1 and 2), but the 2SLS again show that this correlation in no more statistically significant when reverse causality is taken into account. The diagnostic of the IV estimates is still good in the low-tech sub-sample, while it worsens in the high-tech sub-sample, but this is likely the result of a much smaller sample.

Finally, we recognize that the choice of the instruments may be challenged and not fully convincing. We have already discussed the reason why we did not use alternative firm- industry- and province-level variables as instruments (see footnote 15). Here, we aim at further discussing our IV strategy to convince the reader of its validity.

First, we recognize that the choice of *MIGRANTS_PROV* as instrument for *TEMPORARY* may be not be fully convincing, notwithstanding its low correlation with offshoring, at firm- and province-level. Therefore, we run our baseline model with just one instrument (*TEMPORARY_PROV*), finding very similar results to the one presented in Table 2. Nonetheless, we choose to present the model with both instruments since we can test for the overidentifying restrictions.

Second, we use the Kraay's (2012) Bayesian approach to build confidence intervals for instrumental variable regressions with weak exclusion restrictions. The first stage regressions reported in Table 2 (and in the other Annex Tables) should have convinced the reader that our instruments are relevant, i.e they are correlated with *TEMPORARY*. What is probably more challenging is the excluding restriction. We have discussed why the share of temporary workers and of migrants in the province should not affect the firm's decision to offshoring. This assumption is supported by some basic correlations at province level.[18] Anyway, we can imagine that some skeptical reader may not be fully convinced. Hence, we adopt a Bayesian approach recently developed by Kraay (2012) for 2SLS exactly identified models to see what happens if we relax our exclusion restriction. According to Kraay (2012, p. 112), the assumption that the instrument is not correlated with the error term of the structural equation "*is likely to be a poor approximation to the actual prior belief of empirical researchers*." In a nutshell, the Kraay's Bayesian approach quantifies the consequence of prior uncertainty on the validity of the exclusion restriction and maps the degree of uncertainty on the precision of the estimate of the structural parameter.[19] Simulations show that even moderate prior uncertainty can have a large effect on the precision of the estimated parameters. We use the Kraay's approach in a linear model identical to the one with *TEMPORARY_PROV* as a unique instrument (as the one reported in Table 7, columns 4 and 5) to examine the consequence of weakening our priors about the validity of the exclusion restriction. We find that a strong violation of our exclusion restriction yields very large confidence interval (Table 8). In particular, when η=10 (implying that uncertainty is high, since there is a 90 percent probability that the correlation Φ between the error term and the instrument is between -0.34 and +0.34), the confidence interval of the coefficient on *TEMPORARY* is more than seven times larger than those of the IV regressions in which the correlation is assumed to be zero. However, when uncertainty is lower (η=200) so that the 90% confidence interval of Φ is (-0.08, 0.08), the confidence interval of the coefficient on *TEMPORARY* becomes only twice larger than that of the IV estimates. With η=500 the confidence intervals are even closer, suggesting that a small relaxation of the excluding restriction would not affect the validity of our main result.

6. Concluding remarks

The fragmentation of production processes and an increasing flexibility of the labor force are two growing features of the global economy. In this paper, we take Italy as a representative case study

[18] The correlation coefficients between the share of offshoring firms in 2006 and (i) the share of temporary workers; (ii) the share of migrants are, respectively, 0.12 and 0.04 and they are not significant at the 10% level of confidence.
[19] See the notes to Table 8 and Kraay (2012) for a more detailed and formal description of this Bayesian technique.

to assess whether the use of a more flexible labor force acts as a substitute to offshoring, or whether it further enhances delocalization. Firms engaging in offshoring are generally moved by cost-savings reasons and by the necessity to be closer to new potential markets. The replacement of permanent with temporary workers, made possible by recent legislative reforms in the Italian labor markets, could partially offset the potential advantages of offshoring, reducing in particular dismissal costs and increasing numerical flexibility. Alternatively, a more flexible occupational mix could make it easier to substitute domestic with foreign labor, making easier to firms to reap the potential benefits of offshoring opportunities.

The estimation of a model aimed at explaining the firm's propensity to offshore, based on a representative sample of Italian manufacturers, shows that there is a negative correlation between labor flexibility and offshoring, suggesting that the two phenomena can be substitute rather than complements. However, the OLS estimates are likely to be negatively biased. The cost-saving strategies driving offshoring firms reduce the relative demand for unskilled tasks, where temporary jobs are concentrated, and may introduce a negative correlation between the current labor force composition and the future delocalization choice. Once we control for the endogeneity of the share of temporary workers and for spurious correlation, we find that the share of temporary workers does no more contribute to explain the firms' propensity to offshoring. This means that the negative correlation between labor flexibility and subsequent delocalization observed in the data (Figure 1) cannot be interpreted as causation. More precisely, we cannot reject the null hypothesis that labor flexibility has no effect on the propensity to offshoring. While we recognize that our paper does not provide a definitive result, we believe it significantly contributes to the literature and to the policy discussion.

Our results suggest that, on the basis of the available evidence, we should not bother too much about the interaction between labor force flexibility and offshoring decisions. In particular, political support for labor market reforms aimed at further liberalizing the labor market should not be sought after on the implicit threat that firms would otherwise relocate their production abroad. According to our estimates, a solid argument that labor flexibility and offshoring are substitutes has still to be made.

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Annex: Additional tables

Table 3: Static model

Dep. Var.: *OFFSHORING*$_{2006}$	(1) OLS	(2) PROBIT	(3) 1st stage	(4) 2SLS	(5) 1st stage	(6) IVPROBIT
EXPORT	0.069***	0.789***	-0.000	0.069***	-0.000	0.720***
	[0.013]	[0.216]	[0.011]	[0.011]	[0.011]	[0.246]
INNOVATION	0.034**	0.262***	0.003	0.032**	0.003	0.234**
	[0.013]	[0.091]	[0.008]	[0.014]	[0.008]	[0.100]
SIZE	0.024***	0.171***	0.000	0.024***	0.000	0.157***
	[0.008]	[0.041]	[0.004]	[0.008]	[0.004]	[0.046]
SKILL INTENSITY	0.115***	0.789***	-0.013	0.120***	-0.013	0.764***
	[0.024]	[0.143]	[0.017]	[0.024]	[0.017]	[0.156]
MULTIPLE LENDING	0.004**	0.021**	-0.001	0.005**	-0.001	0.021**
	[0.002]	[0.009]	[0.001]	[0.002]	[0.001]	[0.008]
NEGATIVE SALES	0.045**	0.325***	0.003	0.044***	0.003	0.294***
	[0.016]	[0.090]	[0.011]	[0.016]	[0.011]	[0.114]
TEMPORARY	-0.140***	-3.372***		0.339		0.271
	[0.033]	[1.152]		[0.491]		[2.959]
MIGRANTS_PROV			-1.518***		-1.444***	
			[0.473]		[0.459]	
TEMPORARY_PROV			0.433***		0.440***	
			[0.134]		[0.130]	
Observations	915	915	915	915	915	915
R^2	0.080		0.019	0.011		
Pseudo R^2		0.194				
Overidentification				0.772		
Underidentification				0.045		
Weak instrument				11.909		

Notes: The table reports the coefficients and, in brackets, the associated standard errors clustered by region. * Significant at 10%; ** significant at 5%; *** significant at 1. At the bottom of the table we report some diagnostic tests. In particular, for the 2SLS we report the p-value of: 1) the Sargan-Hansen test of overidentifying restrictions (OIR) tests the null hypothesis that the instruments are uncorrelated with the error term; 2) the Kleibergen–Paap rk LM-statistic testing the null hypothesis that the excluded instruments are not correlated with the endogenous regressor; and 3) the Kleibergen–Paap rk Wald F-statistic testing for weak identification. All regressions include 13 industry dummies, 4 macro area dummies, and a constant, not shown for reasons of space.

Table 4: Alternative definition of temporary workers

Dep. Var.:	(1)	(2)	(3)	(4)	(5)	(6)
OFFSHORING$_{2006}$	OLS	PROBIT	1st stage	2SLS	1st stage	IVPROBIT
OFFSHORING$_{2003}$	0.256***	1.013***	0.012	0.252***	0.012	0.870***
	[0.063]	[0.242]	[0.013]	[0.062]	[0.013]	[0.293]
EXPORT	0.063***	0.837***	-0.014	0.068***	-0.014	0.782***
	[0.014]	[0.277]	[0.016]	[0.014]	[0.016]	[0.292]
INNOVATION	0.041***	0.324***	0.009	0.038***	0.009	0.268**
	[0.012]	[0.109]	[0.009]	[0.014]	[0.009]	[0.133]
SIZE	0.007	0.071	-0.012**	0.011	-0.012***	0.101*
	[0.012]	[0.067]	[0.005]	[0.012]	[0.005]	[0.055]
SKILL INTENSITY	0.094***	0.781***	0.014	0.088***	0.014	0.651***
	[0.024]	[0.131]	[0.027]	[0.019]	[0.027]	[0.148]
MULTIPLE LENDING	0.005**	0.028***	-0.000	0.005**	-0.000	0.025***
	[0.002]	[0.009]	[0.001]	[0.002]	[0.001]	[0.008]
NEGATIVE SALES	0.037*	0.302***	0.009	0.035**	0.009	0.250**
	[0.020]	[0.104]	[0.013]	[0.017]	[0.013]	[0.107]
TEMPORARY & PROJECT	-0.134***	-2.687***		0.211		0.606
	[0.030]	[0.712]		[0.432]		[2.395]
MIGRANTS_PROV			-1.615**		-1.613**	
			[0.612]		[0.644]	
TEMPORARY_PROV			0.560***		0.560***	
			[0.151]		[0.149]	
Observations	905	905	905	905		905
R^2	0.144		0.028	0.085		
Pseudo R^2		0.216				
Overidentification				0.917		
Underidentification				0.037		
Weak instrument				17.650		

Notes: The table reports the coefficients and, in brackets, the associated standard errors clustered by region. * Significant at 10%; ** significant at 5%; *** significant at 1. *TEMPORARY & PROJECT* is the share of fixed-term direct-hire employees plus project workers over total dependent employees, in 2003. At the bottom of the table we report some diagnostic tests. In particular, for the 2SLS we report the p-value of: 1) the Sargan-Hansen test of overidentifying restrictions (OIR) tests the null hypothesis that the instruments are uncorrelated with the error term; 2) the Kleibergen–Paap rk LM-statistic testing the null hypothesis that the excluded instruments are not correlated with the endogenous regressor; and 3) the Kleibergen–Paap rk Wald F-statistic testing for weak identification. All regressions include 13 industry dummies, 4 macro area dummies, and a constant, not shown for reasons of space.

Table 5: Additional controls

Dep. Var.:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
OFFSHORING$_{2006}$	OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS
OFFSHORING$_{2003}$	0.236***	0.232***	0.267***	0.263***	0.251***	0.242***	0.247***	0.240***	0.253***	0.253***
	[0.052]	[0.052]	[0.055]	[0.053]	[0.053]	[0.054]	[0.053]	[0.054]	[0.058]	[0.057]
EXPORT	0.056***	0.057***	0.064***	0.064***	0.058***	0.057***	0.061***	0.061***	0.061***	0.061***
	[0.012]	[0.011]	[0.017]	[0.015]	[0.013]	[0.011]	[0.013]	[0.011]	[0.013]	[0.011]
INNOVATION	0.030**	0.027*	0.030**	0.029**	0.031**	0.029**	0.038**	0.036***		
	[0.013]	[0.014]	[0.012]	[0.012]	[0.012]	[0.013]	[0.014]	[0.014]		
SIZE	0.013	0.014*	0.013	0.013	0.014	0.013	0.007	0.006	0.002	0.003
	[0.009]	[0.008]	[0.012]	[0.011]	[0.010]	[0.010]	[0.011]	[0.010]	[0.009]	[0.009]
SKILL INTENSITY	0.093***	0.103***	0.076**	0.077***	0.100***	0.106***	0.086***	0.090***	0.088***	0.100***
	[0.028]	[0.034]	[0.027]	[0.026]	[0.024]	[0.026]	[0.021]	[0.024]	[0.030]	[0.031]
MULTIPLE LENDING	0.003	0.003	0.004**	0.004**	0.005**	0.005**	0.005*	0.005**	0.006***	0.007***
	[0.003]	[0.003]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]
NEGATIVE SALES	0.030*	0.028*	0.046**	0.045**	0.041**	0.041**	0.042**	0.041***	0.059***	0.057***
	[0.017]	[0.015]	[0.018]	[0.018]	[0.017]	[0.016]	[0.016]	[0.015]	[0.019]	[0.018]
TEMPORARY	-0.150***	0.264	-0.170***	-0.004	-0.169***	0.297	-0.166***	0.191	-0.152***	0.197
	[0.035]	[0.581]	[0.036]	[0.424]	[0.033]	[0.473]	[0.034]	[0.511]	[0.037]	[0.756]
AGE	0.002	0.004								
	[0.008]	[0.009]								
CREDIT RATIONED			0.063	0.065*						
			[0.038]	[0.039]						
FAMILY FIRM					0.020	0.013				
					[0.013]	[0.016]				
GROUP							0.015	0.017		
							[0.017]	[0.018]		
R&D INVESTMENT									0.055	0.054*
									[0.032]	[0.033]
Observations	901	901	863	863	903	903	910	910	733	733
R-squared	0.133	0.071	0.151	0.118	0.143	0.077	0.139	0.089	0.145	0.097
Overidentification		0.624		0.868		0.922		0.755		0.485
Underidentification		0.064		0.048		0.049		0.043		0.118
Weak instrument		11.280		13.396		12.778		11.611		5.031

Notes: The table reports the coefficients and, in brackets, the associated standard errors clustered by region. For the sake of brevity, we report only the linear probability model estimates (OLS and 2SLS). * Significant at 10%; ** significant at 5%; *** significant at 1. *AGE* is the logarithm of firm's age from inception in 2006; *CREDIT RATIONED* is a dummy equal to one for firms which applied for bank credit but did not obtain the quantity demanded in 2006; *FAMILY FIRM* is a dummy equal to one for family firms in 2006; *GROUP* is a dummy for firms which were part of a business group in 2006; *R&D INVESTMENT* is a dummy for firms which undertook investment in R&D in the period 2004-2006. At the bottom of the table we report some diagnostic tests. In particular, for the 2SLS we report the p-value of: 1) the Sargan-Hansen test of overidentifying restrictions (OIR) tests the null hypothesis that the instruments are uncorrelated with the error term; 2) the Kleibergen–Paap rk LM-statistic testing the null hypothesis that the excluded instruments are not correlated with the endogenous regressor; and 3) the Kleibergen–Paap rk Wald F-statistic testing for weak identification. All regressions include 13 industry dummies, 4 macro area dummies, and a constant, not shown for reasons of space.

Table 6: Regressions for low- and high-tech sectors

Dep. Var.: $OFFSHORING_{2006}$	(1)	(2)	(3)	(4)
	OLS		2SLS	
	Low-tech	High-tech	Low-tech	High-tech
$OFFSHORING_{2003}$	0.225**	0.260***	0.208**	0.253***
	[0.082]	[0.061]	[0.085]	[0.093]
EXPORT	0.066***	0.043**	0.064***	0.039
	[0.018]	[0.016]	[0.014]	[0.032]
INNOVATION	0.029*	0.052*	0.029**	0.060
	[0.014]	[0.028]	[0.013]	[0.072]
SIZE	-0.012	0.050***	-0.009	0.053**
	[0.009]	[0.016]	[0.009]	[0.027]
SKILL INTENSITY	0.139**	-0.026	0.138***	-0.046
	[0.054]	[0.072]	[0.050]	[0.122]
MULTIPLE LENDING	0.008***	-0.006**	0.008***	-0.007
	[0.003]	[0.002]	[0.002]	[0.005]
NEGATIVE SALES	0.053**	0.03	0.050**	0.026
	[0.023]	[0.032]	[0.021]	[0.034]
TEMPORARY	-0.153***	-0.310***	0.395	-0.807
	[0.042]	[0.080]	[0.361]	[3.091]
Observations	623	292	623	292
R^2	0.157	0.164	0.058	0.125
Overidentification			0.976	0.476
Underidentification			0.080	0.414
Weak instrument			9.068	0.809

Notes: The table reports the coefficients and, in brackets, the associated standard errors clustered by region. For the sake of brevity, we report only the linear probability model estimates (OLS and 2SLS). * Significant at 10%; ** significant at 5%; *** significant at 1.Low- and High-tech sectors are defined using the 2-digit ATECO industry classification and following the OECD classificatory scheme based on R&D intensity: high-technology, medium-technology, and low-technology industries (see Pol et al. 2002). At the bottom of the table we report some diagnostic tests. In particular, for the 2SLS we report the p-value of: 1) the Sargan-Hansen test of overidentifying restrictions (OIR) tests the null hypothesis that the instruments are uncorrelated with the error term; 2) the Kleibergen–Paap rk LM-statistic testing the null hypothesis that the excluded instruments are not correlated with the endogenous regressor; and 3) the Kleibergen–Paap rk Wald F-statistic testing for weak identification. All regressions include 13 industry dummies, 4 macro area dummies, and a constant, not shown for reasons of space.

Table 7: Exact identification

Dep. Var.: *OFFSHORING*$_{2006}$	(1) OLS	(2) PROBIT	(3) 1st stage	(4) 2SLS	(5) 1st stage	(6) IVPROBIT
OFFSHORING$_{2003}$	0.246***	0.971***	0.018	0.237***	0.018	0.749**
	[0.054]	[0.202]	[0.016]	[0.058]	[0.015]	[0.337]
EXPORT	0.061***	0.740***	-0.001	0.061***	-0.001	0.637**
	[0.013]	[0.209]	[0.011]	[0.011]	[0.011]	[0.284]
INNOVATION	0.034**	0.255***	0.004	0.032**	0.004	0.210*
	[0.013]	[0.099]	[0.009]	[0.013]	[0.008]	[0.110]
SIZE	0.012	0.121***	-0.000	0.012	-0.000	0.108**
	[0.010]	[0.046]	[0.004]	[0.009]	[0.004]	[0.046]
SKILL INTENSITY	0.086***	0.710***	-0.015	0.092***	-0.015	0.670***
	[0.022]	[0.123]	[0.016]	[0.027]	[0.015]	[0.147]
MULTIPLE LENDING	0.005**	0.024**	-0.001	0.005**	-0.001	0.023***
	[0.002]	[0.010]	[0.001]	[0.002]	[0.001]	[0.008]
NEGATIVE SALES	0.042**	0.350***	0.003	0.041***	0.003	0.295**
	[0.016]	[0.086]	[0.011]	[0.015]	[0.011]	[0.129]
TEMPORARY	-0.167***	-3.749***		0.311		1.208
	[0.034]	[1.265]		[0.636]		[3.385]
TEMPORARY_PROV			0.465***		0.465***	
			[0.143]		[0.142]	
Observations	915	915	915	915	915	915
R^2	0.137		0.017	0.071		
Pseudo R^2		0.205				
Underidentification				0.035		
Weak instrument				10.497		

Notes: The table reports the coefficients and, in brackets, the associated standard errors clustered by region. * Significant at 10%; ** significant at 5%; *** significant at 1. At the bottom of the table we report some diagnostic tests. In particular, for the 2SLS we report the p-value of: 1) the Kleibergen–Paap rk LM-statistic testing the null hypothesis that the excluded instruments are not correlated with the endogenous regressor; and 2) the Kleibergen–Paap rk Wald F-statistic testing for weak identification. All regressions include 13 industry dummies, 4 macro area dummies, and a constant, not shown for reasons of space.

Table 8: Testing for weak exclusion restrictions

	β on *TEMPORARY*		
η	median	95% confidence interval	
5	0.314	-14.194	15.360
10	0.312	-9.919	10.898
100	0.317	-3.052	4.090
200	0.316	-2.226	3.311
500	0.317	-1.596	2.648
999	0.314	-1.030	2.071
Standard IV	0.311	-1.026	1.648

Notes: Results are estimated using GRETL (Cottrell and Lucchetti 2012) and they refer to the specification of equation (1) as estimated by 2SLS in Table 7, columns 3 and 4, with *TEMPORARY_PROV* and only instrument for *TEMPORARY* and robust standard errors. Following Kraay (2012, p. 114), the parameter η is the inverse of the degree of prior uncertainty about the validity of the exclusion restriction. Specifically, let Φ be a uniformly distributed random variable over the support (-1,1), prior uncertainty about the exclusion restriction is approximated with the following prior distribution over the correlation between the reduced-form error and the instrument, Φ: $g(\Phi) = (1 - \Phi^2)^{\eta}$. In particular, when η=0, the prior is uniformly distributed over (-1,+1). As η increases, the prior becomes more concentrated around zero, and in the limit we approach the standard assumption that Φ=0 with probability one (the standard IV assumption). Setting η=500 corresponds to the rather strong prior belief that there is a 90% probability that g(Φ) ranges between -0.05 and +0.05, while η=200 (η=10) correspond to a prior belief of g(Φ) being between -0.08 and +0.08 (-0.34 and +0.34).