DOCUMENTOS DE TRABAJO

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N° 832 Mayo 2019

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Documentos de Trabajo del Banco Central de Chile
Working Papers of the Central Bank of Chile
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Documento de Trabajo
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Extracting Information of the Economic Activity from Business and Consumer Surveys in an Emerging Economy (Chile)*

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Abstract

The present paper discusses the extent to which business and consumer survey observations are useful for predicting the Chilean activity. The two surveys examined are called IMCE and IPEC, after their Spanish abbreviations, for the business and consumer survey, respectively. The baseline exercises consist in simple calculations of cross correlations between the surveys and activity variables, test for Granger causality and augmentation of autoregressive activity models with survey data to evaluate if the now- and forecast performances are improved. The evidence suggests that both surveys, in general, contain useful information for making predictions of the Chilean activity, particularly for the longer horizons. An additional exercise indicates that the data in the two surveys are complementary in the sense that the longer horizon forecasts improve further when both of them are included in the econometric model.

Resumen

El presente artículo discute la medida en que las encuestas de percepción a empresas y consumidores contienen información útil para predecir la actividad económica en Chile. Las encuestas utilizadas son las correspondientes a los índices IMCE e IPEC, para las empresas y consumidores, respectivamente. Los ejercicios base consisten en cálculos simples de coeficientes de correlación entre los indicadores extraídos de las encuestas y variables de actividad, pruebas de causalidad a la Granger y modelos de actividad autorregresivos aumentados con datos de encuestas para evaluar si su inclusión mejora el desempeño de las proyecciones. La evidencia sugiere que ambas encuestas, en general, contienen información útil para hacer predicciones de la actividad en Chile, particularmente para los horizontes más largos. Un ejercicio adicional indica que la información de dichas encuestas es complementaria, en el sentido de que las proyecciones mejoran al incluir ambos indicadores en el modelo econométrico.

* *We are grateful for the comments and suggestions of an anonymous referee and from the participants at the Statistics Workshop on Economic Tendency Surveys organized by the Central Bank of Chile in November 2017. The usual disclaimers apply and the views and conclusions expresses in this paper are of the authors and do not represent the opinions of the Central Bank of Chile or its board members.*
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1. Introduction

Business and consumer surveys are designed to evaluate the people's sentiments about the current state of the economy as well as their expectations for the nearest future. The outcomes of the surveys are used by policy makers and the private sector to assess the respondents' perception of the economy and the overall business environment. Several studies are dedicated to evaluating the informational content of the surveys and the present paper contributes to this line of research with an empirical analysis with Chilean observations. More precisely, it analyzes whether the business and consumer surveys contain useful information about current and future economic activity compared to what is already included in historical observations.

In general, the results suggest that the Chilean sentiments surveys lead activity indicators in the sense that they Granger-cause activity, whereas the activity indicators do not seem to cause the surveys. As for short-term forecasting (up to one year ahead), simple autoregressive distributed lag (ADL) models suggest that the surveys generally do have some predictive content, especially for the longer horizons. There are some indications that the surveys are complementary in the sense that the predictions for the longer horizons seem to improve when both of them are included in the model.

Since results of tendency surveys are published in a relatively timely fashion, they are useful in the assessment of the conjunctural analysis as economic activity data are published with, on some occasions, considerable, time delay. Furthermore, surveys usually contain questions on the future economic development and, indeed, there seems to be a consensus in the literature that they do contain information useful for predicting real activity.[1] With respect to consumer surveys, early studies such as Fuhrer (1993), Carroll et al. (1994) and Matsusaka and Sbordone (1995) document a link between consumer confidence and future economic activity. In a recent study, Ahmed and Cassou (2016) argue that consumer confidence shocks are likely to reflect news during economic expansions and are consistent with animal spirit

[1] *The usefulness of survey indicators, combined with other economic variables, in now- and forecasting economic activity has been demonstrated by e.g. Giannone et al. (2008), Lahiri and Monokroussos (2013), and Christiansen et al. (2014) for the US; Frale et al. (2010), Banbura and Rünstler (2011), Carriero and Marcellino (2011), and Keeney et al. (2012) for Europe and the euro area; Bragoli (2017) for Japan; Matheson (2010) for New Zealand; Luciani and Ricci (2014) for Norway; Modugno et al. (2016) for Turkey; and Dahlhaus et al. (2017) for BRIC countries and Mexico.*

during contractions. Kim (2016) finds that consumer sentiments can be driven by economic as well as non-economic factors, such as the emotional state.[2] Likewise, business surveys have been shown to contain information that helps to predict macroeconomic activity, for example by Garcia-Ferrer and Bujosa-Brun (2000) for six OECD countries, Hansson et al. (2005) and Österholm (2014) for Sweden, and Kaufmann and Scheufele (2017) for Switzerland.

The existing evidence of surveys' usefulness for tracking and predicting activity is mainly for developed countries, where surveys have been conducted for longer periods than in most emerging economics.[3] Some exceptions are those of Vázquez et al. (2009) for Uruguay and de Mello and Figueiredo (2014) for Brazil. For Chile, OECD (2011) includes components of the Chilean Business Survey in the composite leading indicator for this country,[4] while Central Bank of Chile (2015) analyzes the connection between Chilean business expectations and investment. Pincheira (2014) applies Chilean data from 2003 to 2013 to study the relation between total and sectorial employment and business confidence. He finds some evidence that the survey data contain useful information for predicting employment, more so for the total employment than for specific sectors of the economy. In a recent application, Chanut et al. (2018) focus on sub-indicators of five Chilean qualitative opinion surveys. The study contains a thorough description of the surveys, explores interdependence between them and performs forecast exercises for consumption and investment. The authors calculate twelve new sub-indicators based on the surveys and their results suggest some predictive gains when employing them.

In line with these studies, the one in hand analyzes whether a business survey and a consumer survey from Chile contain useful information, compared to that already included in historical observations, for now- and forecasting the overall macroeconomic activity as well as variables that are related to the survey questions. In this respect, the study updates and expands that of Pedersen (2009b), which was made with less than six years of Chilean

[2] Pedersen (forthcoming) employs sentiments as proxies for forecasters´ mood and shows that they can explain the biases in their output growth and inflation nowcasts.
[3] The paper by Gallardo and Pedersen (2008) contains an evaluation of business surveys for the manufacturing sector in Latin American countries.
[4] The composite leading indicators for Chile calculated by Gallardo and Pedersen (2007) and Pedersen (2009a) do not include sentiment indicators because of too few data available.

business survey data available. Similar analyses are those by Deitz and Steindel (2005) with US data, Klein and Özmucur (2010) for European countries and de Mello and Figueiredo (2014) for Brazil.

After a brief description of the surveys in section 2, section 3 presents some exercises with the objective of assessing the extent to which the Chilean business and consumer surveys anticipate economic activity. The last section offers some concluding remarks. The data employed are described in appendix A, while the appendices B to D report the results of tests and robustness exercises.

2. The surveys

Generally speaking, business surveys consult managers about the current and future state of their companies or organizations. The questions refer to the enterprises' assessment of current production, orders, employment and/or stocks, as well as expectations for the immediate future. Consumer confidence surveys, on the other hand, measure how optimistic or pessimistic consumers are with respect to their current and future personal situation and their assessment of the national economy. This section presents, firstly, the Chilean business survey employed in the analysis and, secondly, that of the consumers.[5]

2.1. The business survey

The business survey applied in this paper (IMCE[6]) was developed by the Central Bank of Chile and outsourced to ICARE[7] and Universidad Adolfo Ibáñez under a tender procedure. The survey was launched in November 2003 and covers private and public companies from four sectors of the economy: retail, manufacturing, mining, and construction, which together account for approximately 35% of the Chilean economy. Table 1 shows the sectors' participation and number of surveyed firms. The sampling considers forced inclusion of the

[5] *While other business and consumer surveys do exist in Chile (see e.g. Chanut et al. (2018)), the ones analyzed in the present document were chosen because of their monthly frequencies and the availability of historical observations.*
[6] *For its Spanish abbreviation: Indicador Mensual de Confianza Empresarial.*
[7] *A private organization dedicated to promoting principles, values and concepts, which inspires the development of private firms and agents of national progress and stands for the rational administration of enterprises.*

largest companies and random selection of the others; forced inclusion is based on value added in the case of mining and sales in the rest of the sectors.

Table 1. IMCE. Sectors' participation

Economic sector	No. of firms	Sector participation	Measure of participation
Retail	179	23%	Sales
Manufacturing	281	35%	Sales
Mining	11	74%	Aggregate value
Construction	136	21%	Sales
Total	607	16%	Weighted sum

Source: Technical specifications, http://www2.icare.cl/imce/ficha.htm. The weights are from 2010.

The survey is conducted monthly and the questionnaires were designed as recommended by the Handbook of the Organization for Economic Co-operation and Development (OECD, 2003) with some exceptions; for example, the Chilean respondents are not asked to adjust their answers to account for seasonal effects, as recommended by the OECD, and in Chile questions about "order books" are formulated in terms of demand. These modifications were incorporated for the sake of clarity of the questions.[8] Furthermore, because of its economic importance, the mining sector is included in the survey.

The confidence indicators are constructed from response balances (B_j), based on the principle that every variable is a function of the percentage of favorable (F_j), unfavorable (U_j) and neutral (N_j) answers: $B_j = F_j - U_j$. Each B_j is standardized to a scale of 0 to 100, where levels above 50 indicate optimism, 50 neutrality and below 50 pessimism. The indicators consider the following variables:

1. Future production trends: will it increase, decrease or remain?
2. Demand level (current orders): is it above, below or at the "normal" level?
3. Inventory level (negative sign): is it excessive, adequate or insufficient?
4. Current business situation: is it good, satisfactory or poor?
5. Business expectations (3 months ahead): will it be less favorable, more unfavorable or unchanged?
6. Expected employment evolution: will it increase, decrease or remain?

[8] *See also Gallardo and Pedersen (2008).*

The four sectorial indices are calculated as shown in table 2.

Table 2. IMCE sectorial indices calculation

Index definition	Components
Retail:	
$ICOM = \frac{1}{2}\left(\frac{SEA + SEF - IPV}{3} + 100\right)$	*SEA*/*SEF*: the general situation of the firm's current and future state, respectively. *IPV*: the balance of inventories for sale.
Manufacturing:	
$ICIN = \frac{1}{2}\left(\frac{PE + DT - IPT}{3} + 100\right)$	*PE:* the balance of the expected production. *DT:* the balance of current production. *IPT*: the balance of current inventories.
Mining:	
$ICMI = \frac{1}{2}\left(\frac{PE + DT - IPT}{3} + 100\right)$	*PE:* the balance of the expected production. *DT*: the balance of current production. *IPT*: the balance of current inventories.
Construction:	
$ICOT = \frac{1}{2}\left(\frac{DT + E}{2} + 100\right)$	*DT*: the balance of current production. *E*: the balance of expected employment.

The overall index of business confidence (IMCE) is then calculated as:

$$IMCE = w_1 ICOM + w_2 ICIN + w_3 ICMI + w_4 ICOT,$$

where w_i (i = 1,2,3,4) is the sectorial weight defined as the share of each sector in the value added of the four sectors in the GDP, last time updated in 2010.

As mentioned earlier, the survey questions are formulated without taking into account the common seasonality and, hence, the indices may be expected to show seasonal patterns. This is indeed the case shown in figure 1 with the original non-seasonally (NSA) and seasonally (SA) adjusted series, and supported by the tests reported in table B1 in appendix B.[9] Note the relatively high volatility in ICMI, which is due to relatively few companies in the sample such that a missing reply from a firm may have a large impact on the index.[10]

[9] *For robustness the now- and forecast exercises were also performed with NSA observations. The results are presented in appendix C. Generally the results with SA data do not change much if applying NSA data.*
[10] *Three firms produce approximately two thirds of the copper in Chile.*

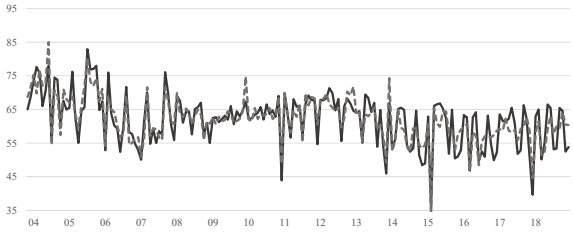
Figure 1. IMCE diffusion indices
(Solid lines: NSA. Dotted lines: SA)

a. Overall index (IMCE)

b. Retail (ICOM)

c. Manufacturing (ICIN)

d. Mining (ICMI)



e. Construction (ICOT)

Notes: Observations from November 2003 to December 2018. SA series are calculated with X-13-ARIMA.

2.2. The consumer survey

The Chilean consumer confidence index utilized in this analysis (IPEC[11]) measures the perception of current and expected personal and nationwide economic situation. The design of the survey is based on the "Index of Consumer Sentiment" of the Michigan University. It is available on a yearly basis from 1981 to 1985, quarterly from 1986 to 2001, and monthly thereafter. It is collected by GfK Adimark (a private company) and commissioned by the Central Bank of Chile. The survey sample is random and considers around 1,100 people over 18 years old, residing in 18 of the largest cities in Chile.

[11] *For its Spanish abbreviation: Índice de Percepción de la Economía.*

The overall IPEC index is constructed as an average of five sub-indexes, calculating the net optimism fraction of answers. The index is distributed in the range between 0 and 100.

IPEC sub-indices are based on the following questions:[12]

1. Current national economic situation: is it good, modest, or bad?
2. Future national economic situation: will it be good, modest, or bad in the next 12 months?
3. Expected national economic stability: the most probable economic situation in the next five years is that it will be consistently good or there will be periods with high unemployment and recession?
4. Current personal economic situation: is it better, worse or the same as one year ago?
5. Willingness to purchase durable goods: is it a good or bad moment to buy goods for your household?

For each of these questions, the following index is constructed: $X_i = (\%positive - \%negative) + 100$. Then, the IPEC index is calculated as follows:[13]

$$IPEC = \frac{1}{10}\sum_{i=1}^{5} X_i.$$

As with the business surveys, the indices calculated for the Chilean consumer surveys are not adjusted by seasonality. Figure 2 shows the original IPEC index and sub-indices, and the indices seasonally adjusted using the X-13-ARIMA method. According to figure 2, responses referring to current personal and national economic situation, willingness to purchase durable goods and future national economic situation (12 months' expectation) seem to be those mostly affected by seasonality. Table B2 in appendix B presents the tests for seasonality.

[12] *Other questions in the survey not included in the IPEC calculation are: (1) Is the business economic situation better, worse or the same as 1 year ago? (2) Will there be more, less or the same level of unemployment in the next 12 months? (3) Will prices increase in the next 12 months (% of "much")? (4) Will the family's economic situation be better, worse or the same as now in the near future? (5) Is it a good or bad moment to buy durable goods? (6) Is it a good or bad moment to buy a house? (7) Is it a good or bad moment to buy a car?*

[13] *There is also a sub-index for each question, which is constructed as* $X_i = \frac{1}{2}[(\%positive - \%negative) + 100]$.

Figure 2. IPEC index and sub-indices
(Solid line: NSA. Dotted line: SA)

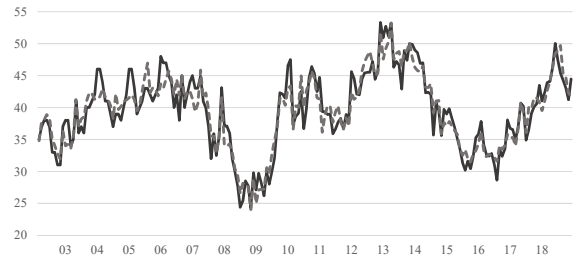
a. Overall index (IPEC)

b. Current national economic situation

c. Future national economic situation (12M)

d. Future national economic situation (5Y)

e. Current personal economic situation



f. Willingness to purchase durable goods

Notes: Observations from March 2002 to December 2018. SA series are calculated with X-13-ARIMA.

3. Surveys' information of Chilean activity

This section studies the usefulness of Chilean business and consumer surveys for assessing the current economic situation and forecasting different macroeconomic indicators. This is done by four exercises: (1) cross correlations with activity indicators, (2) tests for Granger causality in simple bivariate vector autoregressive (VAR) models, (3) estimations of simple ADL models to evaluate the extent to which the survey contains useful information for now- and forecasting activity, (4) evaluation of information contained in sub-indicators i.e.

indicators based on individual questions. Subsection 3.1 presents the results for the business survey, subsection 3.2 those for the consumer survey, while subsection 3.3 discusses the complementarity of the two surveys.[14]

3.1 Extracting information from the business survey

This subsection discusses the information included in the IMCE with respect to now- and forecasting. The exercises presented in the first two subsections are updates of those in Pedersen (2009b). After presenting the cross correlations and tests for Granger causality in subsection 3.1.1, the following one includes the results of the now- and forecasting experiments. The last subsection studies an alternative way of extracting information from the answers to the survey.

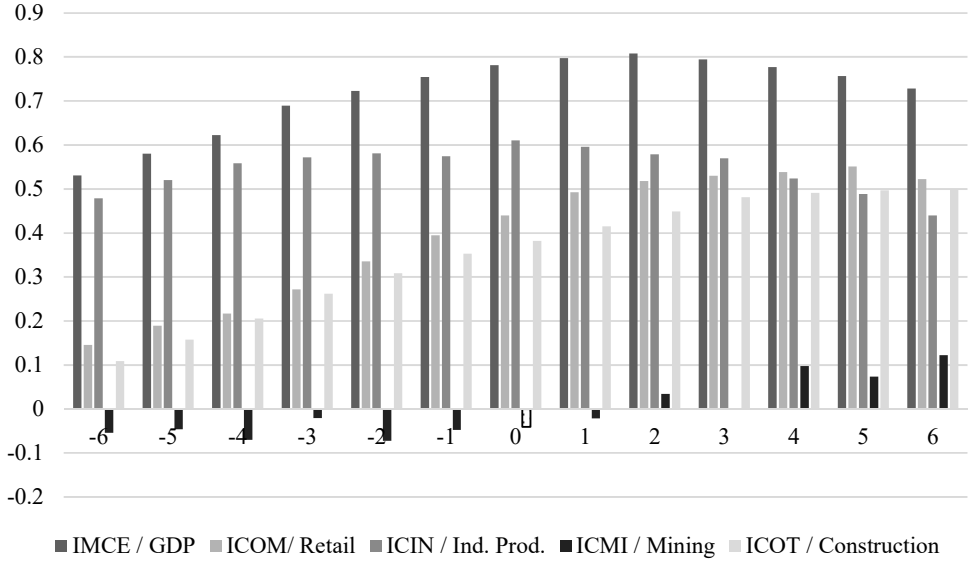
3.1.1. Cross correlations and Granger causality

The cross correlations between different lags and leads of activity variables[15] with the business survey, aggregated and by sectors, are presented in figure 3. Overall the survey seems to be leading economic activity in the sense that the highest correlations are obtained with leads of the activity indicators. The general the IMCE index presents the highest correlation for all horizons with a peak when leading the gross domestic product (GDP) with two months. The retail and construction sectors show similar patterns of increasing cross correlations, with maximums when leading their correspondent activity indicators with between three and five months. For the manufacturing sector, the coefficient is rather stable around 0.5, while the mining sector shows relatively small coefficients for all horizons.

[14] A priori one might expect business surveys to contain better predictive contents than consumer surveys as the questions in the former are formulated about specific economics variables, while those of the consumer survey are often about the perceptions of a current state.

[15] The activity variables correspond to the monthly GDP on the supply side published by the Central Bank of Chile (see Pozo and Stanger, 2009). The data was extracted from the webpage of the Central Bank of Chile and does not include real-time updates, which is the case for all variables employed in the paper and should be taken into account when interpreting the results. In this sense it may be considered as an exercise of forecasting the final observations of published data (or the best estimate of final observations at the time of making the exercise), which seems to be the appropriate use of consumer and business survey observations. A detailed description of the data is presented in appendix A.

Figure 3. Business survey: Cross correlation coefficients



Notes: Negative (positive) numbers on the horizontal axis imply that activity (the survey) is leading the survey (activity). A filled bar indicates that the correlation is statistically significant when applying a 5% significance level.

Tests for Granger causality[16] are presented in Table 3.[17] They indicate that the general index, retail, manufacturing and construction Granger cause the respective activity indicators. For mining, nothing can be concluded with respect to Granger causality. All in all, the evidence presented in this subsection suggests that the surveys do seem to be leading indicators of activity, with the exception of the mining sector.

Table 3. Business survey. Tests of Granger causality (*p*-values)

	IMCE	**Retail**	**Manufacturing**	**Mining**	**Construction**
Activity → survey	0.46	0.67	0.77	0.42	0.57
Survey → activity	**0.00**	**0.00**	**0.00**	0.53	**0.01**

Notes: *p*-values for the null hypothesis of *no* Granger causality tested in bivariate VAR models with the number of lags selected according to the Schwarz information criteria. Data are seasonally adjusted. Bold numbers indicate rejection of the null when applying a 10% significance level.

[16] To obtain Gaussian errors, impulse dummies were included to control for outliers detected by visual inspection. The tests for causality show the same results without or without dummies. Further information of the specific outliers are available upon request.

[17] As noted by Gayer (2010), survey indicators are stationary by their nature. In limited samples, however, the series may behave as non-stationary. In fact, tests often point to non-stationarity for the series applied in the present study. For robustness, the tests for Granger causality were also carried out with Hodrick and Prescott (1997) filtered survey series. The results, which are available upon request, are, unless noted otherwise, similar to the ones reported.

3.1.2. The usefulness of the business survey for now- and forecasting economic activity

The correlations and tests for Granger causality presented in the previous sub-section may indicate some predictive contents in most of the business indices. In this subsection, the predictive power is investigated by means of simple ADL models, which include lags of the annual growth rate of the macroeconomic indicator (x_t) and contemporaneous and lagged effects of the relevant business and consumer surveys (y_t), correspondingly:

$$x_{t+h} = c + \sum_{i=1}^{p} \alpha_i x_{t-i} + \sum_{j=0}^{q} \beta_j y_{t-j} + \varepsilon_t, \quad (1)$$

where ε_t are the errors and the numbers of lags, p and q are determined by Schwarz information criteria. The exercise consists of evaluating the out-of-sample forecasts, and the benchmark used is the simple autoregressive (AR) model,[18] i.e. (1) with $\beta_j = 0$ for $j = 0,1,\dots,q$. Estimations use observations from 2003 to 2013 and the forecast period covers from December 2013 to October 2018.[19] The results are shown in table 4, where root mean square error (RMSE)[20] numbers lower than one indicate that the business survey contains information which is useful for predicting activity.

[18] *It can always be discussed whether the chosen benchmark model is appropriate and in the present exercise it was chosen to employ autoregressive models, to evaluate the extent to which it is possible to improve the prediction by adding to the history of the predicted series. For robustness, the exercises were also carried out with an ARMA(1,1) model, estimated in STATA, as the benchmark. The results are presented in Appendix D and, in general, they are robust to the change of the benchmark model.*

[19] *When data were available at the time of doing the exercises, the forecast period includes observations up to December 2018.*

[20] $RMSE = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(E(x_t) - x_t)^2}$, *where* $E(x_t)$ *is the projection of the variable* x_t *and n is the number of available predictions.*

Table 4. Business survey: Out-of-sample forecasting exercise

		IMCE[(a)]	Ret.	Manuf.	Min.	Const.
Nowcast	RMSE	**0.965**	1.005	**1.009**	0.997	**0.947**
59 obs.	SM better	48.8%	44.2%	51.2%	53.5%	60.5%
1M ahead	RMSE	**1.020**	**0.978**	**1.013**	**0.957**	**0.661**
58 obs.	SM better	45.2%	45.2%	52.4%	64.3%	54.8%
3M ahead	RMSE	**0.829**	**1.010**	**1.015**	**0.806**	**0.203**
56 obs.	SM better	57.5%	47.5%	57.5%	42.5%	60.0%
6M ahead	RMSE	**0.619**	**1.006**	**0.859**	**0.747**	**0.159**
53 obs.	SM better	70.3%	56.8%	67.6%	54.1%	54.1%
1Y ahead	RMSE	**0.523**	**0.888**	**0.810**	**0.740**	**0.101**
47 obs.	SM better	87.1%	64.5%	80.6%	58.1%	77.4%

Notes: "RMSE": RMSE of the survey model divided by the RMSE of the AR model. "SM better": percentage of the observations where the survey model predicts better than the AR model. Bold numbers indicate that the difference is statistically significant when applying a 5% confidence level of the Clark and West (2007) test. [(a)] Includes two more observations. Shaded cell indicates a ratio lower than one, i.e. the RMSE of the survey model is lower than the RMSE of the benchmark model.

Measured by the RMSE, the models including the business survey generally forecast better than the simple AR models especially for the longer horizons, where differences are statistically significant when using the Clark and West (2007) test.[21] For nowcasting and one and three months ahead forecasting, on the other hand, the results are mixed. For the overall, mining and construction indices there are rather large gains when projecting six and twelve months ahead. Finally, when looking at the percentages of cases in which the survey models (SM) make better predictions, the evidence is most clear for the one-year-ahead projections. The overall conclusion is that the Chilean business surveys contain useful information for forecasting activity indicators, particularly for the longer horizons.

3.1.3. Separating between current and future situation

The IMCE general index contains questions regarding current situation of the business and expectations of the short-term state of the business. A valid question regarding this calculation is if it would improve the predictive power of the business survey to split the indices into current and future situation indices. To assess this question, the German ifo Business Climate Index is taken as reference, and an evaluation of the current business situation and business expectations (next six months) is made. According to the ifo methodology, three indices are defined for each sector: general current business situation

[21] *The results of these tests are, however, only indicative as the distribution is only approximate (see Rogoff and Stavrakeva, 2008). Furthermore, the sample of predictions is rather limited, especially for the longer horizon forecasts.*

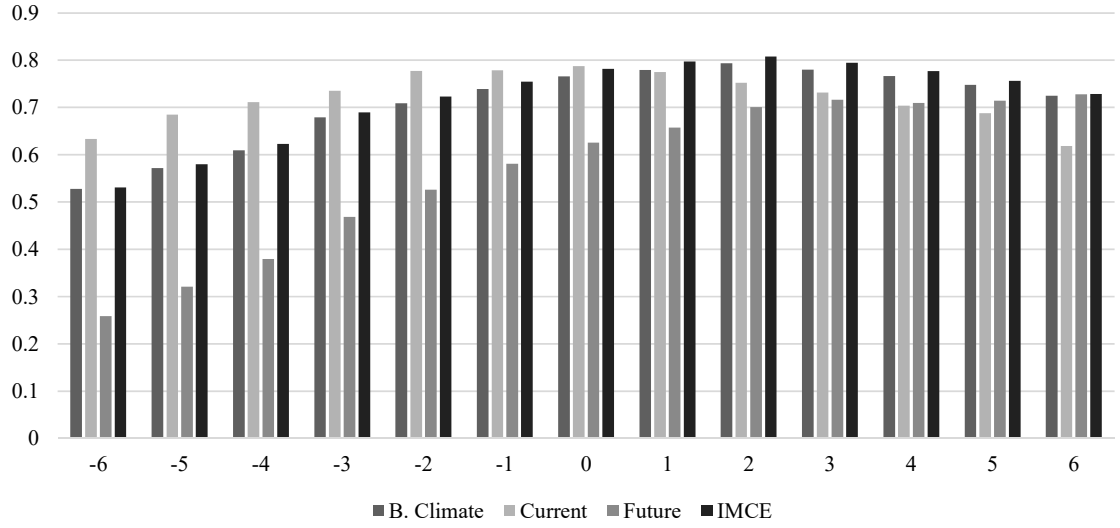
(current), general business expected situation (future) and business climate (BC), which is defined as:

$$BC = \sqrt{(current + 200)(\text{future} + 200)} - 200$$

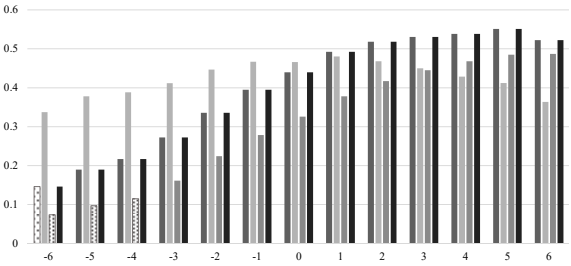
The exercises of sub-sections 3.1.1 and 3.1.2 are replicated for the total and each of the sectors separately. Figure 4 presents the cross correlations of the current situation and expectation indices for each sector, while table 5 reports the ADL model results for the general current business situation and the general business expectations, respectively.

Figure 4. Cross correlation coefficients

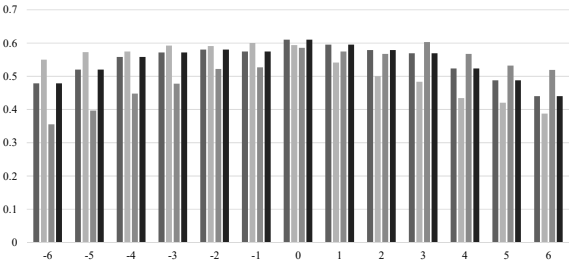
a. IMCE / GDP



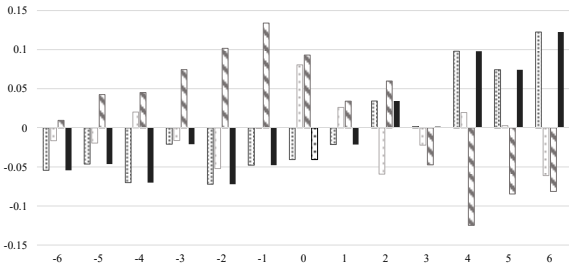
b. ICOM / Retail



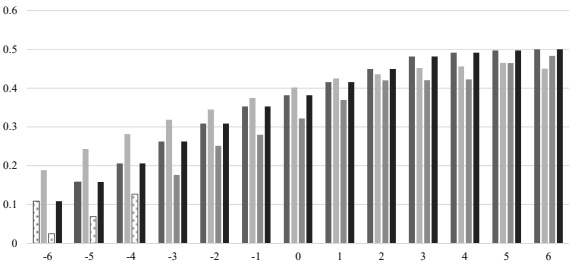
c. ICIN / Manufacturing



d. ICMI / Mining



e. ICOT / Construction



Note: see figure 3.

Figure 4a shows that, compared with the original indicator, the current situation index has a higher correlation with past GDP, but the overall IMCE has higher coefficients with GDP leads. For the four sectors included in the business survey, the results are similar, the current situation index seems to better explain past GDP values, while there is little difference between the correlation coefficients when considering leads of the activity indicators. For the mining sector the correlations are relatively small. The ADL model exercises presented in table 5 confirm the apparently non-significant differences in using the original indices and the ifo-inspired ones for making predictions. In fact, the main part of the statistically significant differences are in favor of the models that included the original surveys. There are, however, a couple of observations where the ifo-inspired models makes better forecasts.

Table 5. Business survey: Out-of-sample forecasting ifo Business Climate exercise

		a. General current business situation				
		IMCE[(a)]	**Ret.**	**Manuf.**	**Min.**	**Const.**
Nowcast	RMSE	**1.074**	0.997	**1.238**	1.001	0.989
59 obs.	ifo better	51.2%	58.1%	34.9%	51.2%	44.2%
1M ahead	RMSE	0.953	0.988	**1.124**	1.001	0.999
58 obs.	ifo better	54.8%	59.5%	26.2%	45.2%	47.6%
3M ahead	RMSE	0.962	0.991	**1.034**	1.009	0.922
56 obs.	ifo better	42.5%	55.0%	22.5%	55.0%	55.0%
6M ahead	RMSE	1.022	1.009	**1.022**	1.034	**0.892**
53 obs.	ifo better	45.9%	40.5%	37.8%	43.2%	62.2%
1Y ahead	RMSE	1.001	1.003	1.083	0.999	0.973
47 obs.	ifo better	58.1%	38.7%	51.6%	48.4%	48.4%

		b. General business expected situation				
		IMCE[(a)]	**Ret.**	**Manuf.**	**Min.**	**Const.**
Nowcast	RMSE	1.011	0.996	1.003	1.001	**1.023**
59 obs.	ifo better	51.2%	58.1%	39.5%	48.8%	41.9%
1M ahead	RMSE	**0.953**	1.006	1.002	1.003	1.011
58 obs.	ifo better	61.9%	52.4%	35.7%	45.2%	42.9%
3M ahead	RMSE	1.009	1.003	**1.056**	0.999	0.906
56 obs.	ifo better	42.5%	52.5%	32.5%	50.0%	55.0%
6M ahead	RMSE	1.028	1.008	**1.084**	1.009	0.968
53 obs.	ifo better	43.2%	48.6%	37.8%	43.2%	45.9%
1Y ahead	RMSE	0.982	0.987	1.011	1.006	0.921
47 obs.	ifo better	61.3%	64.5%	48.4%	45.2%	61.3%

Notes: "RMSE": RMSE of the ADL model that includes the ifo inspired measure divided by the RMSE of the ADL model that includes the survey indicator. "ifo better": Percentage of the observations where the ifo-type model predicts better than the AR model augmented by the survey observations. Bold numbers indicate that the difference is statistically significant according to the Diebold and Mariano (1995) test with the small sample correction of Harvey et al. (1997) when applying a 5% confidence level. [(a)] Includes two more observations. Shaded cell indicates a ratio lower than one, i.e. RMSE of the survey model is lower than the RMSE of the benchmark model.

3.2. Extracting information from the consumer survey

The exercises for the consumer survey presented in this subsection mirror those discussed in the previous one with respect to correlations, causality and predictions. The last subsection evaluates the informational content in consumer survey questions that are not included in the overall IPEC calculation.

3.2.1. Cross correlations and Granger causality

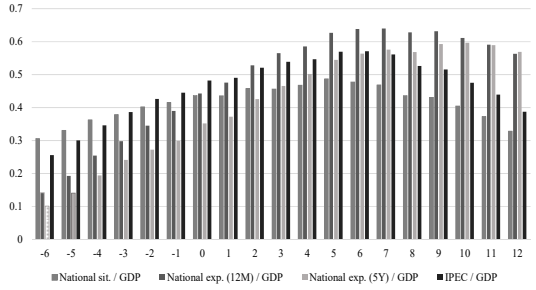
Since the questions included in the consumer survey are not associated with a specific sector, as they are in the business survey, different economic variables are used to calculate the correlation coefficients. Questions regarding the national economic situation are evaluated with respect to the GDP, while the questions about the personal situation are compared, separately, with retail sales and employment rate. The question about the willingness to purchase durable goods is compared with the retail sales and the durable goods retail sales.

The cross correlations between the consumer survey and lags and leads of the economic activity are presented in figure 5. In general, the survey seems to be leading the activity as the highest correlation coefficients are obtained with leads of the growth and employment indicators. Figure 5a contains the questions about the current and expected national economic situation, where the correlation coefficients are similar with an increasing path that peaks when leading the GDP with around seven months. It is the "national expectation (12 months

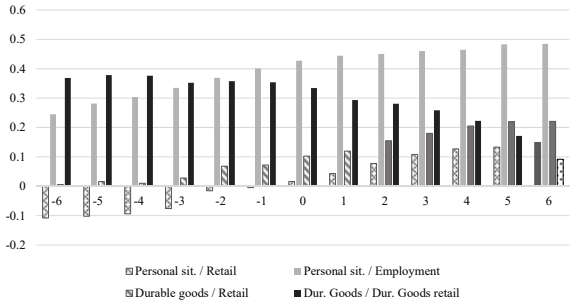
ahead)" question that has the highest correlation for all leading horizons. For questions regarding the personal economic situation, shown in figure 5b, the results are mixed. The personal situation's correlation with employment is increasing with a peak when leading the activity with around five to six months. The correlation between willingness to purchase durable goods and durable goods retail sales is lower and decreasing.

Figure 5. Consumer survey: Cross correlation coefficients

a. National economic situation



b. Personal economic situation



Note: see figure 3.

Tests for Granger causality, separated by personal and national economic situation, are presented in table 6. In general, the tests indicate that the IPEC questions as well as the general index Granger cause the respective activity indicators, while the opposite seems to be the case for the questions regarding the planned purchases of durables good and retail sales of durable goods. Nothing can be concluded with respect to Granger causality for the question regarding durables goods and overall retail sales.[22] Similarly to the results obtained for the IMCE indicators, the evidence presented in this subsection suggests that the consumer survey could be leading activity and employment indicators.

Table 6. Consumer survey. Tests of Granger causality (*p*-values)

a. National economic situation and IMACEC				
	IPEC	**Current economic sit.**	**Future economic sit. (12M)**	**Future economic sit. (5Y)**
Activity → survey	0.26	0.70	0.10	0.64
Survey → activity	**0.01**	**0.08**	**0.00**	**0.01**

[22] *When the survey series are HP filtered, the test indicates that the Durable goods survey series Granger causes the retail sales series. In this case, it is not evident that the question of current personal situation causes the employment as the test cannot be rejected with a p-value of 0.11.*

b. Personal economic situation				
	Current personal sit. / Retail	**Current personal sit. / Employment**	**Durable goods / Retail**	**Durable goods / Dur. goods**
Activity → survey	0.72	0.72	0.39	**0.03**
Survey → activity	**0.04**	**0.06**	0.11	0.28

Note: see table 3.

3.2.2. The usefulness of the consumer survey for now- and forecasting economic activity

The correlations and tests for Granger causality presented in the previous sub-section may indicate some predictive contents in most of the consumer survey indices. In this subsection, the predictive capacity is investigated by replicating the simple ADL exercise carried out in the subsection 3.1.2. Again, the estimations are made from 2002[23] to 2013 and the forecast period covers from December 2013 to October 2018. The results are shown in table 7, where RMSE numbers lower than one indicate that the consumer survey contains information which is useful for predicting activity.

Table 7. Consumer survey: Out-of-sample forecasting exercise

a. National Economic situation and GDP[(a)]					
		IPEC	**Current economic sit.**	**Future economic sit. (12M)**	**Future economic sit. (5Y)**
Nowcast	RMSE	0.996	1.004	0.994	0.981
59 obs.	SM better	46.5%	46.5%	44.2%	44.2%
1M ahead	RMSE	0.992	0.994	1.002	**0.972**
58 obs.	SM better	54.8%	50.0%	47.6%	47.6%
3M ahead	RMSE	**0.827**	**0.823**	**0.841**	**0.806**
56 obs.	SM better	50.0%	50.0%	55.0%	57.5%
6M ahead	RMSE	**0.623**	**0.624**	**0.640**	**0.638**
53 obs.	SM better	67.6%	67.6%	73.0%	70.3%
1Y ahead	RMSE	**0.524**	**0.527**	**0.511**	**0.508**
47 obs.	SM better	83.9%	83.9%	83.9%	83.9%

[23] *The series of durable goods retail sales is only available as from 2005.*

b. Personal economic situation					
		Current personal sit. / Retail	**Current personal sit. / Employment**	**Durable goods / Retail**	**Durable goods / Dur. goods**
Nowcast	RMSE	0.996	1.030	0.990	0.998
59 obs.	SM better	60.5%	48.8%	62.8%	44.2%
1M ahead	RMSE	0.989	0.991	**0.983**	**0.987**
58 obs.	SM better	54.8%	50.0%	61.9%	83.3%
3M ahead	RMSE	**1.021**	**0.531**	**1.017**	**1.056**
56 obs.	SM better	52.5%	65.0%	52.5%	50.0%
6M ahead	RMSE	**1.021**	**0.477**	**1.016**	**0.932**
53 obs.	SM better	51.4%	70.3%	51.4%	59.5%
1Y ahead	RMSE	**0.885**	**0.479**	**0.884**	**0.921**
47 obs.	SM better	64.5%	77.4%	67.7%	51.6%

Note: see table 4.

Measured by the RMSE, the models that include the consumer survey generally forecast better than the simple AR, especially when predictions are for three or more months ahead, even though there are a couple of exceptions. For nowcasting and one month ahead forecasting the results are mostly favorable for the ADL models, although often the differences are not statistically significant. All in all, the evidence presented in this subsection suggests that the Chilean consumer survey does contain some useful information for forecasting activity indicators, in particular for longer horizons.

3.2.3. The informational content in individual questions

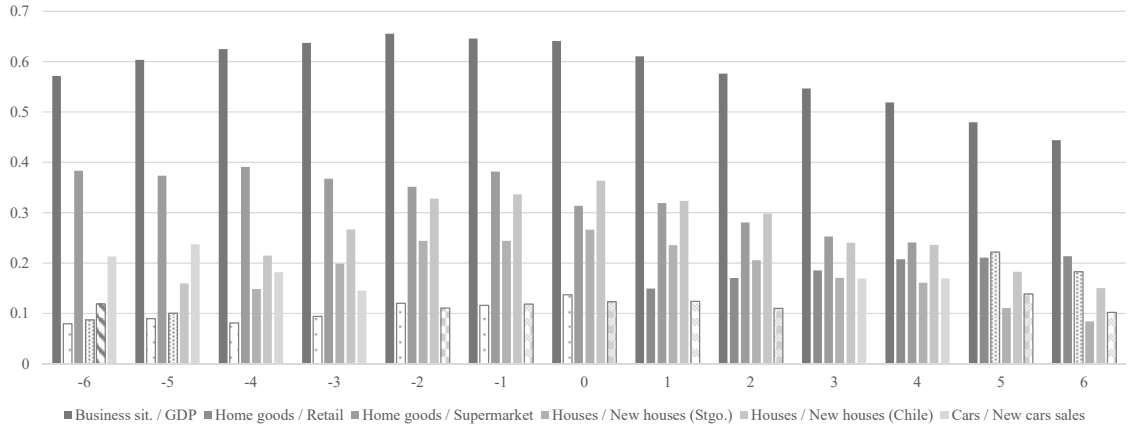
As mentioned earlier, there are additional questions in the Chilean consumer survey, which are not included in the IPEC calculation, about business economic situation, expected employment, expected inflation, family economic situation, purchase of goods for the household, purchase of a house and purchase of a car. The exercise in this subsection studies the usefulness of these questions to predict the following economic variables: GDP, inflation, retail activity, supermarket sales, new house sales and new car sales; the variables referred to in the questions or the ones that are closest to in case of more general formulated questions.

Figure 6 presents the cross correlations of the indices of the additional question and the corresponding economic indicators, separated into questions referred to the current situation and questions about expectations. Figure 6a shows that the question regarding business economic situations has the highest correlation with GDP for all horizons, with a relatively stable coefficient around 0.6 for past and present GDP, and then decreasing for its leads.

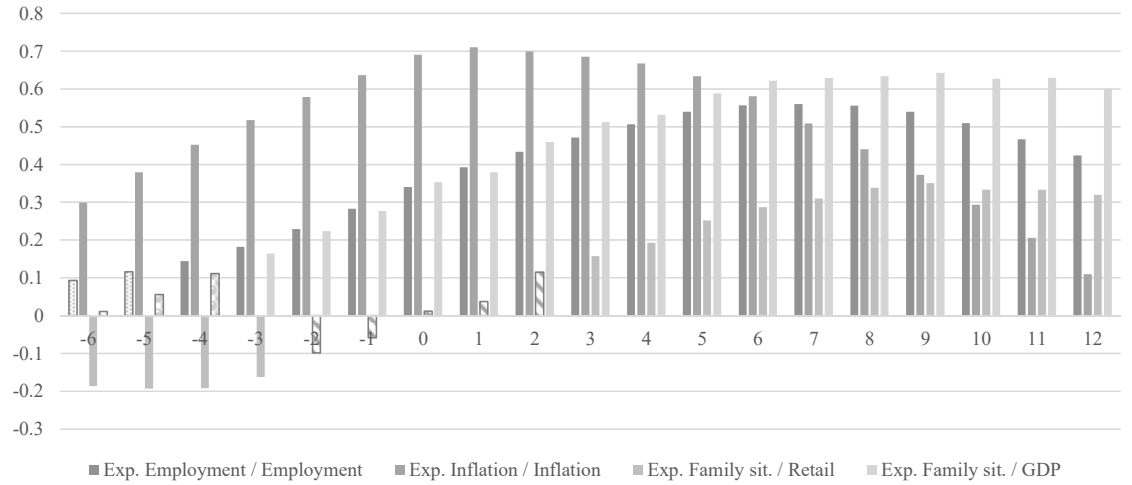
Although somewhat lower, the purchase of household goods index also presents a similar path of correlations with supermarket sales, around 0.4 for past and present values and decreasing for leads of sales. The other indices for current situation – purchase of house or car – have lower and more volatile correlations across horizons. On the other hand, figure 6b shows an initially increasing correlation coefficient for expected values of employment, with a peak around 0.5-0.6 with the seven-months-ahead employment rate. The expected family's (o household's) economic situation correlation with GDP is increasing, with a peak, also around 0.5, for the longer horizons. Finally, expected inflation shows a similar path but with higher correlation coefficients for shorter horizons, reaching 0.7 with the one-month-ahead inflation rate.

Figure 6. Consumer survey: Cross correlation coefficient with other questions

a. Current situation



b. Expectations



Note: see figure 3.

Table 8 reports the results of the prediction exercises. With some exceptions, including the survey observations in the econometric models generally seems to improve the forecast performance and, especially for horizons longer than one month, the improvements are often statistically significant. Particularly the survey questions on home goods (with respect to sales in supermarkets), houses (nationwide), expected inflation and expected family situation (with respect to GDP) seem to contain useful information for predicting the relevant macroeconomic variables for all the horizons analyzed. On the other hand, it is not evident that the question about the expected family situation should be used to forecast growth in the retail sector, except for the one-year-ahead horizon.

Table 8. Consumer survey: Out-of-sample forecasting exercise for other questions

		Business sit./ GDP[(a)]	**Household goods/ Retail**	**Household goods/ Smkt.**[(a)]	**Houses/ New houses Stgo.**[(a)]	**Houses/ New houses Chile**
Nowcast	RMSE	0.984	0.992	**0.981**	0.972	**0.909**
59 obs.	SM better	51.2%	58.1%	62.8%	60.5%	67.4%
1M ahead	RMSE	0.992	0.986	**0.965**	0.960	**0.903**
58 obs.	SM better	59.5%	64.3%	73.8%	61.9%	71.4%
3M ahead	RMSE	**0.823**	**1.016**	**0.940**	**0.773**	**0.730**
56 obs.	SM better	47.5%	55.0%	57.5%	72.5%	65.0%
6M ahead	RMSE	**0.636**	**0.999**	**0.764**	**0.692**	**0.639**
53 obs.	SM better	64.9%	51.4%	67.6%	83.8%	83.8%
1Y ahead	RMSE	**0.543**	**0.871**	**0.673**	**0.716**	**0.646**
47 obs.	SM better	80.6%	67.7%	71.0%	77.4%	83.9%
		Cars/ New car sales[(a)]	**Exp. employ./ Employ.**[(a)]	**Exp. inflation/ Inflation**[(a)]	**Exp. family sit./ Retail**	**Exp. family sit./ GDP**[(a)]
Nowcast	RMSE	1.211	1.023	**0.911**	0.991	**0.975**
59 obs.	SM better	55.8%	48.8%	67.4%	53.5%	58.1%
1M ahead	RMSE	1.482	0.989	**0.967**	0.992	**0.962**
58 obs.	SM better	33.3%	52.4%	66.7%	59.5%	50.0%
3M ahead	RMSE	**0.851**	**0.547**	**0.493**	**1.039**	**0.837**
56 obs.	SM better	62.5%	62.5%	75.0%	52.5%	52.5%
6M ahead	RMSE	**0.686**	**0.497**	**0.422**	**1.018**	**0.624**
53 obs.	SM better	62.2%	73.0%	89.2%	56.8%	70.3%
1Y ahead	RMSE	**0.700**	**0.547**	**0.316**	**0.864**	**0.514**
47 obs.	SM better	64.5%	74.2%	93.5%	67.7%	83.9%

Notes: see table 4. "Smkt": supermarket sales.

3.3. Joint information in the two surveys

The last exercise consists of comparing the predictive power of a model that includes both the IMCE and IPEC indices with respect to the GDP. Table 9 reports the ADL model results when comparing with the projections of the AR model and the models that include each of the indices individually. The table also includes a comparison of the individual survey models. The results indicate that a model including both the IMCE and IPEC general indices performs better than a simple AR model for nowcasts and predictions of the horizons of three, six and, especially, twelve months. For the two longest horizons there seem to be gains in employing both surveys, while it is not evident that either one of them contains better information for forecasting than the other.

Table 9. IMCE and IPEC: Out-of-sample forecasting exercise

		IMCE-IPEC/ AR	IMCE-IPEC/ IMCE	IMCE-IPEC/ IPEC	IMCE/ IPEC
Nowcast	RMSE	**0.966**	1.002	**0.971**	0.969
61 obs.	IM-IP better	48.8%	44.2%	48.8%	51.2%
1M ahead	RMSE	**1.017**	0.997	**1.026**	1.028
60 obs.	IM-IP better	47.6%	50.0%	45.2%	45.2%
3M ahead	RMSE	**0.848**	1.023	1.023	1.000
58 obs.	IM-IP better	55.0%	40.0%	47.5%	55.0%
6M ahead	RMSE	**0.601**	**0.971**	**0.978**	1.007
55 obs.	IM-IP better	70.3%	45.9%	48.6%	51.4%
1Y ahead	RMSE	**0.520**	0.996	0.991	0.994
49 obs.	IM-IP better	90.3%	54.8%	58.1%	58.1%

Notes: "RMSE": RMSE the ADL model that includes the survey to the left of the "/" divided by the RMSE of the ADL (AR) model that included the variables to the right of the "/". "IM-IP better": percentage of the observations where the model to the left of the "/"predicts better than the model indicated to the right of the "/". Bold numbers indicate that the difference is statistically significant when applying a 5% confidence level of the Clark and West (2007) test. Shaded cell indicates a ratio lower than one, i.e. RMSE of the survey model is lower than the RMSE of the benchmark model. The last column compares the IMCE general index model with the IPEC general index model. In this case the test applied is that of Diebold and Mariano (1995) with the small sample correction of Harvey et al. (1997).

4. Final remarks

The exercises presented in this paper represent a step in the direction of understanding better the usefulness of survey data for predicting Chilean activity. The evidence provided suggested that the business survey as well as the consumer survey contain useful information for making the predictions. This evidence was obtained by investigating cross correlations with different lags and leads, testing for Granger causality and estimating augmented

autoregressive models for activity with the survey observations. A final exercise also revealed that the information contained in the surveys seems to be complementary in the sense that it is possible to make better projections for the longest horizons when including information of both surveys in the econometric model.

The research on the informational content of Chilean survey data is still quite limited and there is plenty of scope for further investigation. The econometric models employed in this study are quite simple and it would be interesting to investigate the extent to which the surveys may also contribute to the forecasting performance of multivariate vector autoregressive (VAR) models and dynamic stochastic general equilibrium (DSGE) models. The challenge in the DGSE case would be to incorporate expectations in the theoretical framework. Another issue, which was not discussed in the present paper, is the extent to which the information in the survey applied may be complementary to that of other Chilean surveys. The framework applied in this study could be utilized for such an analysis. These and other issues are left for future research.

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Appendix A: Data description

The main source of the data utilized is the Central Bank of Chile (CBC). The Chilean business survey (IMCE) and consumer confidence indices (IPEC) were extracted from the CBC's web page.[24] Monthly data of economic activity by sector (retail, manufacturing, mining and construction) were constructed using three different series with references years 2003, 2008 and 2013. Monthly series of economic activity by sector (index 2003 = 100) for the period January 2003 to June 2009 were provided by the Macroeconomic Analysis Department of the CBC. The two more recent series (with reference years 2008 and 2013) are published at the CBC's web page. The monthly index of national economic activity (Imacec, for its Spanish abbreviation) is the spliced series with the 2013 benchmark published by the CBC.

The retail indices series for real durable and non-durable goods were constructed using series from the CBC and the National Statistics Institute (INE) of Chile. The INE indices (reference year 2005) cover the period from January 2005 to December 2009. To complete the retail index series until December 2018, the indices published by the CBC, reference years 2009 and 2014, were employed. Other monthly series extracted from the CBC web page are the following: national unemployment rate, supermarket sales general index (reference year

[24] https://si3.bcentral.cl/Siete/secure/cuadros/home.aspx?Idioma=en-US.

2014), total new car sales (units), total new house sales (units), new house sales in Santiago (units), and the headline inflation, annual rate.

Appendix B: Tests for seasonality

Table B1. Business survey. Tests for seasonality

	Parametric[(a)]	Moving seasonality[(b)]	Nonparametric[(c)]	Combined[(d)]
IMCE	**7.475**	**2.953**	**0.0000**	Not present
Retail	**3.565**	**1.873**	**0.0000**	Not present
Manufacturing	**10.440**	1.616	**0.0000**	Present
Mining	2.628	**2.970**	**0.0005**	Not present
Construction	**4.003**	**5.169**	**0.0000**	Not present

Notes: Results of tests reported in the X-13-ARIMA routine in Eviews (see Lothian and Morry (1978)) for the full samples. (a) *F*- statistic for the test for presence of seasonality assuming stability. The null hypothesis is no stable seasonality. (b) Higginson (1975) *F*-statistic for the presence of moving seasonality. The null is that no moving seasonality is present. (c) *p*-value of the Kruskal and Wallis (1952) nonparametric test for the presence of seasonality. The null is that identifiable seasonality is not present. (d) Combined test for the presence of *identifiable* seasonality as illustrated in appendix F in Lothian and Morry (1978). Bold numbers indicate that the test suggests presence of seasonality when applying a 10%/5%/1% significance level in the case of (a)/(b)/(c), the ones applied in the combined test.

Table B2. Consumer survey. Tests for seasonality

	Parametric[(a)]	Moving seasonality[(b)]	Nonparametric[(c)]	Combined[(d)]
IPEC	**21.680**	**1.926**	**0.0000**	Present
CPES[(i)]	**18.910**	**1.281**	**0.0000**	Present
WtPDG[(ii)]	**9.885**	**4.227**	**0.0000**	(Not present)
CNES[(iii)]	**27.556**	**1.179**	**0.0000**	Present
FNES (12M)[(iv)]	**14.513**	**1.372**	**0.0000**	Present
FNES (5Y)[(v)]	**4.699**	**1.698**	**0.0000**	(Not present)

Notes: See table B1. (i) Current Personal Economic Situation. (ii) Willingness to Purchase Durable Goods. (iii) Current National Economic Situation. (iv) Future National Economic Situation (12 Months ahead). (v) Future National Economic Situation (5 Years ahead). "(Not present)" indicates that the combined test suggests that *identifiable* seasonality is probably not present.

Appendix C: Comparing prediction performances of models with SA and NSA observations

Table C1. Comparison table 4. RMSE ratios

	IMCE	Ret.	Manuf.	Min.	Const.
Nowcast	1.007	1.003	1.013	0.999	0.992
1M ahead	1.016	1.001	1.035	1.001	0.999
3M ahead	0.985	1.001	1.001	1.002	1.012
6M ahead	1.000	0.998	1.000	1.001	0.975
1Y ahead	0.999	1.001	1.000	0.999	1.007

Notes: A ratio lower than one indicates that the RMSE of the model with SA observations is lower. Bold numbers (of which there are none in table C1) indicate that the difference is statistically significant according to the Diebold and Mariano (1995) test with the small sample correction of Harvey et al. (1997) when applying a 10% confidence level.

Table C2. Comparison table 5. RMSE ratios

a. General current business situation					
	IMCE	**Ret.**	**Manuf.**	**Min.**	**Const.**
Nowcast	1.012	1.004	1.014	1.002	0.993
1M ahead	1.004	1.001	1.009	1.006	1.004
3M ahead	0.994	0.997	1.019	1.002	0.991
6M ahead	1.005	0.997	1.001	1.003	0.995
1Y ahead	0.999	1.002	1.055	0.999	1.004
b. General business expected situation					
	IMCE	**Ret.**	**Manuf.**	**Min.**	**Const.**
Nowcast	1.008	1.003	1.015	1.001	0.995
1M ahead	1.008	1.001	1.027	1.001	1.001
3M ahead	0.996	1.002	1.007	0.999	0.983
6M ahead	1.007	1.001	0.998	1.001	0.971
1Y ahead	1.000	1.001	1.003	0.999	0.998

Note: See table C1.

Table C3. Comparison table 7. RMSE ratios

a. National economic situation and IMACEC				
	IPEC/ GDP	**National sit./ GDP**	**Exp. National sit. (12M)/ GDP**	**Exp. National sit. (5Y)/ GDP**
Nowcast	1.004	1.009	1.009	1.003
1M ahead	1.002	1.006	1.009	1.000
3M ahead	1.002	1.000	1.010	1.003
6M ahead	0.991	0.994	0.994	0.993
1Y ahead	0.997	0.997	0.998	0.999
b. Personal economic situation				
	Personal sit./ Retail	**Personal sit./ Employment**	**Durable goods/ Retail**	**Durable goods / Dur. Goods**
Nowcast	0.999	1.001	1.001	0.999
1M ahead	1.001	0.999	1.001	0.999
3M ahead	0.998	0.999	1.001	**0.964**
6M ahead	0.998	1.001	1.000	1.003
1Y ahead	1.000	1.001	0.997	1.046

Note: See table C1.

Table C4. Comparison table 8. RMSE ratios

	Business sit./ GDP	**Household goods / Retail**	**Household goods / Smkt.**	**Houses/ New houses Stgo.**	**Houses/ New houses Chile**
Nowcast	0.999	1.002	0.999	0.999	0.995
1M ahead	0.998	1.001	1.001	0.999	0.999
3M ahead	0.999	0.999	1.000	0.999	0.998
6M ahead	1.002	1.000	**1.006**	1.000	1.000
1Y ahead	0.998	0.997	1.003	0.999	0.993

	Cars/ New car sales	Exp. Employ. / Employ.	Exp. Inflation / Inflation	Exp. Family sit./ Retail	Exp. Family sit./ GDP
Nowcast	**1.220**	1.006	0.996	1.001	0.999
1M ahead	**1.152**	1.004	1.002	1.004	1.016
3M ahead	0.997	1.006	0.997	0.998	1.003
6M ahead	0.994	0.996	1.009	1.002	0.993
1Y ahead	**1.045**	1.062	1.008	0.998	0.995

Notes: see table C1. "Smkt": supermarket sales.

Table C5: Comparison table 9. RMSE ratios

	IMCE-IPEC / GDP
Nowcast	1.010
1M ahead	1.017
3M ahead	0.995
6M ahead	0.953
1Y ahead	0.997

Notes: see table C1.

Appendix D: Comparing prediction performances employing an ARMA(1,1) as benchmark

Table D1. Table 4 with ARMA(1,1) as benchmark model

		IMCE[(a)]	Ret.	Manuf.	Min.	Const.
Nowcast	RMSE	**0.937**	1.002	**0.960**	0.999	0.989
59 obs.	SM better	67.4%	48.8%	48.8%	58.1%	65.1%
1M ahead	RMSE	**1.009**	**0.942**	**0.977**	**0.964**	**0.617**
58 obs.	SM better	57.1%	54.8%	57.1%	76.2%	61.9%
3M ahead	RMSE	**0.818**	**0.995**	**0.972**	**0.786**	**0.234**
56 obs.	SM better	57.5%	50.0%	47.5%	45.0%	65.0%
6M ahead	RMSE	**0.661**	**0.973**	**0.913**	**0.727**	**0.217**
53 obs.	SM better	67.6%	62.2%	59.5%	51.4%	67.6%
1Y ahead	RMSE	**0.535**	**0.839**	**0.825**	**0.700**	**0.223**
47 obs.	SM better	74.2%	67.7%	64.5%	54.8%	74.2%

Note: See table 4.

Table D2. Table 5 with ARMA(1,1) as benchmark model

		a. General current business situation				
		IMCE[a]	**Ret.**	**Manuf.**	**Min.**	**Const.**
Nowcast	RMSE	**1.102**	1.008	**1.182**	1.017	0.993
59 obs.	ifo better	39.5%	44.2%	41.9%	39.5%	39.5%
1M ahead	RMSE	0.951	**0.981**	**1.075**	0.993	0.997
58 obs.	ifo better	52.4%	71.4%	35.7%	45.2%	38.1%
3M ahead	RMSE	0.984	1.014	**1.037**	1.006	0.950
56 obs.	ifo better	40.0%	50.0%	35.0%	60.0%	55.0%
6M ahead	RMSE	0.942	**1.005**	1.016	1.018	0.953
53 obs.	ifo better	45.9%	27.0%	43.2%	51.4%	54.1%
1Y ahead	RMSE	0.972	0.999	1.093	0.997	1.006
47 obs.	ifo better	61.3%	48.4%	54.8%	58.1%	51.6%
		b. General business expected situation				
		IMCE[a]	**Ret.**	**Manuf.**	**Min.**	**Const.**
Nowcast	RMSE	1.047	0.995	0.970	0.999	**1.010**
59 obs.	ifo better	46.5%	53.5%	60.5%	46.5%	34.9%
1M ahead	RMSE	0.979	1.032	1.007	0.994	1.018
58 obs.	ifo better	52.4%	50.0%	54.8%	45.2%	35.7%
3M ahead	RMSE	0.982	0.992	1.006	1.008	0.954
56 obs.	ifo better	42.5%	52.5%	40.0%	50.0%	55.0%
6M ahead	RMSE	0.963	1.007	1.029	1.000	1.017
53 obs.	ifo better	43.2%	35.1%	48.6%	43.2%	51.4%
1Y ahead	RMSE	0.980	0.997	0.994	1.008	0.952
47 obs.	ifo better	58.1%	41.9%	58.1%	61.3%	38.7%

Note: See table 4.

Table D3. Table 7 with ARMA(1,1) as benchmark model

		a. National Economic situation and GDP[a]			
		IPEC / GDP[a]	**National sit. / GDP**	**Exp. National sit. (12M)/ GDP**	**Exp. National sit. (5Y)/ GDP**
Nowcast	RMSE	**0.977**	0.986	**0.975**	0.990
59 obs.	SM better	53.5%	53.5%	62.8%	53.5%
1M ahead	RMSE	**0.980**	**0.988**	**0.976**	0.994
58 obs.	SM better	64.3%	81.0%	59.5%	54.8%
3M ahead	RMSE	**0.803**	**0.804**	**0.815**	**0.797**
56 obs.	SM better	47.5%	42.5%	50.0%	42.5%
6M ahead	RMSE	**0.597**	**0.610**	**0.598**	**0.618**
53 obs.	SM better	67.6%	64.9%	70.3%	67.6%
1Y ahead	RMSE	**0.520**	**0.522**	**0.519**	**0.516**
47 obs.	SM better	74.2%	77.4%	77.4%	77.4%

b. Personal economic situation					
		Personal sit./ Retail	**Personal sit./ Employment[(a)]**	**Durable goods/ Retail**	**Durable goods / Dur. Goods**
Nowcast	RMSE	1.004	1.005	0.997	0.997
59 obs.	SM better	46.5%	55.8%	53.5%	46.5%
1M ahead	RMSE	**0.985**	**0.982**	1.001	**0.985**
58 obs.	SM better	71.4%	59.5%	50.0%	57.1%
3M ahead	RMSE	**0.985**	**0.569**	**0.992**	**1.012**
56 obs.	SM better	52.5%	70.0%	47.5%	50.0%
6M ahead	RMSE	**0.975**	**0.458**	**0.963**	**0.840**
53 obs.	SM better	54.1%	70.3%	64.9%	64.9%
1Y ahead	RMSE	**0.843**	**0.480**	**0.847**	**0.840**
47 obs.	SM better	67.7%	74.2%	71.0%	64.5%

Note: see table 4.

Table D4. Table 8 with ARMA(1,1) as benchmark model

		Business sit./ GDP[(a)]	**Home goods/ Retail**	**Home goods/ Smkt.[(a)]**	**Houses/ New houses Stgo.[(a)]**	**Houses/ New houses Chile**
Nowcast	RMSE	**0.881**	0.991	1.022	0.961	0.952
59 obs.	SM better	65.1%	65.1%	53.5%	55.8%	48.8%
1M ahead	RMSE	**0.953**	**0.985**	1.069	**0.951**	**0.937**
58 obs.	SM better	50.0%	57.1%	50.0%	61.9%	81.0%
3M ahead	RMSE	**0.816**	**0.992**	**0.972**	**0.770**	**0.711**
56 obs.	SM better	50.0%	47.5%	60.0%	70.0%	75.0%
6M ahead	RMSE	**0.620**	**0.966**	**0.939**	**0.673**	**0.620**
53 obs.	SM better	64.9%	59.5%	59.5%	81.1%	83.8%
1Y ahead	RMSE	**0.523**	**0.844**	**0.987**	**0.695**	**0.615**
47 obs.	SM better	74.2%	67.7%	61.3%	80.6%	83.9%
		Cars/ New car sales[(a)]	**Exp. Employ./ Employ.[(a)]**	**Exp. Inflation/ Inflation[(a)]**	**Exp. Family sit./ Retail**	**Exp. Family sit./ GDP[(a)]**
Nowcast	RMSE	1.574	0.997	**0.919**	**0.962**	**0.965**
59 obs.	SM better	34.9%	55.8%	67.4%	53.5%	58.1%
1M ahead	RMSE	1.495	**0.969**	**0.973**	**0.937**	**0.955**
58 obs.	SM better	42.9%	54.8%	59.5%	54.8%	52.4%
3M ahead	RMSE	**0.900**	**0.572**	**0.509**	**1.003**	**0.809**
56 obs.	SM better	62.5%	67.5%	72.5%	47.5%	52.5%
6M ahead	RMSE	**0.733**	**0.464**	**0.433**	**0.991**	**0.613**
53 obs.	SM better	62.2%	73.0%	83.8%	56.8%	75.7%
1Y ahead	RMSE	**0.652**	**0.492**	**0.325**	**0.843**	**0.511**
47 obs.	SM better	61.3%	74.2%	90.3%	67.7%	80.6%

Notes: see table 4. "Smkt": supermarket sales.

Table D5. Table 9 with ARMA(1,1) as benchmark

		IMCE-IPEC/ AR	IMCE-IPEC/ IMCE	IMCE-IPEC/ IPEC	IMCE/ IPEC
Nowcast	RMSE	**0.934**	0.997	**0.956**	0.959
61 obs.	IM-IPM better	62.8%	53.5%	58.1%	58.1%
1M ahead	RMSE	**0.996**	1.006	1.016	1.010
60 obs.	IM-IPM better	54.8%	45.2%	50.0%	54.8%
3M ahead	RMSE	**0.785**	1.002	**0.977**	0.975
58 obs.	IM-IPM better	67.5%	47.5%	62.5%	67.5%
6M ahead	RMSE	**0.613**	**0.952**	1.027	1.079
55 obs.	IM-IPM better	64.9%	59.5%	59.5%	35.1%
1Y ahead	RMSE	**0.534**	1.003	1.026	1.023
49 obs.	IM-IPM better	77.4%	58.1%	51.6%	41.9%

Note: See table 9.

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